SUPPORTING THE WORK OF GLOBAL VIRTUAL TEAMS:

THE ROLE OF TECHNOLOGY-USE MEDIATION

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THE ROLE OF TECHNOLOGY-USE MEDIATION

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Attestation of Authorship

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which to a substantial extent has been accepted for the award of any other degree or diploma of a university or other institution of higher learning, except where due acknowledgement is made in the acknowledgements.

Co-authored works

The research programme with which this work is associated has produced several jointly authored publications. Most of these works do not bear directly on the objects of this independent study, but where they are relevant they have been cited within the thesis.

Acknowledgments

I began this journey with a supervision team of Professor Stephen MacDonell, Professor of Software Engineering at Auckland University of Technology, and the late Professor John Hughes, Director of the University of Technology, Sydney's Institute for Information and Communication Technologies, and adjunct Professor of Computing at Auckland University of Technology. Without their collegial support and encouragement this work would not have been completed, and indeed John's untimely death in March 2006 gave this whole endeavour added meaning. Steve has been an active, sage and supportive colleague throughout the process, and as a student undertaking doctoral studies later in life I have appreciated his respect for me as a colleague throughout the process. I hope this work also stands as a fitting tribute to John's mentorship and guidance, which I acknowledge in the poem on the following page.

To the star *John Hughes* in the constellation Pictor

It was hard to write these few words for you John.

At first confused, numbed by the sudden news
Then quietly resigned,
To an absence of words,
Perplexity at how to aptly describe you.
Your many attributes,
Those visible, those hidden and those hinted at.
Appositely recited at your funeral
In a plethora of adjectives,
None disparaging.

A true scholar of the old school,
Scientist, Latinate, erudite
Considered and wise,
An academic leader
You've taken one last flight to another plane.

They will name a star after you
In the constellation Pictor
A graphic memorial,
A twinkling eye
To watch
Avuncular
Over us,
Your extended family.

Our loss will be heaven's gain,
I can see you now
Mentoring the younger stars
Sharing eloquent, sage counsel with the elders,
The Pot brought into service for a banquet,
Accompanied, if not by fine wine,
At least by good spirits gathered.
Orion loosening another notch in the belt,
Lively company, conversation,
Bonhomie and wicked wit.

It may be premature,
But you now have a chance
To take the rest hinted at
In this embedded poem,
Which I shared
With you and Alison
Over dinner at our home
A couple of years ago.
Only recited here,
Because I remember it appealed to you.

Norfolk

Days snatched
Brief interlude
To view the moods
Varied of the Norfolk Broads.
From the first impressions
Driving flooded
Country lanes
With a country
Driver remarking,
"we're placid
folk round 'ere"
A sense of
Holiday ease,
Of a peaceful
Corner of England,
Descends.

And now John you can take your ease,
Fittingly, among the stars.

Travel well,
Star guide and friend.

29/03/2006

(Clear, 2007a)

However this work itself has arisen out of a collaborative and team effort engaging colleagues both locally and across the globe. At each of the three locations a concerted effort has been necessary to both initiate and bring to fruition the global collaboration reported in this thesis. I must acknowledge the sustained co-operation and support of my original collaborating partner Mats Daniels of Uppsala University and his colleague Arnold Pears; the friendship, encouragement and enthusiasm of my AUT University colleagues Diana Kassabova and Kitty Ko of the School of Computer & Information Sciences, without whose capable co-ordinating and teaching skills there would be nothing to report; and the willingness of our colleague Professor Fred Niederman of St Louis University to take part for the first time in our global virtual collaboration. It goes without saying that we are indebted to the students of the Department of Computer Science at Uppsala University; those of the Bachelor of Business programme at AUT University and those from the Global Information Management course at St Louis University who chose to participate in this trial.

Given that this thesis addresses the notion of technology-use mediation in global virtual teams, in addition to the above actors in this globally distributed play, I must acknowledge the hidden and often un-remarked contribution of the large supporting cast at each institution that have helped orchestrate this collaborative venture. Without the complementary roles performed by our flexible learning, pedagogical platform and IT infrastructure support teams, collaborative work of a global nature such as this, will remain solely the preserve of naïve or masochistic pioneers, and will struggle to become normalised in the routines of contemporary universities. I have to thank the members of these teams for generously agreeing to allow me access to their email correspondence in the course of the collaborative trial, which has enabled more detailed study of their roles and activities in mediating the use of the various technologies involved in the trial.

In addition to colleagues closely associated with this work, I have to thank my wider group of professional colleagues who have supported me in taking risks, in not denigrating the value of this work, accepting that we have been striving to provide more global learning experiences for students, discussing reports of work in progress and in generally helping to sustain a common commitment to scholarship.

None of us leads purely professional lives and I cannot conclude this section without thanking my partner Associate Professor Alison Young, who despite her own heavy academic and managerial commitments has been consistently supportive of both this research and my attempts to study. She has been an invaluable sounding board, periodic proof reader and insightful and constructive critic. She has furthermore pushed me to complete the work. As an adult learner with a busy working life and existing set of commitments, the challenge of doctoral studies is not to be taken lightly, and it has inevitably meant late nights and weekends glued antisocially to the computer, distracted periods when I should have been listening more attentively and the need for her to pick up many home responsibilities which I have neglected. I would like to express my love and thanks to her for this generous and consistent support.

Ethics approval

The research studies addressed within this thesis have been covered within two separate ethics approvals, the first for the conduct of the international collaboration itself and the second for this more specific analysis of technology-use mediation. Therefore this work has been approved by the Auckland University of Technology Ethics Committee on 1) 27 April 2004 AUTEC Reference number 99/52 - Collaborative database & collaborative teaching project and 2) on 10 May 2006 AUTEC Reference number 06/11 “Supporting the work of global virtual teams: the role of technology-use mediation in educational settings".

Abstract

This thesis investigates the role of *technology-use mediation* in supporting the work of g*lobal virtual teams*.

The work is set in the context of a longer term action research programme into collaborative computing and global virtual teams, initiated by Auckland University of Technology in New Zealand and Uppsala University in Sweden. Over the period since 1998, global virtual collaborations involving teams of students from both universities have been conducted annually. This thesis investigates the 2004 collaboration cycle, in which participants from St Louis University Missouri joined the collaboration. This was the first triadic collaboration, and covered Northern, Southern and Western aspects of the globe while traversing three widely divergent time-zones.

In spite of the extensive experience in collaboration possessed by the coordinators at all three sites, the results of the global virtual trial were at best mixed. This repeated experience of dissatisfaction in our global virtual collaborations, in spite of the technology being in place has been a primary motivator for this work. Why is global virtual collaboration difficult? What roles and activities are critical? How can we do it better? These are not issues solely to do with the student actors in the global virtual teams, but more to do with the supporting cast, engaged in "activities which involve the shaping of other users activities of [technology] use" (Orlikowski et al., 1995, p.425). Thus came about my interest in exploring the topic of *technology-use mediation*.

This thesis applies a research framework adapted from DeSanctis & Poole's "Adaptive Structuration Theory" (1994) by the author. Initially applied to "facilitation" in virtual teams "Extended Adaptive Structuration Theory (EAST)" (Clear, 1999a), has undergone further development. The resulting research framework "Technology-use Mediated AST (TUMAST)" is applied here for the first time to investigate *technology-use mediation* activities performed during the global virtual collaborative trial.

A corpus of data based on the email communications of supporting parties to the collaboration is analysed in depth in this study, applying a combination of grounded theoretic and structurational techniques. Thus a very rich and firmly grounded picture of the processes of *technology-use mediation* is built. This thesis represents the first known in-depth longitudinal study of *technology-use mediation* in a real global virtual team setting.

From this exploratory study some novel theorizations have resulted. Methodologically it demonstrates analysis of *technology-use mediation* applying the TUMAST framework in a manner that captures the richness and evolution over time of these complex activities. Substantively it proposes a novel theory of "Collaborative Technology Fit (CTF)". It is hoped that future global virtual team coordinators and researchers may apply the theory in order to map their situation, and diagnose their degree of collaborative alignment on multiple dimensions, thus enabling corrective actions to be taken. While the work arises in a tertiary education context, it reflects the reality of professionals at work in a global virtual team. Its application within other domains remains to be proven, but readings from the literature, and personal experience within global virtual software development teams suggest its wider applicability.

Prologue – How to Read This Thesis

This brief prologue is included to aid in the reading of the thesis. This section has been included as something of an epilogue after the oral examination, where it became apparent that additional signposting of the work may be helpful.

Stylistically the thesis has adopted an 'interpretive' epistemology, and as a result makes frequent use of the first person, and is interspersed with personal observations and reflections. Readers more accustomed to work in the 'objective science' tradition may find this unfamiliar. The presence of the authorial voice may also appear intrusive. However I have adopted that approach consciously to set the work in context and demonstrate how I drew my conclusions. This brings to bear the interpretive research principles of "contextualization" and "interaction between the researchers and the subjects" (Klein & Myers, 1999).

The thesis begins with an introductory chapter setting the context, motivating the work and highlighting its contribution.

The next chapter is titled "literature review", but given the range and scale of the related literature, the thesis has adopted a non traditional approach to a literature review. Chapter two merely serves as an overview of the many threads of literature in this topic area and summarises the context for the research in section 2.3.

A fuller perspective on the informing literature will be gained if chapter two is read in conjunction with both chapter three, which further explores the conceptual origins of the work and develops the conceptual framework for the thesis, and chapter four which positions the work methodologically.

Chapter five continues the methodological focus by reflecting upon the issues which managing the data presented. As the "meat" of the thesis lies in the "episode" analysis, the reader could first focus attention on sections 5.3, 5.4 and 5.5 which present a summary of the approach to analysis of the chosen "episodes of interest". Awareness of that framework will help guide the process of reading the subsequent chapter.

The rich data analysis which follows in chapters six and seven generates in itself a form of continuing review of the literature, as more specific themes emerge from the data. That situated form of review arises from grounded analysis, is very context specific, micro-analytic and in depth.

Chapter six presents the analysis of three representative episodes in separate sections, each covering distinct phases of *technology-use mediation*. The first two episodes are

based upon selected critical incidents and thus are comparatively shorter. This sequencing of episodes is intended to help introduce the reader to the analytical approach. The third episode is a much longer one and covers the full phase of "establishment" as a logical unit of *technology-use mediation* prior to the collaboration. These analyses present detailed micro-analytic reviews of each episode, and thus tend to be highly descriptive. Examiners' feedback suggested that they have perhaps suffered from "the sin of inclusion", thereby presenting the consequent challenge of how "to help readers see the forest instead of just the trees".

While these sections (6.2, 6.3. 6.4) follow the sequence of analysis outlined in section 5.4, the summation of the findings tends to come towards the end of each in the visual mapping and temporal bracketing subsections. Thus each episode may be read selectively and perhaps even in reverse order. Readers interested in engaging with the detail of each episode can find them in appendix 20 where the remaining five episodes have been presented in the same manner. At the time of writing, my aim was to simply describe these episodes in depth with a progressive micro-analytic review as I went.

Having completed that stage of the work, which was entirely necessary, alternate ways of presenting the findings have been suggested based upon key themes and their evolution within each episode. However, I needed to complete the detailed analysis to gain that insight, and I am happy to present the work here in its present form as a stage in an ongoing process.

Chapter seven, while presenting a cross-episode analysis may suffer from the same issues as chapter six, with tabulation used as the primary form of description, so again the chapter should be read selectively, with more strongly linked critical review sections coming towards the end of the chapter.

Chapter eight presents a synthesis of the prior work, and ties together several frameworks to produce a theory of "Collaborative Technology Fit" in section 8.5, which is the key section of the chapter.

Chapter nine presents an evaluation of the study aiming to demonstrate rigour in the application of the research. The reader with an interest in application of the chosen research methodologies may find this chapter of interest.

Chapter ten concludes the thesis, reiterating the motivation for and contribution of the work, followed by a set of reflections upon the potential domains of applicability and recommendations for research and practice.

Glossary of Terms and Abbreviations

AAA	Authentication, Authorization and Accounting
ACM	Association for Computer Machinery
Adaptive Structuration Theory (AST)	A framework proposed by DeSanctis & Poole (1994) for studying variations in organizational change that occur as advanced technologies are used. An input-process-output model originally applied to group technologies such as GDSS, AST is based upon the central concepts of structuration and appropriation, and provides a dynamic picture of the process by which people incorporate advanced technologies into their work practices. The theory adopts an interactionist stance to technology, seeing it being recursively shaped through use by the actors, institutional forces and innate technology features.
Adjustment	TUM ongoing adaptation activity in response to feedback, e.g. adjustment of definitions and usage rules for specific AIT features and occasional addition of new AIT features on request
AIT	"Advanced Information Technology" originally used by DeSanctis & Poole (1994) to indicate Groupware, here used more generally to cover a variety of collaborative and communication technologies used to support global collaboration.
ALNs	Asynchronous Learning Networks
Appropriation	Appropriation is the process by which participants invoke or enact available structures (e.g. GSS, agenda, etc.) and thereby give meaning to them...AST posits that the success of an appropriation is determined by three dimensions, the *faithfulness* (in respect to the structure's design principles) of the appropriation, the group's *attitudes* towards the structures, and the group's *level of consensus* (i.e. agreement on how structures should be used).
Appropriation Move	"groups may choose to appropriate a given structural feature in different ways, invoking one pr more of many possible appropriation moves. Given the availability of technology structures, groups may choose to: (a) directly use the structures; (b) relate the structures to other structures (such as structures in the task or environment); (c) constraint or interpret the structures as they are used; or (d) make judgments about the structures (such as to affirm or negate their usefulness)". (DeSanctis & Poole, 1994)
Appropriation Move - subtype	A subcomponent of an appropriation move-type within the range of categories available
Appropriation Move - type	A subcomponent of an appropriation move within one of the four categories above
ASEE	American Society for Engineering Education
AUT	Auckland University of Technology

AUTOnline	The AUT University virtual learning environment – based upon the commercial Blackboard™ platform
Blackboard™	The commercial Blackboard™ platform, variously termed an LMS or VLE depending upon one's view of the online learning process
Theory of Collaborative Technology Fit (CTF)	Theory of Collaborative Technology Fit – a theory developed in this study which incorporates TUM in the process of diagnosing the degree of fit of collaborative technology in a context
CMC	Computer Mediated Communication
CS	Computer Science
CSCL	Computer Supported Collaborative Learning
CSCW	Computer Supported Collaborative Work
CVE	Collaborative Virtual Environment
DGSS	Distributed Group Support System
DMZ	De-Militarised Zone (technology environment outside the firewall, and unconstrained by standard production level security)
DRM	Digital Rights Management
Extended Adaptive Structuration Theory (EAST)	Extended Adaptive Structuration Theory – an extension of AST developed by the author to encompass the facilitator's role, with an augmentation based upon the Orlikowski et al., (1995) model of TUM activities.
EMS	Electronic Meeting System
Episodic Change	TUM major change activity e.g. periodically initiated major changes to the system as a whole
Establishment	TUM set up activity e.g. establishing roles, determining and building consensus around use of the AIT, establishing guidelines etc. for its use
FIE 2003 Conference	IEEE/ASEE Frontiers in Education Conference
GIM	Global Information Management [Course]
Global Virtual Team (GVT)	Loosely - a team of students from two or three locations, working virtually to achieve a common goal, or a team of coordinators and lecturers from three locations working virtually to achieve a common goal. More formally cf. p. 336 below.
GDSS	Group Decision Support System
GSS	Group Support System
GIS	Geographic Information System
IEEE/CS	Institute of Electrical and Electronic Engineers/Computer Society
IM	Information Management
IRB	Institutional Review Board
IS	Information Systems
ISP	Internet Service Provider
IT	Information Technology
ITiCSE Conference	ACM Innovation and Technology in Computer Science Education Conference
LMS	Learning Management System
Local Team (LT)	a component group of a GVT at one location
Metastructure	a mediating institutional, cultural, or technology structure, which serves to shape [collaborative] technology use.
Metastructuring	A set of activities that, although carried out by users, are not activities of use. Rather they involve the shaping of other users activities of use, a process we designate as ***Metastructuring*** (Orlikowski et al., 1995)

Middleware	layers of software that support interconnectivity and interoperability
MNC	Multi-National Corporation
MUVE	Multi User Virtual Environment
NVivo™	A qualitative data analysis software package from QSR International
PKI	Public Key Encryption
RA	Research Assistant
Reinforcement	TUM ongoing activity to encourage use e.g. training, monitoring, and follow-up with members and the group to reinforce the established guidelines;
Runestone	A joint course conducted internationally between students in Uppsala University Sweden and counterparts in the US at Grand Valley State University Michigan
SE	Software Engineering
St Louis	St Louis University, Missouri
Structuration Theory (ST)	Theory proposed by sociologist Anthony Giddens, which argues that institutions are continually and recursively shaped by individual actions.
Structure	A notion proposed by Giddens to highlight the mechanisms by which social structures serve to mutually shape organizations through individual agency to sustain their existence or allow them to wither
TA	Teaching Assistant
Technology-use Mediation (TUM)	structures users' use of technology by influencing their interpretations and interactions, by changing the institutional context of use and by modifying the technology itself. Because *technology-use mediation* is a sanctioned, explicit, deliberate and ongoing set of activities, we argue that it is a particularly powerful mechanism in the context of dynamic organisations, enabling rapid and customised adaptations of the technology and its use to changes in circumstances, organizational form and work practices".(Orlikowski et al., 1995)
TUMAST	Technology-use Mediated AST – a theoretical framework extending AST and developed in this study to explore TUM
Uppsala	Uppsala University
UTS	University of Technology Sydney
VLE	Virtual Learning Environment
Wiki	A collaborative technology delivered over the web, with an underlying collaborative spirit enabling ready contribution and amendment of content by all group members

Chapter 1: Introduction

This thesis investigates *the role of technology-use mediation in supporting global virtual teams.* The primary focus of the study is a global virtual collaboration conducted over the period from early September to early November 2004, although the period of research interest is much larger. Participants in the global collaboration were students from AUT University in Auckland New Zealand, students from Uppsala University in Uppsala Sweden, and students from St Louis University Missouri in the United States of America. Students were formed into multiple global virtual teams to perform the collaboration, during which they aimed to jointly complete a common decision making task.

But alongside the stories of the students in their global virtual teams, ran a concurrent narrative. This narrative concerned the coordinators of the collaboration at each site and the extended cast of supporting actors, who performed a variety of *technology-use mediating* roles to enable the exercise. The activities performed by these actors, were those of a further and distinct global virtual team working in a naturalistic and challenging professional context. Members of this team had links to other groups both within their own organizations and across organizational boundaries. The unfolding of their activities over time is the focus of this thesis.

1.1 Background to the research and the researcher

1.1.1 Research Context

The research reported here arises in the context of a long term action research programme into global virtual teams, collaborative computing and international collaboration conducted by the author (cf. Clear 1999b; Clear 2000; Clear & Daniels 2000; Clear, 2004a; Clear, 2004b; Clear & Kassabova, 2005, 2008). Annual global virtual collaborations between undergraduate business students majoring in Information Technology in New Zealand and computer science students in Sweden have been conducted since 1998. The 2004 international collaboration reviewed here therefore constitutes one cycle of many within the wider research programme. The specific focus of this study on *technology-use mediation* serves to differentiate it (in part) from much of the prior research, which has tended to focus more on the roles played by differing collaborative technologies, pedagogical designs and the students as actors within their

global virtual teams. Some prior research has investigated 'facilitation' in global collaborations (Clear, 1999a, Jiramahapoka, 2005) and 'moderator' roles in 3D Collaborative Virtual Environments (Clear, 2004b), but the fuller troupe of actors engaged in *technology-use mediating* roles has not been investigated prior to this study.

As an actor myself in this scene, I have assumed both the role of author of this thesis and coordinator of the collaborative trial in question, among other roles discussed later. Baskerville (1999, p.4) has asserted that "when the researcher intervenes the researcher becomes part of the study, i.e. one of the study subjects". Therefore the "change oriented" nature of action research wherein the researcher acts as an agent of change, necessitates the "adoption of an interpretivist viewpoint of research enquiry" (ibid.). Accordingly, this section aims for consistency with the recommendations of Klein & Myers (1999 p. 72) who produced a set of seven principles for conducting and evaluating "interpretive field research". I have first briefly addressed their principle of *contextualisation* above "by critical reflection of the social and historical background of the research setting, so that the intended audience can see how the current situation under investigation emerged" (Ibid.).

1.1.2 Researcher Role

Addressing my own role requires the principle of the *interaction between the researchers and the subjects* to be illuminated, through "critical reflection on how the research materials (or "data") were socially constructed through the interaction between the researchers and participants" (ibid.).

My role at Auckland University of Technology at the time of the collaboration was as Associate Head of School within our School of Computer and Information Sciences. I held administrative responsibilities of a strategic and developmental nature within the school, as well as an external and industry relations brief, reflecting abilities brought from my past life as an IT practitioner. Complementing these roles were those of educator, researcher and student – I had begun my doctoral studies in mid 2004.

In my educator role I had developed and initially taught the Intelligent Business Systems course on our Bachelor of Business programme. This was the course in which the AUT University students participated in the international collaboration. My colleagues Diana Kassabova and Kitty Ko taught the course together over the duration of the international collaboration, so I was not directly involved with the students in the classroom setting. Diana and I also team-taught the Collaborative Computing course on

our Master of Computer and Information Sciences degree, so we had worked closely together and were confident in one another's abilities.

In my researcher role I had worked with both Diana and Kitty previously in conducting our international collaborations, and Diana and I had been working that year on a joint publication reviewing a series of prior collaborations (Clear & Kassabova, 2005). The primary research contact for the collaboration with Sweden was Mats Daniels, Director of Undergraduate Studies in the Department of Computer Systems at Uppsala University. Mats and I had been collaborating together since 1998. We had published together (e.g. Clear & Daniels 2000, Clear & Daniels, 2003), and we had been steering the conduct of the collaborative programme over time. Mats, like myself, had stepped back from direct classroom involvement in the collaboration, and his colleague Dr. Arnold Pears had taken over that year. At the St Louis site, the Shaughnessy Endowed Professor of MIS, Dr. Fred Niederman had been introduced to me via email by Professor Felix Tan, then Head of our School and to whom I reported directly. Other key parties were Daniel Ismail the Lotus Notes administrator at AUT, with whom I had worked briefly and had established a productive relationship, and Mark Northover the Manager of Flexible Learning Services at AUT, who had also researched in the area of global collaboration, and whom I knew socially and collegially from his earlier role at Unitec, a local tertiary institution. Mark's team was also familiar to Diana, Kitty and me, and we had interacted regularly over set up of online courses etc.

Thus I was well embedded in the organization at AUT and connected within the external research community, which gave me a solid base of resources from which to leverage this research project. In sum we also had a rich network of actors in place, with varying degrees of experience working together, but each with a role to play in the collaboration. To this extent we met one of the requirements for action research outlined by Baskerville & Myers (2004, p.333) namely,

> "that there must be a collaborative team involved in reasoning, action formulation and action taking".

Even so, the context placed considerable constraints on our ability to act, with powerful institutional forces at the different sites proving at times quite obstructive to the joint endeavour. These constraints will be addressed fully in the analysis conducted in chapters six and following.

Taking a deeper look at the network and the 'level of typical researcher involvement' several levels were in operation. Baskerville & Wood-Harper (1998, p.95) have distinguished between:

> 1) *collaborative involvement* where "each worker is an equal co-worker with the study subjects. The study tasks are shared without distinction and the participants' backgrounds are assumed to be equally valuable";
>
> 2) *facilitative involvement* which "distinguishes the researcher as an expert among the study subjects. While the work is still cooperative, the tasks of the researcher and the subjects are quite distinct. The burden of solving the immediate problem setting rests with the study subjects";
>
> 3) *expert involvement* which "distinguishes the researcher as an expert among the study subjects and still involves cooperation and distinct tasks. However the burden of solving the immediate problem rests with the researcher".

During the collaboration I suppose that I must have alternated roles. Across sites we generally tried to operate in a mode of 'collaborative involvement', (which recognized the considerable expertise in global virtual collaboration at each site) but with Diana and myself coordinating from the Auckland site, that may have been perceived more in the nature of a 'facilitative involvement'. In our interactions with the servicing units I imagine we were seen to act more in the 'expert involvement' category, except for those situations where responsibility lay squarely with them. As far as the students were concerned, again a mixture was probably in operation, since even while no doubt seeing us as 'experts', we expected them as "co-researchers" (Clear & Kassabova, 2005) to operate within a 'facilitative involvement' umbrella, by resolving any issues themselves within their global virtual teams.

In the conduct of the collaboration itself, one explicit research goal had been stated as:

> "to explore the roles and actions of technology use mediators when using collaborative technologies in GVTs" *(cf. Appendix 9 below)*.

However, that was but one research goal of many and its precise scope had not been delimited. When it came to formalising this research study through AUT University's research ethics protocols (cf. appendices 1-3 below) and asking particular participants, who had performed in such roles, for their cooperation in releasing their email communications for analysis, I can only thank my colleagues for their generosity in supporting this work.

1.2 Motivation

McGrath (1985, p.16) has framed the research endeavour in the following manner:

> "All research involves the combination of some set of concepts, some set of methods for making observations and comparing sets of observations, and some set of substantive events that are to be the focus of study".

While McGrath may have projected an essentially positivist worldview, (somewhat at odds with the interpretivist leanings of this study), identifying the three separate domains (conceptual, methodological and substantive) is a useful distinction, when considering the purpose and contribution of a piece of research. This doctoral study began with the intention of contributing across all three domains.

Appendix 9 below identifies a number of goals of interest for the collaboration within which this study has been conducted, framed within the "dual cycle action research model" of McKay & Marshall (2001), and distinguishing the practitioner interest from the research interest. In a sense these were a wider set of goals than those specific to this study. But the roots of this study lie in an 'action research' context, with the dual goals "to *improve* and to *involve"* Carr & Kemmis (1983). Therefore a key driver has been that of contribution in McGrath's *substantive domain* of:

> "the real world systems and phenomena that are the focus of research" (1985, p. 16)

1.2.1 Substantive Motivations

From a 'big picture' perspective, *global virtual collaborations* hold considerable potential. Some *substantive* 'practice' goals from Appendix 9 were:

- Developing global collaborative capabilities in students
- Developing cross cultural understandings
- Demonstrating the challenges and complexities of working within GVT's

These goals sit squarely in the midst of topical discourses about "globalization" (Asprey et al., 2006) and "sustainability" (Mann & Smith (2007). So from an overall perspective, if this mode of learning can lead to improved global citizenship and understanding and (in the present climate of global warming) enhance sustainability by enabling global forms of working without the need for excessive air travel, then perhaps it may contribute significantly to the fostering of international understanding, peace and global sustainability.

{oooh lordy I've got the speech, I think I may stand for Miss World!! :-) }

More concretely as observed in the abstract of this thesis, repeated experience of dissatisfaction in our global virtual collaborations, in spite of the technology being in place has been a primary motivator for this work. Why is global virtual collaboration difficult? What roles and activities are critical? How can we do it better? These are not issues solely to do with the student actors in the global virtual teams, or just the

education domain, but more to do with the supporting cast, engaged in "activities which involve the shaping of other users activities of [technology] use" (Orlikowski et al., 1995). Thus came about my interest in exploring the *substantive* topic of *technology-use mediation*.

Of course *technology-use mediation* is but one component in supporting the work of Global Virtual Teams, but two related 'research' goals in the *substantive* domain from appendix 9 were:

- To explore the roles and actions of technology-use mediators when using collaborative technologies in GVT's
- To explore the moderator's role, and the facilitation process using collaborative technologies

1.2.2 Conceptual Motivations

McGrath (1985, p.16) has defined the *conceptual* domain as referring to "ideas that are abstract representations of aspects of such substantive phenomena". The rationale just outlined for better understanding *technology-use mediation* (TUM) as a substantive phenomenon, led to an interest in developing a conceptualisation through this study that would provide such an understanding. A further rationale comes from the literature, with this recent quote being germane:

> "Technology facilitation has been an important, yet neglected topic for many years [Niederman et al., 1996] about which we know little. Still, its importance seems to have increased as work has become increasingly computer mediated" (Thomas, Bostrom & Gouge, 2007, p. 85).

To further our knowledge of TUM then, demands that we build robust and enduring frameworks that will underpin our understandings of this substantive phenomenon. Providing such conceptual frameworks is one goal for this thesis.

1.2.3 Methodological Motivations

Beise et al., (2003) reviewing the many challenges in researching Distributed Group Support Systems have rued the "complexity of this type of research, largely due to the interaction of so many organizational, technology and individual participant variables". Therefore a further key motivation for this study is that any conceptual frameworks derived from the work, should be readily applicable to investigating the complex and multi-faceted phenomena associated with TUM in Global Virtual Teams. The study itself aims to provide exemplars of the application of *conceptual* and *methodological* frameworks, tools and techniques, which others could adopt (or adapt) to suit their own purposes in similar studies.

1.3 Research questions

At the outset of this work as noted in section 1.2.1 above and appendix 9 below, I operated more according to a set of research goals than highly specific research questions. At that time I lacked a clear enough perspective on the phenomenon under study to formulate one or more precise and succinctly expressed research questions. Therefore the original goals of the thesis were exploratory in nature and simply sought to gain greater understanding. The original formulation of those goals in the application for provisional admission (D1 - May 2004) was:

> The thesis explores the functioning of virtual groups, how they use the technologies available to them, and the role of technology use mediation processes in their effectiveness.

This formulation was refined in the application for confirmation of candidature (D9 - September 2005):

> This thesis aims to investigate the role of "technology-use mediation' in supporting the work of global virtual teams.
>
> This study aims to develop and apply a framework for researching technology-use mediation in global virtual teams.
>
> The aim is to gain deeper insight, in order to develop frameworks for the guidance of researchers investigating global virtual teams.

The latter three research goals to be addressed by the study incidentally addressed the *substantive*, *conceptual* and *methodological* domains respectively.

These have remained the goals of the work, which in the words of Gregor (2006, p.624) aim at developing a "theory for understanding…how and why things happen in some particular real world situation". In turn it is hoped that the resulting insights, theories and techniques will have applicability to other related contexts.

1.4 Intended contribution of the work

Again the three separate domains of McGrath (1985) (conceptual, methodological and substantive) offer a useful categorization, when considering the contribution of a piece of research. It is intended that the contributions of this study to our knowledge of *technology-use mediation in global virtual teams* will traverse all three domains. Accordingly the following summary of contributions resulting from this study is grouped by domain.

1.4.1 Contributions in the Substantive Domain

1) This study profiles a longitudinal field study of professionals in action within a *Global Virtual Team* (GVT) context, representing a 'real' (non student) GVT of global tertiary educators in collaboration.
2) It presents the first known, in depth, longitudinal study of *technology-use mediation* (TUM) in a professional GVT setting.
3) It studies GVTs in a tertiary education context, highlighting the roles of those supporting parties engaged in TUM activities outside the teams, but pivotal to the success of the venture.
4) It adds to the very few field studies in the area of "technology facilitation during team interaction" (Thomas et al., 2007, P.85).
    a. Note: while the above authors reported that they "know of no prior field study examining this topic", there is some prior work of my own in this area reporting field studies from 1999 onwards.
5) It adds to the few studies of long term virtual teams (Saunders & Ahuja, 2006)
6) Addresses a gap in the literature highlighted by (Saunders & Ahuja, 2006, p. 670) namely:
    a. To our knowledge, there have been no studies of the interaction of processes and structures in ongoing distributed teams.

1.4.2 Contributions in the Conceptual Domain

7) This study develops a novel theorisation of TUM by extending the "Adaptive Structuration Theory" (AST) of DeSanctis & Poole (1994), through the "Extended AST" (EAST) of Clear (1999a), to the subsequently derived theoretical framework of "Technology-use Mediated AST" (TUMAST).
8) The study develops a new theorisation of the notion of 'Collaborative Technology Fit' (*CTF*) and outlines the implications for research and practice.
9) The study presents an illumination of "culture" as a many faceted and multi-layered concept (individual – international) in a GVT context
10) The study exemplifies work based primarily upon the "ensemble" view of the IT artifact, in which the technology is "an evolving system embedded in a complex and dynamic social context" (Orlikowski & Jacono, 2001, p. 126) or a "web of computing" (Kling & Scacchi, 1982). This 'ensemble' view is combined with the view of "technology as structure" (DeSanctis & Poole, 1994) in which

structures have been embedded as rules and resources by designers of the technology, which are then appropriated in different ways during use.

11) The study augments the notion of "metastructuring" outlined by Orlikowski et al., (1995, p.438), by introducing an analytic mechanism through the new concept of a 'metastructure'.

1.4.3 Contributions in the Methodological Domain

12) This study contributes to our methodological knowledge through using TUMAST as an analytical framework through which to conduct a multi-level and micro level analysis of TUM as a phenomenon.
    a. In support of that view was this feedback recently provided by my colleague from St Louis

        > "I'd really emphasise that the extensions of AST are in fleshing out detail and looking at 'microlevel' events." (email correspondence Fred Niederman 10/05/2008).

13) The study has demonstrated the application of TUMAST as a research framework in a field study context, thereby demonstrating its viability for the study of TUM
14) The study has adapted and augmented the appropriation move types and sub-types of DeSanctis & Poole (1994) to accommodate 'TUM activity' in addition to actions of 'direct use'.
15) The thesis exemplifies the application of "Action Research" (McKay & Marshall, 2001), "Grounded Theoretic" (Glaser & Strauss, 1967) and "Structurational" methods (Poole & DeSanctis, 2004) to a field study of TUM in GVTs
16) It provides an example of the very few studies conducting analysis of a corpus of email data from multiple contributors (cf. Leuski 2004, & Kanawattanachai & Yoo, 2007).
17) The study addresses some practical issues in research analysis techniques with a corpus of email data

1.4.4 Contribution Summary

As can be seen, the claims for contribution of the work outlined above are many. Contributions have been asserted across the substantive, conceptual and methodological domains. These contributions can be further broken down into two levels at which novel outcomes have been achieved. The first level lies in the contributions of significantly new knowledge and the second in the adaptations or extensions of existing frameworks or methods. The substantive contributions of the thesis all lie in the significantly new knowledge category. The new conceptual contributions through the theories of 'TUMAST', 'Collaborative Technology Fit' (*CTF*), the illumination of the multifaceted nature of culture in a GVT context, and the accompanying notion of a 'Metastructure' could be considered the major contributions of the thesis and all in the significantly novel category. Methodologically the use of TUMAST as an analytical research framework is novel, as is the combination of *Action Research*, *grounded theoretic* and *structurational* analysis research methods to conduct micro level analysis of TUM.

Thus I believe this study has broken significant new ground, but that will be for the readers to judge. I hope the work speaks for itself and that it reads logically and clearly even if brevity is not its hallmark. While this may be a deficiency of the work, I gain comfort from the knowledge that crafting words well and succinctly takes time, but getting the message out is also important. As Coler (1974) has remarked

> "I believe it was Pliny the Elder who said words to the effect: *If I had more time I would have written a shorter letter*" (Coler, 1974, p.382)

Chapter 2: Literature Review

2.1 Introduction

This study investigates the role of "technology-use mediation' in supporting the work of global virtual teams. By nature this interdisciplinary work is informed by several different sources, and a daunting array of intersecting literatures, which will be briefly reviewed in this chapter. This study also builds in part upon an established body of my own work. As a literature review this chapter primarily serves the role of introducing the topic and the context for the work.

A fuller perspective on the informing literature will be gained if this chapter is read in conjunction with both chapter three, which further explores the conceptual origins of the work and develops the conceptual framework for the thesis, and chapter four which positions the work methodologically. Further, in some respects the rich data analysis which follows in subsequent chapters generates in itself a form of continuing review of the literature, as more specific themes emerge from the data. That situated form of review arises from grounded analysis, is very context specific, micro-analytic and in depth. For instance the extensive discussions related to the concept of 'culture' in the later section 6.4.4.1, and to the notions of 'time' and 'space' in section 6.4.4.4, exemplify that approach of contextual linkage to prior literature. Therefore it seemed most appropriate to set the context here, but delve into the literature in greater depth during the analysis, rather than presenting a multifaceted but necessarily decontextualised set of concepts related to *Technology-use mediation* through an extensive precursor literature review.

Technology-use mediation (TUM) as proposed by Orlikowski et al., (1995) refers to activities undertaken by those involved in *supporting the use of* information technology, rather than directly *using* the technology itself. For global virtual teams (GVTs) this involves the work of personnel who play intermediary roles which significantly impact upon GVT outcomes, yet are not well understood. For instance, Zigurs & Kozar (1994, p.277) have remarked that "Little is known about roles in technology supported environments" and more recently Thomas, Bostrom & Gouge (2007, p.85) have reported:

> "Technology facilitation has been an important, yet neglected topic for many years [Niederman et al., 1996] about which we know little. Still, its importance seems to have increased as work

> has become increasingly computer mediated. Here, we report findings of a study that addresses this need by isolating how virtual team (VT) leaders in the IS industry persuade their teams to effectively use ICTs through technology facilitation during team interaction. We know of no prior field study examining this topic".

In response to this directly related study, I communicated recently with Thomas and Bostrom by email (15/02/2008), an excerpt from which is given below:

> "I do in fact have several reported field studies from 1999 which you may find of interest, mostly delivered at conference venues in Educational Technology, and CS Education, plus an M. Phil study. These incorporate both AST and facilitation of global virtual teams in an educational setting, among other topics. While much of the work is also situated within the IS field, I have not reported this work in major IS venues (an omission I hope to rectify in due course), although I have conducted work with Professor Fred Niederman of St Louis University Missouri - a collaboration in 2004 - which is the subject of my Doctoral thesis".

The field study conducted within this thesis directly addresses "technology facilitation" as an aspect of TUM within Global Virtual Teams, and as communicated above has been preceded by prior studies of my own in this area (Clear, 1999a - included in full as appendix 10 below -; Clear, 2000, 2002b; Clear & Daniels, 2000; Clear, 2004a, 2004b; Clear & Kassabova, 2005).

The invited presentation which I gave at the ED-MEDIA conference in Seattle in 1999, (Clear, 1999a - included in full as appendix 10 below) could fruitfully be read in conjunction with this literature review, as it provides the originating theoretical basis for the study reviewed here. That paper provided a "general framework for analyzing technology facilitation roles", drawn from: the Group Support Systems (GSS) literature and the concepts of "process structure", "process support", "task structure" and "task support", (Nunamaker et al., 1993); the work of Bostrom et al., (1993) on "facilitation"; Ackermann's (1996) framework of a "meeting"; the Adaptive Structuration Theory (AST) of DeSanctis & Poole, (1994); and Orlikowski et al's (1995) notions of "metastructuring" and "technology-use mediation". Conceiving a global virtual collaboration as a "meeting analogue", and extending the AST model, the framework proposed enabled a focused analysis to be conducted of the facilitation process in the global virtual collaboration conducted between Auckland and Uppsala in 1998.
An excerpt from that paper linking *facilitation* with the *technology-use mediation* of Orlikowski et al., (1995) is given below:

> "***Facilitation is a dynamic process that involves managing relationships between people, tasks and technology, as well as structuring tasks and contributing to the effective accomplishment of the meeting's outcome***"(Bostrom et al. 1993). It is argued here that both *metastructuring* and *technology-use mediation* are closely allied to the concept of facilitation in GSS environments, whether in synchronous or asynchronous modes. (Clear, 1999a, p. 1760)

However the paper also foreshadowed the potentially wider applicability of the model developed:

> "Given the inherently dynamic nature of the facilitation process, a model capable of reflecting that is required. The base AST constructs have been built upon to incorporate the *technology-use mediation* dimension. This now gives us an **Extended AST Model,** which includes *technology-use mediation* as a further source and form of structure within the model. At this stage the concept is generic, and could include other mediation roles such as systems administrators or designers, but the term *technology-use mediator* should be read to mean *facilitator* for the purposes of this paper". (Clear, 1999a, p. 1763)

This thesis accordingly has taken up the challenge of applying the "**Extended AST Model" (EAST)** developed in that paper to a wider group of actors involved in *technology-use mediation* roles. While the full paper in appendix 10 below provides a deeper coverage of the concepts briefly touched on here, section 2.4 below expands slightly on the conceptual basis for the above developments. As will be noted below in chapter three, through the process of exploring *technology-use mediation* the original EAST conceptual framework from Clear (1999a) has been further developed through this study.

2.2Related Work

Apart from my own investigations, some work in this area has been conducted investigating particular aspects such as: facilitation of virtual meetings and teams (Niederman et al., 1996; Wheeler & Valacich, 1996; Pauleen & Yoong, 2001; Khalifa, Davison & Kwok, 2002; Panteli & Duncan, 2004); e-moderating (Salmon, 2000); roles relating to online multi media courses, (Oriogun et al., 2003; Hafner & Ellis, 2004); roles relating to computer supported collaborative work, (Smith et al., 1998, Guzdial et al., 2000); and TUM in differing organizational contexts (Okamura et al., 1994; Orlikowski et al., 1995; Bødker, 2000; Bansler & Havn, 2003, 2006; Lin & Davidson, 2007). However the focus of much virtual team literature tends to be either on the technology, the group processes or their interaction in a virtual team context, leaving a wide gap in our knowledge of technology-use mediation processes. As an example Pauleen (2003-2004, p.252), while studying 'leadership' in virtual teams has noted:

> "This research raises questions about the role of virtual team leaders as technology-use mediators...This study, although noting that leaders were using technology in new and unique ways, did not pursue this line of enquiry. It is clear...that leaders by assisting the adoption, adaptation, and use of ICT in presumably effective ways in their virtual teams, are in the

> 'frontline' of innovative technology use and are playing a potentially invaluable role as technology-use mediators for the wider organization".

Thus it appears that research in the area of "technology-use mediation" and particularly in the GVT context has been rather sparse, despite its acknowledged importance, and the impact of a changing global climate. Among these impacts are the contemporary trends of increasing globalisation (Asprey et al., 2006), reflected in phenomena such as "increased use of rapidly formed, temporary project teams reflecting multiple functions and often crossing legal firm boundaries" (Yates, Orlikowski et al., 1999, p.101). Changes to the skills and knowledge of Information Technology (IT) professionals have been noted, with one study arguing that the "most important skills that were needed were the ability to work effectively in diverse, global teams" (Reich & Nelson, 2003, p. 28). Yet in developing these skills we are still hampered by significant gaps in our knowledge about the functioning of global teams.

At the group level, how global virtual teams (GVTs) function and the ways in which they interact with the information technologies available to them remains a highly complex and little understood area.

Above the level of the group, in addition to interactions by team members themselves with the technology, the complementary and critical processes enacted by other supporting parties, known as "technology use mediators", have likewise been little explored.

Deeper understandings are required to comprehensively categorise these 'technology-use mediation' roles, the typical focus, tasks and constraints within which they operate, and their significance in supporting the work of GVTs. Such understandings may enable the design of more effective structures, processes, enabling technologies and policies, in order to support the work of GVTs in a variety of domains. Two areas of particular need relevant to this study lie: firstly in the educational domain, with learning designs involving international collaborations between student teams gradually becoming more common (Swigger et al., 2006); and secondly in the IT industry where enabling teams to adapt to the needs of globalised IT practices is an increasing imperative (Asprey et al., 2006).

While this study is primarily focused within the educational domain, IT professionals were included among the parties involved in supporting the collaboration, having to adapt themselves to working with international partners and to the challenges of globalised IT service provision.

This study employed a combination of commercial and prototype applications for *e-collaboration* - i.e. "*collaboration using electronic technologies among different individuals to accomplish a common task*" – (Kock, 2005a, p.i). This *e-collaboration* has involved local and international teams of students studying across computer science and information systems courses, while exploring how GVTs interacted with information technology and how GVTs were supported/hindered in their work.

This study builds on previous work by the author (as noted above), where a moderate body of work has been progressively developed. Underlying that work and informing this study are several frameworks, theories and insights, gained from writings in diverse fields including the following. The illustrative references cited below indicate the diverse literature and set of topics which have been drawn upon to background this work.

E-Collaboration (Kock, 2005a; Kock & Nosek, 2005)

- References introducing the notion of "e-collaboration", as explained in the prior paragraphs

Information Systems Research (Davidson & Chiasson, 2005; Jarvenpaa & Leidner, 1999; Lin & Davidson, 2007; Okamura et al., 1994; Orlikowski et al., 1995; Yates, Orlikowski et al., 1999; Panteli & Duncan, 2004; Pauleen, 2004; Pauleen & Yoong, 2001; Pinsonneault & Caya, 2005; Powell et al., 2004; Sarker & Sahay, 2003)

- Selected references reviewing: global virtual collaborations; introducing the concept of "*technology-use mediation*"; aspects of virtual teams including development of trust; and the notion of "genres" as recognizable patterns of behaviour or practices.

Group Support Systems – GSS (Beise et al., 2003; Chin et al., 1997; Chudoba, 1999; Poole & DeSanctis, 1992; DeSanctis & Poole, 1994; Dennis & Garfield, 2003; Ellis et al., 1991; Khalifa, Davison & Kwok, 2002; George & Jessup, 1997; Hettinga, 2002; Niederman et al., 1996; Romano et al., 1999; Salisbury et al., 2002; Wheeler & Valacich, 1996; Zigurs & Kozar, 1994)

- Selected references reviewing: GSS related phenomena; forms of facilitation in GSS and DGSS; GSS evolution over time; time and space dimensions of GSS; introducing Adaptive Structuration Theory (AST) and variants; introducing the concept of "breakdown analysis".

Computer Supported Collaborative Work – CSCW (Bansler & Havn, 2003, 2006; Bødker, 2000; Bødker & Andersen, 2003; Guzdial et al, 2000; Smith et al., 1998; Neale, Carroll & Rosson; 2004, Rick & Guzdial, 2006),

- Selected references reviewing: CSCW related phenomena; technology-use mediation; roles in CSCW; barriers to CSCW adoption; remote evaluation of distributed CSCW.

Global Collaborations in Computing Education (Berglund, 2005; Bruegge et al., 2000; Clear, 1999b; Clear & Kassabova, 2008; Cramton, 2001; Daniels, Petre et al., 1998; Daniels, Berglund et al., 1999; Favela & Pena-Mora, 2001; Hause, Petre & Woodroffe, 2003; Jarvenpaa Knoll & Leidner, 1998; Jarvenpaa & Leidner, 1998, 1999; Jones et al., 2002; Kim et al., 2002; Klein et al., 2000; Last et al., 2000; Last et al., 2002; Last, 2003a; Montoya-Weiss et al., (2001); Purvis et al., 2004; Qureshi & Vogel, 2001; Richardson et al., (2006); Rutkowski, Vogel, Bemelmans et al, 2002; Swigger et al., 2006; van Genuchten & Vogel, 2007)

- Selected references highlighting: global virtual student collaborations (mostly in computing discipline based courses (CS, SE, IS & some business); common courses; experiences and challenges.
- Associated with this literature in the educational context are selected readings in the global software engineering literature from the software practitioner context:
    - (e.g.) Casey & Richardson, 2006; Herbsleb & Paulish, 2005; MacGregor et al., 2005; Treinen & Miller-Frost, 2006;

Educational Technology Roles (Clear, 1999a; Salmon, 2000; Oriogun et al., 2003, Hafner & Ellis, 2004)

- Selected references reviewing: TUM related phenomena in an educational context; TUM related roles in education; 'Extended' AST (EAST) as a framework for reviewing facilitation in global virtual collaborations.

Small Group & Psychological Research (Arrow et al., 2004; Arrow et al., 2005; McGrath 1991; McGrath et al., 2000; Mennecke & Hoffer (1992); Ilgen et al., 2005; Saunders & Ahuja, 2006)

- Selected references reviewing: small group related phenomena, mostly in a GSS context; group theory; group development over time; groups with history; research approaches addressing groups as dynamic systems.

As the above list attests, researching *technology-use mediation in global virtual teams,* in combination with *global collaborations in computing education*, is a complex undertaking. DeSanctis & Poole (1994) and Neale et al., (2004) as researchers publishing a decade apart, have observed the inherent complexity in evaluating advanced technology use, in the former case with GDSS systems and co-located participants, in the latter case with CSCW systems supporting remote and distributed participants. The latter case reflects the global virtual team context under investigation in this study.

Not only has research into global virtual collaboration developed over time, but as observed by Kock & Nosek (2005, p.3), 'e-collaboration research' is a multi-disciplinary endeavour, which is made up of several research streams, with "their own separate and somewhat independent traditions". Many of these research streams struggle to remain aware of developments in related streams. For instance the CSCW research community has tended to have a focus upon design issues for collaborative technologies, whereas in the GSS research stream, the focus has been upon electronic meeting systems and their impacts in improving the effectiveness of meetings in organisational contexts. Thus research in the area which Kock terms 'e-collaboration', unless following a tight line of enquiry based upon earlier work in one of these streams (e.g. GSS research), will tend to draw upon insights from several related disciplines and literature streams.

One appropriate framework within which to situate this work comes from the early groupware literature and the "time - space taxonomy" of Ellis et al., (1991). As a simple but useful framework for describing the use of a GSS application, it also serves to position this study of global virtual teams across three continents and widely disparate time zones (as outlined below), predominantly in the "asynchronous distributed interaction" quadrant.

	Same time	***Different times***
Same Place	*face-to-face interaction*	*asynchronous interaction*
Different Place	*synchronous distributed interaction*	*asynchronous distributed interaction*

Figure 2.1 Groupware: Time - Space Taxonomy (Ellis et al. 1991, P.41)

2.2.1 Virtual Team Research Themes and Researchers

Qureshi & Vogel (2001, p.28) investigating the question "how do computer supported virtual teams adapt to change?" have produced a mapping of "a sample of research groups studying collaborative technology support for teamwork…to reveal a map of the principle factors of current research". These factors are depicted in figure 2.2 below.

Table 3. Adaptation and organisational challenges in computer support for virtual teamwork

	Adaptation		
Challenges	Technological	Work	Social
Structure	Electronic communications network infrastructure enabling any time/ any where connectivity.	Numerous, smaller decentralised units resulting from virtual teamwork.	Reporting, linking or control mechanisms for virtual teamwork.
Specialisation	Interoperability of different communication protocols.	Job mobility, reciprocal and sequential interdependencies.	Emergence of trust and virtual teamwork as a formal channel of communication.
Coordination	Collaborative technology, group support and/or electronic communications design and development.	Task allocation based on skill and expert knowledge.	Emerging conventions for content structuring and interpersonal.
Task	Tools for information storage and accessibility according to task requirements for information availability and access to relevant skill and expertise.	Facilitation of the content of virtual teamwork combined with moderation and chairing.	Communication etiquette and ability to exchange knowledge electronically.
Learning	Development and effective use of organisational memory and learning mechanisms.	Adaptiveness to new virtual team-working relations and continuous readjustment.	Responsiveness to change and creation of combined action.

Figure 2.2: Adaptation and Organisational Challenges in Computer Support for Virtual Teamwork (from Qureshi & Vogel 2001, p.36)

The concept of *technology-use mediation* (TUM) is not readily discernable from the above figure, although it is embedded within specific categories, for instance "facilitation of the content of virtual teamwork combined with moderation and chairing". However in many cases TUM traverses the vertical and horizontal categories defined in the above table, in rather less defined ways. It may for instance subsume aspects of task design, coordination processes, technology configuration and continuous readjustment across technology, work and social spheres. The detailed analysis in chapter six below provides many illustrative examples. The research groups and their

areas of focus based on the above categorization by Qureshi & Vogel (2001) are depicted in figure 2.3 below.

Table 5. Research groups in terms of organisational challenges and adaptation

Challenges	Adaptation		
	Technological	Work	Social
Structure	Queen Mary and Westfield College, UK Harvard Business School, USA	Massachusetts Institute of Technology, USA Erasmus Univ. Rotterdam, NL	Massachusetts Institute of Technology, USA
Specialisation	University of Arizona, USA Roskilde University, Denmark Harvard Business School, USA	Copenhagen Business School, Denmark University of Texas, Austin	Massachusetts Institute of Technology, USA
Coordination	Massachusetts Institute of Technology, Centre for Coordination Science, USA Roskilde University, Denmark Queen Mary and Westfield College, UK	Massachusetts Institute of Technology, Centre for Coordination Science, USA Delft Univ. of Technology, NL	Massachusetts Institute of Technology, USA
Task	Indiana University, USA Massachusetts Institute of Technology Centre for Coordination Science, USA New Jersey Institute of Technology, USA Queens Mary and Westfield College, UK Roskilde University, Denmark University of Arizona, USA University of Calgary, Canada University of Michigan, USA University of Minnesota, USA University of Strathclyde, UK	City University of Hong Kong Claremont University, USA Delft Univ. of Technology, NL Erasmus Univ. Rotterdam, NL Indiana University, USA University of Arizona, USA University of Baltimore, USA University of Calgary, Canada University of Colorado, Boulder USA University of Georgia, USA University of Maryland, USA University of Michigan, USA University of Strathclyde, UK	Massachusetts Institute of Technology, USA Erasmus Univ. Rotterdam, NL Harvard Business School, USA University of Texas, Austin
Learning	Indiana University, USA Massachusetts Institute of Technology, Centre for Coordination Science, USA New Jersey Institute of Technology, USA University of Arizona, USA University of Minnesota, USA University of Strathclyde, UK	City University of Hong Kong Claremont University, USA INSEAD, France National University of Singapore, Singapore University of Baltimore, USA University of Maryland, USA University of Strathclyde, UK University of Texas, Austin	Claremont University, USA INSEAD, France University of Strathclyde, UK University of Texas, Austin

Figure 2.3: Research Groups in Terms of Organisational Challenges and adaptation (from Qureshi & Vogel 2001, p.40)

As can be seen the collaborations upon which this work is based do not figure in the above table, in part because this work has taken place within a differing literature (mostly computer science and software engineering education research). However as Qureshi and Vogel (2001, p.43) have remarked "given enhanced attention to globalization" there is "more international variety in the research groups" and "the historical research group profile becomes murkier as new and less well defined research groups enter into the picture…emerging as well are research groups that represent partnerships between organisations putting globalization into practice". The 2001

publication date will have meant too, that some newer initiatives will not have been included. The work reported in this thesis comes from the latter emergent grouping, and tends (as Qureshi & Vogel, 2001, p.43 have indicated) to "broaden the range of issues being investigated, which brings forth a richer set of methodologies".

2.3 Study Approach

The approach in this study therefore, tends to be less that of following tightly in the footsteps of a single research stream, than of synthesising insights from many streams considered able to make a useful contribution. In general terms this study does use Adaptive Structuration Theory (DeSanctis & Poole, 1994) as an informing base framework, with significant extensions. To that extent it is well grounded in the Information Systems/Organization Science and GSS literatures, but it borrows the notion of roles (Guzdial et al., 2000) from the CSCW literature, perspectives on time and virtual team development from the small group literature, and insights about global virtual student teams from Computer Science, Software Engineering and Information Systems Education sources.

This doctoral study has its own temporal dimension as it continues to build on its origins within a longitudinal Action Research programme, applying an Action Research methodology (cf. Clear 2000, 2002b; Clear & Daniels, 2000; Clear, 2004; Clear & Kassabova, 2008). Large amounts of existing data from several previous action cycles are available for analysis, and further global collaborative trials and developments are planned. This doctoral study therefore fits within the context of an active current programme of research, within which it represents a particular focus of enquiry. Chapter four will elaborate upon the methodological aspects of this study, and situate the work within the overall research programme.

That broader research programme arose as a loose extension of the international student collaboration undertaken between three universities - Uppsala in Sweden, Grand Valley State in Michigan, and the Open University of UK. This significant Swedish Government funded collaboration known as the "RUNESTONE" project has contributed several academic articles and doctoral theses to the Computer Science Education literature, (e.g. Berglund, 2005; Daniels, Petre et al., 1998; Daniels,Berglund et al., 1999; Hause, 2004; Hause, Petre & Woodroffe, 2003; Last et al., 2000; Last et al., 2002; Last, 2003a, 2003b). Several action cycles have been traversed over the period from 1997 to the present, with an M.Phil thesis (Clear, 2000) reporting the findings from one prior cycle namely the 1999 international collaborative trial. The focus of this

study is the 2004 international collaboration, in which AUT University of Auckland New Zealand, Uppsala University of Uppsala, Sweden and St Louis University of St Louis Missouri, USA participated.

Different frameworks have informed previous analysis of each action cycle, but in this thesis a novel unifying framework has been developed, representing a further expansion upon Extended Adaptive Structuration Theory [EAST], (Clear, 1999a). That framework will be further elaborated in chapter three below.

2.4 Study Basis

As noted above, the study 'methodology' and 'framework' components will be more fully elaborated in their respective chapters, and they should be read in conjunction with this chapter. To avoid undue repetition therefore, the remainder of this chapter will provide merely an introductory overview of the key theoretical concepts informing this study.

2.4.1 Structuration Theory and Information Technology

The structuration theory of Anthony Giddens (1984) has been used by several writers in the IS field as an integrating "meta-theory", with the power to explain many apparent paradoxes (Orlikowski & Robey, 1991; Orlikowski, 1992; DeSanctis & Poole, 1994). It has been used to explain the disjuncture between a particular technology design, and the differing ways in which users appropriate Information Technologies. This appropriation process sometimes occurs in a way that totally subverts the intentions of the designers, and draws into distinction "the difference between technology as a product and technology in use" (Karsten, 1999, p.44). Barley (1986, p.78) has viewed technology "as an occasion for structuring" and Poole & DeSanctis (2004, p. 211) have argued that:

> "the structural set available to technology users is not 'fixed' but instead produced and reproduced in the context of use. This is an 'ensemble' view of technology (Orlikowski & Iacono, 2001). It assumes that technology and user behavior co-evolve as a structurational process during the course of human-computer interaction".

This general perspective on the process of technology structuring, as a reflexive process wherein the users of a system are both shaped by the system and act in turn to shape the system itself, provides a key theoretical underpinning for the thesis.

2.4.2 Metastructuring

In an extension of the notion of "technology structuring" beyond the direct actions of "users" Orlikowski et al., (1995, p.425) have introduced:

> "another set of activities that, although carried out by users, are not activities of use. Rather they involve the shaping of other users activities of use, a process we designate as ***Metastructuring.***"

> "a particular type of metastructuring***, technology-use mediation***, and find that it structures users' use of technology by influencing their interpretations and interactions, by changing the institutional context of use and by modifying the technology itself".

As "a sanctioned, explicit, deliberate and ongoing set of activities" (ibid.) the authors argue that *technology-use mediation* is a powerful mechanism in dynamically adapting technology to changes in its context of use. Orlikowski and colleagues portrayed a cycle of four primary *technology-use mediation* activities: beginning with *establishment*, (when the technology is initially set up); *adjustment* and *reinforcement* (adjusting use of the technology or encouraging its use occurring mid-process); and *episodic change* (when the technology underwent some form of radical revision). This set of metastructuring activities are of primary concern to this thesis, which investigates *technology-use mediation* in global virtual teams.

2.4.3 Adaptive Structuration theory

A specific GSS related framework based upon structuration theory, (but not including the concept of *metastructuring*), has been developed by DeSanctis & Poole (1994). Known as Adaptive Structuration Theory (AST), it has proposed a dynamic input - process - output model to reflect the processes and the technology interactions, which typify G(D)SS environments.

DeSanctis & Poole (1994, p.125) have argued that "Adaptive Structuration Theory [AST] extends current structuration models of technology triggered change to consider the mutual influence of technology and social processes...Its goal is to confront 'structuring's central paradox: identical technologies can occasion similar dynamics and yet lead to different structural outcomes' (Barley 1986, p.105)". The model is not

wholly one of cause and effect, but "is consistent with contingency theories in proposing that use of advanced information technologies may vary across contexts" (DeSanctis, & Poole, 1994, p.128). Thus the AST model has been designed to support the analysis of technology appropriation processes, within the complexities of a GSS context. It owes its basic 'input-process–output' format to prior roots in the small group research (Hackman and Morris, 1975 [cited in Whitworth, 1997 p. 11]; Ilgen et al., 2005) and studies of "group process and outcomes" in GDSS and EMS (Electronic Meeting Systems) research contexts (e.g. Dennis et al., 1988; Nunamaker et al., 1991). Typically such models "contend that the effects of EMS use are contingent on a myriad of group, task, context and technology factors that differ from situation to situation" (Nunamaker et al., 1991, p.45).

AST forms a key theoretical base for subsequent work developed within this thesis. A fuller outline of the constructs, sources of structure and major propositions of the AST framework is given in chapter three below.

2.4.4 Extended Adaptive Structuration Theory (EAST)

My own contributions, developing upon this literature, have come from the combining of the AST and "*metastructuring/technology-use mediation*" frameworks (cf. Clear, 1999a; *appended as appendix 10 of this thesis*). In that paper I introduced an extension to the AST model, which addressed the "facilitator" role within an international collaboration.

> "The base AST constructs have been built upon to incorporate the technology-use mediation dimension. This now gives us an **Extended AST Model,** which includes technology-use mediation as a further source and form of structure within the model. At this stage the concept is generic, and could include other mediation roles such as systems administrators or designers, but the term technology-use mediator should be read to mean facilitator for the purposes of this paper" (Clear, 1999a, p. 1763).

This 'Extended AST' (EAST) model augmented the three AST constructs dealing with sources and forms of structure, as summarized below. A fuller exposition will be given in chapter three below.

- **"Other Sources of Structure**
    - has had the *technology-use mediator* (facilitator) added, with the assumption that much of this intervention would occur during either the *establishment* or *reinforcement* modes of activity…

- **Emergent Sources of Structure**
    - has had the technology-use mediator (facilitator) added, with the assumption that much of this intervention would occur during the *adjustment* mode of activity…
- **New Social Structure**
    - has had the technology-use mediator (facilitator) added, with the assumption that much of this intervention would occur during the *episodic* mode of activity…" (Clear, 1999, p. 1763)

I have used this EAST framework (cf. Clear 2000, Clear & Daniels, 2000), to support more conscious design of elements of collaborative trials (e.g. task design, consciously spelling out and reinforcing the open and shared spirit of individual contributions in groupware environments, designing consensus building processes). The framework has also proved useful for guiding the reflective process when evaluating how effective are certain practices, (e.g. facilitation techniques), in each research cycle.

2.5 Chapter Summary

This chapter has briefly motivated the research, and in noting related work has also observed the paucity of prior studies investigating *technology-use mediation in global virtual teams*. The context setting role of this chapter has been outlined, together with its relationship to the subsequent conceptual framework and methodological chapters. A brief introduction to the prior conceptual work which I have undertaken in the area has been given, to highlight the origins of this study. The broader context has been provided through an overview of the diverse literature base which has informed this study. The researchers in the area of 'virtual teamwork', and their areas of focus have been briefly traversed, while noting the orthogonal nature of this study to much of their work. The progress of this research within a wider longitudinal action research programme has also been profiled. The chapter has sketched the theoretical underpinnings of the study in structuration theory and subsequent derivations within the IS and GSS literatures, augmented by my own work as applied in the context of global virtual collaborations.

Chapter three will now proceed to expand on developments from this point. It explains the further adaptations arising from this study, which have resulted in a new theoretical framework derived for evaluating *technology-use mediation* within *global virtual teams*.

Chapter 3: A Conceptual Framework for Technology-use Mediation in Global Virtual Teams

3.1 Introduction

This chapter outlines a conceptual framework for the study of technology-use mediation (TUM) in global virtual teams. This framework has been developed over some time (cf. Clear 1999a, 2000; Clear & Daniels 2000). Its origins lie in the "Adaptive Structuration Theory" (AST) of DeSanctis & Poole (1994), which aimed at "capturing the complexity in advanced technology use", particularly the use of Group Decision Support Systems (GDSS). This focus on activities of 'technology use' meant that AST had inherent limitations when investigating TUM which, as outlined below, demands an expanded scope of enquiry to include activities and roles beyond those of 'direct use'. Therefore, developing a framework for investigating the activities involved in TUM has required an extension of the AST model.

The original exposition of this framework as "Extended Adaptive Structuration Theory" (EAST) was presented at an invited speaker session at the ED-MEDIA conference in 1999. That paper is attached in full as appendix 10, and could fruitfully be read in conjunction with this chapter.

In this further extension several different threads of thought are integrated from the Group Support Systems (GSS), Information Systems and related literatures, and will be outlined below. In the terminology of Gregor (2006, P.624) this framework represents a "theory for explaining", with a primary focus on *how* and *why* TUM occurs in a Global Virtual Team context. The framework strives to strike a happy medium between parsimony and richness to reflect the inherent complexity of the multiple dimensions under study, but it does not claim to be exhaustive. For instance it fails to address the important but elusive question of "motivation" (cf. Clear & Kassabova, 2005). In part this has been due to the framework's original basis in AST.

Some authors such as Nyerges & Jankowski (1997) have proposed significant enhancements to the AST model which have captured additional elements. Yet despite that model being much more complex than the already rich AST model, the authors concluded by noting, "we are not so bold as to claim that the above aspects are the necessary but sufficient ones" (Nyerges & Jankowski, 1997, p. 238). Even so, their enhancements have had a lesser impact within the more specific field of Geographic

Information Systems (30 citations versus 877 for the original AST – from a Google Scholar search, 6/05/2008).

Thus it would appear that models of complexity, to make a usable contribution, must not themselves be too complex. The framework outlined below, aims to walk a middle path. In sum I would term it conceptually rich but pragmatic nonetheless. The early part of this chapter borrows heavily from the earlier explication of this material in the author's M. Phil thesis (Clear, 2000).

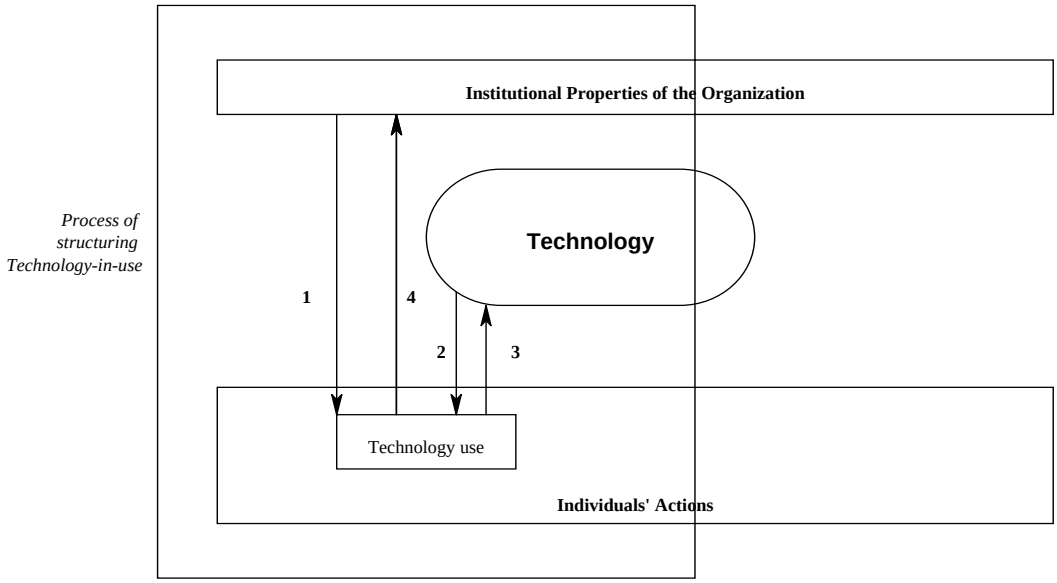
3.2 Structuration Theory in the GSS literature

The structuration theory (ST) of Anthony Giddens (1984) has been used by several writers in the GSS field as an integrating "meta-theory", with the ability to explain many apparent paradoxes arising from the *interaction* effects of the technology and its use (Orlikowski & Robey, 1991; Orlikowski, 1992; Lyytinen & Ngwenyama, 1992; Orlikowski, Yates et al., 1995; DeSanctis & Poole, 1994; Chin et al., 1997; Nyerges & Jankowski., 1997; Chudoba, 1999; Majchrzak et al., 2000; Maznevski & Chudoba, 2000; Olesen & Myers, 1999; Karsten, 1999; Clear, 1999a; Chudoba, 1999; Dennis et al., 2001; Markus, 2005; Pozzebon & Pinsonneault, 2005; Limayem, 2006; Schiller & Mandviwalla, 2007; Coakes et al., 2008; Nikas & Poulymenakou, 2008).

It has been used to explain the disjuncture between a particular technology design, and the differing ways in which users appropriate Information Technologies. This appropriation process sometimes occurs in a way that totally subverts the intentions of the designers, and draws into distinction "the difference between technology as a product and technology in use" (Karsten, 1999, p.44).

In the figure below Orlikowski et al., (1995, p.426) have depicted the interaction effects in the "process of technology structuring", a reflexive process wherein the users of a system are both shaped by the system, and act in turn to shape the system itself.

Process Of Technology Structuring
Adapted from Orlikowski (1992)



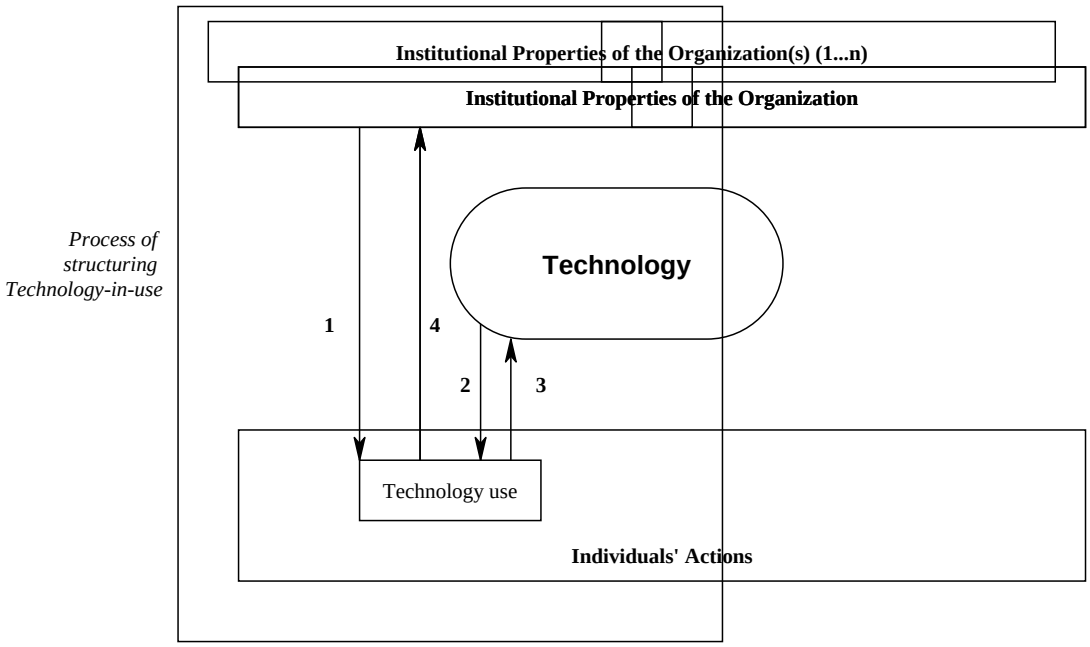
Key:

Arrow 1: Institutional conditions for use
Arrow 2: Technological conditions for use
Arrow 3: Technological consequences of use
Arrow 4: Institutional consequences of use

Figure 3.1: The Process of Technology Structuring

The inherently interorganizational context of Global Virtual Teams, begs the question then, what is the 'institution' across multiple organizations? In response the slightly adapted model below is suggested, (with scope for *n* participating organizations).

Process Of Technology Structuring in a Global Virtual Team Context
Adapted from Orlikowski (1992)



Key:

Arrow 1: Institutional conditions for use
Arrow 2: Technological conditions for use
Arrow 3: Technological consequences of use
Arrow 4: Institutional consequences of use

Figure 3.2: The Process of Technology Structuring in a Global Virtual Team Context

3.2.1 Metastructuring

Elaborating on the 'Technology Structuring' model, Orlikowski and colleagues (1995, p. 425) have introduced:

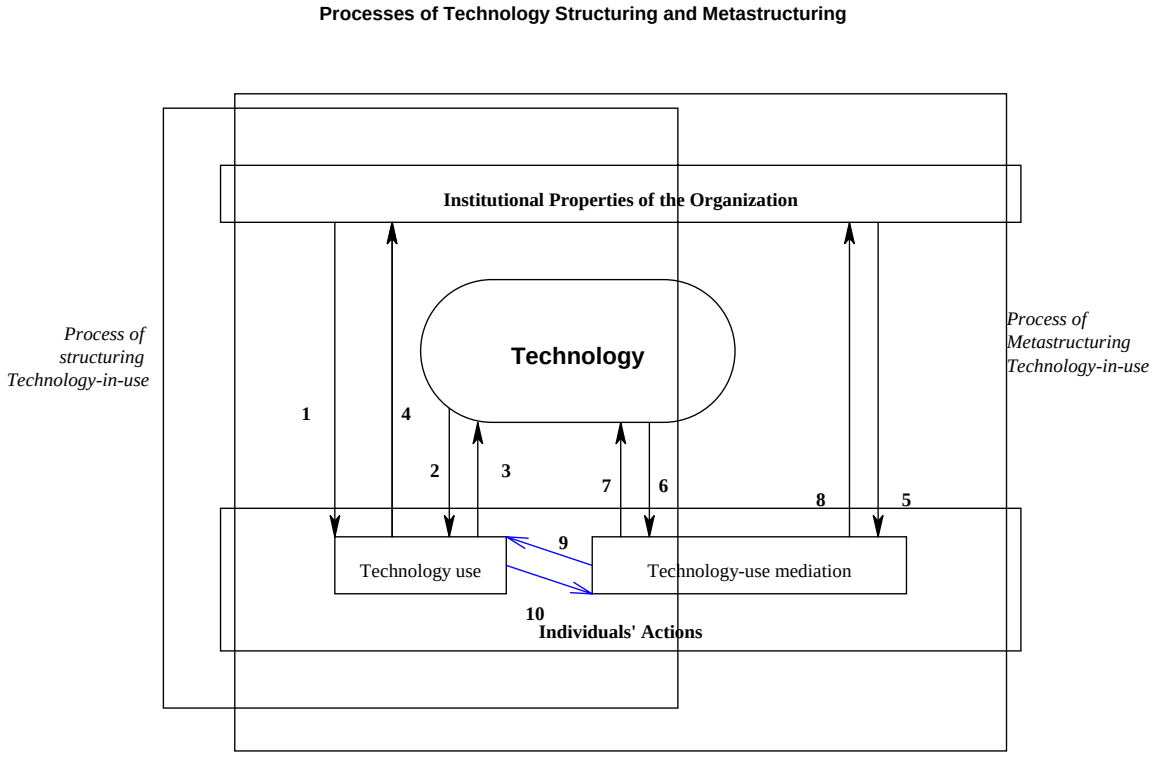
> "another set of activities that, although carried out by users, are not activities of use. Rather they involve the shaping of other users activities of use, a process we designate as ***Metastructuring.***"

This process they further defined by identifying:

> "a particular type of metastructuring***, technology-use mediation***, and find that it structures users' use of technology by influencing their interpretations and interactions, by changing the institutional context of use and by modifying the technology itself. Because *technology-use mediation* is a sanctioned, explicit, deliberate and ongoing set of activities, we argue that it is a particularly powerful mechanism in the context of dynamic organisations, enabling rapid

and customised adaptations of the technology and its use to changes in circumstances, organizational form and work practices" (Orlikowski et al., 1995, p.425).

These processes are depicted in figure 3.3 below.



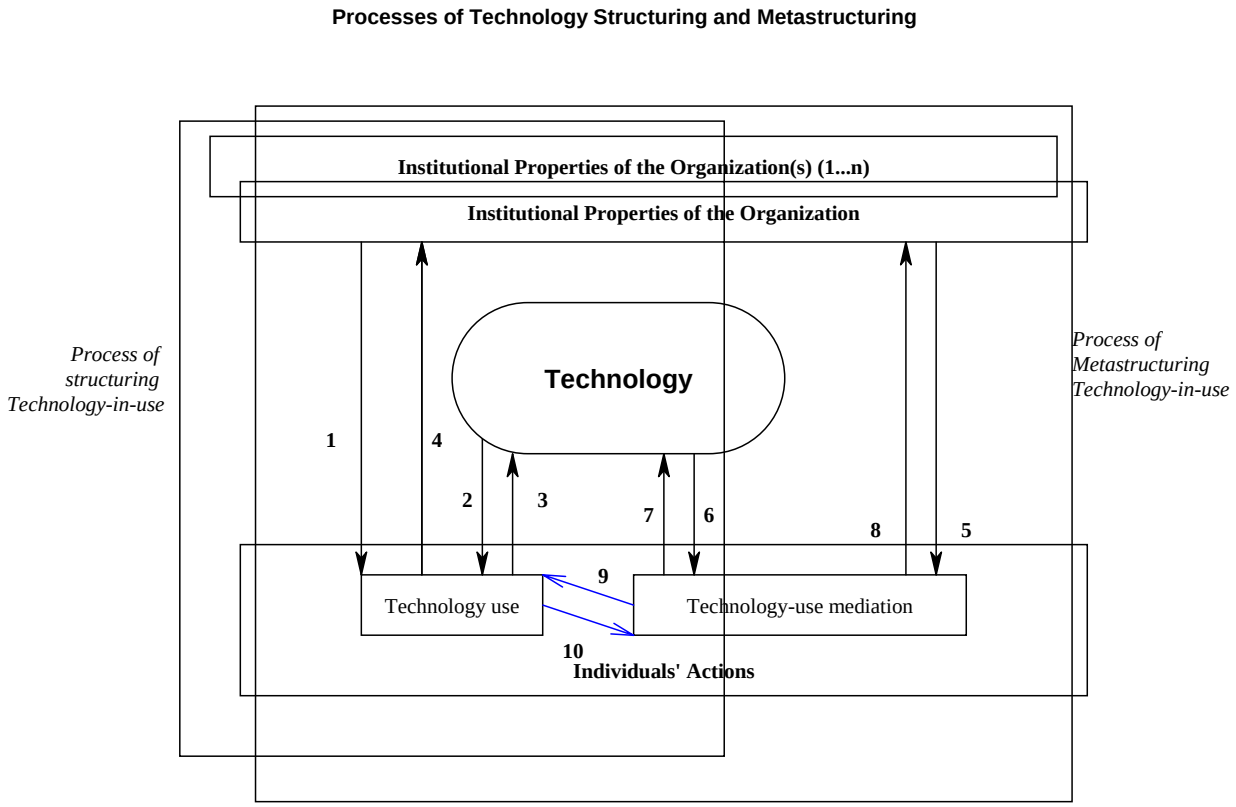
Key:

Arrow 1: Institutional conditions for use	Arrow 5: Institutional conditions for mediation	Arrow 8: Institutional consequences of mediation
Arrow 2: Technological conditions for use	Arrow 6: Technological conditions for mediation	Arrow 9: User consequences of mediation
Arrow 3: Technological consequences of use	Arrow 7: Technological consequences of mediation	Arrow 10: User conditions for mediation
Arrow 4: Institutional consequences of use		

Note: Arrows 9 and 10 are dotted to indicate that the interactions are mediated through the institutional properties. We show a direct relationship for expository convenience.

Figure 3.3: The Processes of technology structuring and metastructuring (Orlikowski et al., 1995, p.438)

An adaptation of the model in figure 3.3 to encompass metastructuring in a 'GVT context' is depicted below as figure 3.4, and again incorporates the notion of multiple organizations. This depiction is provided here largely for convenience sake, rather than as a fully developed extension of the model outlined by Orlikowski et al., (1995). No doubt further interaction effects would arise from the added layers of institutional complexity.



Arrow 1: Institutional conditions for use

Arrow 2: Technological conditions for use

Arrow 3: Technological consequences of use

Arrow 4: Institutional consequences of use

Arrow 5: Institutional conditions for mediation

Arrow 6: Technological conditions for mediation

Arrow 7: Technological consequences of mediation

Arrow 8: Institutional consequences of mediation

Arrow 9: User consequences of mediation

Arrow 10: User conditions for mediation

Note: Arrows 9 and 10 are dotted to indicate that the interactions are mediated through the institutional properties. We show a direct relationship for expository convenience.

Figure 3.4: The Processes of technology structuring and metastructuring in Global Virtual Teams (adapted from Orlikowski et al., 1995, p.438)

3.3 Derivative Conceptual Frameworks.

3.3.1 Adaptive Structuration Theory

A specific GSS related framework based upon structuration theory, (but not including the concept of *metastructuring*), has been developed by DeSanctis & Poole (1994). Known as Adaptive Structuration Theory (AST), it proposes a dynamic input - process - output model to reflect the processes and the technology interactions, which typify G(D)SS environments, and by extension the forms of "web-based groupware" (Dennis et al., 1998, Wheeler et al., 1999) addressed in this thesis.

AST asserts itself as a research framework based upon neither the positivist decision theoretic school nor the purely institutional school, but a third school of thought which DeSanctis & Poole (1994, p.124) have termed the *social technology* perspective. "This third school has advocated 'Soft-line' determinism, or the view that technology has structures in its own right but that social practices moderate their effects on behavior" (ibid., p.125). They argued that "Adaptive Structuration Theory [AST] extends current structuration models of technology triggered change to consider the mutual influence of technology and social processes", with the goal to "confront 'structuring's central paradox: identical technologies can occasion similar dynamics and yet lead to different structural outcomes' (Barley 1986, p.105)" (ibid). In outlining the propositions of AST DeSanctis & Poole noted that "the theoretical propositions presented here can be refined to formulate specific hypotheses, thus providing an empirical research agenda" (1994, p.125). Thus the model is not wholly one of cause and effect, but "is consistent with contingency theories in proposing that use of advanced information technologies may vary across contexts" (DeSanctis, & Poole, 1994, p.128).

AST takes an interactionist view of technology, wherein advanced information technologies (AIT) provide structures which are believed to both constrain and shape human action and in turn be shaped by that action, with the resulting outcome being an interlinked amalgam of both. To this extent the views of DeSanctis & Poole (1994) & the more recent views of Orlikowski appear to partly concur. Markus (2005, p.7) notes that Orlikowski (1992) has refined her ST informed views that "the process of technology design embeds social structures (rules and resources) in technology". More recently (2000) Orlikowski has "rejected the notion of embedded structures" arguing that structures only emerge when "people interact recurrently with whatever properties [features] of the technology are at hand, whether these were built in, added on, modified

or invented on the fly" (Markus, 2005, p.7). TUM activity, as argued in this thesis is a key dimension of such interactions.

An outline of the constructs, sources of structure and major propositions of the AST framework drawn from DeSanctis & Poole (1994), is now given below:

The **input** constructs are:

- Structure of AIT
- Other sources of structure
- group's internal system

The **process** constructs relate to social interaction and are:

- appropriation of structures
- decision processes
- emergent sources of structure
- new sources of structure

The **output** constructs are:

- decision outcomes
- new sources of structure (both process and output)

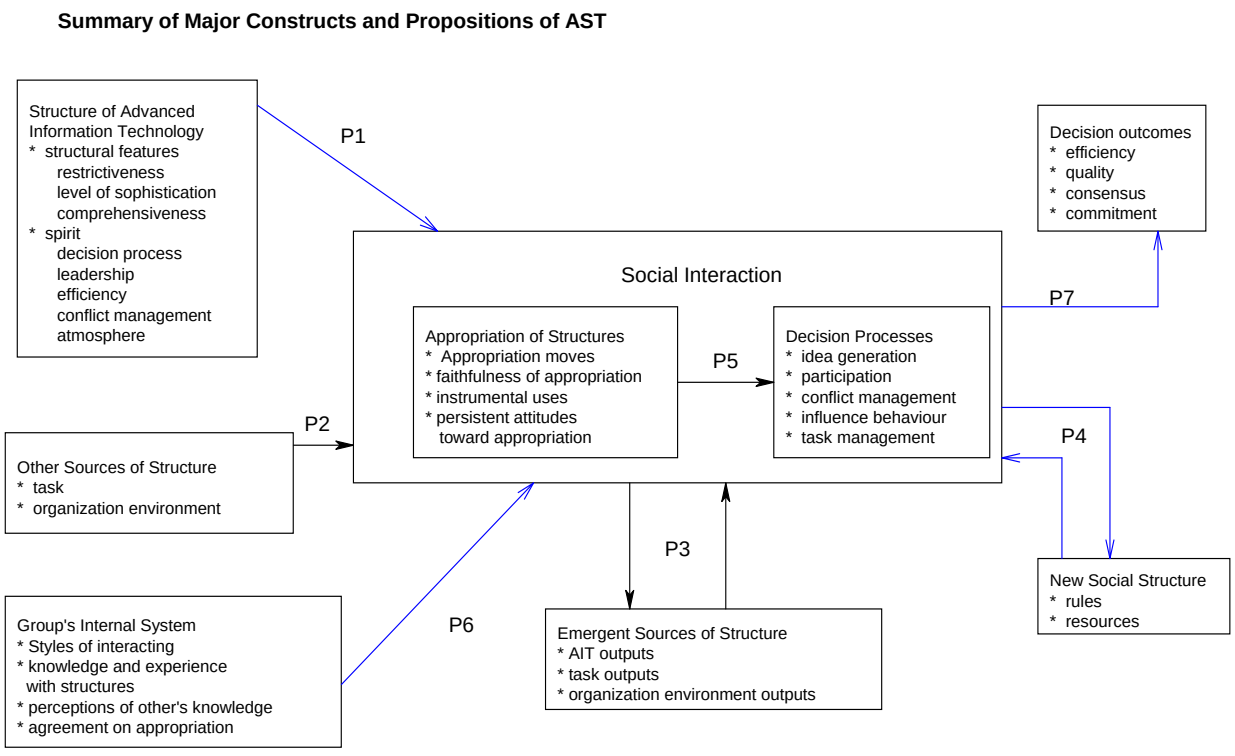


Figure 3.5: Summary of Major Constructs and Propositions of AST

Structure Source	Definition	Examples in GDSS context
AIT (A)	advanced information technology including hardware, software and procedures	Keyboard input devices, viewing screens, group notetaking, voting modules, decision models
AIT outputs (AO)	data, text, or other results produced by the AIT software following input by group members	Displays of group votes, lists of ideas, opinion graphs, modelling results
Task (T)	task knowledge or rules; including facts and figures, opinion, folklore, or practice related to the task at hand	A budget task, customary ways of preparing budgets, specific budget data, budgeting goals and deadlines
Task outputs (TO)	the results of operating on task data or procedures; the results of completing all or parts of a task	Budget calculations; the implications of certain budget figures for other budget categories
Environment (E)	social knowledge or rules of action drawn from the organization or society at large	Applying a "spread the wealth" principle to budget allocation; applying a "majority rule" decision procedure to votes; reference to corporate spending and reporting policies
Environmental outputs (EO)	the results of applying knowledge or rules drawn from the environment	Implications of corporate spending policies for the budget process; the results and implications of applying a "majority rule" decision procedure to votes that have been taken

Table 3.1: Major sources of structure and examples of each

P1. ***AIT's (Advanced Information Technologies) provide social structures that can be described in terms of their features and spirit. To the extent that AIT's vary in their spirit and structural feature sets, different forms of social interaction are encouraged by the technology.***

P2. ***Use of AIT structures may vary depending on the task, the environment, and other contingencies that offer alternative sources of social structures.***

P3. ***New sources of structure emerge as the technology, task and environmental structures are applied during the course of social interaction.***

P4. ***New social structures emerge in group interaction as the rules and resources of an AIT are appropriated in a given context and then reproduced in group interaction over time.***

P5. ***Group decision processes will vary depending on the nature of AIT appropriations.***

P6. ***The nature of AIT appropriations will vary depending on the group's internal system.***

P7. ***Given AIT and other sources of social structure,*** $n_1 \ldots n_k$, **and** ***ideal appropriation processes,*** **and** ***decision processes that fit the task at hand,*** **then** ***desired outcomes of AIT use will result.***

Table 3.2: Propositions of AST

In my work I have found the structurational and AST models particularly useful in explaining the manner in which Information Technologies are appropriated (e.g. Clear & Daniels, 2000). For highly complex e-collaboration environments such as group support systems or electronic collaborative learning contexts (Kock & Nosek, 2005; Kock, 2005a; Fahraeus et al., 1999; Clear 1999a) these models have the value of enabling focus on discrete elements, without losing the dynamic overall context. From the literature, arguments in support of comparability between GSS and collaborative learning contexts have been made by Kock & Nosek (2005, p.3) "subcommunities dedicated to a particular issue in connection with e-collaboration research – for example asynchronous learning networks [cf. Hiltz & Wellman, 1997]", and "Blackboard is a popular e-collaboration tool used in education" (Kock & Nosek, p.4). Wheeler et al., (1999, p.12) have also noted that "educational use" is a major category of web-based groupware applications, with uses traversing co-located, and distributed learning contexts, often directed towards groupware instruction and groupware research.

3.3.2 Enhanced Adaptive Structuration Theory

As earlier noted in the introduction, one extension of the AST model was proposed by Nyerges and Jankowski (1997) for the Geographic Information Systems (GIS) domain, known as "Enhanced AST" (and by chance also abbreviated as "EAST" cf. section 3.3.5 below). In that model the authors identified from various literatures twenty one aspects of a "theory of GIS supported collaborative decision making" (p.232). At least six aspects were additional to those already addressed within AST, and were added to the AST model to produce an "enhanced" model that would more fully reflect the complexities of group decision support in the GIS domain.

This EAST model by Nyerges & Jankowski (1997) is depicted in figure 3.6 below, and shows the several factors not addressed by AST - *power & control; convenor; place & mode of communications; participants' trust in process; decision outcome and group structuring dependence; opportunity for challenge of outcome*.

While this represents a much 'busier' model, and more consciously defines the elements of the initial group phase as "convening constructs", nonetheless it is consistent with AST's roots in GDSS and in representing an input-process-output model. It reflects a model premised on the group process resulting in a set of "decision outcomes", but does modify that premise to capture information about the stability and longevity of that decision outcome. It has also been developed as a model with particular applicability to the GIS domain.

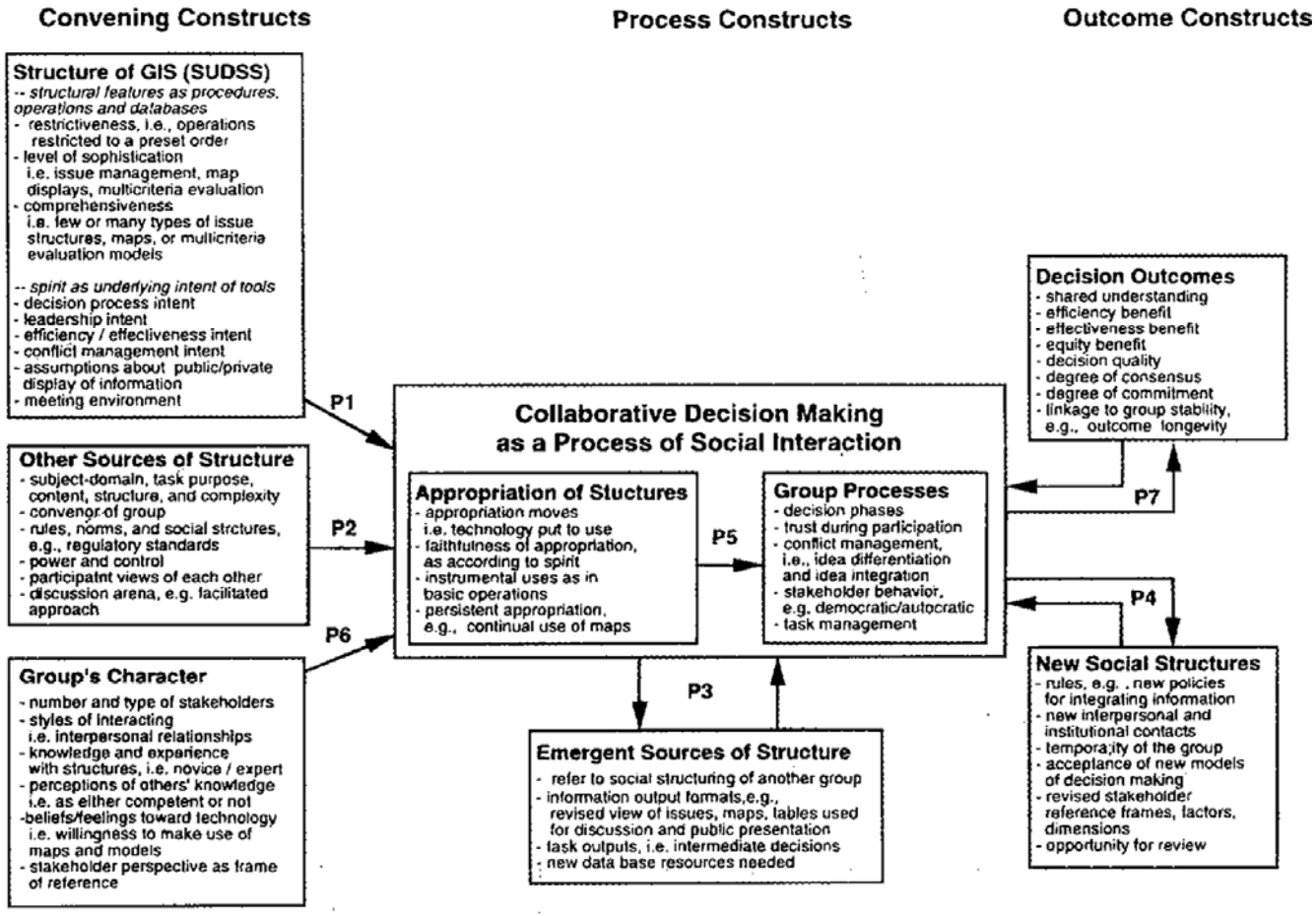


FIGURE 2 Enhanced adaptive structuration theory framework for investigating GIS-supported collaborative decision making.

Figure 3.6: Enhanced Adaptive Structuration Theory: A Framework for Investigating GIS-Supported Collaborative Decision Making. (from Nyerges & Jankowski, 1997 p. 248)

3.3.3 Process Restricted Adaptive Structuration Theory (PRAST)

Another variant of AST was proposed by Wheeler & Valacich (1996, p.432), whereby they theorized, "how facilitation, GSS configuration, and training may act as *appropriation mediators* through the forces of *guidance* and *restrictiveness* to influence specific *procedural dimensions* of the social interaction process, and ultimately, *decision outcomes* (Figure 1). We refer to this theory as Process Restricted Adaptive Structuration Theory (PRAST)". The operation of the theory is outlined in this quote:

> "Appropriation mediators attempt to systematically reduce the appropriation choices available to a group along the six procedural dimensions. In relation to AST, they "tilt" or bias a group's choices and use of potential social structures towards those that represent faithful appropriation and away from those that would be unfaithful relative to the objectives [of] a heuristic. Appropriation mediators are the means through which meeting designers can create guidance and process restrictiveness" (p.435).

The activities of *facilitation* and *training* do come within the bounds of TUM activity, as activities conducted in support of technology use by other than direct users.

Figure 1 Process Restricted Adaptive Structuration Theory (PRAST)

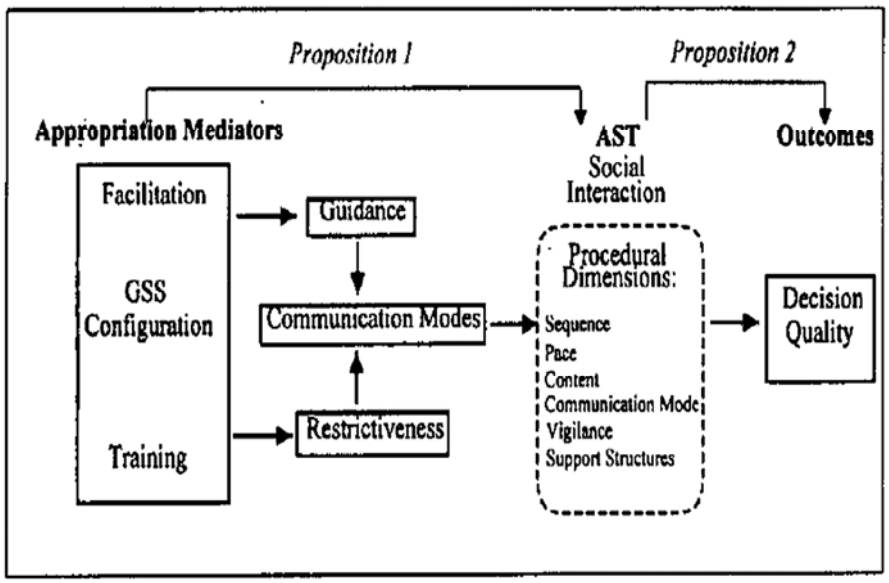


Figure 3.7: Process Restricted Adaptive Structuration Theory: (from Wheeler & Valacich, 1996, p.433)

The *configuration of a GSS* by embedding structures within the technology is also a form of TUM activity, which serves to constrain and shape the technology use of others. The theory of PRAST then does address activities within the realm of TUM, and relevant to this thesis, while substituting the term "appropriation mediator" for "technology-use mediator".

3.3.4 Extended Adaptive Structuration Theory (EAST)

My own contribution to this literature has come from the combining of the AST and "*metastructuring/technology use mediation*" frameworks (Clear, 1999), to encompass the *facilitation* process in GSS contexts, with a specific focus on *collaborative learning* involving *global virtual teams*. This new framework was titled "Extended Adaptive Structuration Theory" or EAST. Some key ideas indicating the extensions as proposed in Clear, (1999a and 2000), Clear & Daniels, (2000, 2001) are briefly excerpted below.

3.3.4.1 Key notions of EAST

"Given the inherently dynamic nature of the facilitation process, a model capable of reflecting that is required. The base AST constructs have been built upon to incorporate the *technology-use mediation* dimension. This now gives us an **Extended AST Model,** which includes *technology-use mediation* as a further source and form of structure within the model. At this stage the concept is generic, and could include other mediation roles such as systems administrators or designers, but the term *technology-use mediator* should be read to mean *facilitator* for the purposes of this paper" (Clear, 1999a, p.1763).

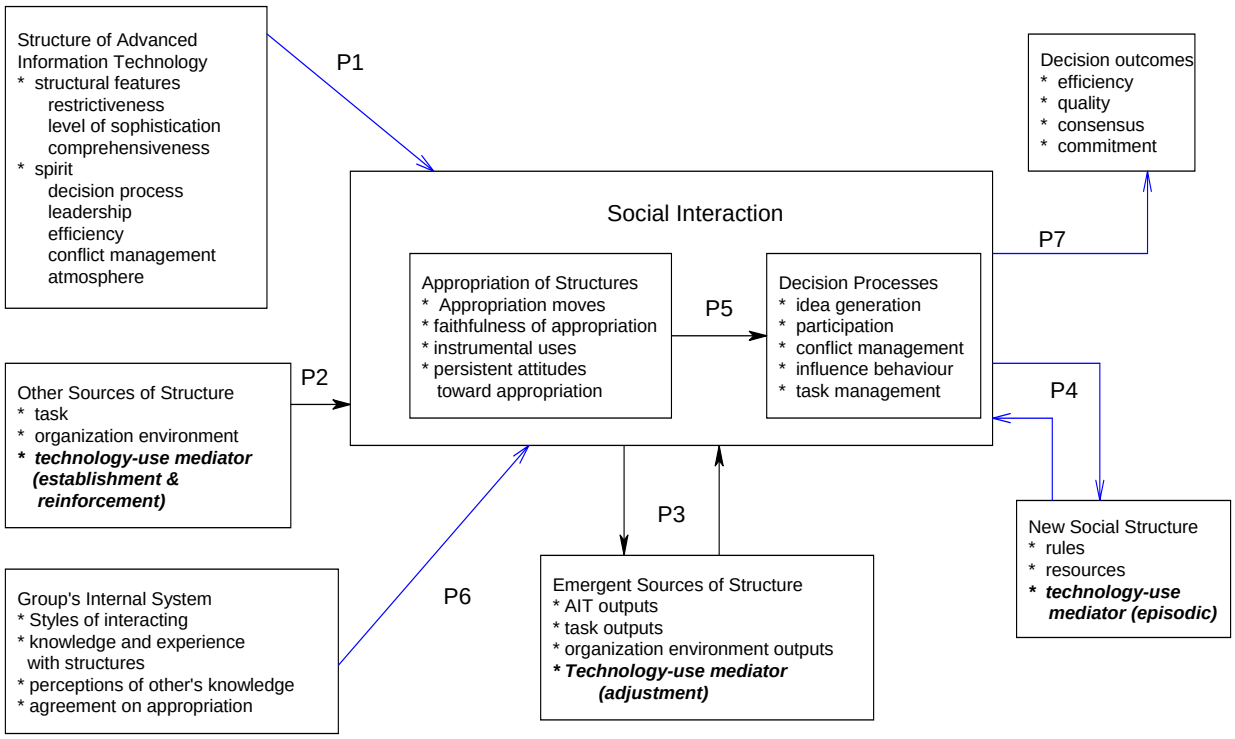


Figure 3.8: Summary of Major Constructs and Propositions of Extended AST Model (EAST) [based upon figure 1 ex (DeSanctis & Poole, 1994, p. 132)]

The modified constructs are highlighted in the redrawn AST model above (bold italics). Basically the three constructs dealing with sources and forms of structure have been augmented:

- **"Other Sources of Structure**
    - has had the *technology-use mediator* (facilitator) added, with the assumption that much of this intervention would occur during either the *establishment* or *reinforcement* modes of activity…
- **Emergent Sources of Structure**
    - has had the *technology-use mediator* (facilitator) added, with the assumption that much of this intervention would occur during the *adjustment* mode of activity…

- **New Social Structure**
    - has had the *technology-use mediator* (facilitator) added, with the assumption that much of this intervention would occur during the *episodic* mode of activity…" (Clear, 1999a, cf. table 2)

I have used this EAST framework to support more conscious design of elements of collaborative trials (e.g. task design, consciously spelling out and reinforcing the open and shared spirit of individual contributions in groupware environments, designing consensus building processes, designing icebreaking activities). The framework has also proved useful for guiding the reflective process and evaluation questionnaires when reviewing how effective are certain practices, (e.g. facilitation techniques), in each research cycle.

3.3.5 Refinement and Extensions to Adaptive Structuration Theory (EAST v.2)

The elaboration which reflected the EAST model at the midpoint of its development during the thesis, was termed EAST (v. 2), and is presented below. This exposition is intended to demonstrate something of the process of refinement which the framework has undergone as this doctoral study has developed. This model incorporated the dimension of technology-use mediation more fully, and went beyond the GSS facilitation role to cover the roles and activities of all actors whose work supported the global virtual team. Before outlining this model in more detail, it may be helpful to

identify some key assumptions or constructs (cf. also Clear, 1999a, included in full as Appendix 10 below) which have been applied in conceptualising this EAST (v.2) framework.

3.3.5.1 Decision Making Models and Meetings

The origins of the AST and EAST models lie in the GDSS literature. Underpinning this literature on decision support is the notion of a "decision". Yet as perspectives have been changing (DeSanctis, 1993), research has moved gradually away from group decision making to systems which more generally support the work of groups (GSS). In the corporate context the meeting has been the most commonly observed symbolic occasion in which groups meet and, perhaps naturally, the general focus of GDSS and GSS has been on the support of group meetings, as electronic meeting systems (EMS). AST's input – process - output model directly refers to the output construct "decision outcomes" as the tangible proof of efficacy of a group supported decision process. In the EAST and EAST (v.2) models I have retained the constructs of AST, because AST is a sound, robust and focused framework addressing a highly complex set of phenomena. The frequency of citings of the AST model of Poole & DeSanctis (1992) and DeSanctis & Poole (1994), as noted in the introduction to this section and for instance (McGrath & Hollingshead, 1994, P. 38.; Chin, Gopal & Salisbury 1997; Chudoba, 1999; Salisbury, Chin, Gopal & Newsted, 2002; Majchrzak et al., 2000; Hettinga, 2002; Sarker & Sahay, 2003; Markus, 2005; Pozzebon & Pinsonneault, 2005; Limayem, 2006; Schiller & Mandviwalla, 2007; Mehra, 2006; Nikas & Poulymenakou, 2008; as a brief sample) in themselves, attest to the value of AST in providing a coherent and usable conceptual framework for group support systems researchers. However I have had to interpret for myself the notion of a "decision" in this context. The model of decision making I prefer is the sixth model proposed by Langley et al., (1995), in which decision making is depicted as "threaded" and decision makers manage "issue streams" which continue over time and resurface periodically as new imperatives require issues to be addressed. This viewpoint also aligns with that of Bostrom et al., (1993) in respect of meetings, in which they observed that "meetings rarely die, they just keep rolling along in a cycle of pre-meeting, meeting and postmeeting activities…The actual meeting is but one phase of a three phase cycle of activities that constitute a meeting".

Ackerman (1996) elaborated upon this structure and broke a meeting into a defined structure comprising several stages:

- The pre-meeting stage
- The meeting itself with three substages
    - Introductory
    - Exploration and development
    - Closure
- The postmeeting stage

The EAST framework in applying the input-process-output model of AST takes advantage of this three stage model of a meeting to situate TUM activities at the pre-meeting, meeting and postmeeting stages inherent in the AST model (cf. figure 3.8 above). Collaborative trials with global virtual teams have thus been conceptualized as occurring in such a "meeting" context, where a *tele-project* is viewed as a meeting analogue within an extended form of meeting. This notion may legitimately be challenged, for instance Beise et al., (2003) have argued "the nature of electronically supported meetings changes in moving from the same-time same-place setting (aka face-to-face or FTF) to the distributed (DGSS) setting, and that this evolution has been underestimated by those shifting from GSS to DGSS research…DGSS challenges the nature and necessity of a 'meeting' per se…DGSS should more properly be aligned with the 'project' than with the meeting metaphor". Yet Beise and colleagues have also classified "learning systems such as…WebCT", which combined email bulletin boards and chat features, as "general DGSS". Thus I have interpreted the notion of a 'meeting analogue' rather loosely here as a project analogue, where the meeting phases may also equate to project phases.

3.3.5.2 Technology-use Mediation and facilitation

As noted in figure 3.3 above Orlikowski et al., (1995) have proposed the notions of metastructuring and technology-use mediation, through which shaping the use of technology by others takes place. In EAST the notion of technology use mediation was linked to the AST model and the group facilitation process. Four different types of mediating activities carried out by the network administration group (NAGA) were identified in the study by Orlikowski et al., (1995):

1) **establishment**: established role, determined and built consensus around use of the communication technology, established guidelines etc. for its use;

2) **reinforcement**: training, monitoring, and follow-up with members and the group to reinforce the established guidelines;

3) **adjustment**: on the basis of feedback obtained from members, adjusted the definitions and usage rules for specific newsgroups and occasionally added new newsgroups on request;

4) **episodic change**: twice during the project, NAGA initiated major changes to the news system as a whole.

These four different types of mediating activities were positioned in the EAST model at the three meeting stages of Ackerman (1996), with the EAST model at that stage being designed to enable study of the activity of facilitators (and not at all focused towards the activities of technical administration staff).

- **Pre- Meeting**
    - the *technology-use mediator* (facilitator) role was added, to the "other sources of structure" construct, with the assumption that much of this intervention would occur during either the *establishment* or *reinforcement* modes of activity. This phase may even extend into the meeting proper, where some of these activities may also occur during Ackerman's (1996) "introductory" substage.
- **During the Meeting**
    - the *technology-use mediator* (facilitator) was added, to the "emergent sources of structure" construct, with the assumption that much of this intervention would occur during the *adjustment* mode of activity.
- **Post-meeting**
    - the *technology-use mediator* (facilitator) was added, to the "new social structure" construct, with the assumption that much of this intervention would occur during the *episodic* mode of activity

3.3.5.3 Technology-use Mediator Roles

In the EAST (version 2) framework the scope of the technology-use mediator role has been broadened to consciously encompass other roles than those of group facilitators. The rationale for this lay in observations over successive global virtual collaborations (for example Clear, 2003), that the success of these ventures was highly dependent not only on direct participants and facilitators of the collaborative trials, but also upon the activities of others performing largely technical support roles for the infrastructure or

the project itself. This dependency on supporting parties was further accentuated when the technologies were fragile. In further support of this view, the five stage model for teaching and learning online proposed by Salmon (2000) in her book on e-moderating, (cf. figure 3.9 below) has identified a major role for an activity which she terms "technical support" at each of the five stages. It seemed to me that many of Salmon's activities here, while having some technical dimensions, would be better framed as 'facilitation' and TUM activities. Much of the critical work of true IT 'technical support' on the other hand, would be either invisible or incomprehensible to the average on-line educator. It is likely that such true 'technical support' activities would be a quite unrelated set of capabilities, which educators would have no freedom to exercise in a production IT environment anyway.

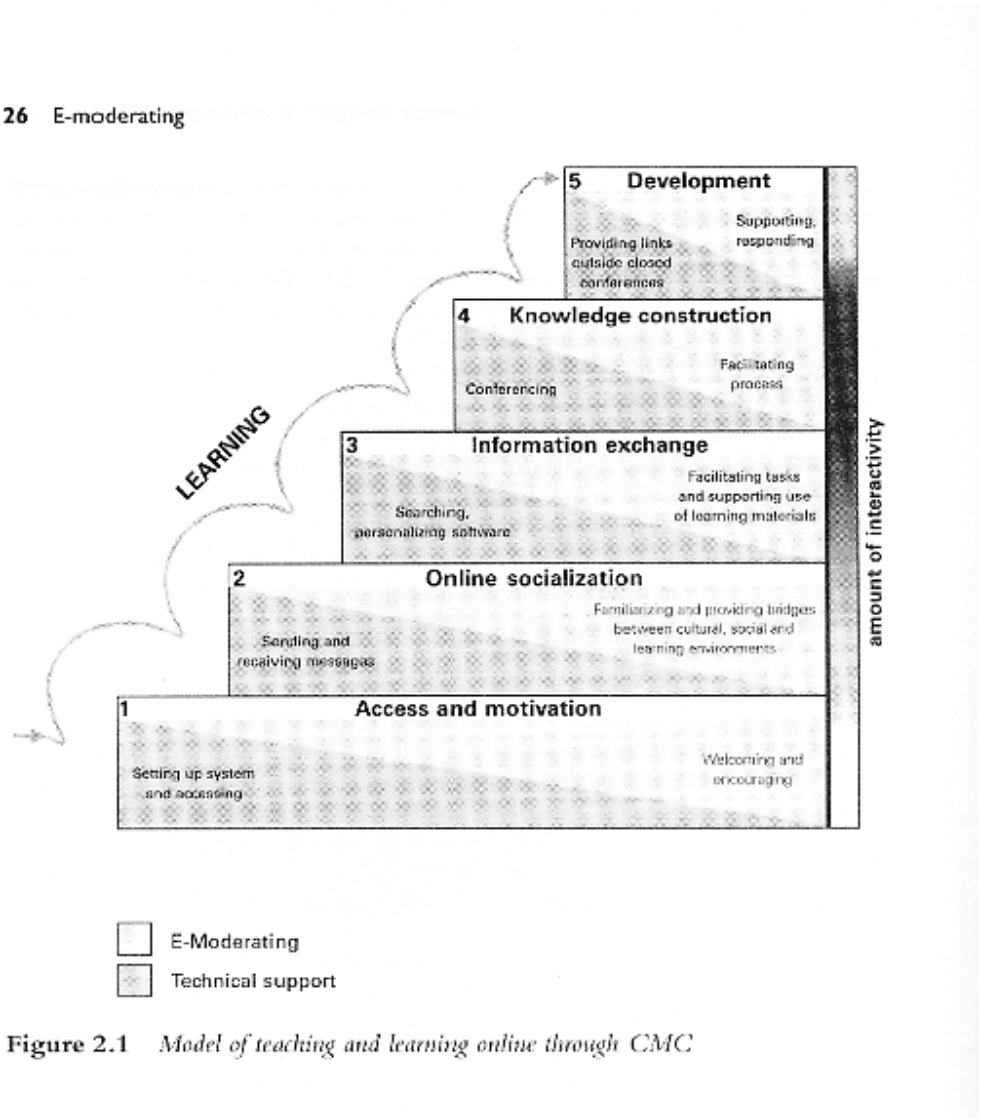


Figure 3.9: Salmon's (2000, p.26) Five Stage Model for Teaching and Learning Online

One noteworthy observation is that 'decisions' are not central to the activities highlighted in Salmon's model, so the TUM activities associated with e-moderating

present themselves as quite distinct from the 'group decision making' activities of GVT participants.

Beyond participants, there is a broad range of actors who may fit into this now expanded model of the technology-use mediator. For instance the original EAST 'facilitator' roles (or e-moderator in Salmon's terminology) remain significant, and in the case of a global virtual collaboration can be further dissected. In our educational context for instance, roles of classroom teacher, trial project manager, site coordinator, software developer, global virtual team leader and local team leader may all share in the facilitative activity required to have the project function at an overall, site or group level.

3.3.5.4 Expanded Roles

In extending the scope of the technology-use mediator role several new categories appear. Alexander (2005) has outlined an onion model of stakeholders in system development, which includes defined groups in a chain of interrelated systems who may have some interest in the project. In this onion model, at the socio-technical level which he terms "our system", he has differentiated between normal operator; maintenance operator and operational support roles. These distinct roles Alexander (2005) defines below as:

- "**Normal operator:** role that involves giving routine commands and monitoring outputs from the product" (p. 39).
- "**Maintenance operator:** role that involves maintaining the product, such as servicing hardware, and diagnosing and fixing faults" (p. 40). (This category excludes software maintenance, which Alexander considers changing the design of the product).
- "**Operational Support:** role that involves advising normal operators of a product about how to operate it. These roles are very close to operations, but support rather than conduct productive use of the product itself...they help to keep the system fully operational (enabling normal operators to continue working effectively). Operational support people such as help desk staff and trainers interact mainly with normal operators. They are maintenance for the humans involved, rather than just for the product" (p. 40).

Alexander (2005) identifies other roles such as "developer" and "functional beneficiary", which may be relevant depending upon the context. In our educational

context of global virtual teams the "developer" role performs technology-use mediation activity by designing and modifying the Lotus Notes databases or other custom built applications such as *Teamlink* (Clear, 2004b) which we have used in each trial. The "functional beneficiary" role may have value in educational contexts as it is a "role which benefits from the results or outputs created by the product… they interact with operators giving them instructions and receiving information or any other benefits that our system is designed to provide" (Alexander, 2005, p. 41). For educators who need to set up the applications for students as "normal operators" to use, while not themselves being direct users of the same functionality, this intermediary role seems to offer a distinctive categorisation which may aid analysis.

In writings related to online multi media courses we have also seen specific roles differentiated, for instance:

- lecturer, tutor, multimedia developer and student roles (Oriogun et al., 2003);
- project manager, author, designer subject-matter expert and shared responsibility roles (Hafner & Ellis, 2004).

Guzdial et al., (2000) have identified a range of roles in the educational context, when using collaborative technology (the CoWeb product):

- Purpose agents (e.g. teachers), central users, peripheral users, site designers, developers, administrators, support staff

3.3.5.5 Role Configuration

So what implications do the extra dimensions implied by these expanded roles hold for the EAST model, and what adjustments are required to reflect them in a later version? In a sense the original model could be left intact with the broader scope of *technology-use mediation* assumed, but this does not aid the conduct of research applying the framework. It has to be acknowledged that operationalising the AST model itself is problematic, for instance Chudoba (1999) has observed that use of micro-level coding schemes "is very time consuming because every phrase is categorized" (p. 135). Poole & DeSanctis (2004) have noted the application of AST in experimental research designs, but that "larger social systems, or networks of groups and teams, have not been feasible to study within experimental designs" (p. 232). Speaking more generally Poole & DeSanctis (2004) have further observed that as a *meta-theory* "structuration theory leaves decisions about research settings, procedures, measurements and analytic tools to

the researchers themselves" (p. 207) . Nonetheless, as a derivative theory AST was conceived as a framework to support research approaches operating at different levels of analysis:

- micro
    - speech or other acts
    - meeting phases
- global
    - entire meeting
    - multiple meetings
- institutional
    - multiple groups
    - across organizations

In addition AST enabled research across units of time:

- Diachronic
    - for analysing a given group, (or comparing groups in parallel) with a specific AIT
- Synchronic
    - For comparing configurations of different AIT's or manual vs. AIT supported groups

AST is extensively cited as a conceptual model by GSS researchers, explaining the notion of appropriation and differing outcomes when groups apply the same AIT technologies, yet few studies appear to have applied the detailed micro-level analysis techniques suggested by DeSanctis & Poole (1994). Hettinga (2002) adapted the micro coding scheme to focus on critical incidents identified as "breakdowns" in her doctoral study, Clear (2000) has incorporated an element of micro-level analysis in his M. Phil thesis; Sadasivan (2005) has applied micro-level analysis using data from international trials; Majchrzak al., (2000) have applied both detailed analysis and a higher level analytical schema to study technology adaptation within a virtual team over a 10 month period; Chudoba (1999) has recommended a less resource intensive macro-level analysis scheme which has been applied by Mehra (2006); and Chin et al., (1997), Salisbury & Stollak (1999) and Salisbury et al., (2002) have devised research instruments for a part of the model to support more quantitative analysis of technology appropriations. The key contribution of AST appears to lie largely in its theoretical

strength and broad explanatory power, and its ability to support focused studies into specific aspects of GSS research.

The particular value then to be gained in clarifying the notion of technology-use mediation in EAST, is the ability to support focused study into TUM activities and their impacts. Given the inherent complexity of technology-use mediation itself, it appeared that some form of isolable sub-model within the EAST framework would be useful. A generic object oriented model based upon the "composite pattern" (Gamma et al., 1995, p. 163ff) was provided by Bruegge & Dutoit (2004) in figure 3.10 below. This model reflected the underlying relationships between the abstract concepts of tasks, activities, roles, work products, and work packages. By applying this model to Technology-use mediation we might clearly distinguish between TUM activities, specific roles and their associated tasks linked through units of work.

Figure 3-9, Associations among tasks, activities, roles, work products, and work packages.

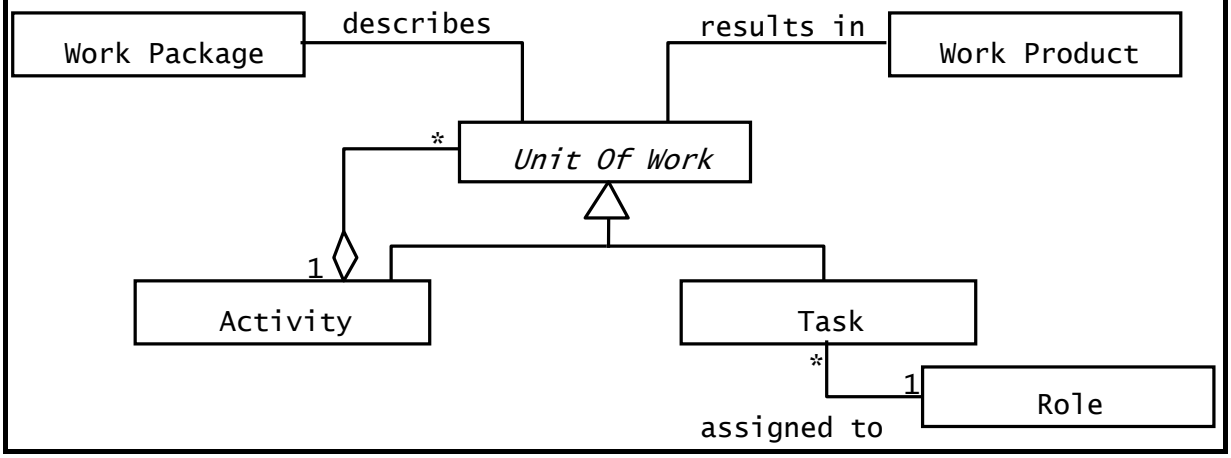


Figure 3:10: Composite Pattern for Activity, Task and Role Relationships – Bruegge & Dutoit (2004, p. 90)

This appeared to offer a relatively simple but comprehensive model for identifying and classifying TUM activities. A short-hand depiction of this in the EAST (version 2) framework, saw "technology use mediator" remain as the "role", and the new subordinate elements "TUM activity", and "TUM task" positioned in the framework

with each of the three current technology-use mediator slots of figure 3.8 above. The revised EAST (version 2) framework is depicted in figure 3.11 below.

The rich data resulting from such a definitional structure might be best analysed using techniques such as grounded theory (cf. Glaser & Strauss, 1967, Allan, 2003, Sarker & Sahay, 2003), from which distinct categories of TUM activity would be expected to emerge and provide a more firm basis to inform future research.

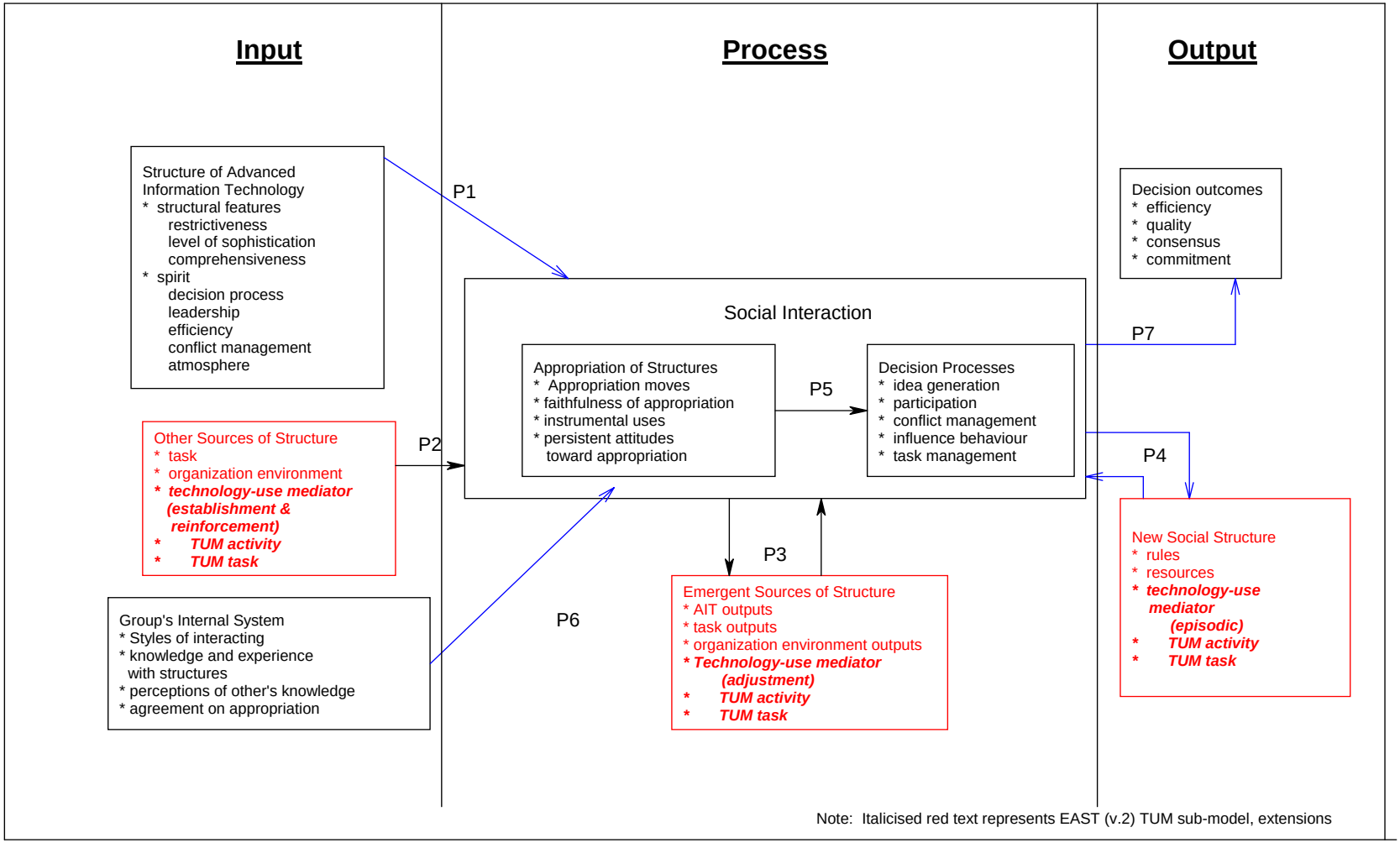


Figure 3.11: Extended Adaptive Structuration Theory (Version 2) - EAST (v.2): A Conceptual Framework for Technology-use Mediation in Global Virtual Teams

3.3.5.6 A Critique of EAST (v2.) as Proposed

This EAST (v2.) model was initially applied in the process of analysing the data for selected episodes, (the episodes of chapter six below outline this data analysis). As a framework it was selected ahead of competing AST originated models in part because I had some experience of applying the precursor EAST model in prior work (cf. Clear, 1999a, 2000, and appendix 9 below). EAST enabled TUM activity to be analysed while remaining embedded within the dynamic group activities of the AST model.

In contrast the "PRAST" model of Wheeler and Valacich (1996) seemed to bundle the AST components into a black box, with the "appropriation mediators" and "forces" being applied seemingly in more of a causative "factor model" rather than a "process model" (Newman & Robey, 1992). Markus & Robey (1988) have categorised "causal structure in theory and research" into three dimensions, with "causal agency" as one dimension which:

> "refers to beliefs about the nature of causality: whether external forces cause change (the technological imperative), whether people act purposefully to accomplish intended objectives (the organizational imperative) or whether change emerges from the interaction of people and events (the emergent perspective)…the emergent perspective admits greater complexity to the issue of causal agency and to the goal of predicting organizational changes associated with information technology…Prediction in the emergent perspective requires detailed understanding of dynamic organizational processes in addition to knowledge about the intentions of actors and the features of information technology. This added complexity makes emergent models difficult to construct" (p. 589).

It seemed to me that the PRAST theory although structurational in design, tended more towards the *technological imperative*, with the "logical structure" (Markus & Robey, 1988, p.584) of the theory being supported by a "variance" model. My own preferences lay more with the "emergent perspective" as more consonant with the structurational underpinnings of EAST, whereby "the uses and consequences of information technology emerge unpredictably from social interaction". I felt in the little explored domain of TUM a theory based on the "emergent perspective" would be richer and provide greater explanatory power.

When considering contending frameworks a balance between the "criteria of comprehensiveness, parsimony and usefulness" (Vogel & Wetherbe, 1984) had to be struck. The EAST (v.2) model appeared to have a suitable balance, and avoided the problems of the contending "*Enhanced* Adaptive Structuration Theory" (*also abbreviated as EAST*) model of Nyerges & Jankowski (1997). I have noted previously the numerous additional elements contributed thereby to the base AST model. To then augment this *enhanced* and 'overly comprehensive' model with the TUM related elements of my own framework appeared to me too great a challenge. It ran the risk of complicating the framework to the point of becoming the "proverbial 'Indian war' with causal arrows flying in every direction", a caution given by Fulk et al. (1990 p. 126) in similar circumstances, referring to the "social influence model". But, once having adopted the EAST (v2.) model, it became readily apparent that a rigorous application of the composite pattern in figure 3.10 to the analysis of "TUM activities" and "TUM tasks" as indicated in figure 3.11 would prove problematic.

I made a couple of specific notes in the course of the episode analysis conducted while applying this model. That analysis has been developed in chapter six below. The first of these notes was written in April 2007 and the second in February 2008. They consisted of reflections on the model and its applicability while undertaking the analysis:

> Note 1: "as a result of the coding activities and the more natural applicability of the appropriation type/subtype codes from Poole & DeSanctis (1992), maybe the activity and task elements here are superfluous, as they tend to emerge anyway from the coding of (meta-) appropriation moves. The AST model supports these already in the process box 'appropriation of structures', although the original set of codes has had to be extended. Steve [my doctoral supervisor] (cf. diary note 23/04/2007) also suggested that there might be more tightness in a communication based coding scheme than the inherent looseness and specificity of an activity and task model? So maybe we just revert to EAST, and the TUM roles then are of interest together with their interactions with appropriation moves?"

The second note picked up on this notion of the inherent difficulty of coding activities and tasks, particularly at the micro-level. It referred to recent literature on "activity centric" computing. Figures 3.12 and 3.13 below are interposed in this discussion to better illustrate the points being made.

> Note 2: 26/02/2008 – "Gave up on idea of 'activity' and 'task' during analysis, "Analytic accounts of activity, such as ethnographies, are difficult to come by, requiring enormous effort from skilled

practitioners…activities are elusive, ephemeral, tacit, dynamic, and often difficult to articulate and categorize" (Moran, 2005). Hill et al., (2006) make similar observations in relation to what they term "artful business processes", as a core driver for "activity centric computing", their table1 gives a sample of processes observed".

Table 1 Sample of processes observed

• New employee checklist	• RFP process
• Organizational chart	• Work order request
• Reserving the LCD projector	• Standard operating procedures
• Travel arrangements, travel reimbursement	• Protocol development
• Document management workflows	• Paper/grant review
• Time management	• Personal reminders for formal processes
• Calendaring and scheduling	• Buying books/procurement
• My meetings	• Inventory tracking
• Organize meetings	• Work action plan
• Compliance-based processes	• Sales and forecasting
• E-learning	• Managing shrink
• Clinical trials monitoring report	• Adverse event tracking
• Clinical trials data analysis	• Tagging
• Prospective process—readme file	• Design review

Figure 3.12: Sample "Artful Business Processes" [from Hill et al., 2006, p.667]

As can be seen some of the 'artful processes' and 'activity' referred to in figures 3.12 and 3.13 below could readily be categorised as TUM activities (*e.g. reserving the LCD projector; calendaring and scheduling; my meetings; organize meetings; prospective process – readme file; chat room authentication process; chat room authorisation process*). The note continues after figure 3.13 below, to discuss Alter's recent views on activities, and my own reflection on the feasibility of mapping TUM activities.

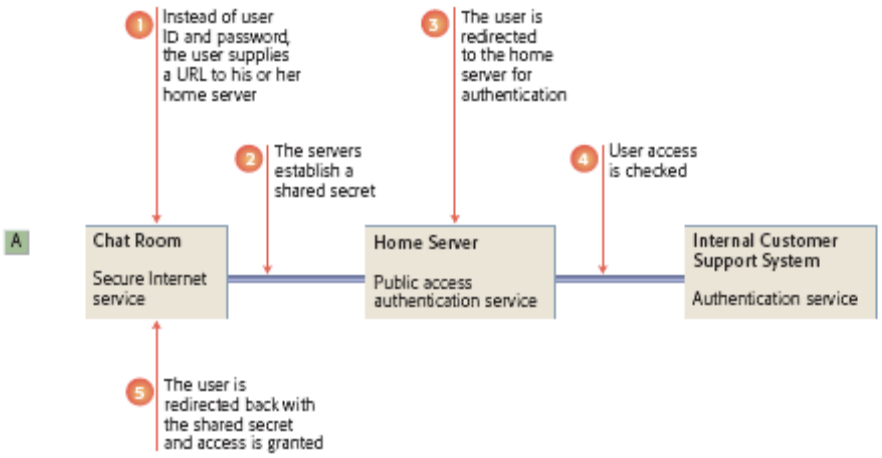


Figure 3.13: Activity building blocks: (A) delegated authentication and authorization for a chat room service [From Hill et al., 2006, p.677]

> "Alter (2007) in his "work system framework", unites "processes and activities" to cover "a full range of situations that might involve highly structured workflows and 'artful processes' whose sequence and content 'depend on the skills experience and judgment of the primary actors'". The TUM activity modes of Orlikowski et al., (1995) are broad enough to be analytically mapped as activities though, but even so require significant effort, as evidenced by the episode analysis in section 6 below".

Thus the conclusion from this note was that mapping "TUM activity" in the four modes of Orlikowski et al., (1995) was viable even if non trivial, therefore validating its inclusion in the EAST model. However the lower granularity of "TUM task" and its interaction with TUM activity remained problematic and a revision of the EAST (V2.) model was warranted.

A further element of this latter note addressed the question of how best to conduct the analysis while applying the concept of a 'metastructure' (a reification of the metastructuring process, elaborated in section 6.2.4.1 below).

> "How the notion of a 'metastructure' fits needs a little further thought –is it a special form or subcategory of a structure or simply synonymous with a structure. May need to consider coding metastructures against AST model elements: *other forms of structure* and *emergent sources of structure*".

How best to accommodate the concept of a 'metastructure' within the model, was eventually addressed within the analysis of chapter 6 below by the use of different approaches including a visual mapping technique. That strategy overcame the need to

portray this added, and innately recursive, complexity within the EAST (v.2) model, or any successor. Consolidating these elements then has resulted in a successor model, which is elaborated below.

3.3.5.7 Further EAST –The Technology-Use Mediated AST Framework (TUMAST)

The elaboration which reflects a variant of the EAST model, at what I hope is a stable point of its development, is now termed 'Technology-Use Mediated AST' (TUMAST), and is presented below. This model incorporates refinements to the dimensions of 'technology-use mediation' within the AST model, to cover the roles and activities of all actors whose work supported the global virtual team.

As a starting point, a new set of four propositions relating to technology-use mediation are given for the TUMAST model. These expand upon the original propositions of AST (DeSanctis & Poole, 1994) and are tabulated in table 3.3 below.

AST

P1. ***AIT's (Advanced Information Technologies) provide social structures that can be described in terms of their features and spirit. To the extent that AIT's vary in their spirit and structural feature sets, different forms of social interaction are encouraged by the technology.***

P2. ***Use of AIT structures may vary depending on the task, the environment, and other contingencies that offer alternative sources of social structures.***

P3. ***New sources of structure emerge as the technology, task and environmental structures are applied during the course of social interaction.***

P4. ***New social structures emerge in group interaction as the rules and resources of an AIT are appropriated in a given context and then reproduced in group interaction over time.***

P5. ***Group decision processes will vary depending on the nature of AIT appropriations.***

P6. ***The nature of AIT appropriations will vary depending on the group's internal system.***

P7. ***Given AIT and other sources of social structure,*** $n_1 \ldots n_k$, **and** ***ideal appropriation processes,*** **and** ***decision processes that fit the task at hand,*** **then** ***desired outcomes of AIT use will result.***

TUMAST

P8. ***The activities of technology-use mediators offer an "alternative source of social structures" for P2 above.***

P9. ***Technology-use mediators are instrumental in P2's "use of AIT and social structures", through the TUM activities of 'establishment' and 'reinforcement'.***

P10. ***Technology-use mediators are instrumental in P3's "emergence of new sources of structure", through the TUM activities of 'adjustment' and 'reinforcement'.***

P11. ***Technology-use mediators are instrumental in P4's "emergence of new social structures", through the TUM activities of 'episodic change'.***

Table 3.3: Propositions of AST and TUMAST (expansion upon DeSanctis & Poole, 1994)

The modified constructs are highlighted in the redrawn TUMAST model of figure 3.14 below (bold italics). As in the prior models [EAST and EAST (v2)] the three constructs

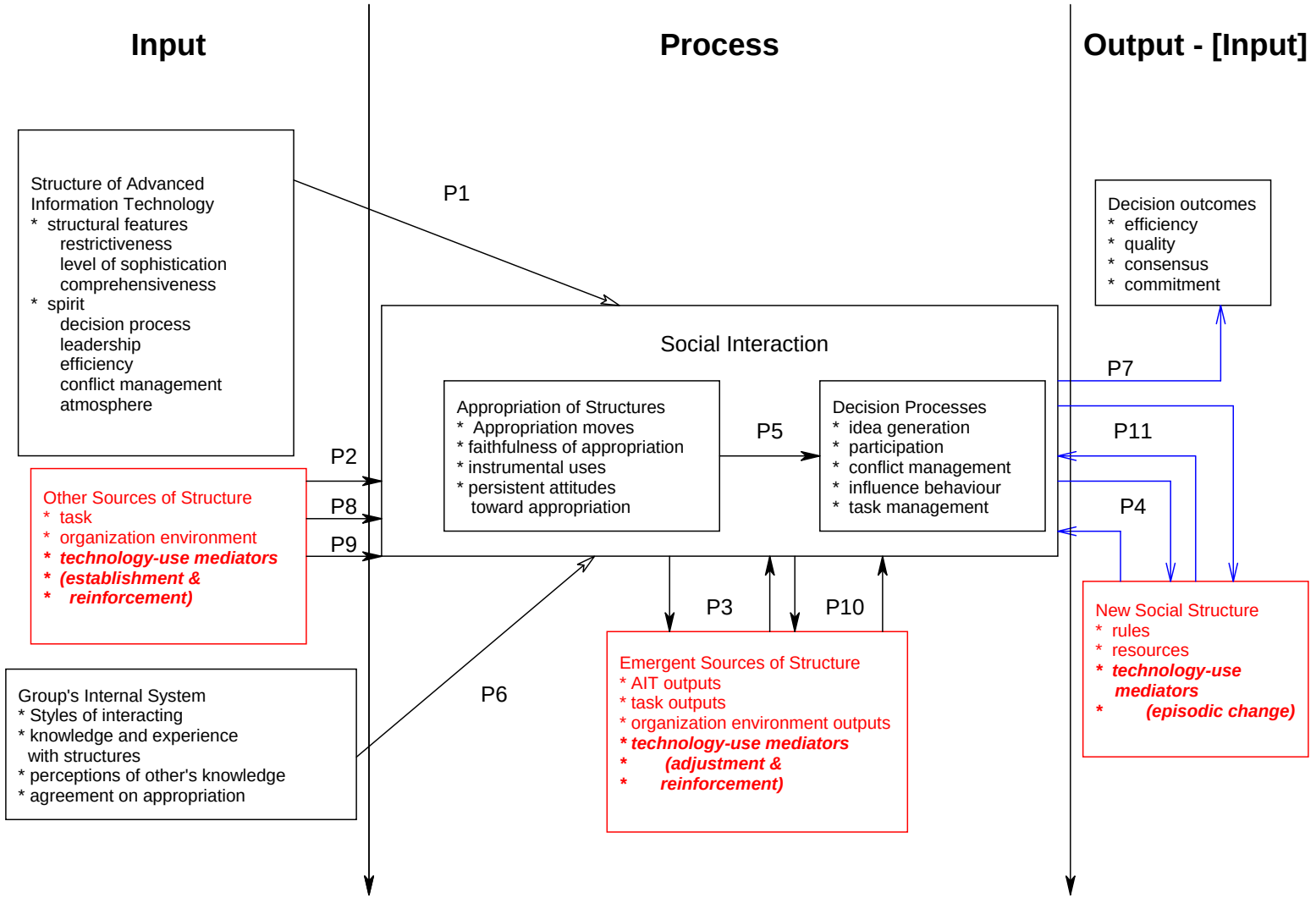
dealing with *sources* and *forms of structure* have been augmented, so this model is a refinement to better portray the intended elements and their relationships:

- **"Other Sources of Structure**
    - has added the roles of *technology-use mediator*s (reflecting not simply the facilitator role, but a variety of supporting roles), with the assumption that much of this intervention would occur during either the *establishment* or *reinforcement* modes of *TUM activity*.
    - The *reinforcement* mode accompanies the *establishment* mode here on the assumption that this would occur during what Ackermann (1996) has termed the "introductory" substage of a "meeting". A global virtual collaboration episode here is framed as a meeting analogue.

- **Emergent Sources of Structure**
    - has added the roles of *technology-use mediator*s (reflecting not simply the facilitator role, but a variety of supporting roles), with the assumption that much of this intervention would occur during the *adjustment* and *reinforcement* modes of *TUM activity.*
    - *Reinforcement* has deliberately been added into the model here as a mid-process TUM activity, in addition to its earlier presence in "other sources of structure" accompanying the *establishment* mode. Based upon evidence from the data analysis in chapter six below, adjustment and reinforcement modes frequently accompanied one another in mid collaboration episodes. This inclusion is also consistent with the views of Orlikowski (2000) who has argued that structures only emerge when "people interact recurrently with whatever properties [features] of the technology are at hand, whether these were built in, added on, modified or invented on the fly" (cited in Markus, 2005, p.7). TUM activity, in *reinforcement* mode, while not necessarily adding new structures, is a key dimension in the emergence of structures either in the form originally envisaged during the design process, or in slightly unexpected forms based upon such situated interactions.

- **New Social Structure**
    - has added the roles of *technology-use mediator*s (reflecting not simply the facilitator role, but a variety of supporting roles), with the assumption that much of this intervention would occur during the *episodic change* mode of *TUM activity*.

The additional TUMAST propositions are represented by the further arrows (P8-P11) in figure 3.14. These augment the set of arrows (P1-P7) which mapped the 7 original AST propositions. The elements of the model have been delineated into input-process-output segments, reflecting the origins of the AST model, but implying a more linear progression than really intended. To offset this, a cyclical model where the output of one cycle becomes the input to the next, is implied by depicting a final output – [input] segment. The topic of cycles and episodes is explored more fully in section 3.3.5.8 below.



Note: Bold italicised text represents extensions for TUMASTsub-model

Figure 3.14: Technology-use Mediated Adaptive Structuration Theory (TUMAST) – A conceptual Framework for Technology-use Mediation in Global Virtual Teams

3.3.5.8 Meetings, episodes and projects

Bostrom et al., (1993) have observed that it is in the very nature of meetings that they "rarely die" but continue in successive cycles. Thus the meeting boundary, while creating a convenient end point for analysis, is inherently a somewhat artificial notion. Therefore the AST, EAST and TUMAST models, being based upon the concept of a meeting, are themselves limited by this artificial boundary. In the conduct of international collaborative trials, this form of *tele-project* can still be conveniently analysed within the AST, EAST and TUMAST frameworks, as such trials have a natural goal (framed around the common group decision-making task, shared course, or set of project goals to be achieved - e.g. Beise et al., 2003; Clear, 1999a; Last et al., 2000; Rutkowski et al., 2004, Neale et al., 2004), and also have a beginning, middle and an end point. As an extended form of meeting they can be viewed as a meeting analogue, even if conducted in an asynchronous mode.

However if we extend the TUMAST model to cover the work of other global virtual teams, such as software development teams, then the meeting analogue tends to break down. Beise et al., (2003) in discussing virtual meetings and tasks note the prevalence of asynchronous activities taking place in sequences over longer durations, and question the continuing validity of the meeting concept which is at the heart of the GDSS and GSS literature. In its place they advocate a distributed project management perspective which gives primacy to the "project" as the organising principle for virtual groups.

To effectively make use of the TUMAST framework it must be acknowledged that, in many instances the project is too large a unit of analysis, and some way of breaking down a project into manageable sub-units for analysis is desirable. The work of Newman & Robey (1992) suggests one answer. Applying a process model (as opposed to the standard positivist factor model with dependent and independent variables and inferred relationships), Newman & Robey (1992) propose a model of user-analyst relationships within a systems development project. In a similar manner the work of Neece (2004, p.296) provides an example of a process model in a "Virtual Work Groups Process Model" with three states, 1) inception during which project objectives are determined, 2) process elements carried out by the team [with feedback loops both to the inception stage and from the achievement of objectives], 3) fulfilment of the project objectives. The notion of a process model with antecedent conditions, a sequence of events comprising development

and resultant outcomes, maps closely to the input-process-output models underlying AST, EAST & TUMAST.

While the Newman & Robey (1992) model represents IS development as a sequence of events, it further categorises these events into two different types "encounters" and "episodes". "An *episode* refers to a set of events that stand apart from others, thus signifying the end of one sequence of activities and the beginning of another"…encounters [by contrast] mark the beginnings and ends of episodes" (p.253). Based upon a punctuated equilibrium model it treats change as "an alternation between long periods when stable infrastructures permit only incremental adaptations, and brief periods of revolutionary upheaval" (Gersick, 1991, p.10). Thus "When change does occur it will be initiated in critical encounters" (Newman & Robey, 1992. p. 253), with the criticality of those encounters being judged by researchers or the actors in the situation themselves.

I do not necessarily agree here with Newman & Robey's (1992) underlying punctuated equilibrium assumptions. For instance (Orlikowski, 1996) has argued for a more gradualist "situated change perspective", with findings from her study suggesting: " - contrary to the punctuated equilibrium prediction that organizations do not experience transformations gradually - that local variations in practice can, over time, shade into a set of substantial organizational metamorphoses" (p.90). But Newman & Robey's notion of an "episode" (1992) as a bounded unit of analysis is attractive, when applying the TUMAST model to the temporally bound activities of global virtual teams. By way of comparison, Ngwenyama's (1998) study of the process dynamics of computer mediated distributed work adopted a longitudinal process research methodology, in which *comprehensive* and *temporal* data analysis strategies were applied. To address the question of *temporal analysis* applying the TUMAST framework here, the concept of an "episode" has been adapted as a distinct sequence of events comprising an analytical unit. This is depicted below in figure 3.15.

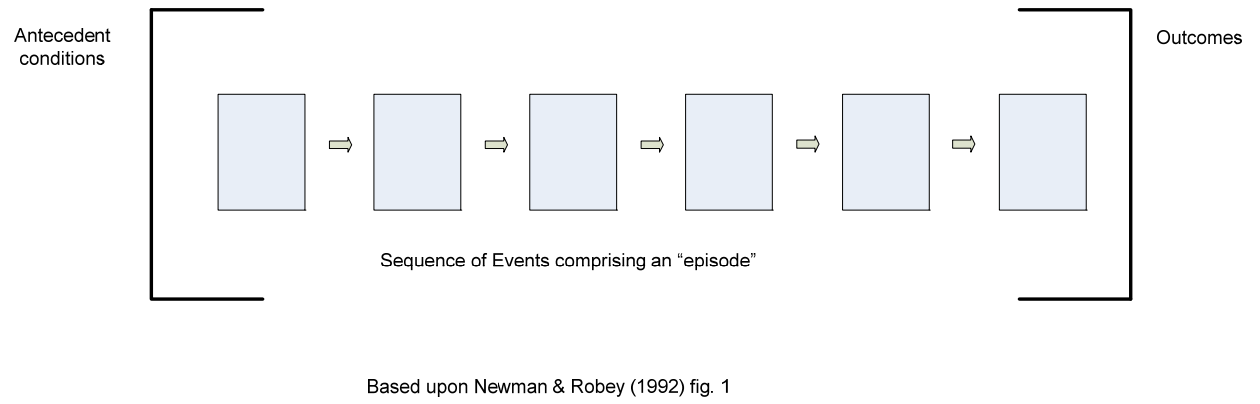


Figure 3.15: The concept of an "episode" as a sequence of events that stand apart from others

While critical events similar to the "encounters" of Newman & Robey (1992) may create junctures between such episodes, it is also likely that the standard beginning and end points of project phases or activities (perhaps also artificial in themselves) will constitute natural junctures by which episodes can be demarcated. In this way in the context of global software development projects an "episode" may equate to a natural phase or activity of the project with "outcomes" which can be assessed against the TUMAST model constructs. For instance, the "new social structures" arising from episodic change can be accommodated by taking stock at the end of each episode, the tasks can be specified and TUM activities at analogues of the *pre-meeting*, *during meeting* and *post-meeting* points can be analysed. This analysis would apply the technology-use mediator sub-model, with the *episode* as the unit now constituting the meeting analogue. Thus several episodes in sequence may combine to form an overall project, and the results from episode level analyses can in turn be fed into a project level analysis. Episodes may thus be of varying length and content, and be flexibly designed by choice of 'encounters' to suit micro or macro level analysis goals. In this way the TUMAST model may support research into TUM activities within global virtual teams using both "episodes" and "projects" as differing units of analysis.

At this point a brief critique is warranted of the *Input-Process–Output* (I-P-O) model as applied to research into *teams* (not to mention *global virtual teams*). Ilgen and colleagues (2005, p. 519) have noted a growing "consensus regarding the utility of I-P-O models" for

such research stating that they fail "to capture the emerging consensus about teams as complex, adaptive systems" (ibid.). They summarise the argument thus:

> "the I-P-O framework is deficient for summarizing the recent research and constrains thinking about teams. As an alternative model, we use the term IMOI (input-mediator-output-input). Substituting "M" for "P" reflects the broader range of variables that are important mediational influences with explanatory power for explaining variability in team performance and viability. Adding the extra "I" at the end of the model explicitly invokes the notion of cyclical causal feedback. Elimination of the hyphen between letters merely signifies that the causal linkages may not be linear or additive, but rather nonlinear or conditional.
>
> In keeping with the temporal features of many recent approaches, we initially organized the review around studies that focus on the early stages of team development (i.e., the IM phase), labeled the Forming Stage, followed by those examining issues that we see as the team develops more experience working together (i.e., the MO phase), labeled the Functioning Stage, and finally the Finishing Stage (i.e., the OI phase), where the team completes one episode in the developmental cycle and begins a new cycle" (Ilgen et al., 2005, p.521).

In discussing earlier versions of this framework with my colleague Diana Kassabova she commented on the need to incorporate "feedback loops" in any derived model (personal communication 10/2/2005). An example of the inherently phasic and cyclical nature of these global virtual collaborations is given in figure 3.16 below, which depicts the phases of the semester 2/2003 collaboration.

> "The IPOI model by Ilgen, Hollenbeck et al. (2005), as illustrated in Figure 1…is a graphical representation of the two phases of the collaborative trial – Icebreaking and Preference Ranking…At the input stage time zero (T0) some ice-breaking activities were initiated among the participants, which led to an output at Tx, where teams knew each other relatively well. Tx now becomes the input of phase 2 where participants were asked to rank the websites and reach a consensus, which represents the final output at Tn" (Mehra, 2006).

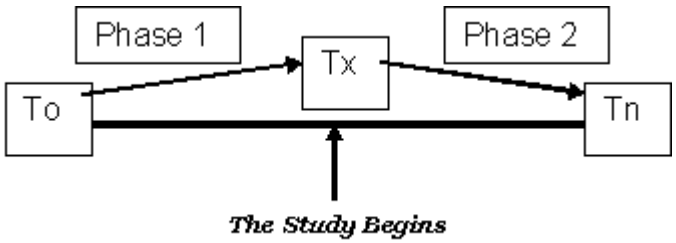


Figure 1. An IPOI Model for collaborative virtual interaction. Adapted from Ilgen, Hollenbeck et al. (2005)

Figure 3.16: An IPOI Model for Collaborative Virtual Interaction (From Mehra, 2006)

In combination this has now built to an analytical model of a project as a series of episodes and events, which is portrayed as an "IPOI model" at different levels (episode or whole project) in figure 3.17 below. The *input –process – output* dimensions represent points at which the TUMAST episodic framework might be applied.

3.3.5.8.1 'Episodes of Interest' Defined

To summarise therefore, building upon Newman and Robey (1992), the notion of an individual "episode" or an "episode of interest" as an analytical unit in this thesis is defined as:

> *A relevant temporally bound sequence of events with antecedent conditions and outcomes, which stands apart from others, and has been selected for analysis.*

Criteria for "relevance" might include such considerations as: Does the episode present a specific example of TUM activity? Or does it exemplify one or more of the TUM modes? Short episodes may be selected on the basis of some form of critical incident in which TUM activity is notable. Typically such incidents presented themselves as some form of "breakdown" (Hettinga, 2002) in the collaboration process. Alternatively longer episodes (e.g. section 6.4 **"**Establishment Episode Full") might be selected by a logical time bound unit, in this case the full duration of the *Establishment* TUM phase for the collaboration, where the TUM mode determined the temporal boundaries.

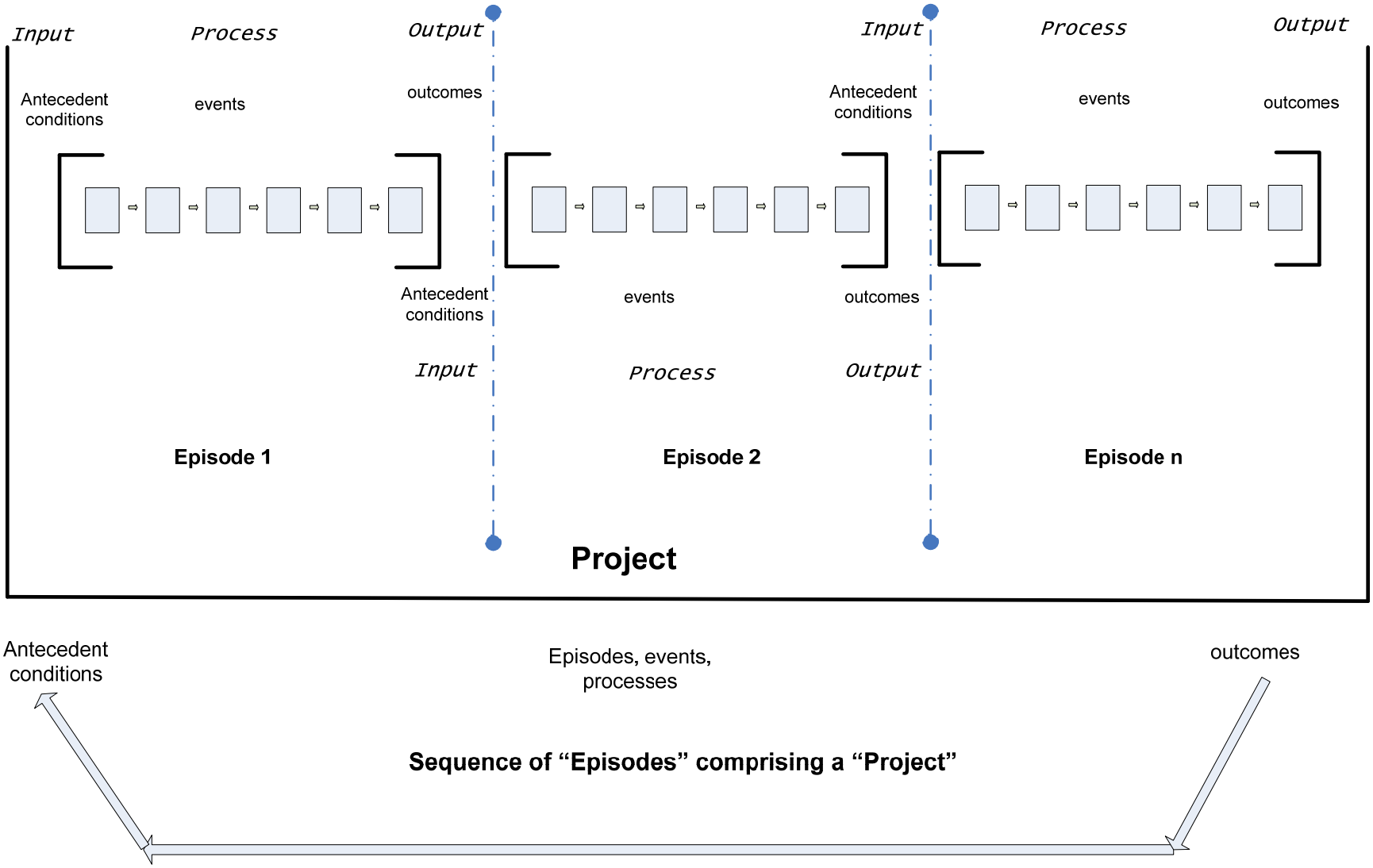


Figure 3.17: Analytical Model of a ‘Project”

3.4 Units of Analysis and Time

3.4.1 Supported Units of Analysis

Given its origins in AST, the TUMAST model is capable of supporting multi-level analyses from the "micro" through the "institutional" levels as outlined in 3.3.5.5 above.

3.4.1.1 Analytical Time scales

Arrow, Poole et al., (2004) note the critical significance of time in any research involving analysis of groups. Time itself, forms an additional unit of analysis in research that investigates group development. Arrow & Poole et al., cite the work of Zaheer and Zaheer (1999), who identified five types of time scales

a) the existence interval – *the time needed for one instance of a phenomenon to occur*
b) the observation interval – *the time over which a process is observed*
c) the recording interval – *the frequency with which a phenomenon is measured*
d) the aggregation interval – *the time scale across which recorded information is aggregated for analysis*
e) the validity interval – *defines the temporal boundaries of the theory*

Arrow, Poole et al., (2004, p. 79) propose that "a theory is 'time scale complete' if it specifies time scale for all its variables, relationships and boundary conditions. Otherwise, researchers cannot make theory-driven choices of observation, recording, and aggregation intervals, and the criteria for evidence either in support of or contrary to theoretical predictions remain unclear".

Although the TUMAST framework is more of a process model than a factor model, consciously identifying the role of time is both illuminating and valuable for a more fully considered definition of the framework, and how it might be applied. These types of time scales are able to be mapped to the TUMAST framework, where they could serve to define the scope of its application in a particular study:

f) the existence interval – *the time needed for one instance of a phenomenon to occur*
    a. could apply at project, episode or event levels
g) the observation interval – *the time over which a process is observed*
    a. could apply at project, episode or event levels

b. could apply to several teams both diachronically over multiple such intervals, or synchronically over multiple instances of advanced technology application, as with the AST model (cf. 3.3.5.5 above)

h) the recording interval – *the frequency with which a phenomenon is measured*

a. could apply consistently across an *observation interval* - continuously for some forms of data (e.g. electronic time-stamped logs of activity, video-recorded sessions), periodically for other forms of data at predetermined sampling intervals (e.g. daily email messages received, sent, weekly reports posted)

b. at discrete critical events deemed significant within the *observation interval,* equating to the "encounters" of Newman & Robey (1992) marking the beginning or end of critical events. Also applicable is the use of breakdown analysis by Hettinga (2002), where "breakdowns" in the flow of activity are identified as critical event triggers highlighting a situation warranting analysis. Thus the frequency of such an event trigger would dictate the recording interval. Naturally such intervals would not be of an even duration.

i) the aggregation interval – *the time scale across which recorded information is aggregated for analysis*

a. could apply at project, episode or event levels

b. could apply to several teams both diachronically over multiple such intervals, or synchronically over multiple instances of advanced technology application, as with the AST model (cf. 3.3.5.5 above)

c. With suitable aggregations diachronically or synchronically, institutional level analyses should be capable of being conducted using the framework.

j) the validity interval – *defines the temporal boundaries of the theory*

a. the TUMAST model may be applied across several units of time (micro through macro) and may support either discrete or multiple project, episode or event levels. In enabling such aggregation and disaggregation of temporal units, the temporal boundaries of the framework are therefore relatively unconstrained. Thus the TUMAST framework could be applied longitudinally to investigate virtual teams with a long history together, or to study ad-hoc teams assembled for short tasks and projects, or dissect single

phases or events within a larger undertaking. This strength demonstrates the value of a process model in such research with global virtual teams, and is consonant with the views of Beise, Evaristo & Neiderman (2003) and Steinfeld, Huysman et al., (2001), who advocate the use of multifaceted research approaches.

3.4.2 The Technology-Use Mediated AST Framework - TUMAST and the Cycles of Episodes and Projects

Figure 3.18 below depicts the ways in which TUMAST may support temporal forms of analysis. Whereas the TUMAST model outlined in figure 3.14 above is applicable at the micro level of an *episode*, figure 3.18 below demonstrates how it may be applied at the macro level of a *project*.

This depiction of "TUMAST and TUM Activities in the Cycles of Episodes and Projects" combines the basic TUMAST model of figure 3.14 as applicable at episode level, with the analytical model of a project from figure 3.17, and the IPOI framework of Ilgen at al., (2005) from figure 3.16 above. Figure 3.18 presents a broader perspective on the TUMAST model and suggests ways in which the forms of temporal analysis suggested by Arrow, Poole et al., (2004) above and in the similar elaboration on 'time' in organizational research by Zaheer et al., (1999), could be supported by TUMAST.

As highlighted by the episode analyses in chapters six and seven below, the development of TUM activities over time, and the varying durations of cycles and the lead times between their repetitions, demands a model that is flexible enough to accommodate analyses over multiple temporal dimensions. This expanded depiction of TUMAST in figure 3.18 demonstrates the temporally situated nature of global virtual collaborations, and the role of project cycles and of episodes embedded within them. Temporality has been experienced as a core reality of TUM activity within the global virtual team collaborations investigated in this thesis. Therefore a model with the level of temporal adaptability and coverage outlined in figure 3.18 is not merely desirable, but vital to support research into TUM within global virtual teams.

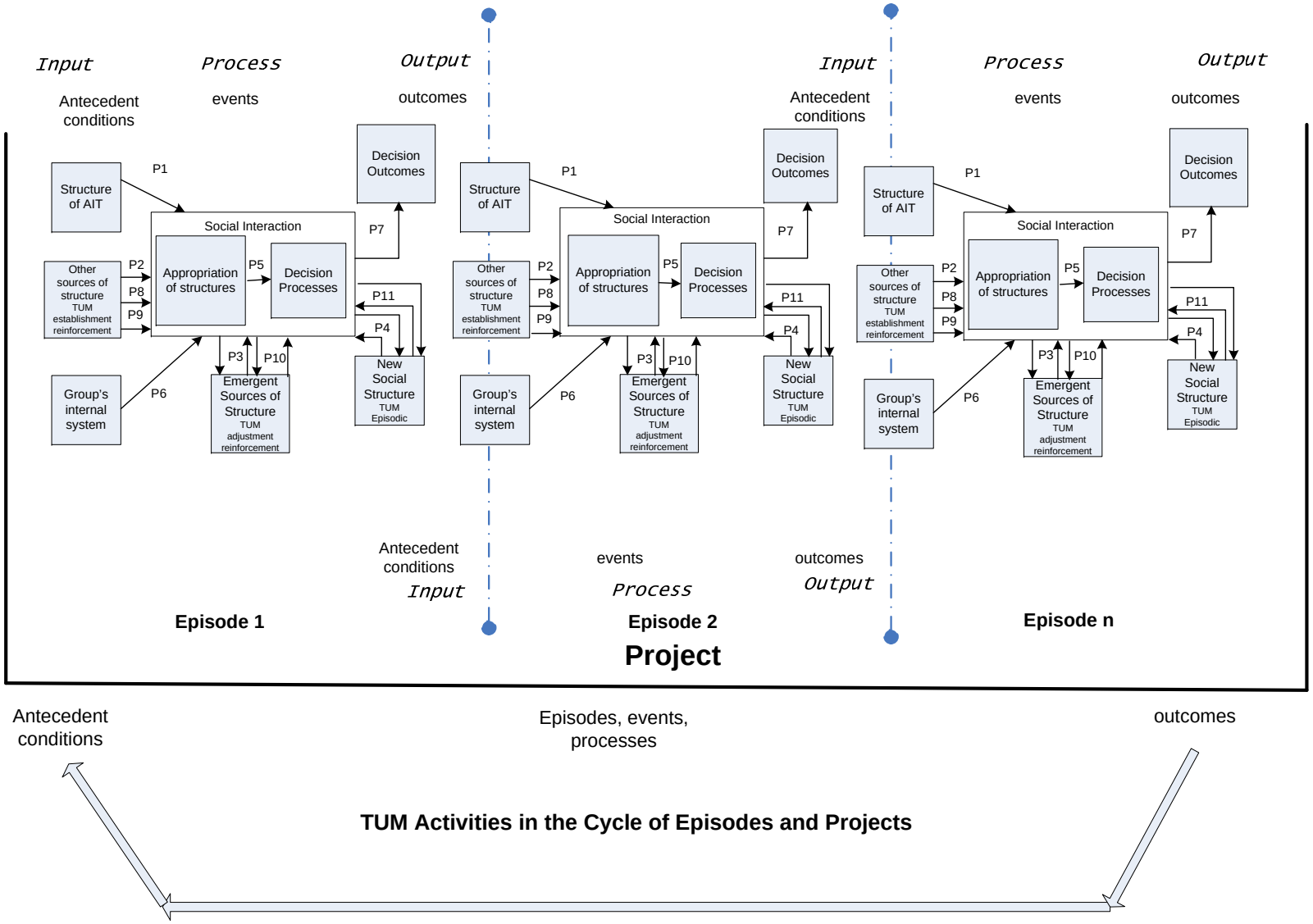


Figure 3.18: TUMAST and TUM Activities in the Cycles of Episodes and Projects

3.5 Conclusion

In this chapter I have outlined Technology-use Mediated Adaptive Structuration Theory (TUMAST), a conceptual framework for researchers to apply when analysing technology-use mediation in global virtual teams. Of its very nature the framework is complex, deriving from the AST model (DeSanctis & Poole, 1994), which originally aimed to "capture the complexity in advanced technology use" addressing Group Support Systems and the differing ways in which groups appropriated them in their use.

The TUMAST model strives for parsimony, while retaining holism at a "meeting analogue" level. That might cover a brief event within an "episode" (as defined in this chapter), a multi-episode phase or a sequence of stages within a project, or span multiple projects. It supports several approaches to research, using differing techniques, levels and units of analysis, and in particular supports temporal forms of analysis. Beise, Evaristo and Niederman (2003) have noted "the complexity of this type of research, largely due to the interaction of so many organizational, technology and individual participant variables", suggesting that it "points towards the high value of multiple qualitative research studies. DPM [distributed project management] action researchers who are attempting to glean what they can from organizational case studies are on the right track" (ibid.). Likewise Steinfeld, Huysman et al., (2001), have advocated the use of multifaceted research approaches and triangulation of qualitative and quantitative data.

I have used the precursor EAST model (Clear, 1999) over successive cycles of action research since 1999, where it has helped support the design and conduct of the research and subsequent analysis, while directing attention to key elements of facilitation in a collaborative trial yet retaining an overall holistic model of the phenomenon of global virtual teams. In chapters six and seven below a combination of structurational and grounded theoretic analyses have been conducted, demonstrating the applicability of the TUMAST model. TUMAST will, I believe, support the types of analyses now required to further investigate the complex characteristics of technology-use mediation in global virtual teams.

Chapter 4: Research Methodology

4.1 Introduction

As evident from the discussion in chapters two and three above, this multi-faceted study has encountered several research challenges from a methodological perspective. The global dimensions of the study have raised specific challenges, as acknowledged by researchers in the area of information systems research known as "global information management" (GIM), itself a challenging area of study. A variety of approaches to the study of GIM have been outlined by Gallupe & Tan, (1999, p.6), who produced a "model for global information management research". Elements of their model include: the global external environment, the global organisational environment, the user environment, IS Development environment, IS Operations Environment, the use process, the development process, the operation process and global information systems characteristics. That combination makes for a rich and complex field of enquiry.

This study addresses the full set of elements within the Gallupe & Tan (1999) framework, and sits at the intersection of their *global environment characteristics, global process variables* and *global information systems characteristics*, as a "Type V study" exploring the "relationship among all variable groups" (p.11). This type of study appears rare in GIM with Gallupe & Tan (1999) reporting only 0.7% of studies classified within that category, and urging scholars to undertake more studies of this type, moving "beyond the single variable approach" to build "a more comprehensive understanding of the field" (p.15). They have categorised the predominant methodologies employed in GIM research as "case studies" and "field studies" (p.11). These two methodologies in turn have been categorised by Alavi & Carlson (1992, p. 61) as "empirical studies" with an "event/process" orientation, and with the following definitions:

> "3. Field Study: no manipulation of independent variables, involves experimental design but no experimental controls, is carried out in the natural settings of the phenomenon of interest.
>
> 4. Case Study:
> a. Single Case: examines a single organization, group, or system in detail; involves no variable manipulation, experimental design or controls; is exploratory in nature.

> b. Multiple Case Studies: as for single case studies, but carried out in a small number of organizations or contexts" (ibid. p.61).

Complementing these categorisations Gallupe & Tan (1999) have slightly modified this classification scheme by including action research and other qualitative research strategies in their "case study" category. They have noted the dominance of interviews as a dominant qualitative research technique in GIM and lamented the lack of qualitative research

> "studies using techniques like ethnography, interpretive epistemology or grounded theory…[and] challenge scholars to consider using alternative qualitative techniques in GIM research" (ibid. p. 15).

This study which has adopted an interpretive epistemology and applied a selection of qualitative research techniques as outlined below (cf. also notes in Appendix 16), has responded to that call.

4.2 Action Research

This study, as noted in section 2.3 above, has occurred within a broader longitudinal action research programme. To that extent it may be categorised as a "case study" within the Gallupe & Tan (1999) GIM Research Framework, although it also has applied a range of other qualitative research techniques. This study may be further categorised within the variants of action research (cf. Baskerville & Myers, 2004, Carr & Kemmis, 1983, Clear, 2004a, McKay & Marshall, 2001), and it may be productive here to map the study against the characteristics of action research forms developed by Baskerville and Wood-Harper (1998).

As can be seen from figure 4.1 below the study has employed three of the primary forms of action research categorised by Baskerville and Wood-Harper (1998, p.96), "canonical action research", "information systems prototyping" and "participant observation". In reality the picture is a little more complex, as elements of 'action science' and 'process consultation' could also be applicable. However those models assumed some form of a researcher-client relationship where the researcher is involved in a consultancy or "helping mode". In this study the teams of coordinators at each location acted as 'researcher-practitioners', so we were in effect our own 'subjects'. Arguably the students as 'co-researchers' (Clear & Kassabova, 2005, 2008) could be separately viewed as 'research subjects' operating in a more dependent relationship.

A Mapping of Action Research as Applied in this Study of TUM in Global Virtual Teams

Characteristics analysis of action research forms *(Based upon Baskerville and Wood-Harper, 1998)*

	Process Model			*Structure*		*Typical Involvement*			*Primary Goals*			
	Iterative	*Reflective*	*Linear*	*Rigorous*	*Fluid*	*Collaborative*	*Facilitative*	*Experiment*	*Organization development*	*System design*	*Scientific knowledge*	*Training*
Canonical action research	1 ●	●		●		2 ●	4 ●	5 ●		●	●	●
Information systems prototyping	●	●			●	3 ●		6 ●		●		
Soft systems												
Action science												
Participant observation	1 ●	●			●		●	●		●	●	●
Action learning												
Multiview												
ETHICS												
Clinical field work												
Process consultation												

Notes:
1) at overall programme level not within research cycle
2) instructors
3) pair programming
4) lecturer-lecturer
5) lecturer-student
6) developer

Figure 4. 1: A Mapping of Action Research Characteristics as Applied in this Study of TUM in Global Virtual Teams

In addition to "forms" of action research, figure 4.1 above highlights the "characteristics" of the research study, where the *process model* was both iterative and reflective; the *structure* combined rigour and fluidity; the *typical involvement of the parties* traversed collaborative, facilitative and experimental (although the collaboration design would be better framed as 'quasi-experimental'); and the *primary goals* were in the areas of system design, scientific knowledge and training (for students and academic staff involved). Of interest is the fact that other external supporting parties as *technology-use mediators* were not explicitly bound into the research, although I had discussed the initiative with Mark Northover the Head of the Flexible Learning Unit to gain his support, and his interest as a researcher himself in the field of global collaboration (Northover, 2004). The level of explicit involvement and shared decision making by participants in an action research project, are key determinants for some researchers of whether the term 'action research' should be applied at all.

> "Action research activity is said by Carr & Kemmis (1983) to have two essential aims, both to *improve* and to *involve*. The focus of this improvement lies in three key areas: improving a practice; improving the *understanding* of a practice by practitioners and improving the *situation* in which the practice takes place" (Clear, 2004a p. 106).

Thus it could be argued that researching TUM, without involving the participants in the overall research design, fails this *involvement* test. That issue is further reviewed in section 9.3 below, but for now this section will elaborate on the action research programme as conducted to date.

The overall longitudinal research programme (as noted in section 2.3 above) arose as a loose extension of the international student collaboration undertaken between three universities - Uppsala in Sweden, Grand Valley State in Michigan, and the Open University of UK - known as the "RUNESTONE" project (Daniels, Petre et al., 1998, Last et al., 2000). Several action cycles have been traversed over the period from 1997 to the present, with an M.Phil thesis reporting the findings from one cycle namely the 1999 international collaborative trial (Clear, 2000), and a Doctor of Management in Organizational Leadership from the University of Phoenix applying data from the 2002 international collaboration cycle, which used a combination of a two dimensional Notes collaborative database and three dimensional avatars (Hammon, 2007). Thus this doctoral study fits within the context of an active current programme of research, within which it represents a particular focus of enquiry.

An illustration of the typical steps within a single action research cycle is given below in figure 4.2.

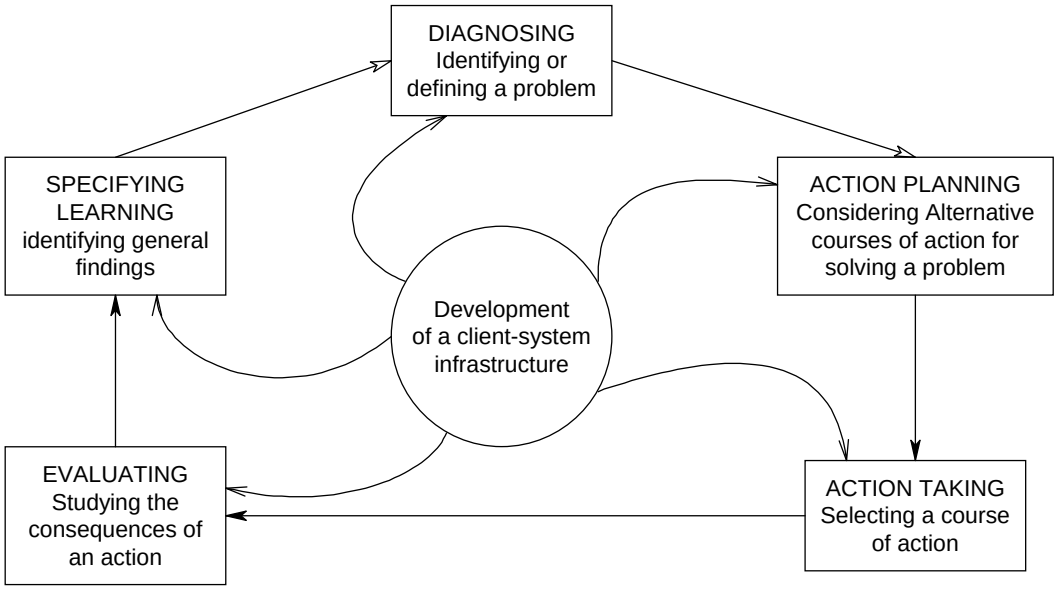


Fig. 4.2: The Action Research Cycle (adapted from Susman & Evered, 1978, p.558)

In this programme the collaborations undertaken each semester offer a natural planning window for an action cycle within the research programme. They provide an opportunity for reflection, to take stock of the progress made and learning gained in the previous cycle and act as a logical planning point for the subsequent cycle. An action plan from each collaborative trial naturally feeds through into the design of the next.

In the conduct of the research the "dual cycle" action research framework of McKay and Marshall (1999, 2001) has been applied, to clearly frame the key dimensions. The outline plan for the semester 2/2004 collaboration is given in appendix 9 below.

Different frameworks have informed previous analysis of each action cycle (c.f. appendix 18 below for details of the full set of cycles), but in this thesis (as elaborated in chapter three above) a novel unifying framework has been developed "Technology-use Mediated Adaptive Structuration Theory" (TUMAST), representing a further expansion upon Extended Adaptive Structuration Theory [EAST], (Clear, 1999). The usefulness of the TUMAST framework for investigating the phenomena associated with GVTs and technology use mediation (TUM) has been tested through its application to the semester two 2004 trial data extracted from the large corpus resulting from the sequence of collaborative trials depicted in tables A18.1, A18.2a and A18.2b below.

In the Mackay & Marshall (2001) variant of action research, the separate components of the research are identified and consciously addressed. Five elements are noted within their framework, which enable a conscious separation of the practice components from

the research elements, and thus enable the research to avoid the trap common to action researchers of having their work described as simply "consultancy". These five separate elements depicted in table 4.1 below comprise:

1) [F] the research framework or conceptual element informing the research;
2) [MR] the research method to be adopted;
3) [MPS] the problem solving method that will be used in the practice situation;
4) [A] the problem situation of interest to the researcher (the research questions);
5) [P] the problem situation in which we are intervening (the practice questions of interest to the practitioners).

The elements of the action research framework, as planned at the point of submitting the doctoral proposal on 16/09/2005, are given in table 4.1 below. These five elements in combination provided a concise means of planning and framing the research endeavour, while capturing both the research and practice dimensions. The practitioner interest here related among other things to "improving the viability of student or software teams engaged in international teamwork". TUM was considered a key dimension in supporting the work of global teams in both contexts.

Element	**Description**
F (Framework)	• Extended Adaptive Structuration Theory (Clear, 1999 & revisions in progress)
$\mathbf{M_R}$ (Research Method)	Practical Action Research, with some aspects of emancipatory action research. Content analysis of online data (email, discussion threads, websites, Notes forms etc.) will incorporate grounded theory for TUM elements
$\mathbf{M_{PS}}$ (Problem solving method)	Prototyping, Collaborative Trials, Practical Action Research, reflective practitioner model
A - (problem situation of interest to the researcher)	• How does TUM operate and support or hinder the work of GVTs? • How does TUM operate and support or hinder e-collaboration? • How do TUM, e-collaboration and GVTs interrelate?

P - a problem situation in which we are intervening	• Improving teaching & learning through active learning approaches
	  • Students as active co-researchers
	  • Collaborative learning models
	• Developing student capabilities in teamwork, cross cultural communication and use of IT
	• Providing an interesting & meaningful learning experience
	• Using e-collaboration to teach and practically demonstrate key concepts of groupware and group decision support
	• Improving viability of student or software teams engaged in international teamwork

Table 4.1: Elements of research investigating TUM in GVTs within a 'dual cycle action research' framework

While the above table has the benefit of separating out the researcher and practitioner interests into distinct elements, it is unspecific about the underlying epistemology or ontology. Action research, as with all research is conducted with some basic assumptions. A useful distinction offered by Orlikowski & Baroudi (1991) suggests three main research paradigms: the objectivist, the interpretivist and the critical or evaluative. Carr & Kemmis (1983, p.136) echo this perspective with three variants of action research each grounded in a distinct worldview:

- *technical action research*, where the researcher acts as the expert and agenda setter, guiding a practice community towards some change based upon that agenda.
- *practical action research* where the researcher acts more in the role of a process facilitator and is conducted in collaboration with the community towards joint goals.
- *emancipatory action research* where the researcher and the practice community unite to address distortions and power imbalances in their situation

The Action Research variant adopted here of "practical action research" (ibid. p.162), is based upon a largely interpretivist and pragmatic worldview, in which the activities in co-operation with practitioners are mainly concerned with improving practice, and encouraging professional reflection. This is in contrast with the more actively "emancipatory action research" approach (ibid. p.162) adopted in the candidate's M. Phil thesis (Clear, 2000, 2004a), which aimed to significantly impact existing structures. Some aspects of this work do retain an emancipatory perspective, in attempting to change the role of students from passive absorption of knowledge imparted by instructors, to participants in a process of joint enquiry. But given the innate power differentials in the teaching situation, and the constraints imposed by the wider educational and institutional contexts within which the initiative occurs, the reality of radical change in learning & teaching models is probably over optimistic.

The goals of understanding TUM in GVTs were also (at face value) likely to be served by a pragmatic and empirical research agenda. Regardless of basic philosophy though, an interpretivist worldview still brings with it the "principle of suspicion" (Klein & Myers, 1999), and several incidents and evolving patterns of practice required a healthy scepticism in interpreting the data within a rich global context. At many points the switch from 'practical' to 'more emancipatory' models of Action Research were

warranted, in the process of undertaking the steps from the previous quote based on Carr & Kemmis (1983):

> The focus of this improvement lies in three key areas: improving a practice; improving the *understanding* of a practice by practitioners and improving the *situation* in which the practice takes place" (Clear, 2004a p. 106).

At several points having reached an "understanding of a practice", the need to improve both the *practice* itself and the *situation* in which we were engaged in that practice became apparent. These issues will be developed further within later chapters of the thesis.

As noted above, this study occurs within the context of a broader programme of work, within which it represents but one action cycle. Fuller details of the overall research programme, collaborations conducted, insights gained and resulting publications is given in appendix 18 below. Data selected from the triadic trial of semester 2/2004 constitutes the body of work for analysis and testing of the TUMAST framework, developed as part of this study.

A similar depiction to that presented in table 4.1 above is provided in Appendix 9 below which outlined the 'Action Research Framework for the semester 2/2004 International Collaborative Trial'. It was developed to clearly frame the research for that action cycle by distinguishing the separate goals of the research and practice dimensions and was shared between the participating researchers at the time. As is evident from appendix 9 below, the scope of the research for that collaboration, while including inquiry into the processes of TUM, extended beyond that specific focus.

4.3 Analytical Strategies and Philosophical Standpoints

While Gallupe & Tan have classified 'action research' within their category of "case study" GIM research, they did not give more specific guidance as to analytic or coding strategies suitable for action research, other than more general suggestions for an qualitative research repertoire "using techniques like ethnography, interpretive epistemology or grounded theory" (1999, p.15).

Baskerville (1999) has similarly noted that "qualitative analytical techniques like hermeneutics, deconstruction and theoretical sampling are common companions to action research" and went further to assert that:

> "since action researchers adopt interpretive and idiographic postures they must also adopt qualitative data as a medium to the empirics" (p. 5).

In their introduction to the MIS Quarterly special issue on action research Baskerville & Myers (2004), discussing the philosophical underpinnings of action research, suggested that:

> "the underlying philosophy shared by most forms of action research is *pragmatism*. As a philosophy pragmatism concentrates on asking the right questions and getting empirical answers to those questions. On its own it does not explain very much, but provides a method to help explain why things work (or why they do not work)" (p.331).

As noted in the conceptual framework section (chapter three) above, the theoretical basis of this study also lies in a structurational perspective, with TUMAST being a development of the AST model. Speaking generally Poole & DeSanctis (2004) have observed that as a *meta-theory* "structuration theory leaves decisions about research settings, procedures, measurements and analytic tools to the researchers themselves".

In this study then, conducting empirical analysis, with a coherent and robust set of tools and techniques, has required a suitable methodological 'toolkit' to be devised. In the broad spirit of pragmatism this selection of strategies has been informed by a variety of sources. I have found myself broadly in agreement with Mingers (2001), who has argued that:

> "a richer understanding of a research topic will be gained by combining several methods together in a single piece of research or a research programme" (p.241).

But Mingers has then gone further to assert:

> "it is possible to disconnect a particular method from its normal paradigm and use it consciously and critically within another setting" (ibid., p.247)

Thereby he has staked out a position in opposition to the notion of "paradigm incommensurability". Consistent with Orlikowski & Robey (1991) he has concluded that the "idea of paradigm incommensurability…is fundamentally flawed" (Mingers, 2001), based on a structurational perspective from Giddens (1984) which demonstrated "that it is not possible to separate out objective and subjective dimensions" Mingers (2001). Mingers has termed this philosophical position "critical pluralism".

The interventionist methodology of action research and a basic goal of improving on a present situation underpin this study. Additionally as highlighted in chapter three above, the analytical roots of the thesis lie in a structurational perspective. Therefore this study might equally be framed within the "critical pluralist perspective" of Mingers. This represents a view consistent with the categorisation of action research as "multimethodological" by Greenwood and Levin (2000, p.93).

This study has chosen a combination of frameworks, research methods and analytical techniques in order to conduct the empirical analysis required, believing that these elements in combination may provide a sound basis for "triangulation" (Jick, 1979, Guba & Lincoln 1981, p.257) to improve the quality and robustness of the findings. Jick has argued that triangulation,

> "may be used not only to examine the same phenomenon from multiple perspectives, but also to enrich our understanding by allowing for new or deeper dimensions to emerge" (Jick, 1979, p. 604).

He has also recommended that researchers mix quantitative and qualitative methods and apply both the approaches below:

> "*within method* triangulation [which] essentially involves cross-checking for internal consistency or reliability, while *between - method* triangulation tests the degree of external validity" (ibid., p.603).

These philosophical standpoints have each served to inform methodological aspects of the research design. Recommendations from virtual team researchers are also germane, for instance Qureshi & Vogel (2001) have made the following observations:

> "Research into the computer support of teams has been dominated by a positivist approach" (p. 39).
> "In order for IS research to be relevant, researchers must in some form or another be exposed to the practical contexts where IT-related usage and management behaviours unfold." However, because the results of interpretive research are restricted to specific contexts, many in the IS community find it difficult to generalise them across the field and package them into concrete recommendations" (ibid., p.42).

This study is innately grounded in a field setting, and therefore these methodological challenges have had to be faced. Qureshi & Vogel (2001) concluded with the following recommendation:

> "that the choice of research approach or combination thereof should depend upon the issue being investigated and not vice versa, thus increasing the practical relevance of research focused on virtual teams"(p. 43).

Beise and colleagues exploring distributed GSS settings, and facing similar issues innate to this form of research, have drawn the following methodological conclusions:

> "The complexity of this type of research, largely due to the interaction of so many organizational, technology, and individual participant variables, points toward the high value of multiple qualitative research studies. DPM [distributed project management] action researchers who are attempting to glean what they can from organizational case studies are on the right track" (Beise et al., 2003).

It is apparent therefore, in response to these innate challenges, that other virtual team researchers have also recommended pluralism in the adoption of research methods, which lends support to the approach taken within this study.

4.4 Grounded Theory and Coding

In order to ground the study firmly in the empirical data, a 'grounded theoretic' coding strategy has been adopted as one analytical technique within this study. The strategy adopted has been the "constant comparative method" championed by Glaser and Strauss (1967), and Glaser (1992). Espinosa and colleagues have asserted the applicability of this method within the domain of interest:

> "Grounded theory is a widely used qualitative method in information systems research [10, 60, 76] and global teams [62], particularly when the study is exploratory and the theoretical development of the topic is in its early stages [60]" (Espinosa et al., 2007, p.145).

As the phenomenon of *technology-use mediation in global virtual teams* was little understood and under theorised at the outset of this study, Espinosa's conditions definitely applied. For a comparative example, Grounded Theory has been applied to the study of virtual teams (cf. Sarker et al., 2001), in an exploratory mode to build theory about virtual team development.

Before outlining the use of Grounded Theory (GT) here, it may be worth stating the variant of GT adopted in this study. One of the key debates in qualitative analysis and grounded theory is, did the results derive from an "a priori" formulation of the critical category, or did the results emerge naturally from the data?

> "Glaser and Strauss insisted that preconceived ideas should not be forced on the data by looking for evidence to support established ideas" (Allan, 2003).

Glaser and Strauss (1967) have asserted that "grounded theory allows no speculation…one can be just as systematic with qualitative data as with quantitative data" (p. 200) and in generating theory the key position is that "the theory should fit the data" (p. 201) and not vice versa.

How one should go about generating grounded theory is a highly contentious issue, with severe controversies in the two grounded theory camps, as expounded in Barney Glaser's (1992) book vociferously objecting to the work of Strauss & Corbin (1990) and its "misinterpretation" of GT. Glaser (1992) saw the Strauss & Corbin model as producing not GT but a methodology for "a forced, preconceived full conceptual description" (p. 3). Glaser actually argued for the Strauss & Corbin variant to be given a totally different name. Also with respect to "axial coding" - This notion of an intermediate level of coding was highly criticised by Glaser "it excludes and ignores theoretical coding. It is a shocking neglect of Glaser's original formulation". (1992, p.

61). The basic message is that GT was originally conceived as an analytical and conceptual, creative process of constant comparative coding by Glaser and Strauss (1967) and yet operationalised by Strauss & Corbin (1990) in a discrete set of coding rules.

Allan (2003) reflected on the difficulties he had experienced while coding: firstly since Glaser and Strauss (1967) "did not instruct the reader in a prescribed mechanism for performing the coding"; and secondly he found drawbacks in applying the Strauss & Corbin (1990) "analysis technique of coding by microanalysis of the data, word by word and line by line". In the first instance there were doubts about what a code should be and in the second the technique was both time consuming and confusing. This led him to follow Glaser by "identifying key points (rather than individual words) and allowing concepts to emerge".

4.4.1 Analytical Tools for Coding

The approach taken in this study involved using the QSR NVivo™ Version 7 qualitative data analysis tool (QSR, 2007), to support the coding process. An initial phase prior to the study proper had involved familiarisation with the software and piloting the analysis process. This pilot drew upon data from a synchronous collaboration using desktop videoconferencing software, which had been conducted within the Collaborative Computing class during August of 2004. This data incorporated a limited corpus of email messages, together with notes from one session in class where we had reviewed the rich set of actors and roles involved in both mediating and performing the collaborative process (cf. tables A20-6.52a and A20-6.52b below for details). In this process of analysis within NVivo I found myself operating at a very micro-level within each datasource, but this initial 'bottom-up' strategy seemed necessary in the process of coming to grips with both the software and the process of coding. As noted in chapter 1.4 above, this study has involved "analysis of a corpus of email data from multiple contributors", and as appendices 4 and 5 below demonstrate, there are a broad range of electronic data sources to be accommodated. As Allan (2003) has observed, in GT research "data collection is usually but not exclusively by interviews", so I needed to experiment in order to develop a coding approach that would handle email data as the primary source of data for this study.

In the choice of software packages for the qualitative data analysis, I had been advised by a colleague to use the more powerful and flexible QSR NVivo7™ product in preference to the alternative QSR N6™, based on her experience noted below:

> Gwyn Claxton personal conversation (re use of QSR N6. less powerful than NVivo and difficulties in comparing across hierarchical trees) Nov 2004 & 2/06/2005 – demo of limitations in displaying matrices with child levels below parent nodes

This note itself reflected my own practice of "diarying" to record field notes throughout the research process, as recommended by Richardson (2000, p. 941), who refers to four types of field notes worth recording, "observation, methodological, theoretical and personal notes". Typically I jotted handwritten notes into a small ruled 8" x 5" hard cover notebook, in chronological order. These notes themselves constituted data sources which were then transcribed to digital form for selected episodes and subjected to GT analysis. Diary notes have been incorporated in several of the "episodes" analysed in detail in chapter six below. Some notes, such as the above methodological observation, were recorded in regularly updated Microsoft (MS) Word™ documents such as the one in appendix 9 below. These often recorded key references and the development of thought which had led, in this case, to the combination of methods applied in the study.

Thus the pilot NVivo7 coding phase served a role as a 'proof-of-concept' for the utility of the software. Further it helped to sensitise me to the forms of data involved in analysing TUM activities for the primary study of this thesis. This sensitising process even extended to the introductory analysis at this pilot stage, and in effect began the process of applying the "constant comparative method" of GT.

As Allan (2003) reports:

> "the theory could be allowed to emerge right from the start…concepts and categories should be noted and merged as soon as they are noticed and this is the start of the theory".

Allan cautions against the natural researcher tendency to collect data first and analyse afterwards, since "in GT this is not the case and needs to be understood and appreciated" (Allan, 2003).

While in the use of NVivo7 for coding email data sources, the process appeared micro-level and bottom up, in practice the codes and concepts developed over time and progressively as insights built, even by seeding at times from literature sources which I had been concurrently reading and themselves became data items for comparative analysis. For instance the four modes of TUM activity (*establishment,*

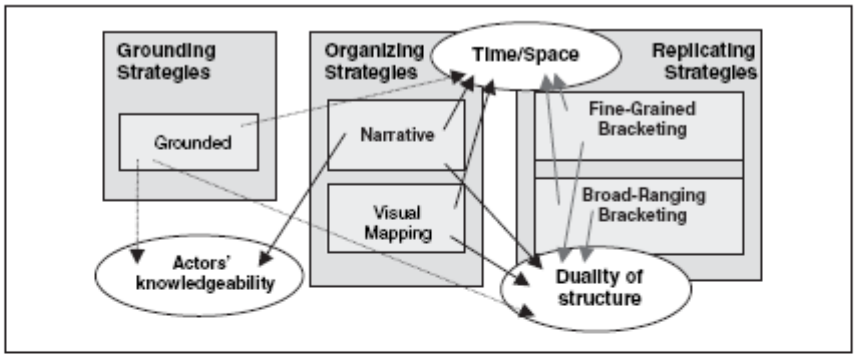
adjustment/reinforcement and episodic change) were incorporated as codes for TUM related concepts drawn from the literature (Orlikowski et al., 1995). In a similar fashion the codes applied by Poole & DeSanctis (1992) for micro-analysis of appropriation moves were incorporated within the code set, and expanded as additional codes for TUM related appropriation moves emerged from the data (cf. appendix 6 below). This was not inconsistent, as Allan has noted, with "Glaser & Strauss (1967, p. 169) who encouraged researchers *to use any material bearing in the area*" (Allan, 2003). The "constant comparative method" of GT thus was exercised initially through iterative comparison across multiple data sources, including the literature, and later across full episodes.

A more specific discussion of the nature and form of the data involved in the study and the process of data analysis will follow in chapter five below.

4.5 Structurational Analysis

Pozzebon & Pinnsoneault (2005) have remarked that "*structuration theory is not intended as a method of research or even as a methodological approach*, and its application in empirical research is widely regarded as very difficult" (p. 1355). As guidance for researchers they have proposed "a repertoire of strategies for applying structuration theory (ST) in empirical IT research" (p.1366). This repertoire is depicted in figure 4.3 below, and demonstrates a number of interlocking strategies they recommend be adopted when conducting empirical research using ST and "process data". The links to the above discussion are apparent in the recommendation of a "grounding strategy", which could involve use of "grounded theory". They suggest that GT operates through an "inductive strategy" involving "the systematic comparison of data gradually to construct an explanation of an observed phenomenon" (Pozzebon & Pinnsonneault, 2005, p.1362). Alternatively they proposed that a "deductive strategy" applying "alternate templates" could be adopted. Application of the appropriation analysis of Poole & DeSanctis (1992) could thus be considered as a *deductive grounded strategy* for which the code set of "appropriation moves" provided a predefined *template*. However, the expansion of that template to accommodate TUM related appropriation moves as additional codes, as the analysis developed (cf. appendix 6 below), better aligns with the application of GT and an *inductive strategy*. The four TUM modes, as discussed in 4.4.1 above, again constituted an 'alternate template' for

data comparison applying a *deductive grounded strategy*. So both grounded strategies have been applied in this research.



	Strategies to be particularly mobilized				
Sensitizing Device	Grounded	Narrative	Visual Mapping	Temporal Bracketing (Fine-Grained OR Broad-Ranging)	Study that illustrates the combination of these strategies
Duality of Structure	Necessary	Strongly recommended	Suitable	Strongly recommended	Barley (1990)
Time/Space	Necessary	Strongly recommended	Suitable	Strongly recommended	Orlikowski (1996); Barrett and Walsham (1999)
Actors' knowledgeability	Strongly recommended	Strongly recommended			Orlikowski (1991)

Figure 5. A Repertoire of Strategies for Applying Structuration Theory in Empirical IT Research

Figure 4.3 A repertoire of strategies for applying structuration theory in empirical IT research (ex. Pozzebon & Pinnsonneault 2005, p.1366)

The structurational analysis adopted in this thesis, has aimed to develop insights based upon an empirically driven strategy firmly grounded in the data, but informed by an applicable theoretical framework. This quest was not simple, as signposted by these remarks of Schiller & Mandviwalla (2007) regarding a general lack of progress with theoretical developments and the paucity of available frameworks in virtual team research:

> "there has been little progress in the development of new theories in virtual team research...The theory most frequently used (nine uses) is adaptive structuration theory (AST)" (p. 18).

AST then, provides the structurational roots for the analysis in this thesis, based upon the theoretical strengths identified by the same authors below:

> "It is not surprising that AST ranks the highest, because it "emphasizes the interplay between technology and the social process of technology use, illuminating how multiple outcomes can result from implementation of the same technology" (DeSanctis & Poole,

> 1994, p. 142). On the other hand, AST is also a broad, process-oriented theory and is not necessarily intended for very specific explanation and prediction. Its limitations are "weak consideration of the structural potential of technologies in general and advanced IT in particular, the focus on institutional levels of analysis, and the reliance on purely interpretive methods" (DeSanctis & Poole, 1994, p. 142). It is possible that the high frequency of use of AST suggests that we are still trying to identify the key explanatory constructs in virtual team research" (Schiller & Mandviwalla, 2007, p. 18).

Yet as Schiller & Mandviwalla have noted above, AST is not without its deficiencies when conducting empirical analysis. Their observations here have echoed the earlier comments of Pozzebon & Pinsonneault about the general challenges of ST research. In this thesis the theoretical developments undertaken to accommodate analysis of TUM in GVTs have been aimed at addressing some of these deficiencies. The TUMAST framework outlined in chapter three (cf. 3.3.5.7 and 3.4.2 above) has been developed with a clear methodological goal, namely that of operationalising a method for empirical analysis of TUM in GVTs. TUMAST has enabled focused analysis of selected "episodes of interest" each of which has focused on a specific mode(s) of TUM. Chapter five below provides a fuller discussion of the forms of data and the episodes analysed within this thesis.

4.5.1 Episodic Analysis

As outlined in section 3.3.5.7 above, the "episode of interest" has constituted the initial unit of analysis, with section 3.3.5.8 providing a rationale for and explanation of the notion of an "episode". McKernan (1991, p.162) in discussing a slightly different form of analysis within an educational setting has described "episode analysis" (EA) as follows:

> "a process of breaking down classroom discourse and events into more manageable units for purposes of analysis...The principal use of EA is in direct observation of action and its subsequent analysis, so it straddles both the observation of action and data analysis dimensions of action research...the aim is to establish coherent units and to examine relationships among and between these units or 'episodes' of classroom action. Thus an episode may be defined as a brief micro unit of human behaviour, whether verbal or nonverbal, that is integral to yet separable from the continuous chain of classroom events".
>
> "one mode of proceeding is to divide social interaction into units that have integral boundaries. Of course there are many logical ways of classifying units: sentences, words, paragraphs and so forth. Yet it is clear that an episode begins with an expression which triggers a response – be it verbal or non verbal behaviour – culminating in a goal or completion of a discourse". (McKernan, 1991, p. 162)

In McKernan's technique for "episode analysis", episodes tended to be very micro level events, such as a brief interaction between a teacher and a student. By contrast

"episodes of interest" in the TUMAST model (cf. 3.3.5.7 and 3.4.2 above) may cover micro or macro level events, and may incorporate multiple data sources for analysis.

TUMAST as applied in this thesis has adopted a multi-layered strategy for analysis, with micro analysis being applied in the process of coding within Nvivo7 every source data item (e.g. diary note, email message, quote, document etc.), for each episode. This micro analysis level of coding has been complemented by comparison of codes and concepts between data items (again at a micro level), and by more macro forms of analysis across episodes and episode groupings.

Chapter six below provides examples of the application of "episodic analysis" within TUMAST, where the 'episode' reveals the operation of TUM activity within a given mode (e.g. *establishment*), and is based upon an identified set of source data items. At a broader level of analysis, the "constant comparative method" of GT is apparent through its application in the "cross episode" analyses of chapter seven below.

While TUMAST has been applied in this study as a framework to support the process of analysis, this analysis has been conducted for each episode within the overall structurational pattern recommended in figure 4.3 above.

Episodes have been presented applying the four strategies recommended by Pozzebon & Pinsonneault (2005) for applying structuration theory (ST) in empirical IT research. These strategies have been realized by analyzing each episode using:

1. first a *narrative summary* to introduce each episode or episode grouping;
2. second a *data-driven, grounded strategy* to analyse the patterns of appropriation moves in each episode or episode grouping, complemented with the roles and other key elements drawn from the data and integral to each episode;
3. third a *visual mapping strategy* to show the evolution or emergence of patterns across time; and
4. fourth a *temporal bracketing strategy* (fine or broad ranging), which is inherent in the selection of each episode or episode grouping, and provides a window within which realized patterns of practice may be observed.

Each such analysis has further aimed to integrate the three sensitizing devices for ST research recommended by Pozzebon and Pinsonneault (2005) within each episode, namely illuminating: the operation of *duality of structure*; the *role of time/space* and

revealing the *actors'* knowledgeability or "*reflexivity* regarding their day-to-day interactions" (ibid. p. 1367).

4.5.2 Visual Mapping Strategies

The visual depiction of the patterns within each episode, has resulted in differing forms of portrayal (for instance a two dimensional tabular summary in figure 6.6 and radar charts in figures 6.21 - 6.25 below). These visual summaries (or maps) of each episode as portrayed in chapter six below, draw in part upon the prior work by Barley (1986), Orlikowski et al., (1995) and Orlikowski (1996) who have used varying visual mapping approaches to depict the evolution of structuring processes over time. Visual mapping proved useful as a means of depicting a "metastructure" (cf. 3.3.5.6 above and 6.2.4.1 below) as a form of "activity pattern".

In Barley's model of the structuring process below (1986, p. 82), he depicts two realms - one of action and one of institutional forces. Windows of analysis are used to show how over time, (as measured by certain key punctuating events), actions are in turn both constrained by and accumulate to impact the institutional realm. Barley uses the term 'script' for the practices enacted by actors within the setting, and observes that these typically exhibit regularities in their patterns,

> "As manifested in the flow of behavior, scripts appear as standard plots of types of encounters whose repetition constitutes the setting's interaction order" (Barley, 1986, p.83).

Figure 1. Sequential model of the structuring process.

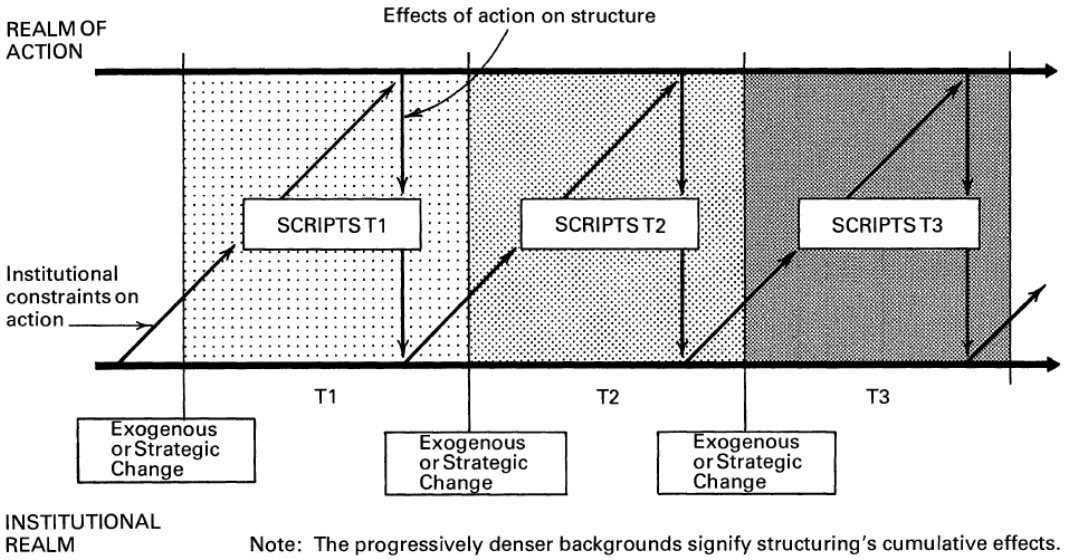


Figure 4.4: Sequential model of the structuring process (ex. Barley 1986, p.82)

Barley concludes that:

> "Social practices therefore constitute institutions synchronically while institutions constrain action diachronically" (ibid. p. 83).

Orlikowski et al., (1995) augmented Barley's visual model of structuring processes over time with a model that further accommodates the stages in the processes of metastructuring (*establishment, reinforcement and adjustment and episodic change*) that were found to constitute TUM. These stages which have been reviewed earlier in the thesis (cf. section 3.3.5.2), constitute key structuring elements for the choice of 'episodes of interest' analysed in this thesis.

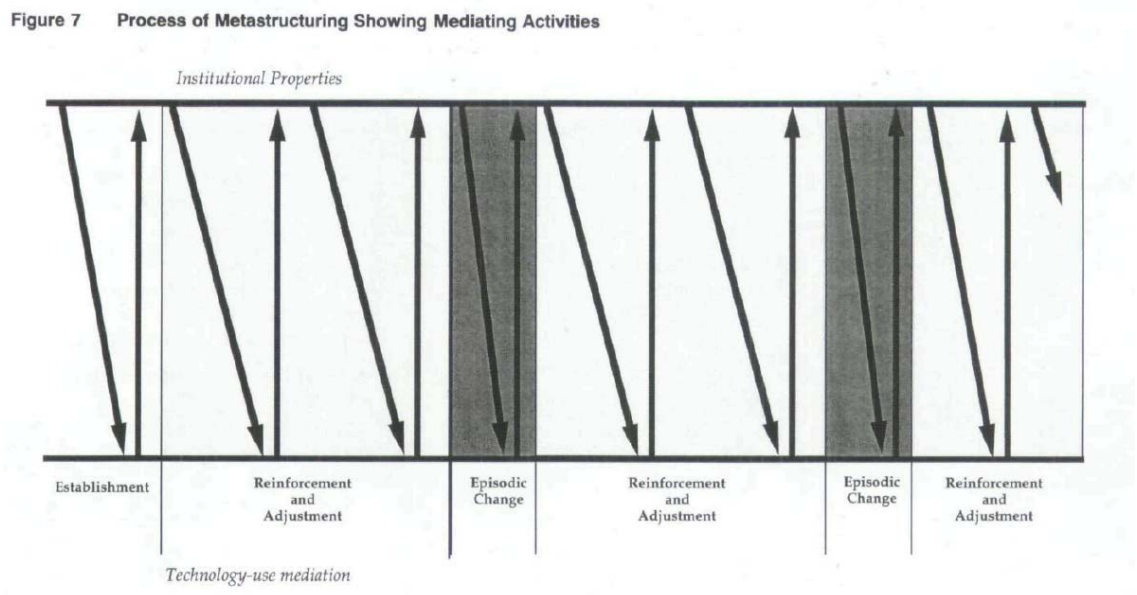


Figure 4.5: Process of metastructuring showing mediating activities (ex. Orlikowski et. al., 1995, p.440)

Therefore the forms of visual mapping such as radar charts employed in this study inherently tend to include an temporal dimension, since they depict the status of the episode at a given point of time, most typically at its conclusion.

4.5.3 Temporal Bracketing

The selection of each episode or episode grouping has provided a window of time within which realized patterns of practice within the chosen TUM activity may be observed. A further visual model offered by Orlikowski (1996), picks up on Barley's earlier notion of 'scripts' and 'social practices' discussed above, and tracks the changes in 'work practices' in an IT Support Centre over time. Three main distinctions are drawn in the figure 4.6 below: deliberate change in work practices (of both managers

and specialists); emergent changes in work practices; and unexpected outcomes. Against these developments are mapped the technology features that were appropriated in that practice.

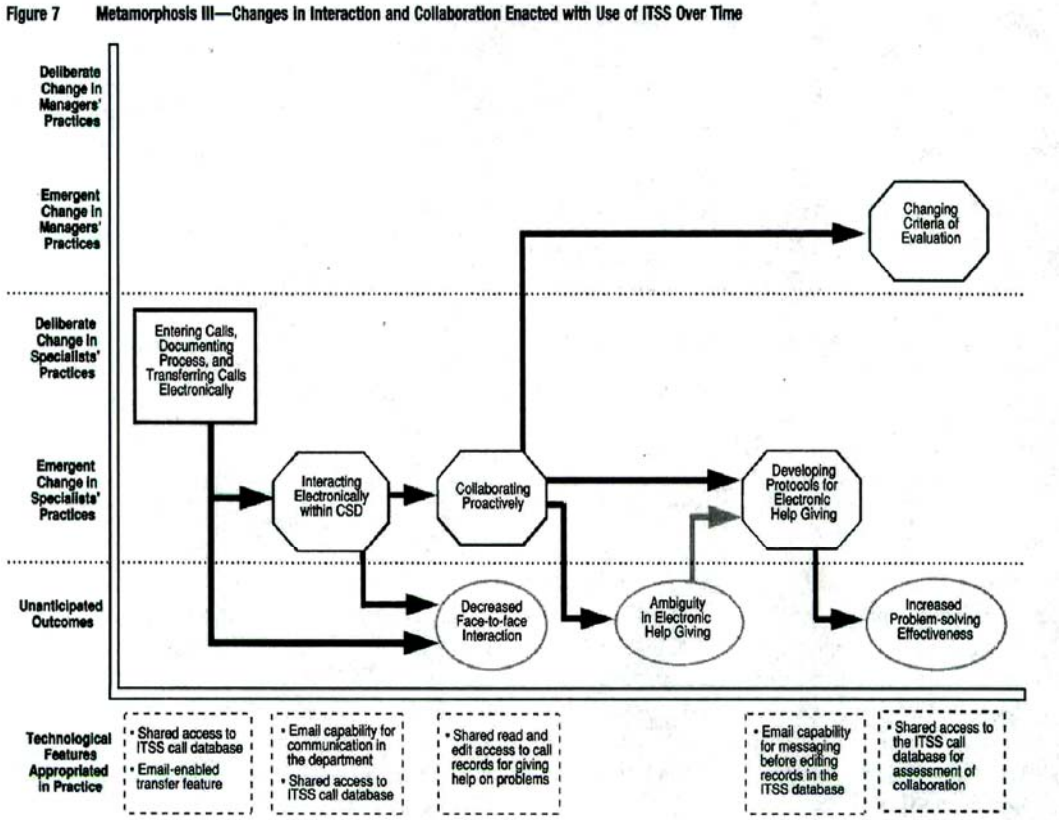


Figure 4.6: Depicting Changing Work Practices over Time (ex. Orlikowski, 1996, p.72)

The episodic analyses of chapter six below have drawn some elements from this combination of diagrams which demonstrate the process of change and structuring of technology over time. In some cases the evolution of practices within the temporal boundaries of the episodes themselves (many of which were rather brief in duration) has proven rather limited. The temporal bracket in most episodes has therefore been extended beyond the episode boundaries, to include prior events and subsequent events which better manifest the unfolding of practices over time. To concentrate such extended analyses, the extensions have been based upon a particular 'TUM activity in focus', within the analysis of that episode. This focussed approach to the analysis of TUM activities, by *TUM activity mode* or specific *TUM activity in focus* has helped overcome the concerns noted in chapter three above (section 3.3.5.6) about the inherent difficulties in analysing "activities". As noted in 3.3.5.6 above, mapping "TUM activity" in the four modes of Orlikowski et al., (1995) was viable (through the inherent restriction to four discrete groupings), even if non trivial.

Accordingly by adopting a broader temporal bracketing strategy, a more graphic illumination of the change process brought about through TUM has been able to be presented for each episode. Likewise 'cross episode' comparisons have incorporated a temporal bracketing strategy, which has aided in developing greater insights into the dynamic process of TUM and its evolution over time.

4.6 Autoethnography

A final methodological comment relates to my own role within the study. This was an action research study in which I played a major role as a coordinator of the collaboration. Therefore my own contributions and TUM activities constituted part of the data for analysis. Several of the data sources, for instance, within the selected episodes of chapter six came from my own transcribed diary notes. Therefore from a methodological perspective the analysis inevitably has an autoethnographic dimension, "where the author is both informant and investigator" (Cunningham & Jones, 2005). The latter writers offered the following description of "autoethnography".

> "While it is an autobiographical genre of writing, the autoethnography is not simple personal narrative. Instead, the author adopts an objective (or rather, as objective as possible) stance to the personal, when interpreting his/her own actions, thoughts, and behavior. At the same time, it is acknowledged that analysis presented in an autoethnography will necessarily "bear the signature and voice of personal interpretations" [5], such that the work will present both a record of activities and how the researcher made sense of those activities" (p.2).

The analysis conducted in this thesis certainly includes those elements. But an interesting counter argument to this view has been given by Heshusius (1994), who in a holistic argument based on "participatory consciousness" has critiqued the whole distinction between objectivity and subjectivity.

> "A long list of questions come to mind when I read about the need for researchers to manage their subjectivity. When researchers tell us (or themselves), here are the subjective parts of me that were involved in the research process, shouldn't they also be able to state what parts of them were not subjective…Don't we reach out (whether we are aware of it or not) to what we want to know with all of ourselves, because we can't do anything else? If there is no ontological or procedural objectivity to guide the research process, then, as many have argued largely from outside education, neither is there an ontological or procedural subjectivity to guide the research process" (Heshusius, 1994, p.16).

As noted in the introduction (section 1.1.2) I have clearly outlined my role in the research context and process, consistent with the Klein & Myers (1999) principle of making clear "the interaction between the researcher and the subjects". With Heshusius

I do question though, to what extent I can make clear the interactions between my separate selves as 'researcher' and 'subject'? However, I do acknowledge the need for some strategies to ensure rigour in the research, to avoid criticisms such as that below.

> "Done badly, autoethnography can be justly criticized as embodying the worst excesses of post-modernism, as the author creates a self-indulgent, un-generalizable, impenetrably individualized narrative [9]. At its best, the autoethnography shares voices that might not otherwise have been heard, and presents insights that might otherwise have been too subtle to elicit". (Cunningham & Jones, 2005, p.2)

Therefore two main strategies can be outlined. Firstly I adopted a consistent practice of diarying to record my actions and those of others, incidents and reflections related to the collaboration and the research in "field notes" akin to the (*observations, methodological, theoretical, and personal notes*) recommended by Richardson (2000) and noted in section 4.4.1 above. I also engaged in summarising and periodic recording of key insights in word documents related to the thesis (e.g. appendix 16 below). These practices appeared consistent with the following autoethnographic recommendations:

> "Issues of unobtrusiveness in observations are more subtle; the researcher must record personal activities without interfering with behavior. In practice, as with conventional ethnography, this entails making notes as soon after the observed behavior as possible [6]. Raw notes are reviewed periodically and insights summarized—perhaps as a series of *reflexive journal summaries*". (Cunningham & Jones, 2005, p.3)

The second strategy involved the use of "triangulation" in data sources and analytical techniques. The large corpus of email data analysed in the thesis obviated the need for journal summaries, as the email data provided another comprehensive and auditable source of raw notes. As this chapter indicates, the rigour imposed by the combination of methodological elements meant that personal insights and contributions were but one source of data among many, and one analytical technique among many. Several of my personal observations, I have also cross-checked with colleagues for verification (*e.g. the discussion with Diana over the role of cultural drivers in AUT students reluctance to post online - section 6.9.4 below*). Again this approach seemed consistent with the autoethnographic recommendations below:

> "Triangulation or confirmation of autoethnographic observations deflects criticism that the study is based solely on personal opinions. Where possible, the autoethnography may be augmented by additional ethnographic data gathering exercises, including document gathering, interviews, and participant observations". (Cunningham & Jones, 2005, p.3)

I hope with these careful considerations of the research process, that, while recounting my own experiences, I have avoided the "worst excesses of post-modernism" (ibid.) in any autoethnographic components of the research.

4.7 Chapter Summary

This chapter has outlined the key methodological elements of the research. The research has been situated within the "Global Information Management Research Framework" of Gallupe & Tan (1999) as a study which sat at the intersection of their *global environment characteristics, global process variables and global information systems characteristics*, as a "Type V study" exploring the "relationship among all variable groups", and methodologically categorised as a "case study", (the category containing "action research" studies).

As an "action research" study it has employed three of the primary forms of action research categorised by Baskerville and Wood-Harper (1998), "canonical action research", "information systems prototyping" and "participant observation". The "characteristics" of the research study, included a *process model* which was was both iterative and reflective; the *structure* combined rigour and fluidity; the *typical involvement of the parties* traversed collaborative, facilitative and experimental (although the collaboration design would be better framed as 'quasi-experimental'); and the *primary goals* were in the areas of system design, scientific knowledge and training (for students and academic staff involved).

The inherently cyclical and reflective nature of action research (AR) has been reviewed. The "dual cycle action research" model of McKay & Marshall (2001) has been presented, as applied in this study, demonstrating how the 'practice' and 'research' interests of AR may be separately defined. The historical context of the research programme into international collaboration has been given, together with its origins in the Runestone project (Daniels, Petre et al., 1998), the delineation of some eight years of subsequent research cycles and the situating of this study in the semester two 2004 international collaborative context.

The variant of AR involved has been identified as primarily "practical action research" (Carr & Kemmis, 1983, p.136) with an interest in improving practice and encouraging personal reflection, by developing an improved understanding of *Technology-use Mediation in Global virtual teams*. Discussion about varying levels of involvement of the parties, and the potential operation of some levels of "emancipatory action research" (Carr & Kemmis, 1983, p.136) has also been traversed.

Philosophical standpoints underpinning the study methodology have been reviewed. The "interpretivism" and "pragmatism" perspectives on AR (Baskerville, 1999, Baskerville & Myers, 2004), have been contrasted with the "multimethodological" models of "critical pluralism" (Mingers, 2001) and the value of "triangulation" (Jick, 1979) of findings. This study has been deemed to match the philosophical position of "critical pluralism" expounded by Mingers.

The role of 'grounded theory' and 'grounded theoretic' analysis in conducting exploratory research studies has been introduced, together with the application of the "constant comparative method" for theory development (Glaser & Strauss, 1967). The application of grounded theory to a corpus of email as opposed to traditional interview data has been briefly discussed, together with a strategy of applying the NVivo7 qualitative data analysis software.

The key methodological contribution of structurational analysis to the study has been presented. This discussion has covered the general challenges of empirical research using structurational methods, and some methodological challenges associated with the use of AST. The use of TUMAST as an extension of AST has been briefly reviewed, and the adoption of a multi-layered analysis strategy (from the micro to the macro-level) has been identified. A different approach to "episode analysis" (McKernan, 1991) has been compared.

The basic approach to analysis adopted within each episode of interest, has been summarised. It has employed the four strategies recommended by Pozzebon & Pinsonneault (2005) for applying structuration theory in empirical IT research, namely:

1. first a *narrative summary* to introduce each episode or episode grouping;
2. second a *data-driven, grounded strategy* to analyse the patterns of appropriation moves in each episode or episode grouping, complemented with the roles and other key elements drawn from the data and integral to each episode;
3. third a *visual mapping strategy* to show the evolution or emergence of patterns across time; and
4. fourth a *temporal bracketing strategy* (fine or broad ranging), which is inherent in the selection of each episode or episode grouping, and provides a window within which realized patterns of practice may be observed.

Each such analysis has further integrated the three sensitizing devices for ST research, namely: *duality of structure*; the *role of time/space* and the *actors' "reflexivity* regarding their everyday interactions" (Pozzebon & Pinsonneault, 2005).

The chapter concludes its methodological analysis by considering the role of the author as "both informant and investigator" (Cunningham & Jones, 2005) when applying autoethnographic analysis techniques. After reviewing the potential pitfalls, a set of counter strategies have been outlined demonstrating the contribution of autoethnography to the study (as but one data gathering and analysis technique among many).

This "pluralist" approach to the analysis forms a combination of methods which, it is argued, are theoretically well grounded, internally consistent and complement one another. In the complex sphere of research into distributed GSS and virtual teams, this combination of methods has been designed to suit both the circumstances and the data, and to match methodological recommendations given by prior researchers in the area.

To complete the methodological picture of the study, the separate chapter 5 which follows will address the pragmatic aspects of data management. Augmenting this discussion of the broader application of research methods, the next chapter provides a more concrete discussion of the nature of the data involved in the research, and the strategies deployed in its preparation and analysis.

Chapter 5: Data Management in the Conduct of the Research

5.1 Introduction

This chapter provides a link between the research methodology and the data analysis chapters. The particular challenges of data management in this study, have suggested the value of a dedicated chapter, as opposed to adding further sections to the preceding research methodology chapter. This chapter explains the nature of the data on which the study has been based, the processes involved in preparing that data for analysis, and the issues which arose during the process. The chapter provides some methodological guidance relating to data management for those wishing to conduct similar forms of research using email data and qualitative data analysis software such as QSR NVivo7.

5.2 The Nature of the Data Involved

An investigation into *technology-use mediation in global virtual teams* requires access to appropriate forms of data, capable of capturing the complexities of the interactions among the actors involved and reflecting the TUM activities in which they have been engaged. Given the long duration of the action cycles investigated in this study, an interview strategy after the event would have been logistically challenging (if not impossible) and of limited value. Appendix 4 below catalogues the research data sources available to support the analysis for this thesis. As can be seen the data was not only voluminous but rich, with nineteen different categories indicated. Email messages (in various stages of preparation for analysis), attached files in differing formats, literature excerpts, various features and forms of AUTonline postings, my PhD notebooks, various online forms and views from the collaborative database, institutional policy documents, student reports, a research design blueprint, course handbook etc. Moreover, the two large East-Lite folders in which I had stored hard copies of much of this data, were not included in this spreadsheet, but as the analysis proceeded a few hard copy items from the folder were added to the analysis, if they filled in the gaps, or reflected some email messages for which I did not have the soft copy in the corpus. [While generally careful to archive the email correspondence during the collaboration, it is my surmise that I may have missed some of my own 'sent messages', which may have been archived by the system]. In the course of analysing each episode in chapter six below further data sources have been added, typically when

extending the temporal brackets beyond the episode boundaries to track the origins or developments of a particular issue. Inclusion of these additional data sources (complementing those within the analysis window of the study itemised in appendix 4) was driven by their relevance and the adequacy of the episode coverage. Yet while additional items were added as appropriate the more immediate challenge was to reduce the number of items for analysis, so a more focussed study could be undertaken. As can be seen from appendix 4, of the approximately 2500 data sources identified approximately 10% were coded to NVivo7 for inclusion in this analysis.

5.2.1 The Nature of 'Data' in Action Research Projects

Defining the meaning of data in action research projects, especially in a complex domain such as this, can be problematic. As an indication, table 5.1 below depicts a taxonomy derived by the author in prior work, applicable to critical action research projects.

Taxonomy of Data Types for Critical Action Research Projects			
Historical and Contextual	**Process**	**Empirical**	**Evaluative**
Examples of forms of data in this project			
Various AUT internal documents	Selected journal articles	Group membership details	Lecturer & course appraisals
Mission statements	Instructions & Timeline for Collaboration	Online evaluation questionnaires	Reflective reports, conference & journal articles
Research reports	Participant Information Sheet	Scoring, individual & group ranking entries	Student assignment reflective analyses
Strategic plans	Consent form	Online logbook entries	Reeves analysis in class
Teaching & Learning Development Plans	Complaint correspondence	In class email survey results	Personal reflection
Policy documents	Ethics approval documents & correspondence	Discussion postings & email messages	Reflective exam questions & Student responses
Programme reports	Database design notes & features	Attached files	Latent Discourses
Newspaper & magazine articles	Discussions in class and related email	Design proposals	Technical reports
Correspondence - research grants, innovative teaching awards etc.	Class presentations, module handbook, course handouts, course text extracts	Website links	Journal articles (online & offline)
newsletters	Database changes		Dilemmas
	Database entries		Emancipatory questions

Table 5.1: A Taxonomy of Data Types for Critical Action Research Projects

(Ex. Clear, 2004a p. 111)

For this project in which 'practical action research' (cf. section 4.2 above) was the

primary action research variant, the data of primary relevance was the “empirical data” represented in particular by the email messages between the actors in the collaboration.

5.2.2 Challenges with Email Data

Permission to use this corpus of email data for the research study was sought from the contributors (cf. appendices 1-3 below), with an excerpt from the information sheet in appendix 2 below outlining the expectations:

> “The participants will be asked to give permission for their email correspondence or online database postings relating to the collaboration process to be analysed. The researcher has a large body of saved email and the Lotus Notes databases relating to each trial, augmented by research diary notes, and it is proposed to sift through these in some depth to identify the roles and activities conducted by those who act in “technology-use mediating” roles [roles performed by indirect users of technology to support the work of direct users]. The research data relating to the semester 2/2004 collaborative trial will be the primary focus of this study”.

Colleagues were highly supportive of the work, with no refusals to release their data, and email and online contributions from 21 participants (including myself and three students) have been incorporated in the study, some after identifying them as actors from the data well into the analysis. In this I count myself very lucky, (for which I have recorded my thanks to my colleagues in the introduction), since analysis of significant corpora of email data has been found to be a challenge by other researchers. For instance the following observations have been made:

> "our experience is that people are very reluctant to share their emails even for confidential research purposes" (Leuski, 2004, p.502)

> "although email is ubiquitous, large and realistic email corpora are rarely available for research purposes...the limited availability is largely due to privacy issues". (Cohen et al., 2004)

Kanawattanachai & Yoo (2007) have reported a large study involving 145 MBA students and 5 professors over four different countries where the email was archived and subjected to content analysis, and Panteli & Duncan (2004) analysed email messages prior to during and on completion of a project, but such studies do appear relatively rare.

Analysis of email data raises several challenges. The nature of email messages is surprisingly complex, as rapidly became apparent during the data analysis phase. Schuff et al., (2007, p.35) in a paper addressing automated approaches to overcoming the problem of “email overload” have drawn the following conclusions:

> “a single message can span several subjects, complicating classification…Conversations can be captured to some extent through the inline inclusion of previous messages, as well as through visual association of messages in

> the same thread…Some level of semantic understanding of message content and structure is necessary to truly capture a conversation, especially when that content also consists of unrelated data".

In a post implementation review of two virtual team projects, consistent with observations from the literature, (Lee-Kelley & Sankey, 2008, p.53) found:

> "the use of advanced technologies is 'relatively uncommon in virtual teams'…and that email seems to be the most common tool…the email and telephone were also the primary communication media for the BankCo migration projects".

Yet while email was "the most common tool", they highlighted several issues related to over-communication:

> Issues with email ranged from being too short and terse to endless mail ping-ponging forwards and backwards with the text of the previous message attached which, when printed, could amount to twenty pages or more. The sheer volume meant that not all emails could be read or fully digested. (Lee-Kelley & Sankey, 2008, p.59),

The prevalence of such email conversation threads has been remarked earlier by Lee (1994, p.155), who noted the creation of "mosaic messages" by managers in his study. A sequence of these "mosaic messages" consisted of forwarded sets of message contents annotated by each individual in the train:

> "With the resulting cumulative mosaic message being like a group meeting, but with the advantage of not requiring the group members all to be in the same location at the same time" (Lee, 1994, p.155).

Noting the role of email users as not merely "passive recipients" but "active producers of meaning", Lee has argued for such interaction as a means of supporting rich communication:

> "in interaction with the e-mail system they transform the data into information they find meaningful…In a sense, an email system might be better described as a reagent than a medium". (Lee, 1994, p.154)

This inherent richness and multiplicity of email messages, posed several issues in determining how best to analyse the rich corpus of data available for this study. As evident from appendix 4 below, the starting number of "raw" email messages was 175. When unpacked into segments this number expanded to 1086 discrete data sources. Once duplicates had been removed from these segments the total reduced to 366 data sources. This corpus was complemented by approximately 30 attachments to these messages, with a variety of file formats.

5.2.2.1 Email Data Management Strategies

In order to conduct any meaningful data analysis, there was a need to first engage in some careful thought and preparation of the data. Naidu and Ja¨rvela (2006) in making

recommendations for content analysis in CMC contexts have noted the unique purposes served by each CMC application and the need for analysis strategies to be tailored to the type of application. Nonetheless their general recommendations given below appear germane to the more generic problems encountered when analysing email data.

> "care needs to be exercised against over analyzing CMC content, or attempting to apply overly reductionist strategies to the study of a rather complex communication channel".
>
> "the procedure for CMC content analysis should comprise, at least, the following critical steps:
> - Determination of the unit of analysis;
> - Development of segmentation procedure;
> - Determination of the reliability of the segmentation procedure;
> - Development of coding categories and rules; and
> - Determination of the reliability of the coding categories". (Naidu and Ja¨rvela, 2006, p.98)

Determining the unit of analysis posed some challenges. McKernan (1991) has noted that:

> "one mode of proceeding is to divide social interaction into units that have integral boundaries. Of course there are logical ways of classifying units: sentences, words, paragraphs and so forth" (p.162).

In appendix 19 below I made a series of notes related to the particular set of issues that continually arose while going about the analysis process, some entries were in the nature of "reflexive journal summaries" (Cunningham & Jones, 2005) and others in the nature of "observation" and "methodological" notes (Richardson, 2000). One discussion recorded in my diary on 23/05/2006 is given below:

> What is the unit of analysis with an email message?
>
> e.g. AP14092004_1932of10.txt incorporates
>
> 1) message from Arnold forwarding a message from Fred that had bounced, within a message from Fred requesting help in forwarding it.
>
> Is this 1 or 3 emails?
>
> 3 to avoid doubling up on analysis, but 1 to preserve semantics.

In a subsequent note (29/05/2006) I had reflected further on this sequence:

> Breakdown as the trigger (critical event) different from normal flow which [presents an] occasion for intervention

As recorded in note 1 of appendix 19, I had discussed the appropriate unit of analysis within these "mosaic messages" (Lee, 1994) with my supervisor and we,

> agreed that stripped individual email messages would be best as data items, but in some cases the sequence would be the more appropriate unit of analysis.

Decisions on “unit of analysis” and “segmentation procedures” (Naidu & Ja¨rvela, 2006), have significant implications. The literature on conversation analysis (as I had recorded in note 10 of appendix 19), has drawn the following distinctions between approaches to analysing discourse:

> “Conversation analysis CA ("involve[s] a micro-analytic investigation of interaction sequences [p.353]
> …based fundamentally on a model of communication as a joint activity. Like dancing or joint musical performance it rejects the typical linguistic model of communication as sending and receiving messages
> ...Sequences are an important focus of an analysis and each utterance (or gesture) is understood as a step (action) in a joint activity. Thus one of the main focuses of CA is on how the interaction unfolds across sequences of actions by different participants. The significance of an utterance or a gesture is highly dependent on its position in a sequence, as well as being jointly negotiated, and this is one reason for conversation analysts’ reluctance to aggregate instances of utterance types for quantitative analysis [p.354])".
> Unlike CA. an IS [Interactional Sociolinguistics] analysis explicitly recognizes the wider sociocultural context impacting on interactions [p. 358]”. (Stubbe et al., 2003)

Picking up on the perspective of Stubbe et al., (2003), I had observed in note 13 of the same appendix, discussing transcription standards as applied in the Wellington Corpus of spoken New Zealand English, that there were no equivalent standards for email analysis:

> This begs the question whether there exists or should exist a standard for transcription of email data for analysis purposes. The two distinct perspectives of email as 1) message exchanges (e.g. Shannon & Weaver (datacomms) or typical linguistics models) or 2) emerging sequences of social interaction (CA) suggest very different approaches to transcribing and analysing an email corpus.

Returning to note 10 of the appendix, I had concluded that a hybrid approach to the analysis made some sense:

> Yet to enable detailed level coding need to separate out detailed message segments, to avoid excessive rework. But may also need to re-code at sequence level in some cases, when investigating conversations highlighting phenomena of particular interest?? This analysis applying GT and AST may be a hybrid, with AST providing some wider contextual dimensions, and sequences demonstrating how interaction unfolds may be significant.

In this respect the unit of analysis remained slightly ambiguous, but could basically be considered as either ‘the message segment’ or ‘the message sequence’. As noted above (cf. section 3.3.5.8) the “episode” was the primary unit of analysis within the TUM model. Yet with each episode containing multiple source data items in most cases, clearly a layered approach to the analysis was demanded. “Mosaic” email messages (Lee, 1994) thus constituted one type of source data item, within an episode, where message sequences between several parties were frequently embedded in each

interaction. As observed in note 3 of appendix 19, such sequences frequently constituted a logical unit of interaction. The individual message segments, once separated out, provided consistent, segmented units for analysis, and thus met the criteria of (Naidu and Ja¨rvela, 2006, p.98) for "reliability of the segmentation procedure". This segmentation process was also necessary to remove the duplicate messages over the multiple message trains. As appendix 4 notes, the expansion from 175 raw (mosaic) messages to 1086 individual message segments and reduction to 366 final message segments once duplicates had been removed, enabled the analysis to focus on the relevant third of the data, without unnecessarily coding duplicate messages. In a way this process was analogous to the pre-processing, data scrubbing and cleansing processes common in data warehouse developments (Kimball et al., 1998).

As noted in appendix 19 the practicalities of this process, and the periodic inconsistencies which arose, made this segmentation process far less simple than at first appeared (e.g. notes 7, 8, 9, 11, 12, 14, 15, 16, 17).

5.2.2.2 Email Data Preparation

I had made a practice of consistently archiving email messages relating to the collaboration in a separate email folder. These messages were stored over the period from late June 2004 through to March 2005, after my visit to St. Louis and the SIGCSE Doctoral consortium. The process of storing and preparing the email messages prior to importing them into the NVivo software for analysis was highly laborious and time consuming. Each archived email message had to be downloaded individually from our Novell® Groupwise® email system and saved as a text file (with a .doc extension for ease of manipulating in MS Word). As noted in appendix 19 I had determined a set of naming standards for identifying each email message (sequence) while representing author, date and time in a consistent manner. The standards also covered files attached to each message sequence, and are briefly repeated here:

> Text files to represent author date and time in consistent manner, coded as follows:
>
> Author initials
> Day month year
> Underscore
> Time of day (on email – local time?) by 24 hr clock
>
> Pattern [aaddmmccyy_hhmm.txt)
>
> This code to be a prefix (followed by underscore) to any attachments to link them to their appropriate email messages

Pattern [aaddmmccyy_hhmm_filename.extension)

I used three separate directories in the process of preparation. One to store the raw (*mosaic*) email message sequences (cf. appendix 19 figures A19.1 & A19.2 below). The second directory stored the "unpacked" messages to which the 'segmentation procedure' had been applied. Some indicative "message headers" (which were used as the point of separation) are presented below, to indicate how the identifiers were drawn from different sequences and email systems. This strategy could be somewhat confounding when messages were interlaced rather than attached whole.

1. From: Tony Clear
   To: Bruce Colloff
   Date: 1/07/2004 1:30:12 p.m.
   Subject: Fwd: contact

   Hi Bruce,

2. From: <tony.clear@aut.ac.nz>
   To: <tony.clear@aut.ac.nz>
   Date: 3/10/2004 6:53:26 p.m.
   Subject: Phase one progress

   Hi Fredrik,

3. >>> Tony Clear 06/23/04 10:01 AM >>>
   Hi Fred,

4. -----Original Message-----
   From: Tony Clear [mailto:tony.clear@aut.ac.nz]
   Sent: Tuesday, October 19, 2004 1:05 AM
   To: niederfa@SLU.EDU
   Subject: IT Personnel research

5. 2004-06-16 kl. 01.18 skrev Tony Clear:

   > Hej Mats,
   >

These were represented by a series of sequences, one file for each original message in both MS Word and text file formats, followed by separate files for the discrete messages within each sequence (figure A19.3 below). As recorded in notes 4 and 5 of the appendix, I had considered automating the message parsing and comparison process, but gave up after some initial investigation and experimentation with Java development and various file comparison utilities, as it would have been too time consuming to develop/adapt the necessary software suite.

In the end I extended the set of naming conventions to identify the individual message segments, within their sequences, so that new files could be created manually, and embarked on the process of segmentation.

For ease of reading, the key elements from appendix 19 are repeated here:

> **Note 5:** (19/10/2006) naming convention for emails when unpacking sequences and translating to discrete text files for NVivo:
>
> Pattern [aaddmmccyy_hhmmssofzz.txt)
> Where ss indicates sequence number of zz total embedded message segments.
>
> *Implication however that author initials 'nn' may be correct as originator of overall sequence but not for each segment. This may require further consideration of naming standard.*

Using MS Word I highlighted the distinct messages within each sequence, using a different colour for each, and cut and pasted the contents of each coloured segment into a new file, appropriately named in sequence according to the standards developed. While most sequences contained less than half a dozen messages, some contained as many as seventeen.

The third directory contained the text file versions of the 'unpacked' segments from the second directory, with the MS Word and text 'whole sequence' files and duplicate messages removed, ready for exporting into the NVivo software for analysis (figure A19.4 below). Removal of duplicates was again a manual process, requiring opening and deleting of suspected duplicate files. While I had become reasonably familiar with the data by now at a detailed level, the quantity did not make the process of identifying duplicates easy. A duplicate 'date and time' [*the string 'ddmmccyy_hhmmss'*] was the most plausible indicator of potential duplicates – since as "Note 5' above from the appendix records, the author initials in the file name related to the originator of the sequence not the author of the message segment. I chose to retain that standard to keep an audit trial on the message sequence. But, in hindsight the naming standards were deficient, in that they did not permit ready sorting of files in directories by author. A more useful standard would have followed the pattern below:

> Pattern [aaccyymmdd_hhmmssofzz.txt)

However at the time, given the challenges with varying New Zealand, European and American dates and time formats, I may have ended up so confused in generating the new filenames that data quality would have suffered. Therefore I persevered with a working method even if flawed in part.

5.2.3 Data Sources for NVivo7 Analysis

This set of now de-duplicated data files were imported from the directory into the NVivo7 software as 'source documents' for analysis (figure A19.5 below). Files had

first to be translated into Nvivo7 compatible MS Word and text files to ensure readability. As 'Note 6' of appendix 19 records below, this involved translation of some file attachments from their native file formats (e.g. .xml, .xls, .html), and a further extension to the naming standard to record that fact.

The process of removing duplicates continued, and as appendix 5 records, there were three rounds of scrubbing the data for duplicate removal. The two further rounds were conducted on the data after export to NVivo7, as additional duplicate entries became apparent during the coding process.

Further data was imported into NVivo7 for analysis, to complement the email data sources. A selection of literature excerpts were transferred (figure A19.6 below). These excerpts had been singled out for inclusion as relevant to the topic of TUM, and able to support the grounded theoretic coding process. Some excerpts supported the "deductive" forms of grounded analysis identified by Pozzebon and Pinsonneault (2005), by supplying a "template" against which coding could be conducted. The codes for "appropriation moves" supplied by DeSanctis & Poole (1994); the codes for "TUM phases" supplied by Orlikowski et al., 1995; the codes for "roles" supplied by Alexander (2005), Guzdial (2000) could be viewed in that sense. More generally the literature formed another source of data for an "inductive" (Pozzebon & Pinnsonneault, 2005) strategy of grounded analysis. In that mode and closer to the classic 'grounded theory" of Glaser & Strauss (1967), the process of comparison began from the outset. As Allan (2003, p.9) has recommended:

> "Concepts and categories should be noted and merged as soon as they are noticed and this is the start of the theory"

As previously remarked (section 4.3.1), I had conducted a preliminary analysis using NVivo7, and had the results of that exercise, complemented by my own prior experiences in the field, to draw upon when reading the literature. Thus some patterns had begun to emerge or at least show promise (e.g. 'AIT' as a concept, various 'roles' from the literature, etc.). Therefore consistent with the "constant comparative method" of Glaser & Strauss (1967), these literature sources contributed themselves to the study as data sources which furnished candidate 'codes' and 'concepts'.

A further source of data imported into NVivo7 for analysis, was a set of non email data sources (figure A19.7 below). This set comprised mainly transcribed diary notes, but included other items such as a transcribed "announcement" entry from AUTOnline, a set of meeting notes and a framework for the action research cycle to be conducted during the collaboration (cf. appendix 9 below). Appendices 4 and 5 catalogue both

the available data sources and those selected for analysis in NVivo7. As can be observed, the diary notes began in late September 2004 and have continued up to the present, so the limited selection of transcribed diary notes represented a very small proportion of the available data.

5.3 Selection of the Data Involved

At a broader level within the research study, the approach to selecting the data for study must be addressed. The logic within this study and inherent in the TUMAST model, has demanded a "theoretical not random, sampling" approach, as Eisenhardt (1989, p.533) has advised case study researchers, for the reason that such a strategy:

> "Focuses efforts on theoretically useful cases – those that replicate or extend theory by filling conceptual categories"

Similarly selection of data following "a replication, not a sampling, logic" has been recommended by Yin (1994, p.51) to those engaged in the "use of multiple-case designs". While bearing some similarities to case study research, this study owes more to its structurational and grounded theoretic roots. However the notion of an "episode" (section 3.3.5.8 above) could be deemed analogous to a "case", and 'within-episode' and 'cross episode' comparisons could be compared to "within-case" and "cross-case" analyses (Eisenhardt, 1989, p.540).

Glaser & Strauss (1967, pp. 62-63) in outlining strategies for GT analysis made the following distinctions between "sampling strategies":

> It is important to contrast theoretical sampling based on the saturation of categories, with statistical (random sampling). Theoretical sampling is done in order to discover categories and their properties, and to suggest the interrelationships into a theory."
> "The adequate theoretical sample is judged on the basis of how widely and diversely the analyst chose his groups for saturating categories according to the type of theory he wished to develop".

In determining which data was relevant to the study of "*TUM in GVTs*", and would support "the type of theory [I] wished to develop" (ibid.), I had to consider which "episodes" to select. In that sense my methodological choice was no different from that of Eisenhardt, Yin, or Glaser & Strauss in that "selecting cases" was a core step in the research. Key in that decision process were some reflections from a diary note written on 24/1/2007, in which I had referred to the [now] "TUMAST" model, noting that an episode had "antecedent conditions, events and outcomes". This gave a temporal framing for any chosen "episode", (as previously defined in 3.3.5.8.1 above):

> *A relevant temporally bound sequence of events with antecedent conditions and outcomes, which stands apart from others, and has been selected for analysis.*

In selecting episodes for analysis, within the TUMAST framework, both temporal aspects and TUM activity modes were relevant. The "meeting stages" of Ackermann (1996) underlying the TUMAST model, and the "virtual play" stages of Panteli & Duncan (2004) were initially considered.

Meeting Stages – (Ackermann, 1996)	**Virtual Play Stages –** (Panteli & Duncan ,2004)
Pre-meeting	scripting
?	staging
During meeting	Performing

Table 5.2: Stages of Virtual Team Activity for Episode Selection

Based on this depiction I had decided that the "scripting" stage for the collaboration consisted of the TUM activity prior to 6 Sept 2004, and equated to the "Establishment" mode of TUM proposed by Orlikowski et al., (1995). Thus the data prior to 6 September could be packaged into an overall logically defined unit as an *"Establishment episode"*. A later note the next day (25/1/2007) amended this window:

> "Extend pre-trial window to 17 Sep to accommodate delays"

A further comment in the 24/1/2007 diary note was germane to defining other episodes:

> "Note: coding breakdowns enables specific junctures to be analysed as episodes of interest – 2 or 3 maybe?"

After considering at the same time the use of an NVivo 'case' to represent episodes, subsequent discussion with a colleague followed:

> "Discussion with Gwyn re using data & use of cases for episodes
> Looks like a lot of extra work so maybe try it with breakdown episodes only?"
> (personal communication, Gwyn Claxton, 26/01/2007)

In the same diary note (26/01/2007) I had recorded the following plan for episode selection:

> Analysis thoughts to test FEAST [now TUMAST]
> 1) Est
> 2) Rein
> 3) Adj
> 4) Episodic
> 5) 1 or 2 breakdowns?

These episodes were represented in the NVivo7 application by the definition of a unique "set" (a form of 'view' of the data within NVivo7), to represent each episode. Appendix 19 (figure A19.8 below) depicts the "sets" involved, and portrays the data sources comprising the first of the 'episodes'. The approach of defining the data with

sets appealed to me, as it did not create artificial boundaries in the data, whereas it appeared that may have been the case had I defined each episode as a 'case' (an alternate and apparently more segregated data component) within NVivo7.

5.3.1 Criteria for Episode Selection

In summary then, representative temporally bound episodes were selected for analysis based upon a theoretical sampling strategy, within the overall TUMAST framework of the four modes of TUM activity (*establishment, adjustment, reinforcement* and *episodic change*). An episode needed to exemplify the TUM activity for the chosen mode. As noted above the full *establishment* phase was chosen as a logical temporal unit, to analyse the *establishment* mode of TUM. For the other phases the strategy involved selecting relevant "breakdowns" (Hettinga, 2002, p.30; Winograd & Flores, 1997, p.165) as 'critical incidents' in which the technology had moved from the background to the foreground, and become 'unconcealed'. These incidents provided notable occasions for reflection and TUM activity, most obviously for the *adjustment* and *reinforcement* modes. Episodes in the *episodic change* mode were again selected on the basis of a longer term response to a 'breakdown' incident, (e.g. cf. section 6.3 below), or as an evident 'juncture' in the flow of activity between collaboration cycles. These episodes had presented themselves progressively as I prepared the data for analysis and become more familiar with its characteristics as the process proceeded.

Therefore I felt that I had developed a justifiable and I hoped manageable "theoretical sampling" (Glaser & Strauss, 1967) strategy to select the data and define it within relevant 'episodes', which would support this investigation of "TUM in GVTs". Moreover I believe the process of selecting data is replicable, following these criteria, although the precise episodes might differ in any selection process. Thus the approach enables the application of a "replication logic" (Eisenhardt, 1989, p. 542), through the analysis of multiple 'cases', where each case may present confirming or disconfirming patterns. Given the adopted "theoretical sampling" mode and the desire to demonstrate "theoretical saturation" (Glaser & Strauss, 1967, pp. 62-63), further episodes could thus serve a confirming or disconfirming purpose.

The eight episodes eventually chosen have been selected as vignettes in order to represent typical aspects of each of the four TUM activities (*establishment, adjustment, reinforcement* and *episodic change*) in operation, and to support their comparison across episodes. The *establishment* activity is represented by one full length episode; *adjustment-reinforcement* (typically in combination) by four smaller episodes; and

episodic change by three episodes.

These multiple episodes have been chosen as 'worthy of note in the development of the collaboration' – or 'episodes of interest' (cf. section 3.3.5.8 above). While this selection is arguably far from comprehensive, I believe it is productively illustrative of the different TUM modes. The grounded theoretic method of data analysis adopted in the thesis, requires that data analysis be conducted using the "constant comparative method" (Glaser 1992, p.39) whereby

> "while coding an incident for a category compare it with the previous incidents in the same and different groups coded in the same category" (Glaser & Strauss, 1967, p.106).

This constant comparison continues only until "theoretical saturation" (Glaser & Strauss, 1967, p. 61) for a category has been reached, and I believe that the diversity and quantity of data across this set of episodes supports such analysis.

5.4 Episode Analysis Overview

5.4.1. Episode Analysis Specifics

For each episode explored in chapter six below, the analysis has been conducted in the following sequence, consistent with the overall strategy outlined in section 4.4.1 above.

5.4.1.1 Overview of Episode Characteristics

An overview of the characteristics of each episode is given, with descriptive statistics relating to the source data and actors in each episode. These statistics are drawn from the data stored in the *QSR NVivo 7* qualitative data analysis software. Each pre-coded episode is stored as a "set" (a logical unit of analysis) within the software. For each episode an *NVivo 7* "source summary" report is run which gives word counts for each source item within the set

5.4.1.2 Narrative Summary of Episode

Each source item is printed and then collated in a hard copy set, which is perused in order to produce a narrative summary of the events encapsulated in the episode.

5.4.1.3 Episode Appropriation Moves Analysis

The next analytical strategy applies a data grounded strategy termed *appropriation analysis*, based upon an extended set of "appropriation move types" and "sub-types" (DeSanctis & Poole, 1994), which include additional codes related to 'TUM

appropriation moves', which have been pre-coded for the episode (cf. Appendix 6 for the set of codes; and Appendix 19 figures A19.16 & A19.7 for their representation within NVivo7). The analysis traverses four groups of 'appropriation moves' reflecting ways in which structures have been appropriated (*direct; constraint; relate and judgement*). These groups are drawn from *NVivo 7* data using the query facility (cf. Appendix 19 figures A19.19 - A19.22) which produces totals for the grouping within the selected set. This data is then exported to MS-Excel and tabulated in bar graph form (cf. Appendix 19 figures A19.25 & A19.26). Selected moves are then analysed, with the features of the *NVivo 7* software enabling drill down to specific coded instances of a particular appropriation move, and (if desired) to a further level of the specific source item, within which the code occurs.

5.4.1.4 Other Grounded Data Analysis

Augmenting the appropriation analysis is a tabulation of the grounded theoretic concepts and codes arising from the episode. Again the software produces results for the set based upon a query, (totaling the number of data items in which a code has occurred at least once, cf. Appendix 19 figure A19.23), which is then exported to excel, zero count codes removed and tabulated with both codes and groupings of higher level concepts and their counts (cf. Appendix 19 figure A19.27). The data analysis proceeds in a similar way to the appropriation analysis, with grounded data being explored by drill down to specific instances of concepts or codes (cf. Appendix A19 figures A19.24, A19.28 & A19.29), and where necessary extends further to surrounding paragraphs in the source data items, which are discussed to the depth considered appropriate to enable explanation. For longer episodes it is common to break out specific concepts such as 'role' or 'time and space' and address them in their own groupings. The analysis further traverses the structurational notions of "duality of technology", "time and space" and "reflexivity of the actors" in order to unpack their operation within the episode. Section 5.6 below reflects further upon the coding process, highlighting particular issues which have arisen.

5.4.1.5 Visual Mapping

The largely textual analysis is now augmented by a visual mapping of selected aspects of the episode. As the analysis has developed, radar charts have been used to depict the operation of selected *metastructures* (based upon the insights drawn from the prior grounded analysis). These 'visual maps', supported by descriptive summary

tabulations for each dimension, have been used to portray at a glance multidimensional aspects of the episode, and frequently depict variation across sites.

5.4.1.6 Temporal Bracketing

In this form of analysis the evolution of the episode is charted over time. The role of TUM in how practices have developed is a typical focus of this analysis, which is informed by Orlikowski (1996) (cf. section 4.5.3 above) and typically charted in a timeline of technology, practices, activities and events. Again this more holistic analysis is informed by the intimate knowledge of the data gained from the earlier grounded forms of analysis in the episode. In many cases this form of analysis requires extending the episode to the origins or destination of an evolving practice or form of technology use. This temporal bracketing strategy (whether fine or broad ranging), is inherent in the selection of each episode or episode grouping, and provides a window within which realized patterns of practice may be observed. I believe that this approach to analysis is rich, deeply grounded in the data and self-triangulating. This form of analysis concludes the set of analytical strategies for each episode.

5.5 Episode Characteristics

This section briefly summarises the focus of each episode and relates the episode to its accompanying NVivo7 "set". The source data elements which comprise the contents for each set are depicted in the associated figure in appendix 19. The focus and characteristics of each episode follow:

1. Establishment episode full
    a. An episode covering the full preparatory period leading to the establishment of the collaboration (cf. figure A19.15 below)
2. Adjustment-reinforcement episode window 1
    a. An episode covering the introduction of the draft instructions for phase 2 of the collaboration (cf. figure A19.8 below)
3. Adjustment-reinforcement episode window 2
    a. An episode from 20 -22 October 2004, with reflective comments on progress from Arnold and Fred, a response from Diana, reinforced by attaching the instructions, and a final constructively critical comment from Fred with suggestions for improvement (cf. figure A19.9 below)
4. Adjustment-reinforcement episode window 3
    a. An episode covering a phone call from Arnold to me on 6/10/2004 and discussions about arranging synchronous sessions (cf. figure A19.10 below)

5. Adjustment-reinforcement episode window 4
    a. An episode from 18 – 20 October covering the Notes server upgrade, a phone call to Fred and arrangements for a visit to St Louis (cf. figure A19.11 below)
6. Episodic change 1
    a. An episode covering the meeting between Mats Daniels and I at the Frontiers in Education Conference in November, 2003 to review the 2003 collaboration (cf. figure A19.12 below)
7. Episodic - adjustment 2
    a. An episode covering the addition of a new question to the final evaluation questionnaire mid collaboration (cf. figure A19.14 below)
8. Episodic change 3
    a. A reflective episode on TUM covering the presentation at St Louis University Missouri 21/02/2005, the SIGCSE doctoral symposium, discussions with Arnold at SIGCSE, and with John Hughes in Sydney on 27 May (cf. figure A19.13 below)

5.6 Reflections on Episodes and Data Analysis

5.6.1 Data Analysis Sequence

The data analysis proceeded in a sequence of episodes which aided exploration of the viability of the process, and assisted in developing confidence in its effectiveness. I began with small episodes and covered episodes with different TUM activity modes. Section 6.2 (which introduced Episode 3) for instance, presented a very brief *adjustment-reinforcement* episode (2 source items). Section 6.3 was again a brief *episodic change* episode (1 source item), whereas section 6.4 undertook the analysis of a very full *establishment* episode. It is probably true to say that I became more proficient at the analysis over time. Overall I consider the analysis still remains robust throughout, as the 'within case' and 'cross case' comparisons of chapter seven below have caused the revisiting of episodic content as the overall analysis for the thesis has progressed.

5.6.2 The *Establishment* Episode

In the analysis for this extremely large episode in chapter six below, tables 6.7a & 6.7b demonstrate the significant message counts for the grounded theoretic 'open codes', 'concepts' and/or 'categories' derived from the data sources in that episode. Combining micro and macro level analysis on the grounded data for the episode proved

challenging.

The "unit of analysis" question (Naidu & Ja¨rvela, 2006) had to be revisited with such a large episode (more than 350, 000 words). The overall unit of analysis within the TUMAST model may have been decreed to be the episode, but within that there were clearly further levels. The source item (e.g. an email message segment) was a further unit of analysis, but that did not necessarily aid coding, when working through a lengthy message. Writers such as McKernan (1991 p. 162), Naidu & Ja¨rvela, (2006), Guba & Lincoln (1981, p.246) appear to agree on the need for consistency in the unit of analysis when conducting "content analysis" on sets of data. But Lacity & Janson (1994) have contrasted the *positivist* models of text analysis, with the *linguistic* and the *interpretivist*, and drew the following distinctions:

> "Positivist text approaches assume that understanding comes about by identifying nonrandom variations in a text…Linguistic approaches assume understanding comes from studying the type and structure of utterances…Interpretivist methods assume understanding comes from intrusive methods in which researchers try to understand how culture and experience influence text interpretations" (Lacity & Janson, 1994, p.139).

Grounded theory researchers have varied on these questions, as highlighted by Allan (2003) when criticising the Strauss & Corbin (1990) approach to "micro-analysis", and uncovering "the rift between Glaser & Straus on this issue". Allan reported his difficulties with following the Strauss & Corbin micro-approach, Glaser's condemnation of the "over-conceptualisation" it produced, and Allan's subsequent response:

> "Dividing the data into words caused the analysis sometimes to become lost within the minutia of the data".
> "…the analysis from this point on followed Glaser (1992). That is, identifying key points (rather than individual words) and allowing concepts to emerge" (Allan, 2003, p.2)

With my own approach as earlier observed in sections 4.5 and 5.2 (p. 103) above, combining "inductive" and "deductive" grounded analysis approaches (Pozzebon & Pinnsonneault, 2005) I found some variability in coding levels. For instance the application of appropriation moves as a "template", could see moves that applied within each message segment at a word, phrase or paragraph (if not even the full message) level. While this "deductive" form of analysis may have introduced some "preconceived codes" (Glaser, 1992, p. 38) against the GT precepts of Glaser, there are counter arguments against those criticisms. As discussed previously I came into this work informed by my own prior experiences of *TUM activity*, and by the pilot analysis conducted preliminary to this study, so previous, thoughts, insights etc. were always going to be informing the analysis. The process of analysis furthermore was a continuing one, for instance, extensions to the coding set incorporated further *TUM*

specific appropriation moves (cf. highlighted codes in appendix 6 below) as the coding process continued. These new codes indicated that even though a prior 'template' was being used, some form of 'inductive' coding process consistent with the tenets of GT was being applied as new '*TUM specific appropriation codes*' emerged from the data through the "constant comparative method". Poole & DeSanctis (1992) noted that the set of codes they applied, were introduced not as a definitive set but to act as a "sensitising device" to reveal the workings of the appropriation process. To extend those as one element in a process of coding in order to better comprehend the TUM process, seemed broadly consistent with a grounded theoretic process of theory building.

Glaser made several recommendations on the process of "open coding", and how to determine the unit of analysis when coding. The excerpt below encapsulates his views:

> "There are a few different ways of approaching open coding. But none can be preconceived. Whether in constant comparative coding during open coding the analyst starts with (1) line by line analysis, closely examining phrases, words or sentences, 2) sentences or paragraphs, or 3) entire documents, depends. It depends on the type of data collected, the variation in data collector's skills, the kinds of interviews or observations etc, and the density/thinness of ideas in the data"
>
> "So variation in units of coding emerges from the data…"
> "To achieve a grounded theory the analyst cannot code for preconceived theoretical codes. He must code for whatever category emerges on whatever unit in the data, and theoretical sensitivity applies to whatever theoretical code fits. The catch work [sic] is WHATEVER. The analyst can start anywhere in the data and trust to emergence in open coding" (Glaser, 1992, p. 48).

In relating these views to the analysis process undertaken in this thesis, I would make the following points. Coding against a set of appropriation moves appeared to be in this study a hybrid process, with both "deductive" and "inductive" GT elements, as recommended by Pozzebon & Pinnsoneault (2005), as but one component within an overall structurational analysis. However, this does beg the question, at what point does a code become "preconceived" as opposed to emerging from the data, especially if the process of "constant comparative coding" begins from the outset? For instance *AIT* as a code (cf. Appendix 19 Figure A19.24), originated in the literature (DeSanctis & Poole, 1994), was clearly evident in the pilot data (cf. tables A20-6.52a and A20-6.52b below) and was again dominant in the data sources of this episode, where it appeared mostly as single words, or two or three word phrases. In a similar vein a code such as "absence" originated from the data, but was drawn from paragraphs and fuller phrases such as depicted in appendix 19 (figure A19.28). Codes thus came from several sources, some furnished from the literature (cf. p.103 above), some from

experience (if able to be codified via field notes, cf. section 4.4.1 p.81 above) but in the end codes were grounded in the data and only populated from the NVivo7 data sources, where some of these informing sources constituted data themselves and may have been generators of suitable codes.

The NVivo7 tree nodes (cf. figure A19.16) thus built progressively over time as codes and concepts emerged and appeared to fit within some developing logical structure. The coding process would typically code words or phrases directly from the data as NVivo7 "free nodes" (cf. figure A19.18), unless a suitable code existed already to represent whatever code or concept was present. Over time free nodes would typically become consolidated into the tree nodes as more stable and frequently occurring concepts. If they remained as solely "free nodes", that usually indicated a relatively rare notion was being coded for that data source.

5.6.2.1 NVivo7 Software Restrictions

Coding data and managing micro and macro level distinctions was one set of issues, but managing the amount of data in this large episode was another. The number of 'grounded data' references resulting from the query for this analysis when analysed as a whole episode, appeared to exceed the limits of the Nvivo7™ software to handle, and it 'crashed' with an 'unrecoverable error' when I attempted to export the results to an Excel™ spreadsheet for further manipulation. In coding mode, I would have categorised this incident as a *Breakdown* and had to develop a *recovery plan*.

My analytical strategy involved initially coding by selecting groups of the tentatively coded Nvivo7™ 'Tree Nodes' at the top level of each tree, but this only produced results coded against the highest code in each tree. Eventually I reproduced an output file which had analysed the full set of nodes, traversing down the trees, resulting in a file with some 3534 references. Using the NVivo7 "hide column" feature, I removed the null cells, and with this workaround I was able to successfully export the now smaller file to an Excel spreadsheet. The Excel spreadsheet was further manipulated to remove the codes related to 'appropriation moves' which had been previously analysed (cf. figures 6.13 - 6.15 in section six).

Excluded from tables 6.7a & 6.7b were 39 messages coded as 'near duplicate', which represented discrete message components from separate email threads. These may omit minor items such as sender, or recipient information, but to all intents and purposes are equivalent to other messages. The content of such messages has not been coded and the 'near duplicate' code indicates they have been omitted to avoid

conflating the analysis. This action constituted another form of data scrubbing to remove duplicates, as discussed in section 5.1.3 above.

5.7 Data Management and Research Conduct - Conclusions

This chapter has reviewed the practicalities of managing the data involved in performing the analysis underpinning this research. It has addressed issues relating to the nature of data in such a study; the special issues that arise with email data; techniques for research data storage and naming standards; data preparation and data scrubbing techniques; strategies for transferring data into NVivo7 for subsequent analysis, and data manipulation techniques within NVivo7 as a software tool in support of qualitative data analysis.

The chapter has also touched on broader principles and the strategies adopted for selection of the data within defined “episodes of interest”; implementation strategies for episode analysis, the characteristics of data within episodes; approaches to Grounded Theoretic analysis; data segmentation strategies and determining suitable units of analysis.

The approach to data analysis adopted in this study has been shown to be multi-faceted, and informed by a combination of theoretical and methodological frameworks. It has also demonstrated a willingness to pragmatically adapt a combination of methodological approaches to the situation, with a resulting hybrid approach. While not necessarily purist in approach, it is believed that the methods adopted here have been appropriate, justifiable and provide a self triangulating set of techniques to support robust and valid forms of analysis.

Chapter 6: Episodes of Interest

6.1 Introduction

In this chapter specific episodes of interest are analyzed through a series of profiles. These profiles comprise sets of individual episodes of differing levels of granularity. In subsequent chapters these episodes will be extended to grouped episodes and cross episode or diachronic analyses. While the episode is the core unit of analysis, differing levels of analysis, as proposed in AST (DeSanctis & Poole, 1994), are also covered from micro level (speech acts, meeting phases) in this chapter, through global (entire meeting, multiple meetings) to the institutional level (multiple groups, cross organizations), in subsequent chapters.

Episodes are presented utilising the four strategies recommended by Pozzebon & Pinsonneault (2005) for applying structuration theory (ST) in empirical IT research. These strategies are realized by analyzing each episode using: first a narrative summary to introduce each episode or episode grouping; second a data-driven, grounded strategy to analyse the patterns of appropriation moves in each episode or episode grouping, complemented with the roles and other key elements drawn from the data and integral to each episode; third a visual mapping strategy to show the evolution or emergence of patterns across time; and fourth a temporal bracketing strategy (fine or broad ranging), which is inherent in the selection of each episode or episode grouping, and provides a window within which realized patterns of practice may be observed.

Each such analysis further aims to integrate the three sensitizing devices for ST research recommended by Pozzebon and Pinsonneault (2005, p.1367) within each episode, namely illuminating: the operation of *duality of structure*; the role of *time/space* and revealing the *actors' knowledgeability* or "reflexivity regarding their everyday interactions" (ibid.).

In the initial version of this chapter I had included all eight episodes effectively as sub-chapters. The focus of these eight episodes has been briefly summarized in section 5.5 above. However, since each episode profile constituted a full micro-analysis of the episode, and to some extent its surrounding context, this made the chapter very lengthy. In the interests of brevity therefore, I have now chosen to represent the first three episodes in full, each depicting a distinct mode of TUM activity for comparison

purposes (*adjustment/reinforcement; episodic change and establishment*). The remaining five episodes have been moved in full to appendix 20, and can be read in sequence as an integral part of this chapter if desired. I would personally recommend that approach to a reader for whom the work has interest, as for me in this work the "devil lies in the detail". Even with this truncated approach to the core of the thesis, the very large *establishment* episode of section 6.4 constitutes a lengthy section.

However I have concluded that if a key contribution of this work lies in:

> "fleshing out detail and looking at 'microlevel events"

as observed by Fred Niederman (cf. 1.4.3 above), then to represent a micro-analysis such as attempted in this thesis, within a wholly macro-analytic format, would not do justice to the work, and would in itself represent an absurdity.

The first episode selected is a very brief one, in effect a micro episode from the middle of the collaborative trial representing the TUM *adjustment/reinforcement* phases of activity. It provides a nicely concentrated starting point to exemplify the four pronged analysis conducted in this series. As an introductory episode it is developed in rather more detail, and with more explicit linkages to the originating literature, than subsequent episodes.

6.2 Episode of Interest Profile: Adjustment-Reinforcement Episode Three

6.2.1 Episode Characteristics - Adjustment-Reinforcement Episode 3

Episode Characteristics	
Duration:	Wednesday 6/10/2004 – Thursday 7/10/2004
Supporting data:	Diary Note: 06/10/2004 Wednesday Diary Note: 07/10/2004 Thursday
No of sources	2
Word count	248 + 184 = 432
Actors:	Arnold Pears, Tony Clear Diana Kassabova, Tony Clear

Table 6.1: Episode Characteristics - Adjustment-Reinforcement Episode 3

6.2.2 Narrative summary - Adjustment-Reinforcement Episode 3

This episode consists of two diary notes on two consecutive days in the middle of the collaborative trial. In the first note Arnold Pears rang from Uppsala at 7:19 pm our time (which he had mistakenly thought would be about 5:00 pm), but I happened to be in the office. We discussed progress of the trial, with Arnold sharing his frustration over the tight format of the trial process [suited to the needs of the teaching team and the students at AUT – but not so readily for the Uppsala team and students]. Several other observations were made related to some confusion on Arnold's part about where things stood and his lacking time to keep up with everything, the differing teaching cultures (e.g. the virtual classroom at each location as a private or a shared space), the extreme time zone differences inhibiting synchronous sessions which Arnold wanted to initiate, (I suggested using the announcement feature of AUTonline to suggest that teams do so) the differing technology environments at home and university in both Uppsala and Auckland, a concern about how his emails would be interpreted by Diana – too brusque in tone, some lost student email communications due to filtering of

hotmail accounts and the lack of usability of the Blackboard™ Learning Management System (AUTonline).

In the second note the next day, I updated Diana with the contents of the discussion with Arnold. Diana observed that three way synchronous collaboration by online chat was inhibited by the group structure of AUTonline (it operated 'intra GVT' not 'inter GVT'), she also observed the busyness of lecturers and the multiplicity of their concurrent tasks, with this as merely one in a wider set of activities. We discussed the notion of a shared classroom and the possibility of a global email list – AUTonline would work for AUT students and lecturers, but Swedish students would need to set up forwarding to their own email accounts, which would take too long to set up now. She also observed the value of pair collaboration as a support & guidance, peer review mechanism. After a busy day with taking the cat to the vet, working on assessments for a postgraduate course and working on an external research project proposal, later that evening at 11.20 pm I checked on progress with the GVT's, where some additional activity had been recorded in teams relating to choosing their group leader.

This episode has been chosen for analysis as one example of an interesting 'breakdown' in the collaboration process. The episode evidences a set of proposed and actual *adjustment* and *reinforcement* technology-use mediation activities that occurred mid-trial, just after the AUT holiday break from 20 September to 3 October, when activities were to begin again.

6.2.3 Appropriation Move Patterns- Adjustment-Reinforcement Episode 3

Figures (6.1 -6.4) below depict the patterns of 'appropriation move types' and 'subtypes' (DeSanctis & Poole, 1994), which characterise this episode, and demonstrate the manner in which the technology has been appropriated. The original set of appropriation move types and subtypes as applied by Poole & DeSanctis (1992, p. 18-20) and presented in table 5 of DeSanctis & Poole (1994, p. 135), have been augmented by further 'move types' and 'subtypes', as noted previously in section 5.4.1.3 and related appendix 6, to more fully reflect not simply activities of *technology-use*, but also those of *technology use mediation*.

6.2.3.1 Appropriation Move Patterns – Adj-Rein Episode 3 Direct

One example of '*direct*' appropriation moves was coded in this episode (Arnold's phone call – coded as 'AIT' and as '*b. implicit*'), showing a low ratio of direct appropriation. This pattern was to be expected, given that the source data consisted solely of diary notes relating to an intended use of technology.

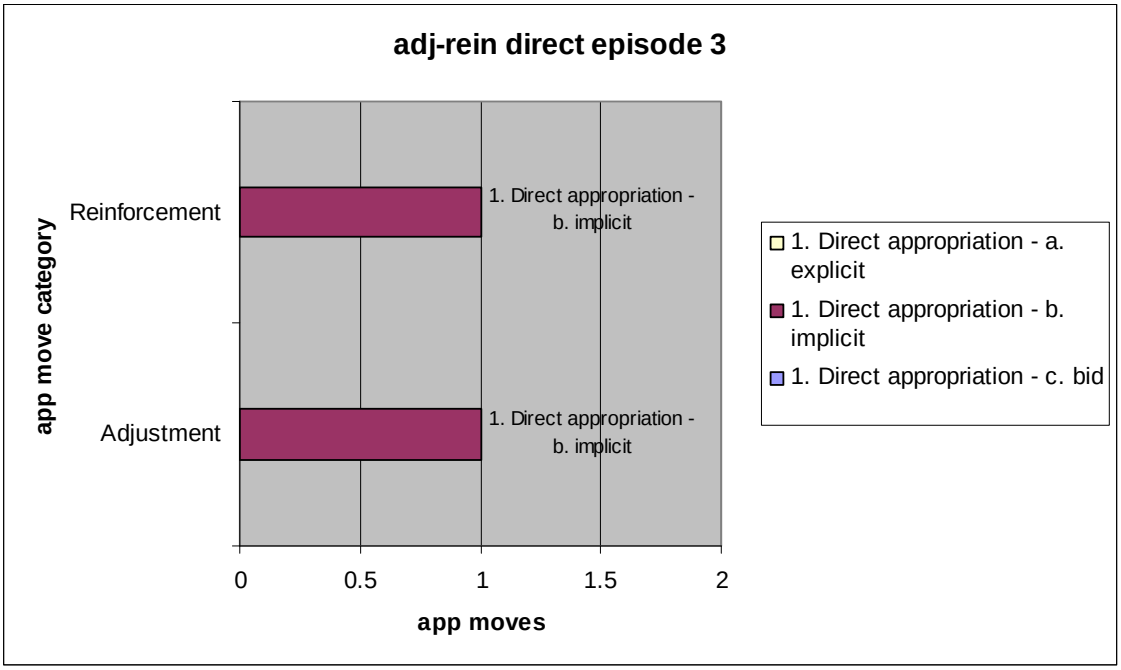


Figure 6.1: Adjustment-Reinforcement Episode 3 - Appropriation Move Types - Direct

The coding of this episode reflects an implicit use of technology (telephone) without referring to it as a 'structure'. The phone fades into the background as a familiar technology form (even if enabled by modern VOIP technology), being used almost unconsciously by the actors in the episode. However phone as technology is an important TUM vehicle in enabling: 1) *reinforcement* of the trial activities (by re-establishing contact and sharing trial status and concerns between the coordinators to help motivate the coordinating GVT); and 2) proposing *adjustment* to the technology-in-use, by seeking to initiate synchronous communication sessions between the student GVT's.

6.2.3.2 Appropriation Move Patterns – Adj-Rein Episode 3 Constraint

The data is richer for moves categorised as '*constraint*', where the 'structure is interpreted or reinterpreted'.

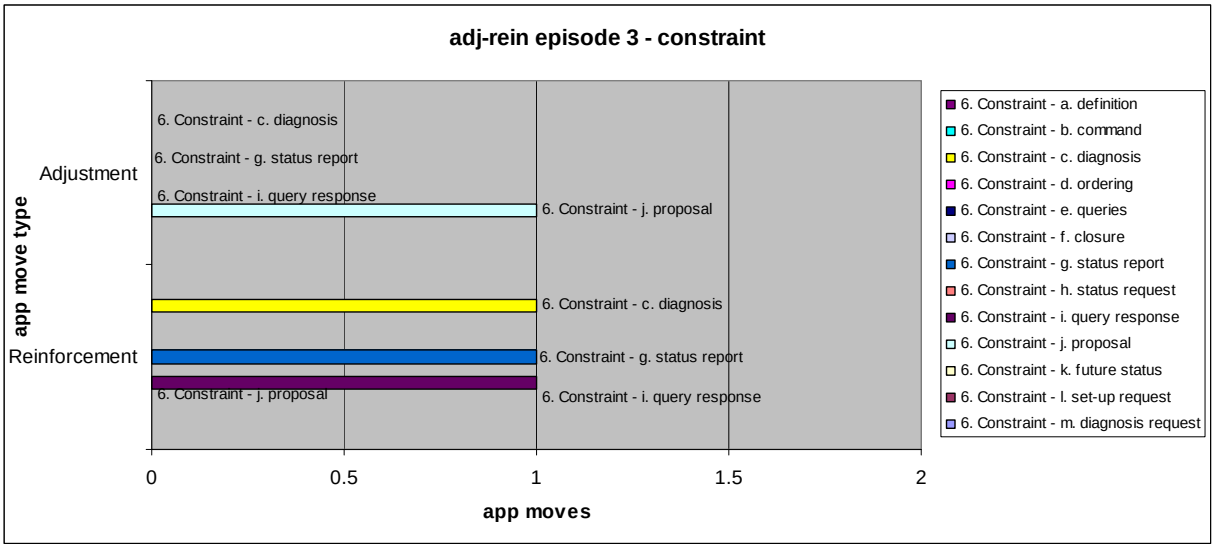


Figure 6.2: Adjustment-Reinforcement Episode 3 - Appropriation Move Types – Constraint

The move coded as '*j. proposal*' (suggesting how the structure should be used) in a discussion between myself and Diana, demonstrates a proposed *adjustment* of the "technology-in-use" (Orlikowski & Gash, 1994), by using a global email list to establish a sense of a shared classroom. *Reinforcement* by contrast, is shown through my suggestion to Arnold as a '*i. query response'* over the usability of Blackboard, that he click on student names at the bottom of the GVT group pages to find the student web pages. In a less technology-focused example, of '*c. diagnosis*' Arnold comments on 'how the structure is working', with his concern that his brief emails not be seen as brusque in tone, and for me to advise Diana accordingly. The '*g. status report*' stating 'what has been or is being done with the structure', derived from my late night progress check of recent trial activity is another example of *reinforcement*. Here the 'structure' in question is both multi-faceted and multi-layered, being the technology structure of the AUTonline system and its embedded features (including the associated Lotus Notes™ Collaborative Database) - themselves representing further structures; the collaborative trial structure with its timeline and set of activities to be completed; the GVT and LT structures and the "group's internal system" (DeSanctis & Poole, 1994, p. 132); all themselves embedded in the separate social structures constraining the

students and coordinators at each site.

6.2.3.3 Appropriation Move Patterns – Adj-Rein Episode 3 Judgement

The data shows evidence for moves categorised as 'judgement', where the actors 'express judgements about the structure'.

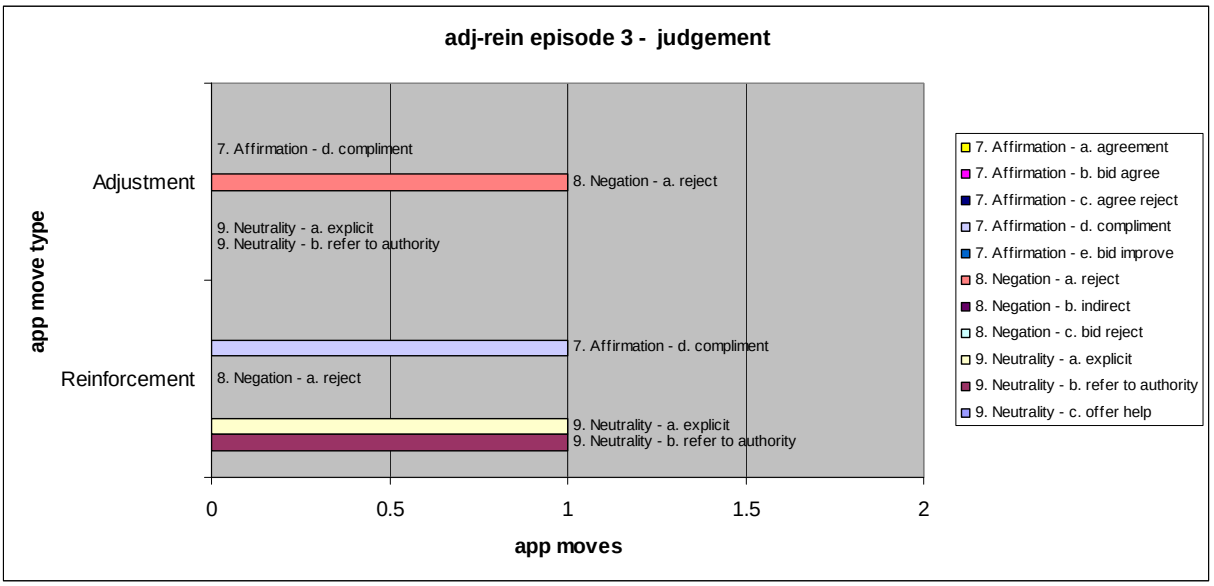


Figure 6.3: Adjustment-Reinforcement Episode 3 - Appropriation Move Types – Judgement

In the *adjustment* mode, we see an example of '*negation –a. reject*', where the actors 'directly reject appropriation of a structure', in this case the creation and use of a group email list to help establish a sense of a shared classroom. Since this would have necessitated that Swedish students individually set a forwarding address for their current AUTonline (ghost) email account, we concluded that it would take "too long to set up now".

As for the reinforcement mode we see examples of 'neutrality b. refer to authority' where Arnold comments on the usability of Blackboard and difficulty of finding student web pages, as an example of 'acknowledging uncertainty towards use of the structure and need to consult an authority'. A lesser need for assistance can be seen in the excerpt related to review of status of the trial - coded 'neutrality a. explicit' where 'uncertainty or neutrality towards use of the structure is expressed'. In this example the status of the team leader decision is questioned for GVT1, namely whether they had correctly defined themselves as a 'self managed team' or had one of their members made an error? Quite a contrasting example is seen in the brief dialogue coded as

‘affirmation d. compliment’, or ‘note an advantage of the structure’, in which Diana observed to me the “value of ‘pair collaborating’ as a support & guidance peer review mechanism”. The ‘structure’ referred to here is not so much a technology based structure, but more in the form of a “process structure [which] refers to process techniques or rules that direct the pattern timing or content of...communication…such as an agenda or process methodology such as Nominal Group Technique” (Nunamaker at al., 1991, p. 45). The form of process structure provided by the set of practices known as “pair programming” (Williams, Kessler, Cunningham, & Jeffries, 2000), could be considered analogous here. A further relevant form of structure is the group level social structure provided by the “group’s internal system” (DeSanctis & Poole, 1994, p.132).

6.2.3.4 Appropriation Move Patterns – Adj-Rein Episode 3 Relate

The data in this grouping shows evidence for moves categorised as '*relate*', where the actors 'relate to other structures' and where the 'structure may be blended with another structure'.

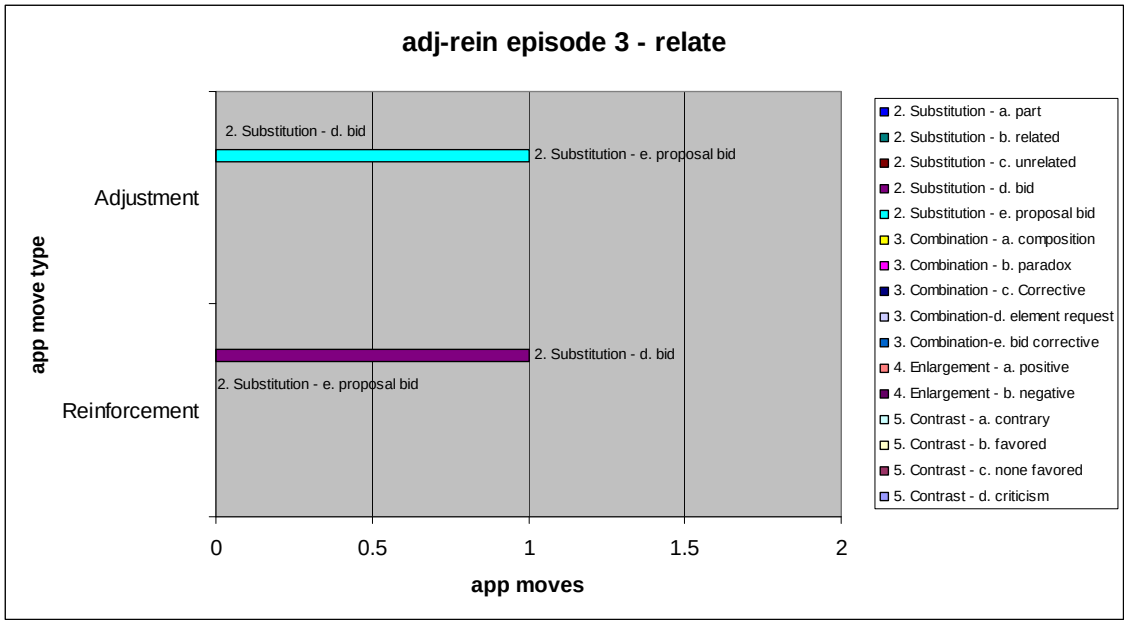


Figure 6.4: Adjustment-Reinforcement Episode 3 - Appropriation Move Types - Relate

The *adjustment* activity in this group of moves is a '*substitution e. proposal bid*' in which an actor 'requests proposal(s) to use a similar structure instead of the structure proposed'. In this case Arnold requested that we "get synchronous sessions going". My response was in the nature of *reinforcement* as a '*Substitution d. bid*' move, where the actor 'proposes to use a similar structure instead of the structure at hand and seeks confirmation'. Specifically I suggested that Arnold use the announcement feature of AUTOnline to "encourage groups to initiate and discuss feasibility" of holding synchronous sessions.

6.2.4 Other grounded data - Adjustment-Reinforcement Episode 3

Complementing the above appropriation analysis, the coding process identified several key concepts occurring within this episode. These concepts are summarised in table 6.2 below.

Concepts	Codes	Count	Subtotals
AIT	AIT	2	
AIT	AIT Spirit	1	3
Breakdown	Breakdown	1	
Breakdown	Recovery Plan	1	2
control	security	1	
control	authorization	2	3
culture	Student culture	1	
culture	cultural issues	2	3
GVT	GVT	2	2
LT	LT	2	2
Metastructure	Metastructure	2	
Metastructure	Metastructure Spirit	1	3
Pressure	busyness	1	
Pressure	concurrent tasks	1	2
Role	Central users - self selected, emergent (like a Coweb webmaster)	1	
Role	Coordinator	2	
Role	Offshore Technical Coordinator	2	
Role	Process Facilitator	1	
Role	Purpose agents - teacher	2	
Role	Undergraduate Student	2	10
socio-emotional	other-directed emotions	2	
socio-emotional	Self-directed emotions	1	
socio-emotional	context & technology-directed emotions	1	
socio-emotional	performance-driven emotions	2	
socio-emotional	motivation	1	7
Space	Location	2	2
Time	Synchronize	2	
Time	Time separation	1	
Time	Time	2	
Time	time zone	1	
Time	Runestone	1	
Time	day	2	
Time	experience	1	10

Table 6.2: Adjustment-Reinforcement Episode 3 – Concepts and codes

The table above provides counts for the grounded theoretic ‘open codes’, ‘concepts’

and/or ‘categories’ (cf. Allan, 2003, Glaser 1992, p. 38ff.) derived using the ‘constant comparative method’ of Glaser & Strauss (1967, p. 106) from the data sources in this episode. Code counts are not complete here, merely representing the presence or otherwise of the code in each data source, but the totals for concepts do partially indicate the frequency of the component elements. These concepts are analysed below in two separate groupings: the first addressing the three key elements of a structurational analysis recommended by Pozzebon & Pinsonneault (2005); and the second a more general analysis identifying the further TUM related concepts that have emerged from the data within this episode.

6.2.4.1 Duality of Structure - Adjustment-Reinforcement Episode 3

The “agency-structure duality” as Pozzebon & Pinsonneault (2005, p.1358) argue, is central to structuration theory, but further inherent in the notion of the “duality of technology” expounded by Orlikowski (1992). In this episode we see the interplay between action, structures and technology as closely intertwined elements. The interchange in this episode had arisen from a frustration on Arnold’s part about arranging a synchronous chat session between the GVT’s. In discussing how to initiate such a session we see the constraints converging from many sources: the pre-specified nature of the process – suiting the NZ teaching team and student cultures, but not the Swedish; the global virtual classroom culture – inherently shared for Uppsala vs. assumed private local student communications for the NZ teaching team; the absence of a global email list to support a shared classroom culture – constrained by the AUTonline platform and the registration process at AUT for external students [who had AUT internal email addresses which would need to be individually adapted by Uppsala students to forward messages to their personal email addresses – a lengthy and probably fraught process, so waived by the team]; as a corollary of this, the interchange includes an observation on the loss of email messages originated from students hotmail accounts by unduly aggressive university spam filters, so we see that even pragmatic student initiatives are blocked; Diana’s later comments on how global communications to the joint student body might be supported by the AUTonline platform again observed that three way synchronous communication was constrained since the platform supports intra - GVT communication, but not inter – GVT message sharing.

I made a suggestion that Arnold use the announcement feature of AUTonline to communicate globally to the teams, and exhort them to initiate and discuss the

feasibility of arranging their own synchronous sessions.

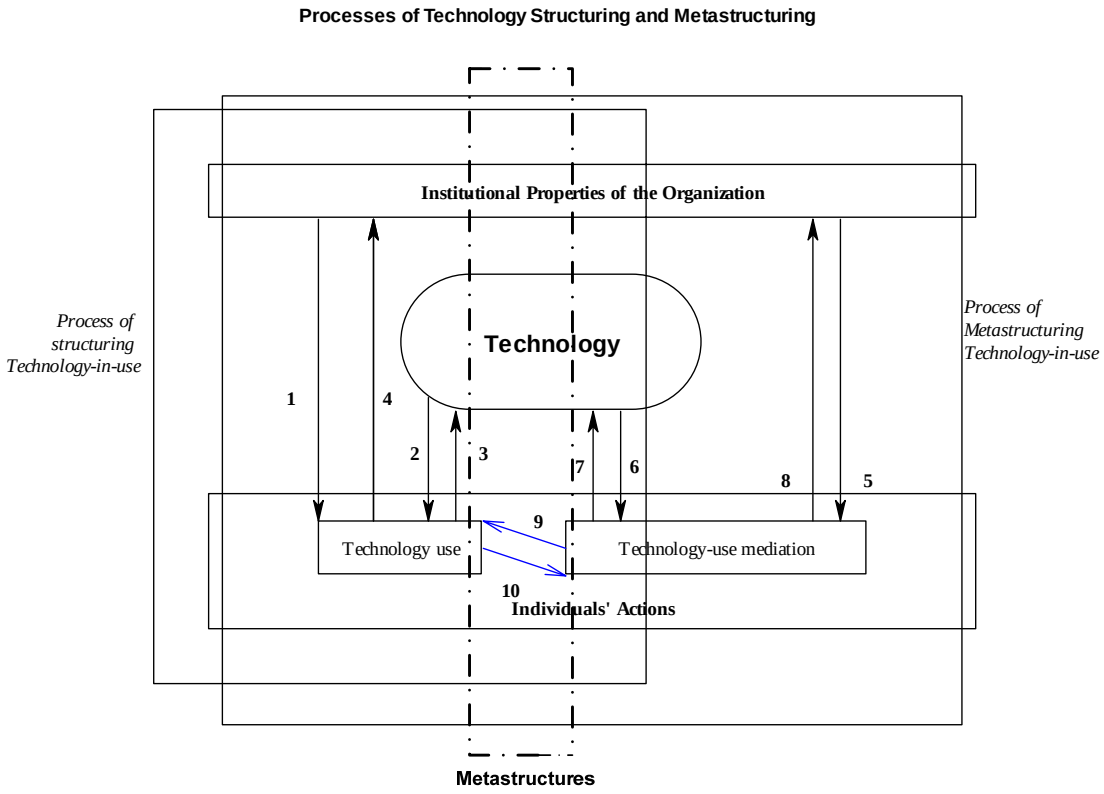
This latter communication provides a good example of 'reinforcement' (Orlikowski, 1995) as a technology use mediation activity, as does another suggestion I made that Arnold click on the student names at the bottom of the group pages section of AUTonline in order to view their personal webpages. The establishment of synchronous chat sessions between GVT's or of a global email list for the trial, would likewise have been good examples of an 'adjustment' activity (Orlikowski et al., 1995), had they been achieved in this episode.

The structuring and metastructuring processes observed in this episode, gave rise to a further concept to represent this duality, the notion of a *metastructure*. While to some extent a reification of Giddens' (1984) 'structuring' process, this notion of a *metastructure* was conceived as a

> *mediating institutional, 'cultural' [e.g. shared classroom, cf. below] or technology structure, which served to shape technology use.*

Thus a *metastructure* serves to link the six elements of institutional properties, [culture as an additional element discussed below], technology, individual actions, technology use and technology-use mediation, and thus fills the gap between the arrows 9 and 10 of Orlikowski et al.,'s (1995, p. 438) figure depicting the "processes of technology structuring and metastructuring".

Figure 6.5 below shows the notion of 'metastructures" as integrating structuring forms, which are tightly interrelated and recursive, superimposed on the original figure.



Arrow 1: Institutional conditions for use

Arrow 2: Technological conditions for use

Arrow 3: Technological consequences of use

Arrow 4: Institutional consequences of use

Arrow 5: Institutional conditions for mediation

Arrow 6: Technological conditions for mediation

Arrow 7: Technological consequences of mediation

Arrow 8: Institutional consequences of mediation

Arrow 9: User consequences of mediation

Arrow 10: User conditions for mediation

Note: Arrows 9 and 10 are dotted to indicate that the interactions are mediated through the institutional properties. We show a direct relationship for expository convenience. (Orlikowski et al., 1995)

Figure 6.5: *Metastructures* in the processes of technology structuring and metastructuring (Adapted from Orlikowski et al., 1995, Figure 6, p.438)

Examples of *metastructures* in this episode are the global email list, with its accompanying '*metastructure spirit*' of supporting global inter classroom communication – an *AIT "spirit"* (DeSanctis & Poole, 1994, p.126) which has not been realised within the combination of the design of the AUTonline platform, and the registration process and email account set up for external students at AUT University

where the platform was hosted. Similarly the notion of a *GVT* and *LT* and accompanying group page within AUTonline provide other examples of a *metastructure*, as do firewalls, student web pages, announcements, online questionnaires and video-conferencing - all data items observed within this one brief episode. The blend of institution, technology and culture (as a form of group agency) come together in the notion of a global virtual classroom as a *metastructure,* with contention over its underlying '*metastructure spirit*' – *shared* for the global teaching team, or *private* to local teams. Here we see the institutional properties of the teaching and learning process through the notion of a 'classroom'; the technology properties of the platform to represent that virtually (to varying extents); and the cultural properties through the '*spirit*' of the collaborative teaching team (*GVT*), itself a *metastructure,* combining to jointly structure the teaching and learning process.

6.2.4.2 Time and Space - Adjustment-Reinforcement Episode 3

As can be seen from table 6.2 above, *time* related topics are heavily represented in this episode, and the concept of *space* is also evident. The first observation about time and space relates to Arnold's ringing at 7: 19 pm, a *time* at which I was serendipitously still in the office. For his part Arnold had assumed the *time* was 5:00 pm in our zone – an easy mistake to make when operating across widely divergent time zones. The many faces of time are seen in the next passage when commenting on Diana's reticence to communicate across classroom spaces and Arnold refers to his five years of *experience* with the *Runestone* project, from which came a natural assumption of the global virtual classroom as a shared teaching space. Then an admission of confusion, and a lack of *time* on Arnold's part, to keep up with everything. Next follows an observation about the extreme *time zone* differences in this trial, and the *locational* impacts - as opposed to the eight hour difference in Runestone which enabled an early in the morning or evening *synchronisation* point between teams, especially *from* "*dorms* with broadband internet for video conferencing using Gnome (open source)". By contrast in NZ, dial-up access was then (mid 2004) more common for students *at home,* also making such a technology option less feasible.

In the second message, time is less explicitly mentioned, although the busyness of the participating lecturers is noted. The three way communication issue discussed in the section above and the barriers to global classroom communication were noted, and here we see the *GVT's* and *LTs* as forms of *space* dependent entities, with the global

classroom as a broader collective cyber*space* entity. The limitations of the technology platform could be seen as deficiencies in the virtual learning environment design which failed to accommodate a distributed collaborative mode of learning. The *time* of 11:20 pm. is noted in the diary as the remaining *time* after a busy *day* available to check on progress of the trial – a *reinforcement* activity on my part as trial *coordinator*, although somewhat passive. Nonetheless it is true that regular and timely monitoring of progress enables ready interventions at times of '*breakdown*' or crisis in such collaborations. A brief progress report from me on changes to the database content noting a few new postings from each *GVT* or *LT* [in their allocated virtual *spaces*] concludes the diary note.

6.2.4.3 Reflexivity of the actors - Adjustment-Reinforcement Episode 3

The nature of the conversation within the episode indicates a high degree of conscious awareness of the situation on the part of the actors. Perhaps this is especially inherent in TUM where the actors are deliberately acting to shape the activities of others, so their knowledgeability about what they themselves do in the situation is rendered more explicit. The occasion of a *breakdown* (Hettinga, 2002 P. 16, Winograd & Flores, 1997 P. 69) creates a fertile opportunity for reflecting about one's situation, and the required actions. If we accept the philosophical position of Heidegger, it may in fact be unnatural for us to consciously reflect on our actions in everyday engagements:

> "Heidegger asserts the primacy of our "being in the world," our everyday action as an expression of our essential nature, engaged action as an expression of cognition. Reflective thought on the other hand is a secondary mode of being in the world, occasioned by some need to reflect upon breakdowns in normal patterns and expectations. In other words, for Heidegger, *to be* and *to do* is the natural expression of human existence, *to think* is secondary" (Clear, 1997, p.25).

The situation of '*breakdown*' highlighted in this episode relates to Arnold's expression of "Some frustration at inability to actively collaborate b'cos process is so actively locked down (overspecified for SE students)". In response to this my suggestion was that he use the announcement feature of AUTonline to encourage teams to arrange synchronous sessions, this suggestion in turn was coded as a *recovery plan* for the breakdown situation. An additional interchange evidencing self-reflective awareness was the discussion of "Diana's reticence to communicate across classroom spaces" in

contrast to Arnold's experiences with the *Runestone* project (Daniels et al., 1999), where the shared classroom *culture* was the norm. In both these interchanges, tightly specified process vs. loosely specified, and shared versus private classroom, we see within the GVT of trial coordinators a distinct contrast between LT and GVT *culture*. Then in the subsequent discussion with Diana over how to achieve a shared classroom model, we see the awareness of the limitations of the AUTonline group pages feature inhibiting inter group communication through its security. Thus we see awareness of *control* imposed limitations: through the security features of the *AIT;* its *spirit* of atomic private groups; informed by its underlying spirit of "wooden objectivist pedagog[y]" (Clear, 2002b, p.19), a pedagogy based upon a top down instructor driven model of control, in contrast with a design supportive of greater student control in a collaborative cross institutional model of shared learning. The counter proposal of using the global email list to contact all students collectively, in turn ran up against the constraints of institutionally imposed *control* over external email accounts for non AUT University registered students. Thus the *AIT spirit* of AUTonline, in combination with the *Metastructure spirit* of the student registration process, are the focus of conscious reflection, and active manoeuvring on the part of the coordination team to circumvent. A very concrete example of such reflection has already been observed in 6.2.3.3 above:

> "Since this would have necessitated that Swedish students individually set a forwarding address for their current AUTonline (ghost) email account, we concluded that it would take 'too long to set up now'".

Thus we see the constraints imposed by a systemically interlocking set of features (technology, technology-use, institutional and cultural forces, individual actors) that privilege the individual learner, and conspire to constrain the technology-use mediation activities required to enable more group oriented and collectivist learning models. It is questionable however, to what extent this individual versus collectivist bias in this reinforcing set of structures was apparent to all actors in the situation. I had written about individualist versus collectivist learning models previously (Clear, 2002b), so it was certainly a personal bias (if not a hobby-horse). Nevertheless, we do see the coordinators here, conspiring consciously to meld the technology and social structures in order to support the *metastructure spirit* of the intended collaborative learning process.

6.2.4.4 Other key concepts from this episode - Adjustment-Reinforcement Episode 3

Table 6.2 above has identified several concepts within this episode, the majority of which have been addressed within the above analyses. Three further concepts have had limited mention however, namely *pressure, role and socio-emotional.* For the concept of *pressure* we see the nature of day-to-day academic work illuminated, with many *concurrent tasks*, and *busyness* as a characteristic, some relevant quotes being:

> "busyness of lecturers and multiplicity of concurrent tasks, with this as merely one set of activities"
>
> "lacking time to keep up with everything"
>
> "Busy day, wolfie to vet, - collab computing articles & reviews u/a, TOKM project. 11:30 pm checked GVT activity"

This brief excerpt also highlights the 'cost' to academics of innovative teaching in a university context, coming as it does on top of a multiplicity of other responsibilities and demands, in the midst of a teaching semester, which will normally of itself generate high workload peaks. Alexander and McKenzie (1998) for instance, in their Australian study of innovative IT projects in education, have reported graphically that: "many of the staff involved in projects incurred a high cost in terms of time, resulting in loss of research and personal time. In some cases this had an impact on their opportunities for promotion and tenure". These findings, rather ironically depict the academy as a dangerous locus of IT led innovation – at least in the teaching domain.

> [As an illustrative note: while coded initially here as *pressure*, in subsequent chapters (cf. for instance section A20-6.8.4.2 below), this concept was further refined to *time pressure*, reflecting its temporal nature, and recoded accordingly].

In addition to *pressure* the notion of a multiplicity of *roles* was apparent in this episode. These situated roles in many cases mapped to similar roles, earlier identified from various literature source extracts, and coded in the data corpus as part of the process of 'grounded theoretic' (Glaser & Strauss, 1967) code development. Academics assumed several different roles in addition to the expected role of "[purpose agent -] teacher" (Guzdial, Rick & Kerimbaev, 2000). *Process facilitator* (Goodyear, Salmon, Spector, Steeples, & Tickner (2001) was one identified role, highlighted in these excerpts:

> "cultural difference within NZ teaching team and desire for tightly defined process"
>
> "process is so actively locked down (overspecified for SE students)"

where the process facilitation role of the teaching teams, and the tight versus loose style of process facilitation, at the NZ and Swedish sites respectively, are apparent:

A *local expert* (Trigg & Bødker, 1994) role was evident in my assuming the *Central user* role [*Central users - self selected, emergent (like a Coweb webmaster)]* (Guzdial et al., 2000), to assist Arnold, as an example of a TUM *reinforcement* activity:

> "…difficulty of finding student web pages. (told him to click on student names at bottom of GVT.)"

Commenting on the *teacher* and *central user* roles Guzdial and colleagues, writing about collaborative applications in the educational application domain, have maintained, "These roles are natural, stable… and probably appear in most long term Computer Supported Collaborative Learning (CSCL)…and Computer Supported Collaborative Work (CSCW)…applications" (ibid.).

Further roles apparent in the episode were those of *coordinator* (Roy, Bernier & Leveille, 2006; Smith, Hixon & Horan, 1998) and *offshore technical coordinator* (DSDM, 2005, p.12). The responsibilities of the latter role are defined by the DSDM Consortium as "Liaise with onshore technical co-ordinator on establishment and maintenance of effective technical infrastructure" (ibid.).

These two coordinative roles are more general descriptive roles for Diana and myself as *coordinators* and Arnold as *offshore technical coordinator,* and evidenced through the overall set of coordinative activities which we conducted in the episode. For instance the whole dialogue over establishing synchronous group chat sessions, and strategies for addressing the associated technical barriers was an example of both roles in operation. The episode also illustrates the non-exclusivity of the roles and actors within them, and the fact that roles were fluid and dynamic rather than fixed and static.

An *undergraduate student* role was apparent too, in the various discussions concerning their access rights as individuals and groups, how to communicate with Swedish students, the artefacts they were meant to contribute to the collaborative repository, and their progress in doing so.

The third conceptual category identified was classified as *socio-emotional* (Fuller & Trower, 1994; Benne & Sheats 1948, cited in Zigurs & Kozar 1994; McGrath 1991). The socio-emotional category was included partly through issues noted in prior literature, (e.g. the clear distinction between 'task' and 'social' needs in GDSS noted in DeSanctis & Gallupe, 1987; the group "well being" and "member support" dimensions

of the "Time Interaction and Performance (TIP) theory" distinguished by McGrath, 1991); partly through prior personal experience of its significance; and partly because it stood out as a category within the data. For instance Zigurs & Kozar (1994, p.279) reference the early "Typology of Benne & Sheats (1948) [which] 'classifies group member roles into three categories: (1) group task roles, (2) socio-emotional group-building and maintenance roles, (3) individual roles'". Mennecke & Hoffer (1992, p.550) represent motivational factors under "incentives & rewards", as an input to a group's meeting process. Again from the GSS literature Huang, Wei & Lim (2003, p.83), note that "most prior GSS research focuses on supporting task-oriented teamwork and largely neglects socio-emotional activities of a team….More research is therefore needed to study how to support a team's socio-emotional activities using a GSS".

With a focus on the student learning experience Järvenoja, & Järvela, (2005) and Wosnitza, & Volet, (2005) identify the emotional and motivational dimensions of the learning process. The importance of motivation in the virtual team mode of learning is something which we have reported upon ourselves (Clear & Kassabova, 2005). Socio-emotional dimensions are implicit in aspects of the original AST model of DeSanctis & Poole (1994), but rather dispersed. "Beliefs/feelings towards technology" is an additional component added to the AST model by Nyerges & Jankowski (1997), in their model of "Enhanced Adaptive Structuration Theory" for decision support in the GIS context.

So there appears to be a degree of under-theorisation of the socio-emotional dimensions in technology supported groups and virtual teams. It is not a conscious aim of this thesis to focus strongly in the socio-emotional area, but some analysis of the evident supporting data is warranted at this point, to identify to what extent socio-emotional aspects do support the technology-use mediation process.

The first category of emotions noted in this episode is, *other-directed emotions* (Wosnitza & Volet, 2005). These are evident in such interchanges as: the one between Arnold & myself concerned about motivation of students at Uppsala; about Diana's reticence to communicate across the classroom boundaries; Arnolds' emails to Diana and concerns over whether they would be seen as too brusque; my observations about the busyness of lecturers and their need to juggle many concurrent tasks; and Diana's observations about the value of pair collaboration as a supportive structure for the collaboration.

In the category of *self-directed emotions* (Järvenoja, & Järvela, 2005), we see some of the above items dual coded, for instance the busyness of lecturers applied equally to me as did the value of pair collaboration.

Context & technology directed emotions (Wosnitza & Volet, 2005), again gives rise to some multiple coded items. Concern over the brusque tone of emails, has a technology element, as does the dialogue over the shared versus private virtual classroom and prior Runestone experience. Other items coded were Arnold's expression of frustration over the "locked down process" for collaboration; Arnold noting he was a "bit phased by things and needing time to catch up"; the extreme time-zone differences in this collaboration as opposed to Runestone, where there were more opportunities for synchronization (start or end of day) supported by broadband and Gnome open source desktop video-conferencing technology in dorms, versus dial-up limited options from home in NZ.

Performance driven emotions (Järvenoja, & Järvela, 2005), again overlaps with the other categories. Arnold's comment about "being phased" also relates to his performance in the trial, the busyness of lecturers again impacts negatively on performance in the trial, whereas, by contrast, the value of pair collaboration actually aids performance in the trial.

The concept of Motivation (Clear & Kassabova, 2005; Beise, Evaristo & Niederman, 2003, Yang, Li, Tan & Teo, 2007) is briefly highlighted in this episode as Arnold and I "talked about motivation issues here vs. Sweden". This topic arose out of a prior discussion about the differing styles of coordination and process structuring between the NZ and Swedish sites, and Arnold's desire to initiate synchronous chat sessions between groups. Implicit in this discussion is the contrast in both student cultures between sites and in the cultures of the two teaching teams. The Alexander & McKenzie (1998) study noted that projects which were not successful "over-estimated students willingness to engage in higher level learning activities, especially when they were not related to assessment". Tensions arising from the differing institutional and student cultures between Uppsala and AUT University, has also been noted in Clear & Kassabova (2005). It appears from this interchange that the explicitly scripted model designed to minimise confusion and motivate the AUT University students and teaching team, may have had the opposite effect for their Swedish counterparts. This may require us to revisit our earlier conclusions "Addressing the question of meaningfulness of directions, we have spent much time and effort in developing

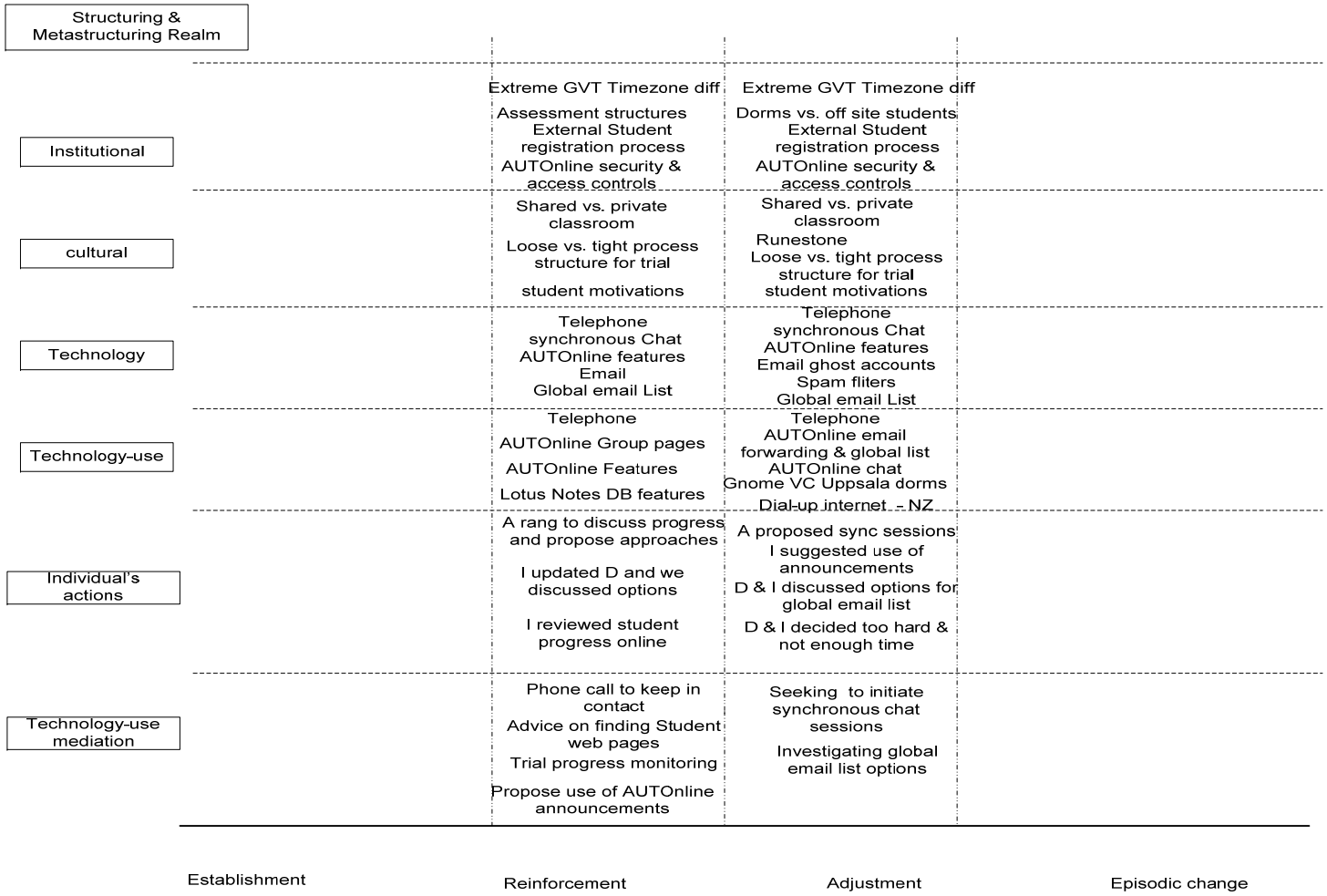
explicit, clear yet succinct instructions for students to follow" (Clear & Kassabova, 2005). It should be noted though that our view has been supported both by our own experience and findings from prior literature, "asynchronous distributed sessions require a very, ***very*** explicit set of instructions which should have been pilot tested with several people to eliminate ambiguity. The instructions must be complete, unambiguous, specific, detailed and easily understandable by all participants. No small order" (Beise, Evaristo & Niederman, 1999). This specificity of course means that more generic outcomes are less likely. However, Beise & colleagues (ibid.) also observe the value of synchronous sessions in accommodating changes in direction "with a few words from the facilitator and a few questions from group members". Given the logistical and other barriers noted above, in the absence of synchronous sessions, finding a happy means to keep both teaching teams and student bodies motivated is clearly a challenge. There is some consolation at least, to be found in the comment by Rutkowski, Vogel, Van Genuchten et al., (2002, p. 225) that "appropriate structure to some is stifling to others".

In summary, the socio-emotional dimension appears to add significantly to the analysis. We see more interlocked evidence supporting the findings highlighted in table A18.2b below, from the 2003 – 2004 series of collaborative trials that socio-emotional tasks are important. We also see some contrasting evidence against the semester one 2005 trial findings, reporting the "*value of clear and explicit instructions*" (cf. table A18.2b below). However, that trial was an internal collaborative trial involving only AUT Business students, who are more comfortable with such an instructional style. As a broader conclusion on the value of this socio-emotional analysis, it appears to provide a further triangulation mechanism for the concepts that emerge from the data, it seems to canvass similar ground to that covered in the analysis above and provides a relatively efficient lens for picking up the key elements in an episode. It certainly indicates that technology-use mediation has a strong socio-emotional dimension.

6.2.5 Visual Mapping - Adjustment-Reinforcement Episode 3

The diagram in figure 6.6 below represents a two dimensional visual summary, approximating at this stage a 'map' of the episode, consistent with the recommendations of Pozzebon & Pinnsoneault (2005) that ST analyses should

incorporate a visual mapping strategy to show the evolution or emergence of patterns across time. Subsequent episodes have evolved more sophisticated visual mapping approaches, but at this point a mere tabulation has been adopted. It can be questioned whether there is enough in this episode to pictorially indicate a progression, but given the fine-grained nature of this particular episode, a detailed analysis seems appropriate as a means of giving an overview picture of TUM within the episode. The realms of structuring and metastructuring used to segment the episode, are drawn from Figure 6.5 above where the notion of 'metastructures' and their component elements have been developed.



Adjustment-Reinforcement-Episode 3 Visual Map Summary by TUM Phase

Figure 6.6. Two Dimensional 'Visual' Map - Adjustment-Reinforcement Episode 3

Figure 6.6 above, while a relatively static snapshot of a brief window in time, draws some elements from the combination of diagrams presented in chapter four above (section 4.5.3).demonstrating the process of change and structuring of technology over time. Section 6.2.6 below discusses the implications of applying a temporal bracketing strategy, and demonstrates alternative approaches to depicting the evolution of patterns over time.

With the adoption of a broader temporal bracketing strategy, a more graphic illumination of the change process brought about through TUM can be presented in the following section.

6.2.6 Temporal Bracketing - Adjustment-Reinforcement Episode 3

The use of a temporal bracketing strategy for analysis is slightly contentious in ST research according to (Pozzebon & Pinsonneault, 2005, p.1361) "Because mutual influences are difficult to capture simultaneously, it is easier to analyse them by temporally 'bracketing them' ... Several authors warn that bracketing analysis risks distorting Gidden's meaning of duality of structure' and overlooking that structuration occurs in every instant of action …". The counterargument is that such a strategy permits the analysis of change over time and space, by analysing how change in one period of analysis impacts the context which affects action in the subsequent period, which is at the core of a structurational analysis.

For this tightly focused, short *episode of interest* it might almost be more appropriate to speak of it as a 'Micro episode'. While still periodic it represents a shift in granularity. The episode provides a very brief window for a "temporal bracket" and the appropriate form of analysis would therefore be a very "fine-grained" one, where "Fine grained bracketing purposively breaks down events into the effects of action on structures on the one hand and the effects of institutional constraints on action on the other, over a thin continuum of time" (Pozzebon & Pinsonneault, 2005, p.1364). Figure 6.6. above has depicted the happenings in this episode, which itself represents the 'temporal bracket' selected from 6/10/2004 – 7/10/2004. Unfortunately, working solely with the data selected for the episode, affords very limited scope for showing any progression of events, other than between the three actors in the episode and their interactions, which do not develop to any significant extent. To gain a fuller understanding of the episode, its origins and its impact, it appears necessary to broaden the window of analysis and therefore select a wider temporal bracket. This inherently goes against the notion of an 'episode of interest', unless we conduct a detailed analysis of the intervening data as well - a non trivial undertaking substantially expanding the analysis task, depending upon where we place the boundaries for the episode. It would seem a pity to abandon the existing analysis, as it has shone fruitful light on the episode, which itself was selected as a self contained unit of analysis for the perfectly valid reasons noted in 6.2.2 above.

Yet while we may analytically "parse structuring's ceaseless flow into temporal phases" (Barley, 1986, p. 82), like any flow or stream the water before us has its origins upstream and will have downstream impacts. Therefore to shed light on the

current episode, a widened lens may better place it in context, and analyse how changes occur over time. The focused nature of the episode itself helps in this extension of the temporal bracket. The key TUM activity highlighted in the visual map of figure 6.6 above, relates to the use of synchronous chat technologies in the collaborative trial process. A judicious selection of data sources addressing this 'TUM activity in focus' may reflect its development over time, as a narrowed 'distillation' derived from the broader flow of structuring. A selective search, tracking the origins of the 'TUM activity in focus' and its outcomes over time resulted in the set of related data sources for analysis, which are summarised in Table 6.3. below.

Extended Episode Characteristics	
Duration:	7/11/2003 - 30/10/2004
Supporting data:	Meeting Notes: 07/11/2003 Trial Instructions (Phase one): 24/08/2004 Chat messages: 09/09/2004 – 26/10/2004 Discussion Board Posting and reply: 29/09/2004 Wednesday Diary Note: 29/09/2004 Wednesday Diary Note: 30/09/2004 Thursday Diary Note: 03/10/2004 Sunday Email Message: 04/10/2004 Monday Diary Note: 04/10/2004 Monday Email Message: 05/10/2004 Tuesday Diary Note: 05/10/2004 Tuesday Diary Note: 06/10/2004 Wednesday Diary Note: 07/10/2004 Thursday Announcement Posting: 08/10/2004 Friday Chat messages: 20/10/2004 – 30/10/2004
No of sources	31 – focal lens of TUM activity related to synchronous chat
Actors:	Mats Daniels, Tony Clear, Arnold Pears, Fred Niederman, Diana Kassabova, Bridgit, Fredrik, Students in GVT2, GVT4 & GVT5

Table 6.3 Extended Episode Characteristics - Adjustment-Reinforcement Episode 3

6.2.6.1 Narrative summary – Extended Adjustment-Reinforcement Episode 3

This episode consists of a sequence of events over a full year period, involving a broad

group of actors in a combination of face to face and technology supported communications. The sequence begins with a meeting I held on 7th November 2003 with Mats Daniels at the Frontiers in Education Conference in Westminster Colorado. The meeting aimed to: 1) address motivational issues experienced by both sets of Uppsala students in the 2003 trial exercise; 2) agree a common set of goals for both sides of the collaboration; 3) resolve Uppsala student disgruntlements over the prototype Lotus Notes collaborative database. Mats observed that 'the Notes icebreaker had proved a hurdle for weaker Uppsala groups causing loss of momentum – too complex, too serial?' In an attempt to rectify these deficiencies, among other things we agreed that groups should have the 'freedom to choose software' which would hopefully be more motivating for the technically stronger and more vociferous students. This design was realised in the instructions for the 2004 trial, which saw the introduction of the AUTonline platform, supported by a modified Notes collaborative database in a less pivotal role, and a trial design mandating a less restrictive technology choice:

'The means for communication are to be agreed on by the students themselves. Any combination of the following communication channels supported by AUTonline can be considered: Group Forum, Lightweight Chat, Email and Individual Web pages'.

Some recordings of the online chat feature are available in AUTonline. The first set appear to be from 3 groups of students beginning in early-mid September as tests for local Auckland groups. GVT2 and GVT4 did not persevere with the use of this mode of communication. GVT5 had two burst of use, in early September and towards the end of October, in none of these recordings was it evident that they had connected with students outside their LVT.

Arnold's posting to the tutor discussion thread on 29/09/2004 proposed for stage 2 of the trial, since it was already underway, that groups hold a synchronous session. In my diary note of the same day I had observed 'wants a synchronous session - too hard', and replied with a thread to that effect. Again on 30/09/2004 after Diana, Kitty and I had reviewed the draft trial instructions for part 2 of the trial, I had checked the worldtimezone.com site and in my diary note recorded a candidate telephone time for a synchronous session between the coordinators at the three sites,

08:00 am Friday NZ

03:00 pm Thursday US

10:00 pm Thursday Sweden

and noted ‘not enough time for others to review the draft instructions first, decided to leave it for now’. A further diary note on Sunday 3/10/2004 was a note to myself commenting on the deficiencies in the AUTonline platform, with its absence of an overall email list preventing the sending of a global reminder that the trial was recommencing on Monday. I further observed that global email lists had been very useful in past collaborations. Monday 4/10/2004 saw an email forwarded via Bridgit of Learning Support from a student ‘Fredrik’ [no other details] questioning the lack of communication from members of his group, that again raised the issue of the presence/absence of a global email list. In my diary note discussing the issue with Diana, she observed that while offshore students had AUT email they did not have access to it, so all emails sent to offshore students had effectively gone into a ‘black box’. Diana was opposed to establishing a global list and felt that local coordinators [as educators responsible for their own almost ‘sancrosanct’ classrooms] should communicate directly with their local students. On 5/10/2004 we made contact again with Fed and Arnold, (who had been away at a conference), Arnold emailed suggesting online meetings facilitated by the coordinators with three teams each. I noted that I was going to reply to Fred, but wanted to check with Diana first.

The next two data sources (diary notes 06/10/2004 and 07/10/2004) are those that have constituted the body of the analysis in this chapter, and for which the narrative summary is given in section 6.2.2 above. In response to the suggestions given in that exchange, Arnold on 8/10/2004 posted an announcement to AUTOnline visible to all participants proposing that students set up chat meetings, indicating several technology options in addition to AUTonline, and requesting once a time had been agreed for the team that staff be kept informed and invited to join. This extended full year episode closes with a series of recorded chat sessions over the period 20/10/2004 to 30/10/2004, posted by group GVT5. Again this set of exchanges echoes the earlier set of recorded chat, with no evidence of inclusion of any participants beyond the LVT, or in other words the desired GVT synchronous collaboration had not occurred. The sole synchronous GVT activity in this extended episode then, was the phone call between Arnold and myself observed in the diary note of 6/10/2004.

6.2.6.2 Extended Adjustment-Reinforcement Episode 3 Evolution Over Time

In her case study analysing organizational transformation and changing work practices in an IT support group over time, Orlikowski (1996) mapped a series of deliberate and

emergent changes in practice, unanticipated outcomes and technological features appropriated in practice, in a depiction showing how the situation evolved incrementally to result finally in a radically different set of technology supported work practices. The temporal bracket discussed in this section of the thesis can be portrayed in a similar manner, by mapping the evolution of practices in an adaptation of the depiction used by Orlikowski (1996, p.72), cf. figure 4.6 above. Figure 6.7 below provides a visual mapping for this temporal bracket, showing the evolution of practices, TUM activities and technology use over time.

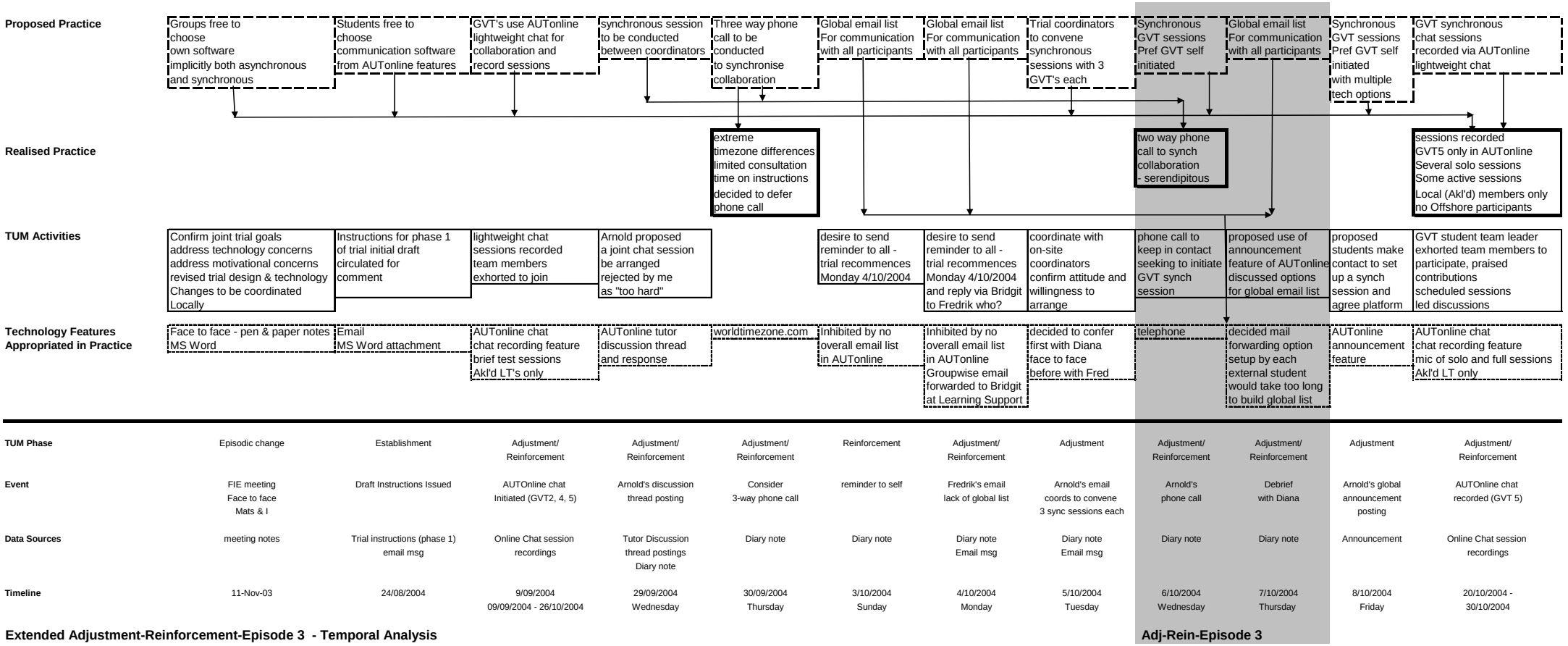


Figure 6.7: Temporal Bracket: Extended Adjustment-Reinforcement Episode 3 - Evolution Over Time

As is evident from figure 6.7 above, the proposed practices related to use of synchronous collaborative technologies have been only partially realised. No three-way synchronous sessions eventuated between the coordinators at each site. The closest event was a two-way phone call between Arnold from Uppsala and myself, which only fortuitously happened because I had stayed late in the office that night. Synchronous events between student GVT's appeared limited to test sessions between three teams of Auckland members (LT's only), and patchy and sporadic events within one of the nine GVTs (GVT5), which again involved LT members only and did not extend to its offshore members. It is of interest to note that the development of this episode requires a full year's window to track its origins and motivations, the TUM activities during phases of episodic change, establishment, adjustment and reinforcement, and various unsuccessful TUM attempts to bring about the desired practices. While the desire to motivate the Swedish students by giving them a wider range of technology choices: as initially agreed in November 2003; as brought to fruition through the explicit inclusion of the AUTonline platform with its variety of collaborative technology features in the trial instructions; as encouraged by Arnold via a group announcement proposing an even wider choice of synchronous technology options, did not result in active student take-up of the desired practices. Some of the reasons for this have been reviewed in the chapter above and relate to a complex set of often conflicting metastructures, which are not aligned to achieve the collaborative outcomes desired.

6.3 Episode of Interest Profile: Episodic Change 1

6.3.1 Episode Characteristics – Episodic Change 1

Episode Characteristics	
Duration:	7/11/2003
Supporting data:	Meeting Notes: 7/11/2003
No of sources	1
Word count	765
Actors:	Mats Daniels, Tony Clear

Table 6.4: Episode Characteristics - Episodic Change 1

6.3.2 Narrative summary - Episodic Change 1

This episode consists of the notes of the face to face meeting which I had held with Mats Daniels in Westminster Colorado at the Frontiers in Education Conference (FIE'2003), at which we were presenting a paper reporting on a prior collaborative trial (Clear & Daniels, 2003). The significance of this meeting has already been partly addressed in the extended temporal analysis of section 6.2.6.1 above.

The meeting had the primary aim of resolving some issues relating to the most recent trial, which had suffered mixed success in generating student enthusiasm for the exercise, and had generated some dissatisfaction among the students at Uppsala University. Since the trial design and coordination had mostly tended to be led by the Auckland team, we were hoping to agree a more mutual set of goals across sites, determine a strategy for better motivating the students to participate, and address disgruntlements over the prototype Notes collaborative database, where the icebreaker design had proved a hurdle for weaker Uppsala groups in this context, causing a loss of momentum in the trial. We reviewed the goals of the exercise against the participant information sheet given to AUT students, which included seven stated goals, a secondary set of goals and the learning contribution of the project in twelve areas. We agreed four common priority goals from a student learning perspective and a secondary set of goals which related to research and generating and disseminating new knowledge

in the area of global virtual collaboration. We removed the goal related to '3D collaborative environments' at that stage, given the complexity (from our 2002 experience) of coordinating 3D Collaborative Virtual Environment (CVE) software trials, and troubleshooting errors (cf. Clear & Daniels, 2003). For the learning contribution of the project we agreed four common goals, and noted that some goals were specific to the AUT students only.

We then agreed some changes for the trial design, namely:

- "Give groups freedom to choose software, (hopefully more motivating for technically stronger and more vociferous students)
- Use collaborative database for storing key decisions, evaluations and critical research data
- Use collaborative database as a default option for those who choose to use it"

Elements of the overall trial design were discussed, with a general framework of three elements: an icebreaker task; a collaborative task; an evaluation and individual report, being the primary components. In design of these tasks suitable research frameworks were also to be taken into account, both to aid design and to support subsequent analysis.

6.3.3 Appropriation Move Patterns- Episodic Change 1

Figures (6.8 - 6.10) below depict the patterns of 'appropriation move types' and 'subtypes' (DeSanctis & Poole, 1994), which characterise this episode, and demonstrate the manner in which the technology has been appropriated.

6.3.3.1 Appropriation Move Patterns –Episodic Change 1 Direct

This episode contained no *'direct'* appropriation moves as it did not involve a direct case of technology use, but rather a snapshot of a review and planning process preparing for later technology use.

6.3.3.2 Appropriation Move Patterns –Episodic Change 1 Constraint

There is a large singly coded section of moves categorised as *constraint*, where the 'structure is interpreted or reinterpreted'.

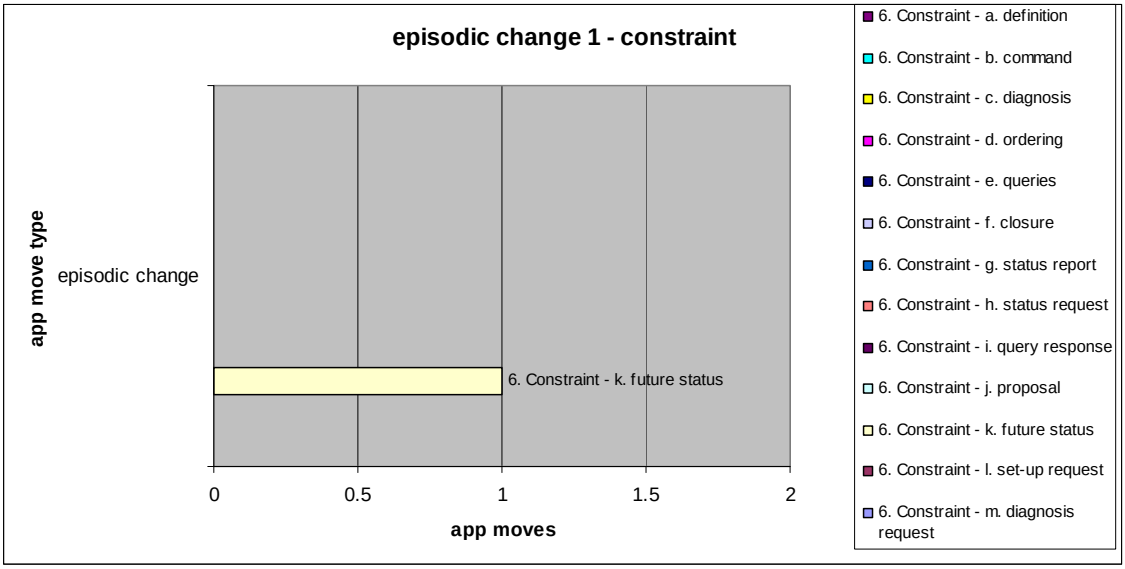


Figure 6.8: Episodic Change Episode One Appropriation Move Types - Constraint

The move coded as ‘k –future status’ (stating what is proposed to be done with or to establish the structure) demonstrates an example of episodic change, where it was proposed that the technology structures supporting the prior collaborative trial would change. Students were to be given the freedom to choose their own software, with the Notes prototype being retained for storage of key decisions, evaluations and critical research data, or as a default collaborative technology for those who chose to use it. A general design for the collaboration was proposed, comprising 1) an icebreaker component, 2) a task element, 3) evaluations and individual reports. The proposed icebreaker task involved choosing a leader, by a set deadline, with technology for this to be open to the groups to choose (Notes database as default), and leader details and an evaluative/descriptive summary of the process to be posted to the Notes database. The task would involve their choice of collaborative software and a justification. As a ‘judgment task’ requiring a decision process related to ‘preference’ and “requiring selection of an alternative for which there is no objective criterion of correctness” (DeSanctis & Gallupe, 1987, p.600) it should have a defined process, and perhaps involve a multi criteria decision making framework. The default option would compare email and the collaborative database, and the task would also involve students posting to the collaborative database at intermediate points indicating the “choice of software and what they were working with”. The proposed evaluation report involved individuals completing reports on the experience (adopting a suggested format) to be collated offline and posted by the team leader as a group report.

The suggested report format was mostly free form, with an area to discuss “my own contribution to the trial”; a second area to discuss “how well did the team leader

perform the role", here three specific criteria were to be included with room for free form discussion on each; the final section allowed scope for additional comments/observations.

Individuals would complete their own online trial evaluation entries, as in previous collaborations. As a final note it was proposed that the task design be informed by relevant research frameworks such as activity theory (cf. Engeström, Miettinen & Punamaki, 1999, pp 29-32) or the group task circumplex of McGrath (McGrath, 1984, P.61). As I had recorded in the meeting notes this was intended:

> "to create a theory informed design with some rigour and increased chance of success" (TC 9/11/2003).

This set of moves demonstrate the coordinator, teacher and researcher roles in combination as the trial is redesigned in specific ways to address observed problems, and in a tightly managed yet loose format to accommodate both mutual needs and individual needs at each site.

6.3.3.3 Appropriation Move Patterns –Episodic Change 1 Judgement

This episode has one example of a *judgement* move, where the actors express judgments about the structure.

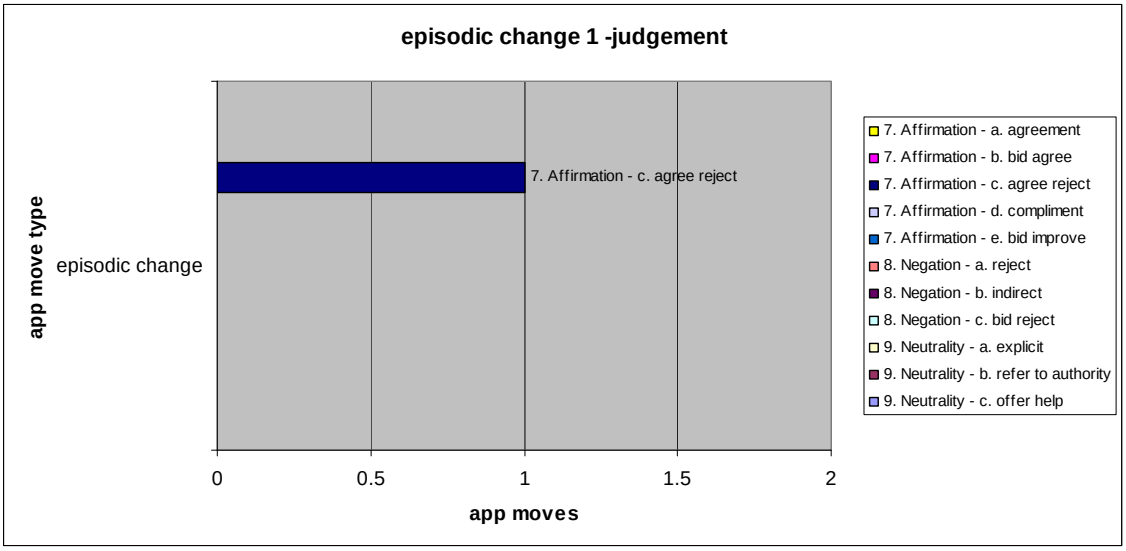


Figure 6.9: Episodic Change Episode One Appropriation Move Types - Judgement

The move coded as *'c agree reject'* relates to the removal of the phrase:

> ~~the role of avatars as mechanisms to enrich the electronic communication processes~~

where the trial coordinators explicitly agreed that investigating 3D collaborative environments, which had been the subject of study in 2002 (Clear & Daniels, 2003), would not be a focus for the planned 2004 collaboration. The goal of investigating

'user interface issues' was accordingly modified to exclude the 3D elements:

3. Agreed, but omit [including 3 dimensional interfaces]	User Interface Issues, including 3 Dimensional interfaces in a collaborative workspace

Thus the process of synchronising coordinator perspectives and goals across sites, now also tidied up inactive goals from past trials.

6.3.3.4 Appropriation Move Patterns –Episodic Change 1 Relate

This episode shows an example of a move categorised as '*relate'*, where the actors 'relate to other structures' and where 'the structure may be blended with another structure'.

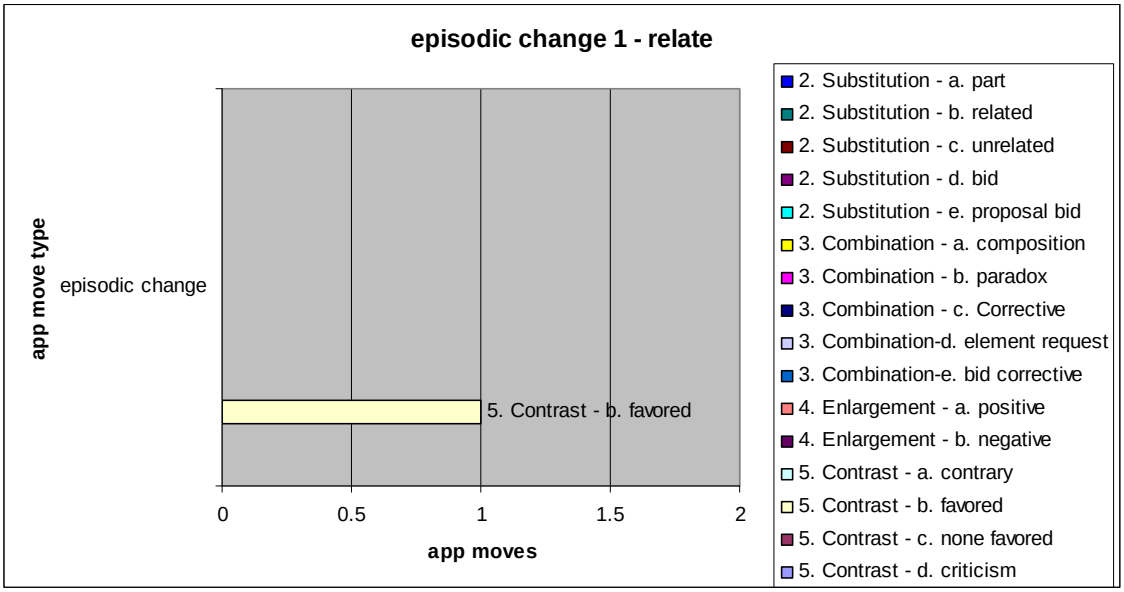


Figure 6.10: Episodic Change Episode One Appropriation Move Types - Relate

The episodic change activity in this move is a '*contrast b. favored*' move in which 'structures are compared, with one favored over the others'. Changes are proposed including:

"Give groups freedom to choose software, (hopefully more motivating for technically stronger and more vociferous students)

- Use collaborative database for storing key decisions, evaluations and critical research data
- Use collaborative database as a default option for those who choose to use it"

Thus we see choice favoured over the existing technology options, in order to better motivate some students, but the retention of some current collaborative database features which are favoured for archiving and research purposes, and as a default option to provide some support for students who preferred a predefined structure.

6.3.4 Other Grounded Data -–Episodic Change 1

Concepts	Codes	Count	Subtotals
Activity	scripting	1	
Activity	trial planning	1	2
TUM Activity	Adjustment	1	1
AIT	AIT	1	
AIT	AIT Spirit	1	2
Breakdown	Breakdown	1	1
Collaboration	collaboration	1	1
Control	freedom	1	1
Culture	Student culture	1	
Culture	cultural issues	1	2
Env output	Formally scripted interactions	1	1
GVT	GVT	1	1
Metastructure	Metastructure	1	
Metastructure	format	1	
Metastructure	Metastructure Spirit	1	3
Research	research design	1	
Research	paper	1	
Research	data	1	
Research	Review	1	4
Role	Coordinator	1	
Role	Researcher	1	
Role	Undergraduate Student	1	
Role	GVT Leader	1	4
socio-emotional	context & technology-directed emotions	1	
socio-emotional	performance-driven emotions	1	
socio-emotional	motivation	1	3
Space	Location	1	
Space	face to face	1	2
Task	Task	1	
Task	Learning task	1	
task	Assessment	1	3
Time	stages of scripting the project	1	
Time	Synchronize	1	
Time	Time	1	3

Table 6.5: Episodic Change Episode One – Concepts and Codes

Table 6.5 above provides indicative counts for the grounded theoretic 'open codes', 'concepts' and/or 'categories' derived from the data sources in this episode. These have been derived in a similar fashion to those in section 6.2.4 above, and a similar form of structurational analysis is applied below.

6.3.4.1 Duality of structure - Episodic Change 1

In this episode again we see the interplay between action, structures and technology as closely intertwined elements. The episode provides an example of what Panteli & Duncan (2004, p.423) term a *scripting* process, the first of their two primary stages of virtual team "performance" namely "scripting" and "performing". In this episode through a process of *scripting* Mats and I as *coordinators* of the trial process, designed the stage for a set of future actors, namely the Auckland and Uppsala *undergraduate students* in a future *GVT collaboration*. Deficiencies in the prior trial had been noted in the case of the technology problem below coded as *breakdown*:

> "Mats observed that the Notes icebreaker had proved a hurdle for weaker Uppsala groups causing loss of momentum – too complex, too serial ?"

In contrast the revised design in this episode proposed to give students more *freedom* of choice:

> "Give groups freedom to choose software, (hopefully more motivating for technically stronger and more vociferous students)"

Therefore the *trial planning* activity had as one goal the reshaping of the *AIT* platform and its associated *AIT spirit* to address issues of student *motivation* in order to produce a better designed, and technology supported trial. From the two excerpts above it is evident that there are differences in *student culture* that also need to be accommodated. In tandem with this came a review of the *learning task* and the *assessment*. To align these across sites required that the actors *synchronize* the goals for the GVTs across the two separate courses. The episode has a focus on the *task* design, and the confirmation of a mutual set of goals for the *collaboration* and shows a resulting set of common priorities, while enabling each site to conduct its own assessment specific to each course. The focal object for determining a mutual set of goals was the 'information sheet' given to AUT University students in the semester two 2003 collaboration. This had been developed as a requirement of the AUT University Ethics Committee (AUTEC):

"Participation of a human subject in any research project or teaching session must be voluntary and based on understanding of adequate and appropriate information about what such participation will involve" (AUTEC, 2000, p. 19).

Again in the terminology of Panteli & Duncan (2004, p.433) this represented a *formally scripted interaction* conducted by me as AUT *coordinator* in the further role of *researcher*. A formally scripted interaction frequently serves to set the scene and frame the virtual team activity, as noted in the quote below:

…the contract is a key script for the virtual team performance; it is important because it clarifies roles, triggers interactions and most importantly enables the interactions to continue (Panteli & Duncan, 2004, p.436)

While in this episode the 'Information Sheet' may not have constituted a legal contract, the whole AUT Ethics Committee process does serve a similar function as the above for a *researcher*. In fact the whole research project was dependent upon such approval, which had been gained some time earlier. In further checking the full information sheet (not fully available in the source item for this episode), I noted that approval for this collaboration had been gained more than a year earlier and for the overall research programme some three years prior to that in 1999:

"Approved by the Auckland University of Technology Ethics Committee initially on …15 April 2002. for a period of …2… years, AUTEC Reference number …99./52….."

Thus we see implicitly in this episode an echo of the scenario profiled by Panteli & Duncan (2004, p.433), where:

"…some definition of the virtual work setting has already been achieved prior to the contractual agreement, at the pre-scripting stage".

We can thus regard the ethics approval implicit in this episode as playing a role analogous to that of formal commercial or employment contracts, which have been observed by Panteli & Duncan (2004, p.436), as:

"one of the main characteristics of virtual organizing (DeSanctis and Monge, 1999)".

The formally scripted interaction here evidences the 'duality of structure' (Pozzebon & Pinsonneault, 2005, p.1357), in operation as it provides the link between the individual in the researcher role, the institutional context and the possibility of the actors taking part in the collaboration at all, without which there would be no need for technology, or technology-use mediation.

6.3.4.2 Time and Space – Episodic Change 1

The episode has a few coded items related to the concepts of time and space. The

location of the meeting *face to face* at the FIE 2003 conference in Westminster Colorado grounds it in a very specific spatial setting, and at a concrete *time* - namely on the date of 7/11/2003. Co-location in time and space are significant for this meeting, with its very goal being for the coordinators to *synchronize* activities across sites for the forthcoming trial by agreeing a mutual set of goals and a design for the next *collaboration*. The temporal dimension is further highlighted in the discussion in the preceding section, where the role of this episode in the *stages of scripting the project* is elaborated. This episode follows the 2003 international *collaboration*, but precedes the three-way *collaboration* conducted in 2004, (which is the primary analytical focus for this thesis), and shows evidence for pre-scripted elements with the *formally scripted interactions* over the information sheet (again time-fixed with a specific date of 3/09/2003) and the preceding AUTEC ethics process and a *scripting* process for the planned collaboration, the latter of which in the terms of Panteli and Duncan (2004, p.432) would constitute the stage of "performing" the project. It is worth noting here, that the meeting at this point assumed a solely two-way collaboration between Auckland and Uppsala. Thus an alien physical space for both of us was chosen here, perhaps ironically, as the setting to plan for future work in cyberspace and in which to plan the virtual technology spaces which future *GVT* participants would inhabit. However the conference was a space that enabled us to come together for a joint purpose (namely to publish our research), to which we added the furthering of the existing collaborative research programme. When considering the temporal elements, there are also many implicit and further time dimensions to this episode, especially if we restrict ourselves to the meeting notes as the sole data item for the episode of interest. Perhaps this is innate in a case of an episode featuring episodic change, which would naturally occur in a post and prior project situation.

6.3.4.3 Reflexivity of the actors – Episodic Change 1

The *review* profiled in this episode had arisen from concerns over the conduct of the semester two 2003 collaborative trial, and a desire to improve the process for next time. This form of review is also consistent with the "evaluation" and "specifying learning" phases of an action *research* lifecycle (Susman and Evered, 1978, p.558) where each collaborative trial represents an action cycle, as previously noted in section 4.2. Thus in itself this episode represents a conscious process on the part of the actors of *trial planning*, *synchronisation* and mutual alignment to improve the outcomes for a later *collaboration*. This process was conscious in both addressing a "problem situation of

interest to the researcher[s]" and from a practitioner point of view "a problem situation in which we are intervening" (McKay & Marshall, 2001, p. 48). The actors are very conscious of their *roles*, the deficiencies in the technology, the differing *student cultures* and the learning needs of students of varying types, and the need to provide a more *motivating* learning experience for the Swedish students, and as a consequence for their collaborative partners in the Auckland students. The episode involves myself and Mats negotiating priorities for the exercise to make sure we were better aligned in our own views. The primary goals we agreed and ranked were the learning goals for students at each site. Secondary to this but still included were the research goals namely the:

> "contribution of new knowledge" in the area of [collaborative software], web based groupware, the nature of virtual teams and group decision making processes, the issues involved in creating and sustaining virtual groups, ~~the role of avatars as mechanisms to enrich the electronic communication processes~~, and in understanding international collaborative learning and e-learning.

As can be seen in the strikethrough section, we explicitly agreed to exclude the 3D elements from the trial's research goals, really more in the nature of a corrective action than a more intentioned change, giving an example of *adjustment* as a form of TUM within this overall case of episodic change. In addition we advised students that *research paper(s)* may result from the work.

In a more specific goal alignment section, we agreed that the learning contribution for the students (as expressed in the information sheet given to AUT University students), would be:

> 1) "Collaborative Systems, virtual team concepts and Web Based Groupware", 2) "The Individual versus the Social dimension in computing", 3) "User Interface Issues, in a collaborative workspace", 4) Developing student capabilities as stated in the goals above

We further agreed that "agents and the role of intelligent agents" and "fuzzy logic" were topics specific to the AUT course. Thus the actors are fully conscious of the technology dimensions to be embedded in the course, and through joint deliberation agree which elements need to be given emphasis. In addition the course has an explicit set of broader learning goals, such as:

> To develop capabilities in teamwork and communication by electronic collaboration using web based groupware (as stated in the module handbook page 2). It is intended by this to

> demonstrate some of the business, human and IT issues related to creating and maintaining effective virtual international teams in organisations.

In addition to the above an internationalisation goal and exposure to cross *cultural issues* were agreed as goals. As the episode unfolds, the actors propose a new design for the trial allowing students to have greater *freedom* of choice of collaborative software "(hopefully more *motivating* for technically stronger and more vociferous students)", complemented by more selective use of the current collaborative database, among other things to preserve *research data* for later analysis. The general design for the trial is proposed, with a draft *format* for student reports and a final comment on applying research frameworks to the *task* design, in order to aid the success of the exercise. In the draft report format we even see one question related to a TUM role namely that of the student *GVT leader*:

> "How well did the team leader perform the role?"

Thus this episode has demonstrated the actors as conscious technology use mediators engaged in a set of technology shaping processes, constrained by institutional and cultural forces. We see the process of *Metastructure design* in action, as the six elements of institution, culture, technology, technology use, technology-use mediation and individual's actions are brought into closer alignment around the *metastructure* of an *international collaboration* based upon a prior diagnosis. The actors have of necessity adopted a highly reflexive stance, in jointly designing future technology use across the two courses and student groups, in order to infuse a positive *Metastructure spirit* into the learning design to achieve more successful learning and research outcomes in this *GVT* context.

6.3.4.4 Other key concepts from this episode – Episodic Change 1

Table 6.5 above has identified several concepts within this episode, the majority of which have been addressed within the above analyses. One further concept has had limited mention however, namely the *socio-emotional* category. The issue of *motivation* has been covered in sections 6.3.4.1 and 6.3.4.3 above, but there are two sections coded against *context & technology driven emotions*

> "Addressing disgruntlements over Notes collaborative database"

> "the Notes icebreaker had proved a hurdle for weaker Uppsala groups causing loss of momentum – too complex, too serial ?"

We see in both these excerpts that disgruntlement over the collaborative technology had been an issue with the Uppsala students (indeed more so for the "technically

stronger and more vociferous" ones as noted above), and equally for the weaker students who had struggled to master the technology. Thus the *AIT* design had failed to realise the intended *AIT spirit*.

The second excerpt was further coded as *performance-driven emotions*, where the complexity or serial design of the AIT had inhibited student progress *'causing loss of momentum'*. In response to these concerns the revised trial design aimed to eliminate the reliance on the prototype collaborative database, while retaining it as a default option, and keeping it as a repository for periodic postings of data to support the research goals. These *socio-emotional* codes appear to be at the core of the episode, as the motivators for the revised design of trial, technology and task in order to better align the student learning, technology, and research elements of the *collaboration*. However as subsequently noted in reflections with Diana upon this mode of learning:

> "teaching and learning move from a process of information transmittal, or acquisition of known facts or skills to achieve learning goals, to a model of joint enquiry into the unknown. This carries inherent risks as the findings may be negative, yet failure in the planned activity may reflect success in the research, but the scope for tidy packaging of the whole learning process is reduced, with a corresponding rise in uncertainty and ambiguity" (Clear & Kassabova, 2005).

Therefore some challenges were inherently to be expected, but since we had agreed that our joint priority one goal for the trial was "To enrich and broaden the student learning experience" it was imperative that we devise a design for the collaborative experience that would prove more appealing to students. This episode reflects our joint attempts to do so.

6.3.5 Visual Mapping – Episodic Change 1

The diagram in figure 6.11 below represents a two dimensional visual summary, at this stage approximating a 'map' of the episode, consistent with the recommendations of Pozzebon & Pinnsoneault (2005) for ST analysis, and featuring the realms of structuring and metastructuring earlier shown in figure 6.5 above. As noted for the prior episode, subsequent episodes have evolved more sophisticated visual mapping approaches, but at this point a mere tabulation had been adopted.

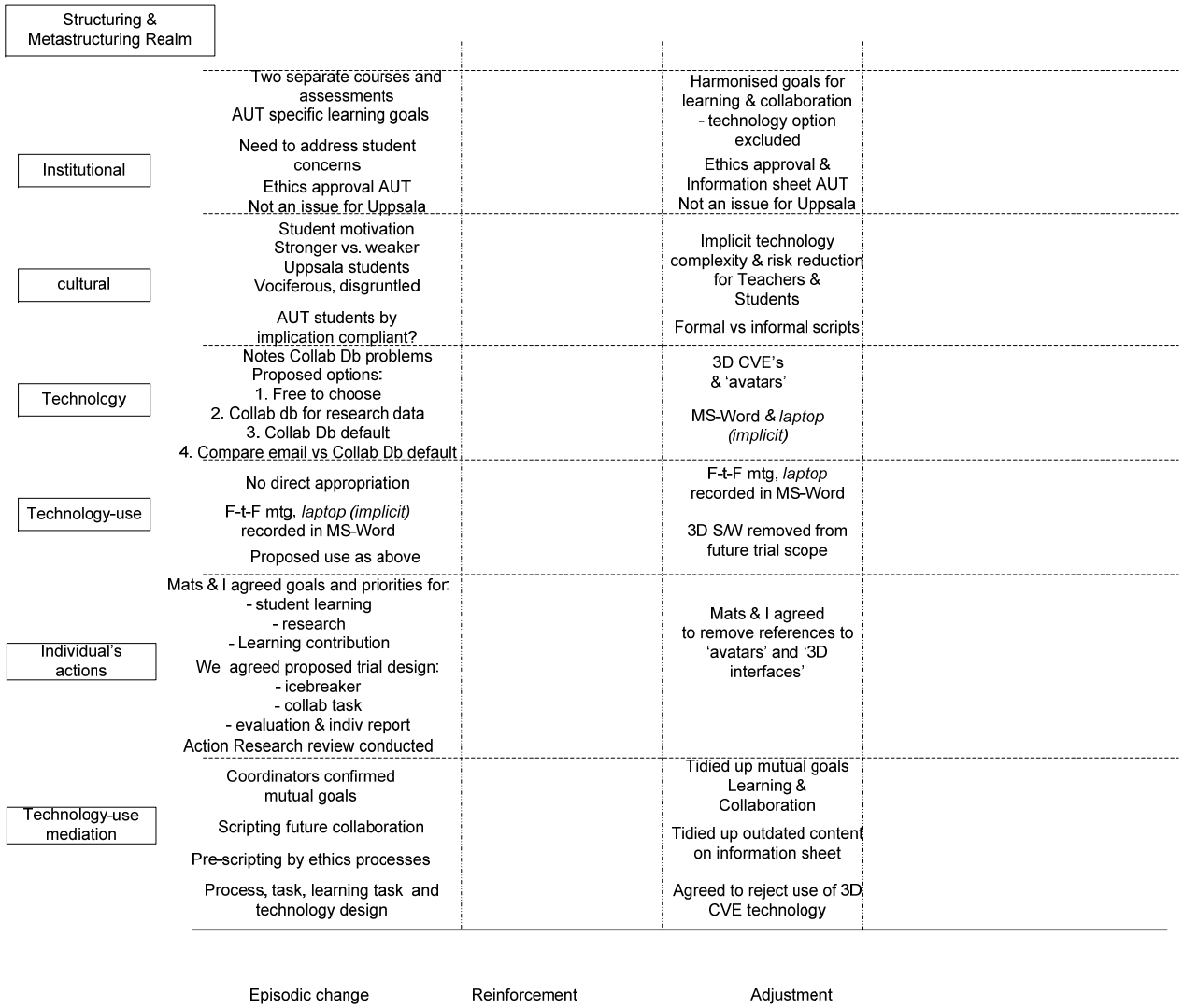


Figure 6.11: Two Dimensional 'Visual' Map – Episodic Change 1

6.3.6 Temporal Bracketing – Episodic Change 1

This episode with its single data source, just like the prior episode profiled in 6.2.6 above, offers limited scope for temporal analysis and again affords restricted scope for showing any progression of events. As an instance of TUM involving episodic change this episode inherently has a past, and if projected forward will likewise have a future. In fact such an evolution has previously been portrayed in figure 6.7 above, in which this episode is shown as the origin for the specific development within that temporal bracket. The strategy adopted in section 6.2.6 above therefore, of extending the window of analysis by widening the temporal bracket, is one obvious strategy. The 'TUM activity in focus' for the extended temporal bracket would in this case be the proposed redesign of the collaborative trial, and its subsequent realisation. However it is my intention in chapter seven of the thesis to conduct broader 'diachronic' (DeSanctis & Poole, 1994) or cross-episode analyses. The natural scope of such analyses will include episodes that traverse the four TUM phases of episodic change, establishment, adjustment and reinforcement. As the earliest of the eight episodes selected for investigation, this episode would be an ideal candidate for such broader analysis. Therefore the temporal bracket analysed here will be restricted primarily to the data source underpinning this episode, although it is appropriate to make a slight extension to the source data to include the research paper presented by the protagonists at the same event (Clear & Daniels, 2003). Since this paper directly addresses the use of the Teamlink software in an avatar-based 3D collaborative trial, traces of which remain in the meeting notes, it seems a reasonably arguable extension of the current episode.

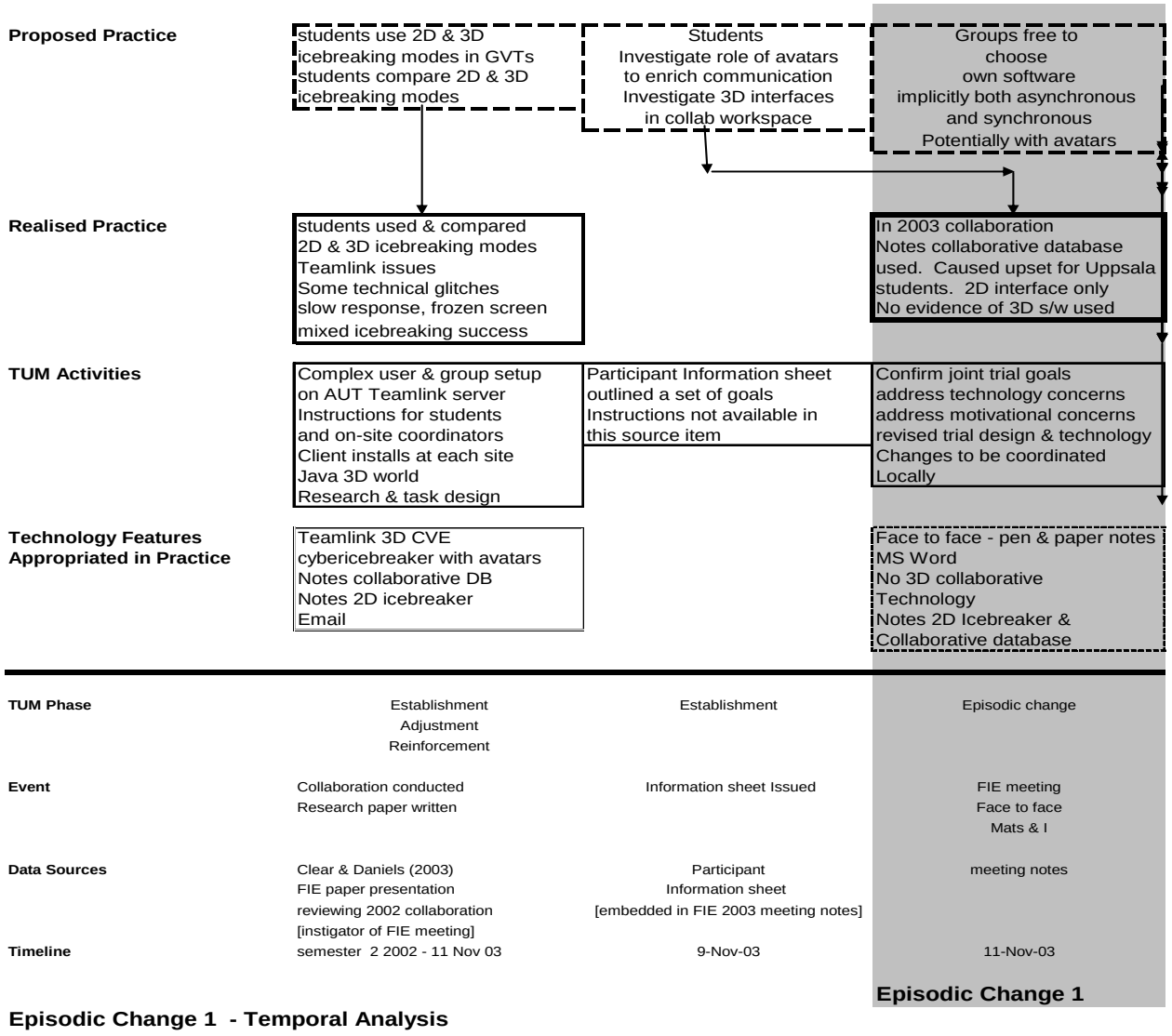


Figure 6.12: Temporal Bracket: Extended Episodic Change 1 - Evolution Over Time

The above episode could be analysed in greater depth than given in figure 6:12 above, as no rationale for the events is fully developed. But for now it is sufficient to say that the progression depicted above shows an evolution extending back to the adoption of the 3D Collaborative Technology in 2002; its reporting in our joint research paper in 2003; the traces of interest in 3D environments persisting in the trial information sheets given to students in 2003 and its final relinquishment as a goal for the forthcoming trial in 2004. This episode briefly highlights the researcher and coordinator roles in operation together. The action research model adopted (cf. Clear, 2000 pp. 108-139, and section 4.2 above) positions each international collaboration as a natural cycle in the research, after which a review is conducted. At the review stage a research publication is often drafted, although several recent collaborations have still to be written up. (This work has taken precedence). The international conference venues provide logical meeting places for planning subsequent cycles in the collaborative research programme and reconsidering the best contribution it may make to student learning. New directions of enquiry may arise and persist, as in this case, perhaps beyond their natural lifespan. Nonetheless I remain interested in the scope for engaging and accessible 3D collaborative spaces to be used in the continuing research programme, and envisage such technology coming back into use in future collaborations. To enable this initiative to be readily undertaken, technical and logistical assistance from a teaching/research assistant would probably be required.

6.4 Episode of Interest Profile: Establishment Episode Full

6.4.1 Episode Characteristics – Establishment Episode Full

Episode Characteristics		
Duration:	04/09/2003 –14/10/2004	
Supporting data:	No.	
	1	Email Message: Aterea Brown 16/09/2004
	1	File: Aterea Brown 16/09/2004
	22	Email Messages: Arnold Pears 23/06/2004 – 17/09/2004
	3	Email Messages: Bridgit Bretherton Jones 24/08/2004 – 16/09/2004
	5	Email Messages: Brendan Dobbs 30/06/2004 – 23/08/2004
	80	Email Messages: Diana Kassabova 23/06/2004 – 14/10/2004
	10	Files: Diana Kassabova 18/08/2004 – 17/09/2004
	1	Email Message: A Pseudonym 01/07/2004
	38	Email Messages: Fred Niederman 10/06/2004 – 14/09/2004
	6	Files: Fred Niederman 05/09/2003 – 01/09/2004
	2	Email Messages: Felix Tan 04/09/2003 – 25/09/2003
	1	Email Message: Fredrik 14/10/2004
	3	Email Messages: Gordon Grimsey 01/09/2004 – 06/09/2004
	2	Email Messages: Kitty Ko 01/07/2004 – 01/07/2004
	1	File: Kitty Ko (IBS Handbook) 15/07/2004
	2	Email Messages: Mats Daniels 16/06/2004 – 17/09/2004
	1	Files: Mats Daniels 16/06/2004
	6	Email Messages: Mark Northover 05/07/2004 – 23/08/2004
	2	Email Messages: Naveed Iqbal 16/09/2004 – 16/09/2004
	28	Email Messages: Tony Clear 10/06/2004 – 17/09/2004
	1	File: Tony Clear 25/07/2004
No of sources	216	
Word count	367, 973	
Actors:	15	Aterea Brown, Arnold Pears, Bridgit Bretherton Jones, Brendan Dobbs, Diana Kassabova, A Pseudonym, Fred Niederman, Felix Tan, Fredrik, Gordon Grimsey, Kitty Ko, Mats Daniels, Mark Northover, Naveed Iqbal, Tony Clear

Table 6.6: Episode Characteristics - Establishment Episode Full

6.4.2 Narrative summary - Establishment Episode Full

This episode consists of the full window of *establishment* TUM activities selected prior to the collaboration. The prior episodes have been in the nature of 'micro' episodes being based upon relatively few source items, but this episode (as can be seen from table 6.6 above),draws upon the work of numerous actors and a varied set of data items. With 215 source items, 15 actors, some third of a million words and expanding over a full year's duration, this analysis window could properly be termed a 'macro' episode. The end boundary of the establishment phase for the collaboration has here been set at 17/09/2004, the date at which the trial effectively started, despite 6/09/2004 having been planned as the official start date. Exceptions to that boundary are two student communications on 4/10/2004 and 14/10/2004 querying the state of play, and indicating that their groups had not stated yet, suggesting that the establishment process for them at least had not yet taken effect.

The episode includes a rich sequence of interconnected TUM activities, which together serve to establish the conditions within which the planned student GVT's are to function. An early interchange in September 2003 serves to introduce Fred Niederman (as a global virtual colleague, since neither the New Zealand or Swedish team members had met him) to the collaborative team. The processes of introduction, mutual sharing of information, securing approvals and establishing the St Louis course in Global Information Management are developed in the sequence of messages within this episode.

The process of linking the courses across three sites to the global collaborative programme is inherent in these discussions – all conducted by email. The courses and student bodies differed significantly: in Uppsala the students were newly arrived first year Computer Science students studying an Information Technology course, at St Louis - mostly International Business students studying Global Information Management in the final year of their undergraduate Business degree, and at Auckland - Intelligent Business Systems students, mostly IT majors in the final year of a Business Degree. Thus differences in ages, country of study, style of institution, course of study and discipline constituted key differences in the student culture within the GVT's to be formed. In addition, as Diana observed to our American and Swedish colleagues, the AUT students were extremely ethnically and linguistically diverse (cf. 6.4.4 below).

In the course of linking to collaborate across the three sites, a series of activities

address the planning and design for the collaboration prior to its initiation. Agreeing a common time window for conducting the collaboration was critical, especially with differing Northern and Southern hemisphere semester patterns, course calendars and holiday breaks. Accommodating the needs of the three distinct course designs and their differing assessment structures across sites, while conducting a mutually worthwhile and educationally engaging learning task with a research dimension was a theme of this *establishment* episode. This in turn related closely to the assessment programme for each course and determining the appropriate weighting to give assessments associated with the collaboration exercise. While trying to remain as consistent as possible on the collaborative task, in the end each site determined to run its local assessment programme to meet the specific needs of their courses and student bodies.

The roles of the global virtual teaching and research team were clarified, with my AUT originated research brief being shared across the sites (cf. Appendix 9). At this point my Uppsala collaborating colleague Mats Daniels, introduced Arnold Pears as the lead instructor for their course this time round. I was the only one of the team who had met Arnold previously, but I had never worked with him before. Arnold had five years prior experience in the international collaborative "Runestone" project (Daniels, Berglund & Petre, 1999; Daniels, Petre, Almstrum et al., 1998), the inspiration for the collaborative programme profiled here, so brought a useful set of skills to our global team.

The components of the technology platform to support the collaboration were negotiated between us, which resulted in adopting a combination of email, several component features – both synchronous and asynchronous - within AUTonline, (the AUT hosted Blackboard™ Virtual Learning environment), and an AUT hosted custom developed Lotus Notes database (serving also as a research data repository), which was to be tailored to meet the requirements of the collaboration design. In tandem with the platform determination, the design of a two stage collaboration was worked out, with phase one being an icebreaking phase and phase two being a common task where GVT's would select and rank websites related to assigned collaborative technology topics. Detailed and explicit instructions to students for the collaboration were drafted and shared between coordinators at each site for confirmation. Initial instructions only addressed phase one as I had not completed developing the Lotus Notes collaborative database to meet the needs of phase two of the trial. Diana and I arranged to meet to

work on this.

Having organised the basic plan for the collaboration, the next major thread in this episode relates to a complex and evolving multi party dialogue concerning the identification and registration of external students into the AUTonline platform, and the registration of the off shore technical coordinators, and teachers. Issues related to control and security were to the fore here. Authorisation and authentication, security privileges, roles, privacy concerns, file generation of usernames passwords and contact details, file sharing, determining and stabilising class numbers – these were all prominent issues. Intertwined with the processes related to registering students to the site was the process of determining and forming the GVTs, which was highly dependent upon student numbers at each location. A major issue arose in the midst of GVT formation when Fred advised that his Institutional Review Board had not given ethics approval for him to use the St Louis student data for research purposes, although the collaboration itself was perfectly acceptable as a teaching activity. This occasioned a redesign and renegotiation of the GVT make up to isolate the contributions of three GVTs (to whom the St Louis students were assigned) of the nine GVTs to be created, in order to be able to exclude US data from the research programme.

In addition to the body of messages above concerning collaboration and coordination, there was a strong thread of communication related interchanges. One thread concerned the setting up of a videoconference session at the beginning of the collaboration to enable the GVTs to make initial contact. Different options were canvassed at each site with the technical support staff, and discussions regarding GVT originated sessions using webcams and desktop videoconferencing were canvassed. In the end these investigations proved unsuccessful, given the challenges of different time zones for the three sites, different days of week for courses, student culture and willingness to participate outside standard class times, residential versus non residential student bodies and access to suitable technology, the limited level of teaching assistant and technical support available etc. Fred suggested uploading brief video clips as an alternative (which did not eventuate), and in the end Diana uploaded team photos of AUT student teams to AUTonline, in an attempt to build some sense of team cohesion.

Another communication related thread concerned a telephone conference between the coordinators at the three sites, and contact numbers were interchanged, but the session did not eventuate. As an apparent substitute the AUT team took the lead in proposing the plan for the trial, based upon prior asynchronous communications from all parties,

and draft instructions were circulated, which became adopted by all parties.

In a third major thread there were a series of interchanges between the AUT Learning Support and Technical Support teams, and the GVT coordinators at each site relating to external student email options, which proved highly fraught, and required individual external student action to create a diversion account so that email went to their personal email accounts rather than the accounts in AUTonline, which were not operative outside the AUT email system. On a related theme there were several communications relating to SPAM filtering and lost or bounced email messages.

So we see the three C's of coordination, collaboration and communication strongly in evidence in this episode which addresses the TUM activity of *establishment*.

This 'macro' episode profile is developed further below by the same structure of analysis which has been used previously in the thesis to profile 'micro' episodes. The analysis is, of necessity, more selective in coping with the volume of data in this episode and will frequently be conducted at a higher level.

6.4.3 Appropriation Move Patterns- Establishment Episode Full

Figures (6.13 - 6.15) below depict the patterns of 'appropriation move types' and 'subtypes' (DeSanctis & Poole, 1994), which characterise this episode, and demonstrate the manner in which the technology has been appropriated. Appendix 6 provides a full summary of the types of appropriation moves categorised below.

6.4.3.1 Appropriation Move Patterns – Establishment Episode Full Direct

This episode contained no *'direct'* appropriation moves as the data did not revolve around direct cases of technology use, but rather a continuing series of planning, coordinating and communication processes establishing the conditions for subsequent technology use by others. The more indirect use of technology in these "scripting" and "staging" phases of a global virtual team (Panteli & Duncan, 2004) by technology-use mediators, thus appeared to differ from the direct use that could be expected in observing actors within the virtual team engaged in the "performing" stage.

6.4.3.2 Appropriation Move Patterns – Establishment Episode Full Constraint

The episode indicates an extensive set of moves categorised as *constraint*, where the 'structure is interpreted or reinterpreted'. Such a pattern is consistent with an episode in which new technology structures are established, and their meanings communicated

and negotiated within the GVT of coordinators and the extended supporting cast of actors engaged in TUM activities.

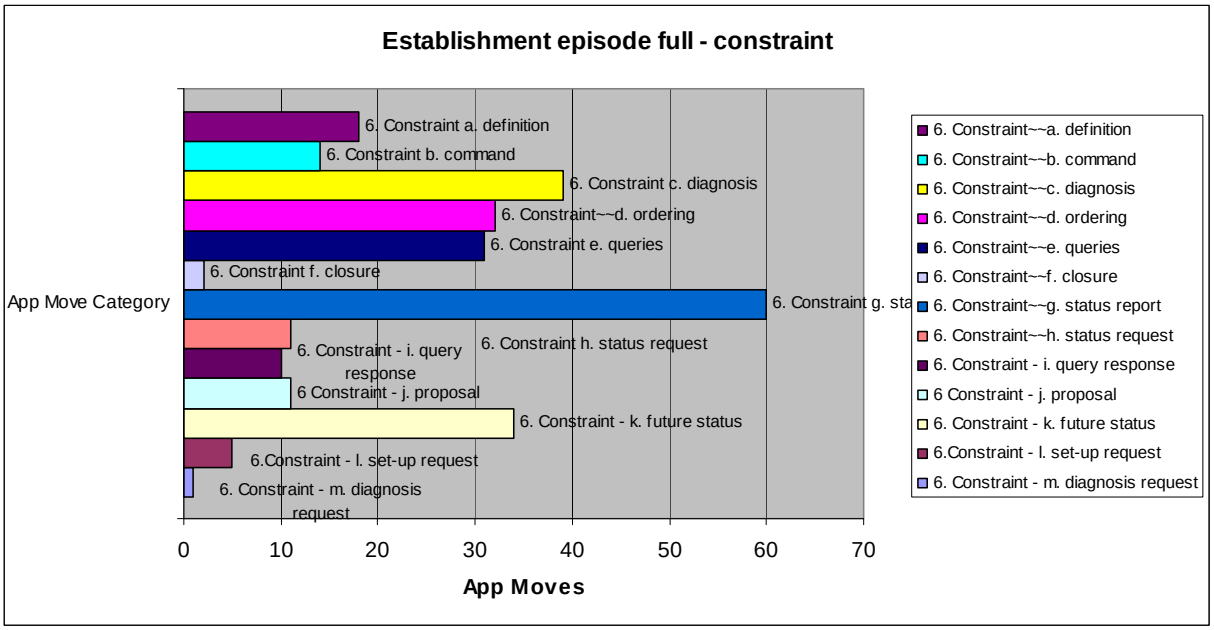


Figure 6.13: Establishment Episode Full Appropriation Move Types - Constraint

A selected analysis of particular moves follows. This analysis will concentrate on the three most frequently coded types of appropriation move, with additional attention given to the four types added to the coding scheme originally proposed by Poole & DeSanctis (1992).

6.4.3.2.1 Establishment Episode Full Constraint - Diagnosis

Examples in the first subtype of "diagnosis" reflect "comments on how the structure is working" (positive or negative). In this grouping we see an ongoing interchange about creating and sharing the metastructure of "student lists" between sites, for entering into the AIT represented by AUTonline. Arnold noted that:

> Students have the right not to give out their email addresses, and so there are some students for whom I do not have contact addresses yet. (AP 09/09)

With Diana responding:

> As far as I understand the process here, emails are needed so the students can get their login info by email. (DK 08/09)

The relationship between Diana and the Flexible Learning Services and Technical Support teams is apparent in the following two messages, reflecting a delay between receipt of names from the two offshore locations:

> It is indeed good to have more or less finalised lists of names as our technical support here made it clear to me they didn't want to be dripfed with names. (DK 31/08)

> As you know we are expecting the colleagues from overseas to forward to us their students lists that are needed for the International collaboration. Apparently they are having some administrative problems over there and haven't sent the lists yet. (DK 03/09)

The relationship between class lists and GVT formation is another topic under this heading, with Arnold commenting in the negative about his student list, Diana commenting in the positive about the flexibility within AUTonline to remove students from groups, and Diana also commenting in the negative about uncertain numbers of students at the AUT site:

> It seems like there is likely to be a problem with my student list, since it appears to include a lot of names of people who are not taking the course this year. At least 10 people too many seem to be on the official list. (AP 13/09)

> So if there are students that drop out (or in our case opt out of this exercise) we can easily remove them from the groups, regardless of the fact they are uploaded in AUTonline. (DK 01/09)

> This semester it appears that we are going to have fewer students, perhaps about 35, but we won(t know the exact number until the first or even second week of the semester. (DK 05/07)

6.4.3.2.2 Establishment Episode Full Constraint - status report

In the next 'constraint' move subtype "status report", the actors "state what has been or is being done with the structure". In this (the most frequently coded 'constraint' move) we see various communications in which the coordinators share information about progress, the status of technology or other forms of metastructures at their sites. In this way they were actively addressing the "mutual knowledge problem" observed by Cramton (2001. p.355) in which "failure to communicate and retain contextual information" is a frequent challenge for dispersed teams, who lack information about "the contexts in which their distant partners work" (ibid.). As an example we see below selected messages sharing information from each site about the status of their courses and students:

> Uppsala
> First intro session is this afternoon at 3pm local time. I will be dealing with the project, and there will be another person giving the lecture sequence, and yet another person doing the lab supervision.(AP 17/08)

> I have already introduced the exercise, and given a few more details on what I want from my students. I have asked them to reflect on the usability of the tools in the Blackboard env. and also to think about what mix of tools and techniques work well to support international collaboration and software development. (AP 14/09)

> Auckland
> We started yesterday, explaining to the students what the collaboration will involve, and getting them to sign our consent forms (required for our ethics approval). Students form some of the groups already introduced themselves in the group forums, the others will

> do so in te next day or two and are very much looking forward to getting in contact with their GVT members from the US and Sweden. (DK 08/09)
>
> St Louis
> My GIM course will be starting next Tuesday! I am attaching a copy of the most recent syllabus. (FN 17/08)

The first message from Arnold also reveals the number of local actors involved in the collaboration – a good illustration of the observation by Cramton (2001, p.366) that "dispersed teams in practice typically include co-located subgroups". This is an area she noted as warranting further research - namely "the dynamics involving subgroups" (ibid.) a topic given some attention in this thesis through the notion of a student local team (LT), but further reinforced here by the notion that the LTs comprising instructors and coordinators are another significant dimension in the collaboration and a source of quite involved TUM processes. Two further "status report" messages highlighting the LT actvities at the Auckland site, with setup of the AUTOnline system and design of the collaborative database are also given below:

> i have given Tony and Kitty access to the organisation as leaders, Brendan Dobbs does not currently have a staff account in AUTonline so i will make him an account and then add him as an instructor as well. (BB 24/08)
>
> We haven't finished the update of the database for this semester yet, but it will be available in a couple of weeks as planned for the second phase. (DK 13/09)

6.4.3.2.3 Establishment Episode Full Constraint – future status

The third 'constraint' move subtype "future status", is a TUM specific code augmenting the list developed by Poole & DeSanctis (1992, p.21) in which the actors "state what is being proposed to be done with (or to establish) the structure". As might be expected in an episode related to the "establishment" mode of TUM activity, "future status" is a dominant coding, and vital in the process of communicating expectations and plans, ensuring "mutual knowledge" (Cramton, 2001) and aligning activities across sites.

Interchanges relating to planned actions at each site are common within this coding category. For instance in the three excerpts below, we see notifications related to the upcoming collaboration itself, to student online registration, and to GVT formation.

> It's been a while since we talked about our international collaboration exercise, but it's coming up in two weeks time. (DK 19/08)
>
> As I forwarded your and Arnold's lists of students to our support staff yesterday, we can expect them to be uploaded some time today. (DK 13/09)
>
> As soon as I see that your students appear in the system, I'll do my best to add your students to the first 3 GVTs in groups of 3 as you suggested and will email you. Arnold is going to add his students himself. (DK 13/09)

While the first phase of the collaboration had begun, and initial instructions had been developed, there remained several issues (technology, task and assessment related) outstanding for the second phase, which occasioned the messages below, indicating plans for that phase:

> We believe that the instructions for the second phase are best to be compiled once the icebreaking phase is underway. The idea is that all LTs will upload the URLs of two Web sites related to groupware/GDSS. After that all GVTs will get engaged in evaluating the sites uploaded by their LTs and then through a negotiation process reach a consensus on ranking the sites. (DK 25/08)

> We are planning for the second phase students to make use of the database prototype that Tony has created (we want to integrate it in Blackboard) as it provides some functionality that should give some structure to the task. We are planning to work on this next week and then write up the instructions for the second task. (DK 27/08)

In the next interchange Diana asked for information on Fred's course plans and Fred shared details of plans for his student assessment:

> For our assignment specifications here we're planing something similar to your assignment and will appreciate very much if you forward your paper to us when you develop it. (DK 27/08)

> As I mentioned before, I will ask each student to keep a journal and comment on cultural, technical and task related observations with a final short paper on lessons learned (positive and negative). (DK 27/08 FN)

The message below is one of several related to the attempt to arrange an introductory asynchronous video conferencing session, indicating that Fred would check with his technical staff at the St Louis site, as he was unsure of the configuration options at their end:

> Regarding teleconferencing (I received your last message, Tony, and will check this with our tech guys. I am doubtful that we have minicams set up on workstations. If we have two or three large groups (maybe it will be better to do 2 sessions (one USNZ; the other US/Sw (with a third NZ/Sw if you wish) than to try to do one session with all three groups. (FN 09/07)

A key factor in establishing the collaboration was determining final student lists, which impacted on both online registration and GVT formation activities. Fred indicated in the message below, a date by which he believed he would have a stable list:

> I should be able to have a stable list of students with recommended usernames and passwords by August 31 we are usually stable in enrolment at that point in the semester. (FN 18/08)

As can be seen from these few excerpts, sharing 'future status' is a key appropriation move and a critical aspect of the TUM process, as it helps coordinate activity between sites and ensures that mutual knowledge of rapidly evolving activities and plans (despite careful prior planning) is held by the actors at each participating location. It also appears to revolve around certain core metastructures which are critical to the

success of the collaborative endeavour.

6.4.3.2.4 Establishment Episode Full Constraint – query response

The fourth 'constraint' move subtype "Query response", is a TUM specific code augmenting the list developed by Poole & DeSanctis (1992) in which the actors "answer questions about the structure's meaning or how to use it".

In one instance of a 'query response' Diana had sent a long message explaining several aspects of the AUTonline setup to Fred and concluded the message with:

> I hope that I have answered your questions. If you need any other information please email me and I'll do my best to help as soon as I can. (DK 13/09)

Instances of the 'query response' code can also be seen in internal communications such as the messages below:

> The paper name and number are: Intelligent Business Systems 407106 (DK 23/08)

> Here are the emails of the two overseas instructors:
> Fred Niederman niederfa@slu.edu
> Arnold Pears Arnold.Pears@it.uu.se (DK 24/08)

In the first of the above messages details were advised to Mark Northover Head of Flexible Learning Services at AUT so the course could be set up for us. In the second message contact details for overseas instructors were advised so that their access rights could be established and advised to them,

A further response from Mark, below advised how students could set up diversion email addresses:

> This can now (as of about two days ago) be done by the students themselves from offcampus, using the form at https://webmail.aut.ac.nz. (MN 05/07)

Thus it can be seen that such moves are typically AIT related, and can be very specific to aspects of the technology, related metastructures, and how the AIT can work or be supported.

6.4.3.2.5 Establishment Episode Full Constraint – proposal

The fifth 'constraint' move subtype "proposal", is a TUM specific code augmenting the list developed by Poole & DeSanctis (1992) in which the actors "suggest how the structure should be used". One example of a 'proposal' relates to the discussions concerning the relationship between the collaboration and the student assignments at each site, with the excerpt below being typical of a suggestion I had made to Fred:

> Maybe we should come back to you with our collaborative task list and see if they will work for your students? (FN 18/08 TC)

The process of GVT Formation is a further focus for several interchanges coded as 'proposal'.

Fred initially proposes forming groups on the following basis:

> at present I have 12 students signed up for the course. What do your groups look like? I would recommend that we make 9 groups 3 with US Sweden students; 3 with US NZ students; and 3 with NZ Sweden students. This could make interesting comparisons if we use the outcomes for research purposes in the future. We then divide each of the three classes into 6 sets and allocate the students randomly to the groups. (FN 17/08)

Then adjusts his proposal based upon notification that he does not have IRB approval for research:

> I'd like to make a suggestion that could address both the team size/grouping problem and the IRB problem. Suppose we had 12 groups of about 8 students each inclusive of all the participating students. 3 of the 12 groups would each have 4 of our US students (and 4 Swedish and 4 New Zealand students). For the moment, the data collected from those groups including the US students would be held back from the research pool and used just for educational purposes. If there were anomolies or other interesting characteristics that merited inclusion in the data pool at a later time, I could petition for inclusion as archival data. (FN 18/08)

Diana Responds with a counter proposal

> We suggest 10 GVTs, each of them has one NZ LT and one SE LT, but only GVT1 to GVT5 have US LT. This way each LT has between 2 and 5 students. (DK 18/08)

Then Diana follows up with an adjustment to the counter proposal based upon the number of students at each site:

> As our groups have just been formed in relation to another piece of assessment in the same course, we already have 9 groups (between 2 and 4 students in a group) and would like to stick to them.
>
> We are suggesting now (see the attached diagram) 9 Global Virtual teams (GVT). The first 3 GVTs will have 3 Local Teams (LTs) each (one from NZ, one from US and one from Sweden) and will not be considered for research (unless at a later stage Fred obtains the IRD permission). Each of the other 6 GVTs (GVT4 to GVT9) will have two LTs one from NZ and one from Sweden and data collected from them could be used for research. (DK 19/08)

Thus we see a process of active proposal and counter proposal to resolve the GVT structures and their composition taking place over some four days (excluding time zone differentials), with the fluidity of the situation (student numbers, other course design factors, institutional influences) acting dynamically to shape this process. In a co-located scenario, by contrast, the same activity might take an hour or so.

6.4.3.2.6 Establishment Episode Full Constraint – set-up request

The sixth 'constraint' move subtype "set-up request", is a TUM specific code augmenting the list developed by Poole & DeSanctis (1992) in which the actors make a "request to establish or modify the structure".

The main focus of exchanges under this category revolves around the setup of the AUTonline system, arranging access for instructors local and remote, and arranging 'dummy' student accounts for instructors. Typical separate messages sent by Diana to Flexible Learning Services are given below:

> I would like to know if you could create a new instance in autonline for us (DK 19/08)
>
> Can we also have a couple of generic students' accounts so we can make sure the settings for the exercise appear to the students exactly as we want them? (DK 23/08)
>
> We also need our overseas colleagues Fred Niederman and Arnold Pears to have the same rights for access as us. (DK 24/08)

Fred in turn had previously sent a similar request to Diana

> Can you set me up with a BB account so I can poke around and see how itworks? I(ll be very pleased to have the US students doing the same things as the other students with this SW. (FN 09/07)

One further message exchange requested a username and password since those originally advised were not working. The key insight from this set of TUM oriented appropriation moves is that they are vital to the establishment and functioning of the collaboration. They demonstrate the extent to which the parties in the exercise are both dependent and interdependent. The trial coordinator Diana was here highly dependent on the host servicing unit, in this case Flexible Learning services, (but behind them other technical units supporting the IT infrastructure at AUT). In turn the offshore technical coordinators (Fred and Arnold) were dependent upon the trial coordinator to ensure the establishment and suitable configuration of the technology platform to support the work.

6.4.3.3 Appropriation Move Patterns – Establishment Episode Full Judgement

This episode contains several instances of judgement moves, where the actors 'express judgments about the structure'. Moves coded in the categories of affirmation, negation and neutrality all feature in the episode.

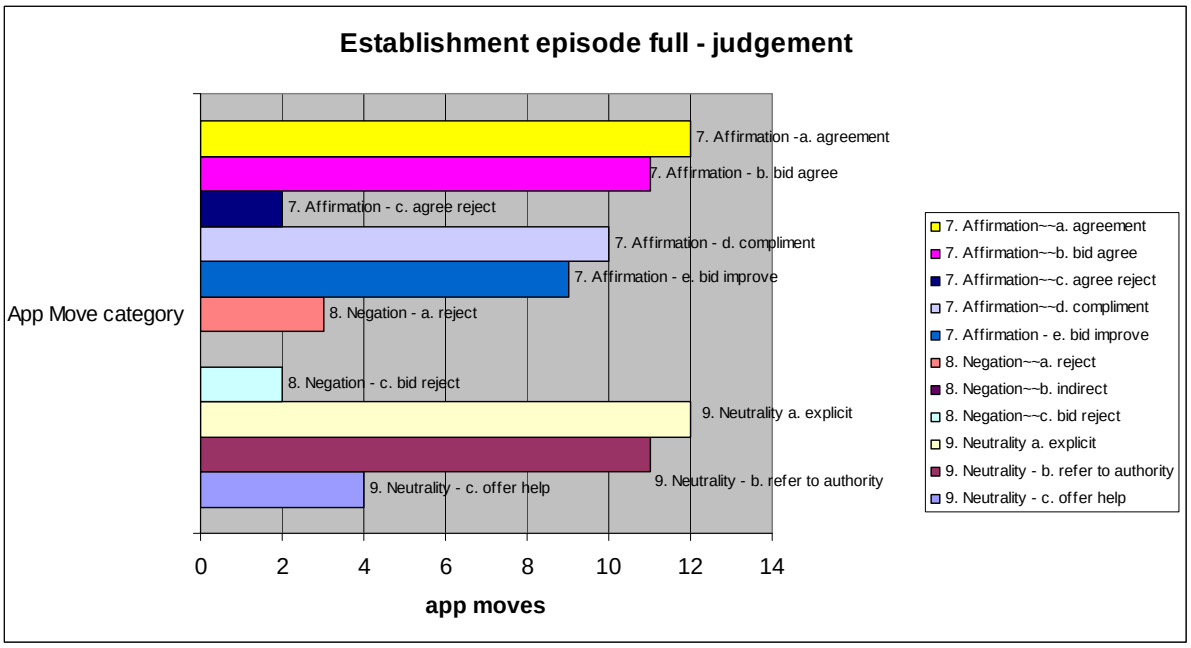


Figure 6.14: Establishment Episode Full Appropriation Move Types - Judgement

6.4.3.3.1 Establishment Episode Full Judgement – agreement

Within this category appropriation moves typically reflect the trial coordinators agreement to use certain proposed technology features or structures. For instance Arnold agreed to use the 'manage groups' and 'add user' features of AUTonline to set up the Swedish group members in the system once they had been loaded. Again Arnold broadly agreed with the task of evaluating websites, for which the instructions and the AUTonline, and Lotus Notes Database technology platforms have been specifically tailored:

> I would like the web sites that teams look at be more related to communications tools (as I have said earlier) but I am flexible there, and have no particular problem with anything you have suggested. (AP 14/09)

Fred also referring to topics for websites, comments in a similar vein:

> I'll flow with any topics, just to make life easy. (FN 17/08)

And again referring to the team structure proposed by Diana, Fred agrees:

> Your v2 alignment of teams will work fine for me. (FN 21/08)

In discussing the proposal for a video conferencing session, Fred agrees and makes an additional proposal:

> This is exactly my thinking. If the VC involves 2 or 3 large groups, perhaps each student can take a turn in front of the camera and say a few things about their interests, why they are in the class, why they might make a good leader, this sort of thing. (FN 09/07)

So this set of appropriation moves is important to the collaboration, since this active agreement represents the gelling of plans and their realisation through concrete use of the technology. In some cases the agreement to use a technology feature is slightly indirect through a metastructure (such as 'topic' or 'GVT'), to be realised through a technology feature which has been, or is being, designed and/or configured.

6.4.3.3.2 Establishment Episode Full Judgement – bid agree

Under this category others are 'asked to agree with appropriation of the structure'. Codings under this category are a little more mixed, both in terms of actors and structures. Arnold had three separate threads of conversation: one relating to the assigned collaborative task where he made a new proposal for others to agree/disagree with; another relating to the use of IRC as a synchronous technology in preference to videoconferencing technology; and a third where he suggested that the coordinators communicate via the tutors discussion forum set up on AUTonline. Fred in contrast sought confirmation for a GVT design that would have an inevitable impact on the research outcomes:

> Would this present too large a technical or other problem for you? In effect you would be risking the loss of about 15 data points (and 3 groups), but if there were interesting differences, you'd have a reasonably distinct set of group memberships to contrast. (FN 20/08)

Diana had a mostly coordinative set of communications under this category, variously: seeking agreement to the trial schedule; the GVT structure (initially from me, and subsequently from Fred); the idea of a videoconference session; and encouragement to students to use a specific technology:

> I also encouraged them to experiment with the chat feature in AUTonline. (DK 10/09)

6.4.3.3.3 Establishment Episode Full Judgement – neutrality

Under this category, actors 'make explicit statements expressing uncertainty or neutrality about a structure'. Statements again are wide ranging within this coding category, with reference being made to institutional structures, technology and features, GVTs and tasks, schedules and research papers. The expressions of uncertainty are also quite varied, being statements of opinion, indirect requests for help, shared musings, statements of intention, questions or forecasts of probable future outcomes. The following examples illustrate this diversity. In the first example, Arnold acknowledged his uncertainty about the ethics process, expressed an opinion and recommended that we just moved on:

> I am not clear on the nature of the Ethics Committee issue in Fred's case, but since it is irrelevant to the exercise…I think that we should just ignore that issue (AP 20/08)

In a more technology related interchange Diana expressed uncertainty about an email problem previously relayed via Arnold by Fred:

> I did get one of Fred's messages yesterday, have no idea why his messages were bouncing back. (DK 12/09)

> I've been having trouble with people saying they aren't receiving the email I'm sending from home. (FN 22/06)

Such an issue in a heavily email dependent international collaboration was obviously a critical concern, as it is more generally whenever we suspect that our email systems are not behaving reliably.

Several communications related to the issues associated with GVT formation, online registration and configuring and populating AUTonline with the appropriate student groups:

> Are there any problems with the process of adding the remaining students to groups? (DK 17/09)

> Tony and I had a discussion about your proposed changes and how they would impact on the design of the collaborative system and also on the logistics of the exercise. (DK 19/08)

> At this point I think I have about 10 students signed up for the course, but we are notorious for late changes up or down. I am guessing that 20 students would be a likely maximum. (FN 29/06)

> We may need to be more specific about individual versus group structures in AUTONLINE once we have worked them out, (TC 25/08)

This exchange illustrates the sharing of information about student numbers (and implicitly about the GVT formation restrictions imposed by ethical constraints), leading to their likely impact on GVT structures, the shaping of the exercise and consequences for design and configuration of the technology. The tightly coupled nature of these different macro and micro level structures is apparent, as is the intrinsically fluid and emergent nature of the trial and its supporting technology design. Further exchanges under this category include one between Diana and myself regarding a research paper we had been writing and a direction it had taken which meant a change of name and focus from that originally intended. Exchanges between Fred, Diana and I about the planned learning task shared a desire to remain open to options but not so vague as to confuse, plus Fred advising that he had visited the prior collaborative website and while a little confused about the nature of the technology did intend to work it though according to the instructions. Another communication from

Fred indicated that while he was broadly in agreement on the planned timing schedule for the trial, he was unsure of the precise meaning of our start and end dates.

In summary messages coded under this category served multiple roles: to advise of status (often one of some confusion); to share information requiring action to be taken; to seek clarification; to indicate plans and implicitly seek feedback; to set a direction; to ask for help; and to build "mutual knowledge" (Cramton, 2001) of the situation at each site.

6.4.3.3.4 Establishment Episode Full Judgement – bid improve

Under this TUM category of appropriation move, in which actors 'request suggestions to improve the structure', coded passages typically consist of requests for input and further suggestions. Fred for instance, suggesting use of both synchronous and asynchronous communication technologies simply asked us for our "Thoughts?". Diana in proposing the technology platform for the collaboration (AUTonline) suggests as an addition:

> we could get the students(feedback for the two stages of the exercise (icebreaking and group decision making) using some of our existing online forms. This way the feedback can be saved for further analysis and research by staff.
>
> We would really appreciate if you can get back to us with any suggestions, comments or ideas. (DK 05/07)

Several similar passages reflect Diana in her coordinator role requesting feedback on the schedule for the collaboration, a diagram outlining the GVT composition, the draft instructions to students, and sharing prior student suggestions on improving the collaboration. In these communications there was often a first cycle internal to the AUT LT of coordinators, prior to wider circulation to the full GVT of offshore coordinators.

A final passage coded under this category is one in which I shared with Fred the URL for the previous trial website so that he could review the ranking criteria used last time, and requested his input:

> You might like to check them and give your own comments (TC 29/07)

This set of interchanges illustrates the TUM process furthered by seeking input from others on technology, process or task related (meta)structures. The collaborative spirit of the endeavour is reflected in such interchanges, as is the tension for the coordinators between driving the process to a conclusion, and both maintaining "group cohesion" (Salisbury et al., 2006) and development of "personal trust" (Nandhakumar &

Baskerville, 2006), despite limited opportunities for face to face contact, through a spirit of openness and inclusion.

6.4.3.3.5 Establishment Episode Full Judgement – neutrality acknowledge uncertainty & need to consult authority

Under this category coded passages have a heavy focus on technology issues, and how to resolve problems or address questions relating to establishment of the technology. Typical of the types of issues are the following in which I asked Diana for help in using AUTonline, who in turn suggested that Flexible Learning Services might need to be consulted:

> I don't seem to be able to access the discussion threads from the announcements while visible the links are not active for me, (TC 09/09)
>
> We'll have to find out about this from Bridgit perhaps. (DK09/09)

Other technology focused passages request help in: finding the correct URL's; forwarding email messages which had "bounced"; sending different file formats (including to the designated email address) so that they can be read by the recipient (excel 2000 format vs. xml, unzipped versus zip files); establishing and naming the AUTonline course through Flexible Learning Services; the process for incorporating overseas lecturers and students in AUTonline; and preferred options for sharing their logon details and email addresses.

A further sequence narrated below, relates to establishing videoconference sessions between sites, with acknowledged gaps in the information held by the coordinators. The need to consult further with technical support units at each site, to establish the technical viability of each option is apparent.

> One of the options was to consider using a videoconference to get the students together. It will cause some logistical challenges (classes on different days, times and time zones) so I'm not sure if this is a good option, but it would help first to know a little about the service we offer at AUT.
>
> But that brings its own technical challenges, requiring each institution to download the software onto the local client and have external access to bypass their firewalls. This would need local technical support, and I'm not sure how each site is set up for that, (TC 01/07)

Finally a less technology focused passage relates to the need for me and Diana (as the trial coordinators at AUT) to consult over the student numbers and the GVT composition for the collaboration.

> Re no of students & groups we would expect about 35 or so NZ students, maybe 60 Swedish and your 12. I think a triadic grouping (NZ, SE, US) with pairs from each country might be best, but I will think through the implications of that with Diana. (FN 18/08 - TC)

As can be seen the expected number of students from each site is a critical piece of input data for determining the numbers and composition of the GVTs. While I had proposed an initial structure in this communication with Fred, I informed him that I would consult with Diana before we came to a firmer conclusion, which we could then propose to the others.

Again therefore in this set of passages we see the progressive building of "mutual knowledge" (Cramton, 2001), with limitations in expertise being acknowledged and the rationale for joint decisions being cumulatively built. We also see the TUM process in evidence in problem resolution mode, through the need to seek support from other parties (both within the coordinators' GVT and outside) in the design, configuring and use of the technology and associated structures.

6.4.3.3.6 Establishment Episode Full Judgement – neutrality offer help

In slight contrast to the above category in which actors acknowledge their limitations, the passages coded here represent more supportive forms of TUM. Typical statements are general expressions of willingness to help. For instance, Diana offered to help anyone having difficulty in the process of creating groups within AUTonline, Fred asked how he could

> be helpful at each step as the design and implementation of the database continues. (FN 22/08)

Mark Northover asked

> Let me or Bridgit know if there is anything else you want us to do for this course for now. (MN 23/08)

In a slightly more active role, acknowledging a confused situation and offering to help coordinate a means for its joint resolution, I had suggested a phone call between the trial coordinators in order to resolve the outstanding issues:

> I think we may need a phone call to sort some of this out, so that we can agree a clear direction and manage our risks. Could you let me know your phone number there and we will try to synchronise for a suitable time.
> Arnold maybe likewise?? (FN 18/08 - TC)

This action of "individual initiative" could be seen as consistent with the recommendations by Jarvenpaa & Leidner (1999, p.807) for "communication behaviors that facilitated trust early in a group's life". The other passages coded under this category may serve a similar role, mediating technology use in a supportive trust building capacity. For Mark as manager of the Flexible Learning Services unit, his expression of support may also have served to include him in the collaboration, (if not

fully in the GVT of trial coordinators), at least partly in the LT of AUT trial coordinators. Enhancing this perception, (and not explicitly captured within the data for this trial), was my own prior experience with Mark as a postgraduate student, colleague and researcher into international collaboration in the educational technology field (cf. Northover, 2004), while he had been working at Unitec (a sister tertiary institution in Auckland, at which my partner Alison Young was also Head of School of Computing and Information Technology). Mark had studied on their Master of Computing degree, so we had also mixed socially. This had created a further set of interpersonal bonds, which aided the continuing work of the local and global teams, and acted to obviate the assertion by Nandhakumar & Baskerville (2006, p.380) about longevity and GVTs that, "the teams could not continue without face-to-face interactions and building personal relationships". The supportive form of TUM observed in the interactions coded above, may have augmented with virtually developed "personal relationships", the task related and institutionally derived binding power of "previously successful interactions, which are sedimented and embedded in the institutional context, as impersonal or abstract trust relations" (ibid.).

6.4.3.4 Appropriation Move Patterns – Establishment Episode Full Relate

This episode shows several example of moves categorised as '*relate'*, where the actors 'relate to other structures' and where 'the structure may be blended with another structure'.

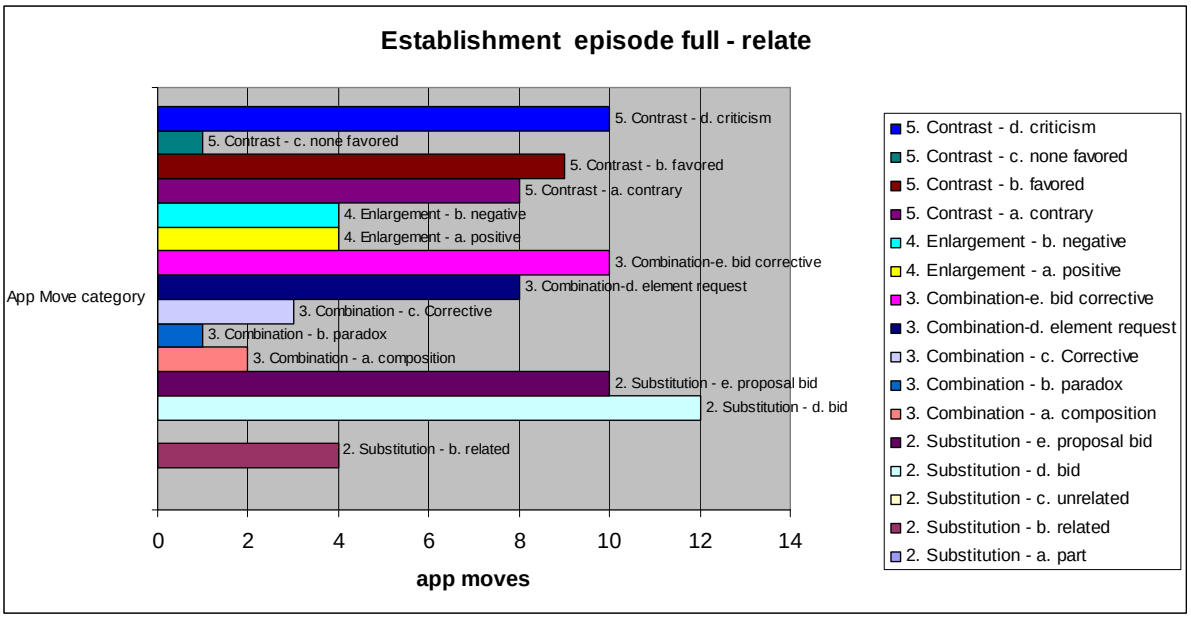


Figure 6.15: Establishment Episode Full Appropriation Move Types – Relate

6.4.3.4.1 Establishment Episode Full Relate – Substitution Bid

In this TUM category the actors 'propose use of a similar structure instead of the structure at hand and seek confirmation'. Examples suggesting use of similar 'technology' related structures include a proposal to use the tutors' forum in AUTonline as an email alternative, the need to add the URL for the site in the instructions to students, and a suggestion to set up an AUTonline account to enable Mats to observe the trial (as an alternative to "piggybacking" on Arnold's account). There are several suggestions relating to the 'learning task' such as: adding in extra communication tools for evaluation; incorporating websites related to alternative groupware technologies; developing assignments that students could do as 'multinational teammates'; suggestions regarding assignment deliverables, and their assessments from each site (e.g. a paper and marks for participation), with questions relating to the significance of the topic and the importance of a common assignment across sites for research purposes; and dialogue between Diana and Fred regarding the focus and content of assignments and sharing ideas across sites as they develop, with the aim of remaining consistent as far as possible.

One interchange between myself and Fred, in which I had answered a long sequence of questions, suggested at a macro level exchanging the collaboration itself with a face to face event:

> 13) On that note, I see that the SIGCSE Technical Symposium will be in St Louis next year on 23 27 February, and I hope to be there. Mats usually comes too, and maybe Arnold? So we could have a face to face event to follow up the cyber experience maybe?? (DK 29/07 – TC)

At this stage in the collaboration Fred and I had not physically met. This interchange does lend partial support to the earlier observed assertion by Nandhakumar & Baskerville (2006, p.380) that, "the teams could not continue without face-to-face interactions and building personal relationships" (cf. 6.4.3.3.6 above for a contrasting view).

Several interchanges coded under this category relate to the suggested use of videoconferencing technology to support the process of introducing teams to one another. This sequence shows the development of the suggestion and the process of to-ing and fro-ing over alternatives, arriving at a plan to use an alternate structure than originally proposed.

> Do you (or anyone) like the idea of starting off with a videoconference? (FN 29/06)

> Regarding teleconferencing (I received your last message, Tony, and will check this with our tech guys. I am doubtful that we have minicams set up on workstations. If we have two or three large groups (maybe it will be better to do 2 sessions (one USNZ; the other US/Sw (with a third NZ/Sw if you wish) than to try to do one session with all three groups. (FN09/07)
>
> If the VC involves 2 or 3 large groups, perhaps each student can take a turn in front of the camera and say a few things about their interests, (FN 09/07)
>
> 2) Re voluntary participation yes we are constrained to this by the terms of our ethics approval, but I think it makes sense to track who does participate in the video conference sessions. (DK 29/07)
>
> Regarding asynchronous communication, our thought is to videotape short student segments (35 minutes each); convert the segments to Windows media format; post them to an HTML from which you should be able to download them and play them at your end. Similarly, you could videotape your students (either directly into digital format or by digitizing videotape) and post it for downloading here and viewing by our students. (FN 17/08)
>
> What would you think of videotaping small student segments digitizing and exchanging them so that students get a little taste of the people on the other end? On our side, this should be relatively easy. (FN 18/08)

Thus the development of the original notion and its implications from a logistical, ethical and technical perspective are addressed in the above interchange. While some elements of the conversation are missing, the dialogue shows how this set of appropriation moves (with alternative bids for substitution of technology structures) demonstrates the detailed workings of the TUM process through a series of appropriation moves. .

6.4.3.4.2 Establishment Episode Full Relate – Combination Corrective

Under this category actors 'use one structure as a corrective for a perceived deficiency in another'. Coded items here address institutional (meta)structures and GVT formation. The first item relates at the 'institutional' level to the structures associated with the ethics approval process, in which Arnold outlined the professional process he intended using at Uppsala to avoid the issues experienced at St Louis (cf. section 8.6 below for a fuller discussion of this topic).

Under 'GVT formation' the two messages below from Fred indicate how the volatility of class registers impacts on the process of forming teams, and the risk that LT numbers may become subcritical, and thus put the whole GVT at risk.

> I've attached the names of the students some of these may have already dropped the course as they haven't shown up for one or two classes, but I don't expect to add any. I've sorted the ones likely to have dropped so that at least 2 should remain for each group. (FN 01/09)
>
> Do you need email addresses for each of the students? I am down to 9 students, but 3 remain from each team I set it up that way. (FN 09/08)

As a corrective the GVT design has been geared towards ensuring that a viable group will remain by pre-filtering those students considered least likely to remain in the course.

6.4.3.4.3 Establishment Episode Full Relate – Contrast Criticism

Messages coded under this category exemplify instances of 'criticizing the structure but without an explicit contrast'. Main categories addressed in this grouping are technology, the logistics of the collaboration itself, the nature of the learning task and several communications on a control/security theme.

Technology related criticisms include observations by Diana about the AUTonline site and the chat recording feature. In the first observation Diana noted that:

> For the time being the site doesn't have much of a structure (DK 24/08)

This was to reassure her colleagues in the collaboration, as she subsequently noted that the site would be configured (group forums etc.) once students had been loaded. The online chat feature was criticized in the observation that students had to actively record their sessions for them to be available for subsequent listening.

> apart from chat sessions that students either forget (or choose not to) record (DK 27/08)

Logistics of the collaboration were remarked upon in an almost throwaway fashion, with the criticism seemingly serving a socio-emotional role in building the team:

> This is just another of the many logistics we all will have to deal with, part of the whole experience I guess. (DK06/07)

> that's it for now I've probably forgotten some things but will come back later, (DK 29/07 TC)

The learning task was criticized with respect to its suitability for each site. Arnold noted his desire to use or evaluate a wider range of communication software than provided for in the chosen collaboration platform. Diana observed to Fred that his assignment looked suitable for AUT students but the type of groupware and the weight of the assessment would need consideration.

Control and security related criticisms include such issues as: Arnold's criticism of AUTonline for not letting users set their own passwords, and then criticizing the passwords themselves as too simple and a likely security risk; from our collaborative computing course (running at the same time) Diana relayed a student concern over the lack of permissions to create a new group forum in the discussion board section of

AUTonline. I had previously criticized commercial so called 'learning management systems' as tending in "their implementation to be objectivist in pedagogical style" and "based largely on the model of 'education as knowledge transfer'" (Clear, 2002, p.16). This student communication illustrated the extent to which the assumption was that the so called 'instructor' was in control. The system had no provisions for students to create their own forums, which conflicted directly with the desired collaborative spirit of the course.

In contrast this semester we have used the newly implemented "wiki" feature within Blackboard™ for both the postgraduate collaborative computing course and for this year's international collaboration and it has proven very flexible and well suited to a collaborative model of learning, where students take more responsibility for their own learning. Collaborative technology of this nature is far from novel of course, as attested by the work of such writers as Guzdial et al., (2000), Rick & Guzdial (2006) and Bergin (2002) using differing forms of "wiki" technology in support of learning. However it has taken some time for the collaborative concepts from the open source community to migrate to the domain of commercial Learning Management Systems.

The final communication in this category again had a control and security theme:

> Unfortunately, our software requires a login and password and for reasons of contract with the vendors we are not allowed to provide this for anyone not already enrolled as student, faculty, or staff. I knew this, but had forgotten when I wrote to you yesterday. Sorry about the slip up. (FN 18/08)

Fred acknowledged the limitations in attempting to host the collaboration at his university. The vendor contract did not allow for unofficially enrolled parties to use the software. Thus we see the influence of institutional culture restricting the educational and collaborative goals. This "formal script" (Panteli & Duncan, 2004) of the "contract with the vendors", supported by institutional policies and technology related mechanisms enabling or restricting access to the system, all conspired to constrain an educational innovation, in which the university might seek to extend globally beyond its own walls. This situation contrasts starkly with the more positively framed version of the same phenomenon "Contractual agreements were the most explicit and formal script of the performance. They have been found in the literature to be one of the main characteristics of virtual organizing" (Panteli & Duncan, 2004, p.436). Whereas in the latter study the commercial contract helped frame and enable the project, here the vendor contract served to constrain and potentially stifle the collaboration.

As an individual teacher of a course within an individual institution, this set of forces represents formidable opposition to a local initiative, where one aims to operate in opposition to the existing framing of teaching and learning in the institution. In the microcosm of this single communication we see graphically highlighted the barriers to collaboration, in an institutional context where the institution regards itself as a singular entity.

6.4.3.4.4 Establishment Episode Full Relate – Combination Bid Corrective

Under this TUM category actors 'propose use one structure as a corrective for a perceived deficiency in another'.

One example is given by an early conversation with Fred where I had indicated that I would not be able to meet him beforehand at the "AMCIS" conference:

> it is always good to meet face to face to talk thorough the details of such a collaboration, but I guess we'll have to work virtually!! (TC 23/06)

There is an echo here of the observation by Beise et al (2004, p.84) about virtual project managers, that "when the going gets tough they rely on traditional FTF interactions to resolve problems and re-order priorities". Ironically, in the above communication the collaboration itself is the proposed corrective structure.

'Technology' related structures under this category include messages relating to: a suggested 'workaround' that Mats use Arnold's login name and password to check out the AUTonline site; student inability to change passwords so they would need to use memory as a corrective or ask their lecturer; an email notification that a file containing "potentially dangerous content" had been "removed for your safety" and could be requested from helpdesk; and advice that students could have their preferred email addresses set up as a "diversion address".

The next sequence of messages relates again to the attempts to establish introductory videoconferencing sessions. In each message we see structures proposed to be used as a corrective for a deficiency in the original proposal: group technology support rather than full cohort; US rather than international scope of videoconference; multiple sessions rather than a single full cohort session; proposal for videotaped messages as an achievable fallback in place of a synchronous event; and finally an acceptance of defeat and a plan for exchanging videotape messages:

> We are also considering using desktop videoconferencing with a product udner development at our technology park speak'nsee (http://www.aut.ac.nz/research_showcase/research_activity_areas/serl/projects.shtml) This could work at a group level if the conferencing room option doesn't look viable. (TC 01/07)

> If we can't get this to work, we (here at SLU) can probably do a videoconfernce with folks in other US timezones, so this is a positive addition rather than a central required element of the course in my mind. (FN 02/07)
>
> Regarding teleconferencing (I received your last message, Tony, and will check this with our tech guys. I am doubtful that we have minicams set up on workstations. If we have two or three large groups (maybe it will be better to do 2 sessions (one USNZ; the other US/Sw (with a third NZ/Sw if you wish) than to try to do one session with all three groups. (FN 09/07)
>
> The purpose of this is to create some contact for the students. If this proves too diffiuclt or expensive, perhaps we can videotape messages from the students to send for later playback. It isn't interactive, but could be helpful in generating some interest and involvement. (FN 17/08)
>
> It looks like a live videoconference is a dead issue. I've written in a message to everyone about the possibility of exchanging asyncronous videotape messages. (FN18/08)

6.4.3.4.5 Establishment Episode Full Relate – Combination Element Request

Under this TUM category actors 'request one structural element required in order to create a composite structure'. Interchanges coded in this category offer a diverse set of requests, including: a request for student lists to support online registration; a request for an AUT student to work with Fred's student on curriculum development for the St Louis GIM course (or for that matter any assistance with the development); a request for the URL to enable Fred to link to the AUTonline course; a request from Fred for an unzipped copy of my thesis since the whole file zip was not manageable; a request for a copy of the AUT Ethics proposal and approval in order to aid the IRB process at St Louis (since St Louis would not recognise external IRB approvals); a request for phone numbers to enable a global telephone conference to be scheduled; a request for a quick reply to confirm that an email from Fred had been received and his system was working; a request for one or two sentences describing how I used Lotus Notes databases to support AUT licensing approvals; a request from me to Arnold for a reference to the Runestone project to help set the scene and the research context for Fred.

This rather mixed collection shows how the TUM process for a GVT works in some way like a jigsaw puzzle in which discrete pieces help create larger sections as part of a bigger whole. In this way the "mutual knowledge problem" (Cramton, 2001) is addressed and the necessary elements are marshalled to conduct the collaborative project.

6.4.3.4.6 Establishment Episode Full Relate – Substitution Proposal Bid

Under this TUM category, actors 'request proposal(s) to use a similar structure instead of the structure proposed'. The main categories addressed in this grouping are less diverse than the previous category, with requests for proposals being interchanged relating to the schedule for the collaboration, the learning tasks involved, a joint research paper being written, the IRB process (where it was suggested that St Louis might 'piggyback' on the AUT proposal) and proposals for synchronous and asynchronous sessions involving videoconferencing and video technologies.

Determining the schedule for the collaboration was a critical component in the project, given the need to align across institutions. Diana proposed a tentative duration and window for the trial and requested feedback from Fred, who sought clarification while confirming general acceptability:

> Can you please let me know what time you believe is the best for you to run the trial (DK 24/06)
>
> The dates you mention below look fine, though I'm not fully certain what you mean. Would you want to start the week of Aug. 30 and end the first week of October, thus finishing at the end of your two week break, or finish in the third week of October, thus allowing 7 weeks but acknowledging the 2 week break. Please let me know and I will adjust the syllabus to accommodate. (FN 29/06)

In a subsequent interchange Diana proposed a design for the learning tasks and requested feedback on a set of draft instructions from the other coordinators:

> The idea is that all LTs will upload the URLs of two Web sites related to groupware/GDSS. After that all GVTs will get engaged in evaluating the sites uploaded by their LTs and then through a negotiation process reach a consensus on ranking the sites.
> Looking forward to your replies, (DK 25/08)

A significant set of interchanges relates to coordinating "both" a synchronous videoconferencing session and independently sharing video clips in asynchronous mode. As can be seen there is a sharing of ideas, intentions and preferences in an open manner seeking to achieve a workable consensus:

Fred and Mats/Arnold any thoughts on the desktop VC option? That would give more freedom for each group to arrange their own conferences, but would the required configurability and technical support be available at each of your sites? (TC 01/07)

I was not necessarily envisioning the videoconference as or during a class session per se. Our classes will be from 2 to 4 p.m. on Tueday and Thursday US Central time I figure that is still the middle of the night in New Zealand. I was hoping we might arrange a special, additional, perhaps voluntary session around 6 or 7 p.m. US Central time which might be around 8 a.m. (I haven't double checked the exact times) NZ time. (FN 02/07)

My preference is to do both to give the students a sense of the different alternatives there are to communications and a contrast between the forms.
Thoughts? (FN 17/08)

We think that the video clips should be made available to everyone participating in the trial how do you feel about this? (DK 27/08)

Items coded under this set of appropriation move types demonstrate a further manner in which the TUM process develops. The tone of such messages is invariably open, constructive, encouraging and supportive, with an underlying motivational dimension. Communications are consistent with the Jarvenpaa & Leidner (1999, p.807) recommendations for actions that developed trust early in a GVT's life, namely "communicating enthusiasm" and "coping with technical uncertainty". In support of the collaborative spirit required for an effective GVT, this set of TUM moves appears to strongly underpin the process of coordinating GVT activities.

6.4.3.4.7 Appropriation Move Patterns – Establishment Episode Full Conclusion

This concludes the analysis of appropriation move patterns for the establishment episode of section 6.4.3. As can be seen from reviewing appropriation move types across the whole establishment episode, the combination of direct appropriation of structures (technology and other), and the more TUM specific appropriation moves have acted in a concerted and interlocking fashion to establish and shape overall technology use within this phase of the collaboration.

6.4.4 Other Grounded Data -– Establishment Episode Full

Concepts	Codes	Count	Subtotals
Activity	planning-meeting scheduling	20	
Activity	scripting	20	
Activity	trial planning	3	43
TUM Activity	Episodic change	2	
TUM Activity	Reinforcement	4	6
AIT	AIT	84	
AIT	Attachment transmission	18	102
Breakdown	breakdown	45	
Breakdown	recovery plan	31	
Breakdown	technical issues	1	77
Collaboration	collaboration	1	1
communication	communication	1	1
Control	authentication	24	
Control	usernames	1	
Control	authorization	1	
Control	control	1	
Control	freedom	1	
Control	Online registration	40	
Control	security	2	70
Culture	Asian	1	
Culture	European	1	
Culture	Pacific Island	1	
Culture	Maori	1	
Culture	Pakeha	1	
Culture	cultural issues	2	
Culture	Student culture	15	22
Economic	economic issues	3	3
Env output	Formally scripted interactions	17	17
GVT	GVT	38	
GVT	GVT Formation	36	74
Informating up	Informating up	2	2
LT	LT	17	17
Measures	Measures	1	1

Table 6.7a: Establishment Episode Full – Concepts and Codes

Concepts	Codes	Count	Subtotals
Metastructure	Genre	1	
Metastructure	Metastructure	153	
Metastructure	format	15	
Metastructure	Metastructure Spirit	1	
Metastructure	Pedagogic patterns	1	
Metastructure	syllabus sample	1	172
Organizational unit	ISP	1	
Organizational unit	Inst för Informationsteknologi	1	
Organizational unit	audiovisual unit - SLU	2	
Organizational unit	IT Services	2	
Organizational unit	Organizational unit	3	
Organizational unit	IRB	4	
Organizational unit	School of Computer & Information Sciences	6	
Organizational unit	Technology Services	8	
Organizational unit	Academic Hospital [Uppsala]	1	
Organizational unit	Flexible Learning Services	20	48
Research	research design	8	
Research	paper	2	
Research	data	5	
Research	research	6	
Research	research subject	3	24
Facility	Facility	2	2
socio-emotional	other directed emotions	26	
socio-emotional	us-them emotion	1	
socio-emotional	I-them emotion	1	
socio-emotional	I-s-he emotion	2	
socio-emotional	self-directed emotions	5	
socio-emotional	task directed emotions	18	
socio-emotional	context & technology-directed emotions	24	
socio-emotional	performance-driven emotions	19	
socio-emotional	motivation	1	97
Task	Task	5	
Task	Learning task	33	
Task	Assessment	12	50
task outputs	task outputs	2	3
Trust	trust	1	
Trust	recommender trust	4	5

Table 6.7b: Establishment Episode Full – Concepts and Codes

Tables 6.7a & 6.7b above provide message counts for the grounded theoretic 'open codes', 'concepts' and/or 'categories' derived from the data sources in this episode. These have been derived in a similar fashion to those in section 6.2.4 above, and a similar form of structurational analysis is applied below. Combining micro and macro level analysis on the grounded data for this episode proved challenging. The number of references resulting from the query for this analysis when analysed as a whole episode, appeared to exceed the limits of the NVivo7™ software to handle, and it 'crashed' with an 'unrecoverable error' when I attempted to export the results to an Excel™ spreadsheet for further manipulation. In coding mode, I would have categorised this as a *Breakdown* and had to develop a *recovery plan*. A process note detailing the approach taken to NVivo7™ analysis has been included in section 5.6.2.1 above. Excluded from this table are 39 messages coded as 'near duplicate', which represent discrete message components from separate email threads. These may omit minor items such as sender, or recipient information, but to all intents and purposes are equivalent to other messages. The content of such messages has not been coded and the 'near duplicate' code indicates they have been omitted to avoid conflating the analysis.

The majority of codes identified in the episode have been presented in tables 6.7a and 6.7b above, with a further concept frequency summary given in figure 6.16 below. Selected categories have been excluded from tables 6.7a and 6.7b to enable more focused discussion, and to aid their presentation. The dominant category of 'role' in this episode has been excerpted and is presented separately in Table 6.14 below. The codes relating to the concepts of 'time and space' have also been separately tabulated in the applicable section 6.4.4.4 below.

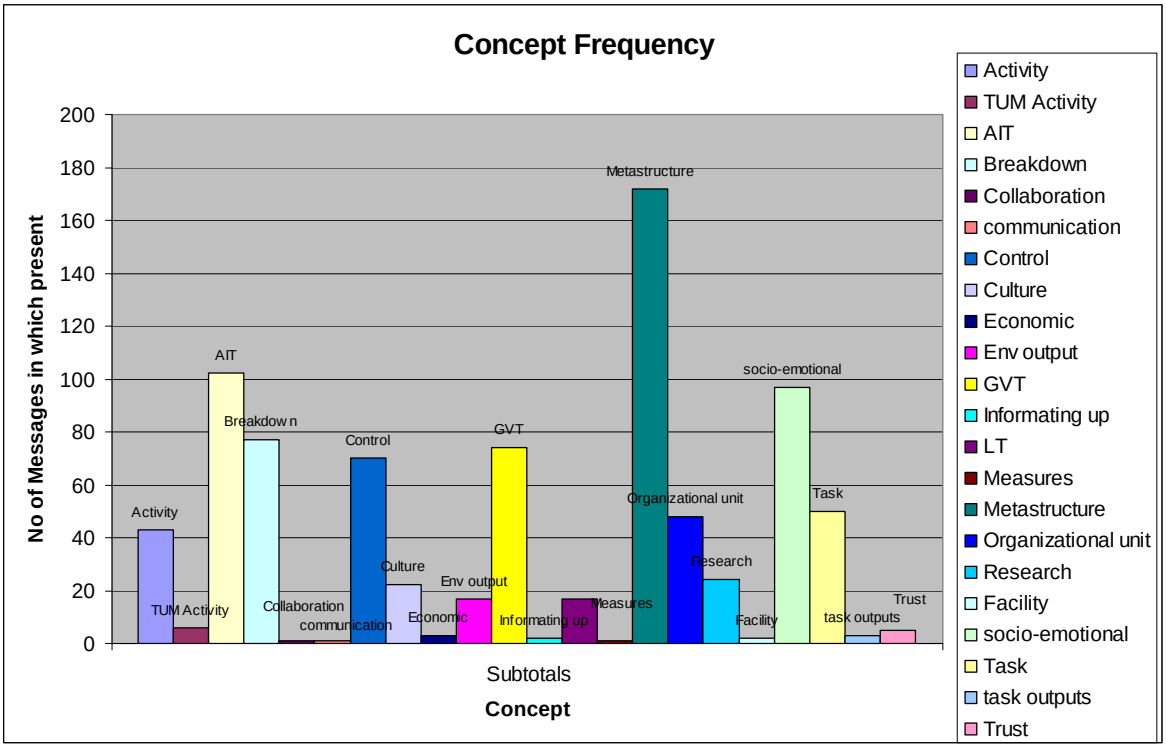


Figure 6.16: Establishment Episode Full - Concept Frequency Summary

(Note: the counts here simply represent the presence of the concept or its subordinate code, in each message analysed, and not the number of times it occurred overall).

The above figure indicating the relative frequency of occurrence of the concepts identified in this episode, supports selection of the more dominant concepts for analysis. Applying an arbitrary cut-off point of 20 occurrences, results in 11 concepts for discussion in this subsection.

6.4.4.1 Metastructure Analysis – Establishment Window Full

The most frequent concept in this episode is that of a *metastructure* which has previously been defined in section 6.2.4.1 as:

> "a mediating institutional, cultural, or technology structure, which serves to shape [collaborative] technology use".

The term 'cultural' in this context represents a broadly defined notion whereby culture, represents "the collective programming of the mind which distinguishes the members of one group or category or people from another" (Hofstede, 1991; cited in Myers & Tan 2002, p.27). Yet in interpreting this definition, it accepts the reservations of Myers & Tan (2002) about Hofstede's notion of culture as linked to nations and nation states. It recognises not only that "culture is contested temporal and emergent" but "that culture is complex and multidimensional and can be studied at many different levels"

(Myers & Tan , 2002, p.29). Similarly Swigger et al., (2004) have observed that different treatments of the notion of culture have created problems for researchers, "Unfortunately no consistent definition of culture is used in studies on teamwork performance in the research literature on either geographically distributed dispersed collaborative learning or computer- supported collaborative work" (p.368). In their study Swigger and colleagues applied a specific instrument, the Cultural Perspectives Questionnaire (CPQ), with the reservations that, "While the attributes measured by the questionnaire correlate well with culture, these attributes could also be viewed as personality traits (that just happen to be fairly consistent within cultural groups)" (ibid.). This thesis adopts a more grounded theoretic and structurational approach to the multifaceted notion of 'culture'. Thus, in the above definition of a *metastructure* the 'cultural' dimension serves to augment the 'institutional' dimension of Orlikowski et al., (1995) and incorporates elements at different levels of analysis, such as national, professional, student and group cultures and subcultures. 'Group culture' has been further defined as:

> "the set of shared thoughts that guide the actions of group members and provide a common interpretive framework for their experiences" (Levin & Moreland, 1999, P.258, cited in Gruenfeld and Hollingshead, 1993).

The significance of group culture has also been noted previously by Hogg et al., (2004):

> "Whereas culture at the global level certainly affects the way in which small groups operate—for example, leadership processes—culture can also be analyzed at a more microsocial level: Different groups have different cultures and thus different ways of thinking, acting, and relating to and among one another" (p. 266).

Selected examples of items coded as *metastructure* in this episode may serve to illustrate how the 'cultural' dimensions of a *metastructure* constitute themselves at differing levels, from the international to the participant group. Since the concept of a *metastructure* occurred in some 80% of the source items in this episode, it further creates a neatly orthogonal lens for viewing the other dominant concepts (among which 'culture' itself is numbered) from tables 6.7a and 6.7b above. Thus the discussion which follows will also use *metastructures* as a lens to view the other concepts in context.

6.4.4.1.1 Metastructures and National Culture – Establishment Window Full

The three quote segments excerpted in table 6.8 below demonstrate how '*cultural background'* may serve to act as a *metastructure* to mediate the collaboration process.

Excerpts	**Institutional**	**Cultural**	**Technology**
At AUT we have a large diversity of ethnical and cultural backgrounds (apart from our New Zealand Students (Maori and Pakeha (the term for New Zealanders with European origin) we have students from Asia (China, Taiwan, Japan, India, Vietnam etc.,) from the Pacific Islands (Samoa, Fiji, Tonga etc.) and also from some European countries (Sweden, Germany, Russia, Yugoslavia etc.). Ad you can imagine, students (communication and language skills) vary widely	At AUT we have a large diversity of ethnical and cultural backgrounds	a large diversity of ethnical and cultural backgrounds (apart from our New Zealand Students (Maori and Pakeha (the term for New Zealanders with European origin) we have students from Asia (China, Taiwan, Japan, India, Vietnam etc.,) from the Pacific Islands (Samoa, Fiji, Tonga etc.) and also from some European countries (Sweden, Germany, Russia, Yugoslavia etc.). students (communication and language skills) vary widely	
not really that useful for the students, and the sound and picture are often not that good. In a multicultural set of people where not all of them have English as a first language even a bit of "noise" on the line can make		a multicultural set of people not … English as a first language	sound picture "noise" on the line
Topics I'd like to see would include globalization of IT labor; intellectual property rules; and cultural effects on user interfaces.		Topics globalization of IT labor cultural effects on user interfaces.	user interfaces.

Table 6.8: Establishment Episode Full –'Metastructures' and National Culture

The first communication regarding the diverse nature of the AUT student body was aimed at clarifying expectations for both instructors and students across sites, (and incidentally avoiding issues from prior collaborations where Swedish students had commented adversely about the quality of the English in some postings). Several issues logically follow from the nature of this student profile, one of which is the tendency earlier remarked, on the part of the AUT teaching team to make written instructions to students very explicit (cf. section 6.2.4.4). At an institutional level cultural diversity is a set of forces that also shapes the nature of AUT as a university. In the second communication we see '*a multicultural set of people*' and '*not…English as a first language*' as a constraining 'cultural' *metastructure*, which it is argued militate against the use of [videoconferencing] technology, since deficiencies in

'sound' and 'picture' or 'noise on the line' [in Arnold's experience from the Runestone project (Daniels, Berglund & Petre, 1999)] detract severely from the effectiveness of that *AIT* in introducing students to one another. Thus the interactions between the technology features and the cultural elements within this set of *metastructure*s are apparent, where 'videoconferencing', 'sound', 'voice', and 'line' as 'technology' *metastructures* serve as examples of either *AITs or* features thereof, with the 'line' itself being a carrier and a medium enabling communication. In the third communication we see the *metastructure* of 'topic', a "genre" (Orlikowski & Yates, 1994, Clear, 2002c) within the structure of an assessment *task* from the "genre repertoire" (ibid.) of University educators. Here elements of *culture* both 'professional' (assessment 'topic') and 'international' ('globalization', 'cultural effects on user interfaces'), are blended with *AIT* technology – explicitly in the mention of 'user interfaces' and implicitly in reference to the previous international collaboration in which the assigned 'topics' were embedded in the Lotus Notes collaborative database as drop down lists. At an early stage within this episode I had sent Fred a message with the URL for the 2003 database in order to access the previous trial evaluations. Figure 6.17 below depicts this implementation of 'topic' as an *AIT* feature.

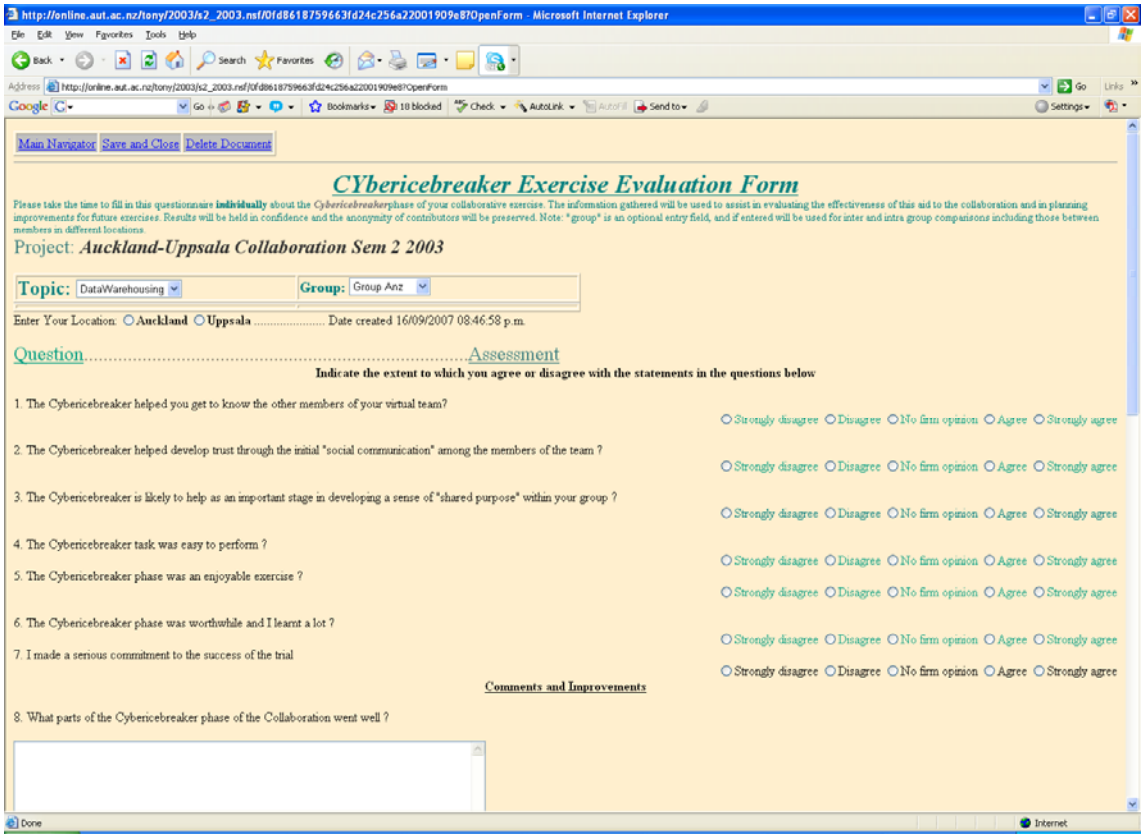


Figure 6.17: 2003 International Collaboration - Topic Selection by DropDown Listbox

6.4.4.1.2 Metastructures and National/Institutional Cultures – Establishment Window Full

The next, and more extensive, set of excerpts given in tables 6.9a and 6.9b below, again illustrates the interplay between the cultural, institutional, and technology dimensions of metastructures in a series of messages which relate to *GVT formation.* It should be observed that *GVT* as a notion is itself both a concept and a *metastructure*. In this series of interchanges we see not only metastructures in action, but also their relationship with such key concepts (from tables 6.7a and 6.7b) as *AIT*, *Research*, *GVTs* (*GVT, & GVT formation), LTs*, and *Activity (scripting, trial planning) Control, Breakdown, socio-emotional and Organizational unit (IRB, ethics committee).*

Excerpts	Institutional	Cultural	Technology
As our groups have just been formed in relation to another piece of assessment in the same course, we already have 9 groups (between 2 and 4 students in a group) and would like to stick to them.	course	our groups have just been formed in relation to another piece of assessment in the same course… would like to stick to them.	9 groups (between 2 and 4 students in a group)
I'd like to make a suggestion that could address both the team size/grouping problem and the IRB problem. Suppose we had 12 groups of about 8 students each inclusive of all the participating students. 3 of the 12 groups would each have 4 of our US students (and 4 Swedish and 4 New Zealand students). For the moment, the data collected from those groups including the US students would be held back from the research pool and used just for educational purposes. If there were anomolies or other interesting characteristics that merited inclusion in the data pool at a later time, I could petition for inclusion as archival data. In the meantime, we would treat this data with the same level of confidentiality and care as the rest of the data, just in case it proved useful later.	IRB the data collected from those groups including the US students would be held back from the research pool and used just for educational purposes petition for inclusion as archival data	team size/grouping problem IRB problem. Suppose 12 groups of about 8 students each inclusive of all the participating students. 3 of the 12 groups would each have 4 of our US students (and 4 Swedish and 4 New Zealand students). data collected from groups including US students for educational purposes. at a later time, could petition for inclusion as archival data. In meantime, treat this data with confidentiality and care in case useful later.	12 groups of about 8 students each inclusive of all the participating students. 3 of the 12 groups would each have 4 of our US students (and 4 Swedish and 4 New Zealand students) data pool archival data
The first 3 GVTs will have 3 Local Teams (LTs) each (one from NZ, one from US and one from Sweden) and will not be considered for research (unless at a later stage Fred obtains the IRD permission).	will not be considered for research (unless at a later stage Fred obtains the IRD permission).	The first 3 GVTs will have 3 Local Teams (LTs) each (one from NZ, one from US and one from Sweden) will not be considered for research (unless at a later stage Fred obtains the IRD permission).	The first 3 GVTs will have 3 Local Teams (LTs) each (one from NZ, one from US and one from Sweden)
I also would like to let you know that due to the conditions of our Ethics committee approval, our students can withdraw from the exercise at any stage. They will still have to let both the virtual team and their tutor know	due to the conditions of our Ethics committee approval, our students can withdraw from the exercise at any stage	due to the conditions of our Ethics committee approval, our students can withdraw from the exercise at any stage. They will still have to let both the virtual team and their tutor know	our students can withdraw from the exercise at any stage. They will still have to let both the virtual team and their tutor know
Now we suggest 9 Global Virtual Teams. The first three (GVT1 to GVT3) have 3 Local Teams (LTs) each and are not considered for research purposes. The remaining 6 GVT (GVT4 to GVT9) have two Local Teams each – one from NZ and one from Sweden and data can be used for research.	(GVT1 to GVT3) have 3 Local Teams (LTs) each and are not considered for research purposes. (GVT4 to GVT9) have two Local Teams each – one from NZ and one from Sweden and data can be used for research.	Now we suggest 9 Global Virtual Teams. The first three (GVT1 to GVT3) have 3 Local Teams (LTs) each and are not considered for research purposes. The remaining 6 GVT (GVT4 to GVT9) have two Local Teams each – one from NZ and one from Sweden and data can be used for research.	9 Global Virtual Teams. (GVT1 to GVT3) have 3 Local Teams (LTs) each (GVT4 to GVT9) have two Local Teams each – one from NZ and one from Sweden and data can be used for research.
We need the list of students more urgently as our support staff need to upload them in AUTonline. Once this is done, we ourselves will be creating the groups and assigning students to them on the site. So if there are students that drop out (or in our case opt out of this exercise) we can easily remove them from the groups, regardless of the fact they are uploaded in AUTonline.	list of students support staff students that drop out (or in our case opt out of this exercise)	we ourselves will be creating the groups and assigning students to them on the site. So if there are students that drop out (or in our case opt out of this exercise) we can easily remove them from the groups, regardless of the fact they are uploaded in AUTonline.	list of students AUTonline. groups assigning students to them the site. So if there are students that drop out (or in our case opt out of this exercise) we can easily remove them from the groups, regardless of the fact they are uploaded in AUTonline.

Table 6.9a: Establishment Episode Full –'Metastructures' and 'National/Institutional' Cultures

Excerpts	Institutional	Cultural	Technology
I am not clear on the nature of the Ethics Committee issue in Fred's case, but since it is irrelevant to the exercise, and also not something that I can help with I think that we should just ignore that issue and let poor Fred deal with it as best he can this year. Here we need to inform the students that data is being collected and allow them the option of refusing to participate, or specifying that their data will not be included. I will also have to ensure them that all data used by researchers will be anonymised before the data is released. In addition no published data will identify a particular student or group of students. With those provisos met we should have no problems here.	Ethics Committee Here we need to inform the students that data is being collected and allow them the option of refusing to participate, or specifying that their data will not be included. I will also have to ensure them that all data used by researchers will be anonymised before the data is released. In addition no published data will identify a particular student or group of students. With those provisos met we should have no problems here.	Ethics Committee issue in Fred's case, irrelevant to the exercise, and also not something that I can help with just ignore that issue and let poor Fred deal with it Here we need to inform the students that data is being collected and allow them the option of refusing to participate, or specifying that their data will not be included. I will also have to ensure them that all data used by researchers will be anonymised before the data is released. In addition no published data will identify a particular student or group of students. With those provisos met we should have no problems here.	
collaboration will involve, and getting them to sign our consent forms (required for our ethics approval).	consent forms (required for our ethics approval).	collaboration will involve, and getting them to sign our consent forms (required for our ethics approval).	collaboration
Your v2 alignment of teams will work fine for me. What I'll need to do is simply allocate students into the three teams locally then assign one of each of those teams to partner with fellows in Sweden and NZ. I appreciate your willingness to shift around the teaming to accommodate an unusually difficult IRB process here in the US.	I appreciate your willingness to shift around the teaming to accommodate an unusually difficult IRB process here in the US.	Your v2 alignment of teams will work fine for me. What I'll need to do is simply allocate students into the three teams locally then assign one of each of those teams to partner with fellows in Sweden and NZ. I appreciate your willingness to shift around the teaming to accommodate an unusually difficult IRB process here in the US.	Your v2 alignment of teams will work fine for me. What I'll need to do is simply allocate students into the three teams locally then assign one of each of those teams to partner with fellows in Sweden and NZ.
I am certainly sensitive to these issues having come across them in the course of doing my M. Phil thesis cf. the discussion in chapter 7 attached. I think there are some real tensions here which the scandinavian University systems seems to handle better than we do,	I think there are some real tensions here which the scandinavian University systems seems to handle better than we do	I am certainly sensitive to these issues having come across them in the course of doing my M. Phil thesis cf. the discussion in chapter 7 attached. I think there are some real tensions here which the scandinavian University systems seems to handle better than we do,	

Table 6.9b: Establishment Episode Full –'Metastructures' and 'National/Institutional' Cultures

The excerpts above demonstrate the influences of 'National/Institutional' *culture* in the interplay relating to the ethics approval processes pertaining at each site. While 'ethics approval' and 'IRB process' act as *metastructures* at an 'institutional' and 'national' level of *culture* in this dialogue sequence, they interact tightly with the 'professional' *cultures* inherent in the researcher/educator roles, and the *Activities* involved in the *scripting* processes by which the 'exercise' is planned, and during which the *GVTs* are formed, team members assigned prior to loading into the collaborative systems and the technology features of the *AIT* tailored to underpin the *collaboration*.

Reviewing the data in table 6.9a above shows the dominance in the first message of the 'professional' educator *culture*, where the common group structure across two AUT 'assessments' is Diana's driver for retaining an existing *GVT* and *LT* structure. In the next message from Fred, we see a movement to align with the AUT response. Fred notes both a 'team size/grouping' and 'IRB' problem [Institutional Review Board at St Louis University], and suggests 12 groups, with only one quarter of these to include St Louis students so that the *research* and teaching only groups can be disentangled, and both interests can be successfully supported. However the *data* could be kept for a later 'petition for inclusion as archival *data*' should circumstances suggest it. Here we see the 'professional' *culture* of the researcher/educator in opposition to the 'institutional' *culture* imposed by the IRB. The next message echoes a constraint imposed by the 'Institutional' *culture* of the 'Ethics Committee' at AUT, noting that students can withdraw from the 'exercise' at any stage, but (as an educator mandated 'professional' courtesy) they will have to let their tutor and 'virtual team' know. Thus the 'Institutional' and 'professional' *cultures* are again apparent, with a further hint at 'student' culture. In the next message a very concrete proposal comes from Diana for 9 *GVTs*, with the first 3 to have 3 *LTs* including US students for non research purposes and the remaining 6 with 2 LTs each, one Swedish and one with NZ students eligible for research. This is a very close match to Fred's prior suggestion of 12 groups, and with similar cultural imperatives in operation. The next message from Diana requests a 'list of students' urgently to enable their *online registration* a *control* process by which students are entered into 'AUTonline', the AUT hosted *AIT* for the collaboration. Once loaded by the support staff, the trial coordinators are then free to create 'groups' and assign students to them on the 'site'. This enables the coordinators themselves to easily remove students from the groups, should they 'drop out' or 'opt out' of the 'exercise' even if they are registered to 'AUTonline'. This interchange demonstrates a complex interplay of metastructures, cultures, technology and roles, which I would suggest is not uncommon for *GVTs* when engaged in the TUM activity of *establishment.* The hitherto conceptually defined *GVTs* are now to be realised within the *AIT* of *AUTonline*, but students need first to navigate the *control* processes for external students dictated by AUT's 'institutional' *culture*, and supported by an AUT internal *organizational unit.* However educators are free within the 'technology' features provided by the *AIT* to create their own group structures and assign their own

group membership, thus the *metastructure spirit* of the *AIT* at this level could be said to be enabling for 'instructors' as it supports a 'professional educator' *culture* which desires to promote a collaborative *pedagogic pattern*. The enabling character of the technology is vital here in supporting *GVT formation* and changes in *LT* membership occasioned either by students who 'drop out' from the course, or 'opt out' of the 'exercise'. The former case is a function of both institutional *culture* (allowing students early changes from the *metastructure* of a 'course') and student *culture* (uncertain commitment to a 'course' at the outset). The latter case is a function of institutional *culture* (allowing students as voluntary participants to opt out of the *metastructure* of a research 'exercise'), professional researcher *culture* (supporting informed and voluntary participation) and student culture (uncertain commitment to an 'exercise' at the outset). In addition the differences at each site suggest that some 'national' dimension of *culture* may also be in operation.

Table 6.9b develops this notion of national differences, with Arnold outlining the Uppsala position concerning ethical approvals. There is a clear difference of opinion over the salience of the issue, with Arnold (while commiserating with Fred), nonetheless dismissing it as 'irrelevant to the exercise'. The authority for research at Uppsala appears to reside more closely with the educator/researcher as a professional, with making provision for voluntary participation by students and safeguards over use and release of identifying data simply being an element of 'professional' *culture*. As a contrast to this position, the AUT requirement expressed in the subsequent message, is for written informed consent from students with 'consent forms' as the supporting *metastructure*. Likewise Fred's response in the next message acknowledges that the proposed *GVT formation* process will work for him by allocating students into *LTs* and then assigning each of these *LTs* to partner with fellow *LTs* from NZ and Sweden. Fred further expresses his gratitude for our flexibility on the *GVT formation* issue, and acknowledges the "unusually difficult IRB process here in the US". So we see here also the *socio-emotional* dimension of the issue, grateful *other-directed emotions* from Fred towards us, and somewhat apologetic *context and technology directed emotion* about the whole IRB process, augmented by *task directed* and *performance-driven emotions* with respect to the critical path *task* of *GVT formation*. Echoing the problematic nature of this formal institutional constraint in the US context, is the next message in which I acknowledged my own sensitivities, again an example of *context and technology directed emotion* based upon my own experiences in this respect. To

bolster my support, I enclosed a copy of my M. Phil Thesis (Clear, 2000), in which I had been highly critical of the application of the human subjects ethics review process to educational action research projects, noting that "AUT's ethics committee approval process…provided a significant additional overhead and proved a barrier to innovation" (p.266) and supporting the views of Zeni (1998) who has urged "academic institutions to support reflective teaching and to minimise the bureaucratic hurdles that discourage research by teachers to improve their own practice" (p. 13). Thus it appears that New Zealand and US institutions in this case have adopted similarly cumbersome centrally mandated research risk management regimes for human subjects review, whereas the Uppsala model places much more responsibility in the hands of the professional educator/researcher. A colleague who is a senior educational researcher in Hong Kong further regards such work as outside the proper jurisdiction of ethics committees, being simply the practice of Boyer's (1990) "scholarship of teaching" (Carmel McNaught, personal communication, Sept 2007). Zeni (1998) places the cause for such dissonance in the origins of the human subjects review process and its "roots in medical research" (p.11), a field within which tightly prescribed formal experiments to test given hypotheses are the more common research method. The inherent linear mind set underpinning such a model does not translate readily to the more cyclical and evolutionary model underlying an action research process. Whether the different approaches to ethics review processes between the three locations in this case lie more in the national/legal framework or the specific institutional *cultures*, is a question for further study, and addressed in section 8.6 below, but it is clear that I favour the approach taken by the "Scandinavian University system" of responsible professional autonomy.

6.4.4.1.3 Metastructures and Student Culture – Establishment Window Full

In table 6.10 below aspects of 'student' *culture* at each site are displayed. The 'institutional' *metastructure* of a "2 week break" occasions the observation that AUT students could be 'encouraged' (but not 'force'[d]) to 'participate' during their semester break. Thus 'institutional' *metastructures* and the *socio-emotional* dimension of student *motivation* are seen to be interrelated. In the subsequent message we see an attempt to align between US and NZ sites, through the *metastructure* of the '*communication* project' as a *learning task* with its associated *assessment*. Educators at both sites share views about tailoring aspects of 'groupware' as an *AIT* and the

assessment ‘weight’ to meet the needs of each student body. In the next message Fred distinguishes his students as ‘International Business’ rather than ‘MIS majors’. The notion of a ‘major’ then becomes a ‘cultural’ *metastructure*.

Excerpts	Institutional	Cultural	Technology
then we have 2 weeks break (during which time students could be encouraged to participate, although we cant force our students to do so as officially they have a break)	2 weeks break we cant force our students … as officially they have a break)	students could be encouraged to participate, although we cant force our students to do so as officially they have a break)	
The communication project looks like a good one for our IBS students too, although the type of Groupware will have to be considered carefully, as well as a few other aspects, including the weight of the assessment etc.	our IBS students	The communication project looks like a good one for our IBS students too the type of Groupware will have to be considered carefully, as well as the weight of the assessment etc.	the type of Groupware will have to be considered carefully
Most of my students will be international business students rather than MIS majors, so this might also present an interesting mix for example the students here might focus on business issues while your students focus on technical issues, but have to resolve any differences.	Most of my students will be international business students rather than MIS majors	Most of my students will be international business students rather than MIS majors, so this might also present an interesting mix for example the students here might focus on business issues while your students focus on technical issues, but have to resolve any differences.	MIS majors your students focus on technical issues
Re student cohorts ours are essentially business students too, typically year two or three IT majors with some technology awareness our graduate profile from this degree is a business analyst not a CS or SE graduate. The Uppsala students are more technical but less experienced as students (they are first year).	business students typically year two or three IT majors with some technology awareness our graduate profile from this degree is a business analyst not a CS or SE graduate Uppsala students are more technical but less experienced as students (they are first year).	Re student cohorts ours are essentially business students too, typically year two or three IT majors with some technology awareness our graduate profile from this degree is a business analyst not a CS or SE graduate. The Uppsala students are more technical but less experienced as students (they are first year).	year two or three IT majors with some technology awareness Uppsala students are more technical

Table 6.10: Establishment Episode Full –'Metastructures' and 'Student' Culture

The differing study-major and focus of these 'student' *cultures* or *subcultures* suggests a combined approach: one in which US students might have a business focus to the *task* and the AUT students more of a focus on the technology (*AIT*), but they would need to work to jointly resolve differences. In response to this proposal I noted to Fred that our 'IT majors', while relatively senior undergraduates were more 'business analyst' than strongly 'technical' in focus. This hybrid skill set meant that they would lack the 'technology awareness' of a "CS or SE graduate". Yet the 'Uppsala students, while studying a technical course, were still very junior 'first year' students. This series of messages shows the *metastructures* of student 'major' and 'year' of study, as presenting an "interesting mix" [in Fred's words] of 'student' *cultures* in such a "*communication* project".

6.4.4.1.4 Metastructures and Institutional Culture – Establishment Window Full

Excerpts	Institutional	Cultural	Technology
unpleasant story, but I've never been able to download a zip program from the web without getting several viruses and don't seem to be able to get anyone to install one on the computer here at school.	don't seem to be able to get anyone to install one on the computer here at school.	unpleasant story, but I've never been able to download a zip program from the web without getting several viruses and don't seem to be able to get anyone to install one on the computer here at school.	I've never been able to download a zip program from the web without getting several viruses don't seem to be able to get anyone to install one on the computer here at school.
Warning: This message has had one or more attachments removed	Warning: This message has had one or more attachments removed	Warning: This message has had one or more attachments removed	Warning: This message has had one or more attachments removed
Yes our email filters out html scripts which is great when you want to send javascript to someone!!	Yes our email filters out html scripts which is great when you want to send javascript to someone!!	Yes our email filters out html scripts which is great when you want to send javascript to someone!!	Yes our email filters out html scripts which is great when you want to send javascript to someone!!
I should be able to have a stable list of students with recommended usernames and passwords by August 31 we are usually stable in enrolment at that point in the semester.	we are usually stable in enrolment at that point in the semester.	I should be able to have a stable list of students with recommended usernames and passwords by August 31 we are usually stable in enrolment at that point in the semester.	a stable list of students with recommended usernames and passwords
Fred and Mats/Arnold any thoughts on the desktop VC option? That would give more freedom for each group to arrange their own conferences, but would the required configurability and technical support be available at each of your sites?	would the required configurability and technical support be available at each of your sites?	Fred and Mats/Arnold any thoughts on the desktop VC option? That would give more freedom for each group to arrange their own conferences, but would the required configurability and technical support be available at each of your sites?	Fred and Mats/Arnold any thoughts on the desktop VC option? That would give more freedom for each group to arrange their own conferences, but would the required configurability and technical support be available at each of your sites?

Table 6.11: Establishment Episode Full –'Metastructures' and 'Institutional' Culture

The first in this series of messages introduces a *control* theme with a reference to the 'technology' *metastructures* of "viruses", but in tandem with the concept of *breakdown*. Fred expresses some frustration at his inability to function professionally due (ironically) to the lack of 'Institutional' support for safely unzipping files provided by his technical staff. Here we see the interplay of the *metastructures* provided by 'professional' *culture*, 'institutional' *culture* and technology. The next message notes a further instance of *breakdown* in the removal of an 'attachment', by a virus filter, both of which represent 'technology' *metastructures* and the result of the *control* mechanisms introduced to support the broader 'institutional' *culture*. In this case the filtering has occurred at the AUT site, and as noted in the next message which I sent to Fred, had resulted from a quarantining of a file containing embedded "html" [Fred's Global Information Management course *syllabus sample*] a *metastructure* which he was trying to share with us. Thus the "email filter" acts as a technology *metastructure* to reinforce the 'institutional' *culture* of *control* over potentially system harmful technologies. However for educators in the computing field (as for other computing professionals) the need to share files with the potential to run

computer programs is a common requirement in their 'professional' *culture*. So the cultural tensions between 'professional' and 'institutional' *cultures* here manifest themselves through email and virus filtering technology *metastructures*.

6.4.4.1.5 Metastructures and Professional Culture – Establishment Window Full

The first in the series of messages from table 6.12 below illustrates Diana as a professional educator/coordinator communicating in the *reinforcement* mode of *TUM activity* with her colleagues in the coordinating *GVT*. This message outlines the steps taken by Diana to build initial student *GVT* rapport by sharing *LT* photos, after having given up on the introductory videoconference option (cf. 6.4.2). Several technology *metastructures* are in evidence in this message: "word file with photos"; "virtual café"; 'link"; "announcements board"; 'GVT forums"; "Tutors space". The "virtual café" is an example of a *metastructure* in which the 'Institutional' *culture* of *control* is relaxed in order to create a common social "place" (Harrison & Dourish, 1996) for all participants within the *AIT* of AUTonline. In the second message Fred proposes making voluntary an introductory 'teleconference' a technology based *metastructure* to support the student *GVTs*, and notes that a *research* question could concern its subsequent impact on those who did participate, but notes that such a design would require tracking of participation. The voluntarism in the *research design* allows for relative *freedom* for the *research subjects* but in turn vies with the need to *control* the *research* process and *data* gathering. The 'professional' researcher and educator *cultures* are both in operation here. The next message sees the 'professional' educator take prominence. Fred outlines the *metastructure spirit* that he intends should pervade the exercise. *GVT* activities or *learning tasks* should be "fun", "not heavily graded", but with a follow up *assessment task* that requires students to reflect on their experiences of 'global interaction'.

Excerpts	Institutional	Cultural	Technology
I have uploaded a word file with photos of my 4 local teams in the Virtual cafe (available to all students and tutors) there is a link to the cafe from the Announcements board for the students to follow. I have also uploaded a photo of each of my teams in their respective GVT forums (already said this in the Tutors space too)	the Virtual cafe (available to all students and tutors)	I have uploaded a word file with photos of my 4 local teams in the Virtual cafe (available to all students and tutors) there is a link to the cafe from the Announcements board for the students to follow. I have also uploaded a photo of each of my teams in their respective GVT forums (already said this in the Tutors space too)	a word file with photos of my 4 local teams in the Virtual cafe (available to all students and tutors) a link to the cafe from the Announcements board a photo of each of my teams in their respective GVT forums the Tutors space
My inclination is to make this voluntary, but keep track for research purpose of who uses and who doesn(t. Could be a research question regarding the effect on performance of the groups that follow a teleconference. Note that different numbers of folks from different groups in various combinations might participate if it is voluntary, which means it is important to (take roll(and keep track of who does what.		My inclination is to make this voluntary, but keep track for research purpose of who uses and who doesn(t. Could be a research question regarding the effect on performance of the groups that follow a teleconference. Note that different numbers of folks from different groups in various combinations might participate if it is voluntary, which means it is important to (take roll(and keep track of who does what.	. Could be a research question regarding the effect on performance of the groups that follow a teleconference. Note that different numbers of folks from different groups in various combinations might participate if it is voluntary, which means it is important to (take roll(and keep track of who does what.
My goal is for the activities with the teams to be fun, not heavily graded, but then have a follow up paper including a journal of their activities with explanations about why they did what they did and how they experienced it as well as what lessons they learned about global interactions.		My goal is for the activities with the teams to be fun, not heavily graded, but then have a follow up paper including a journal of their activities with explanations about why they did what they did and how they experienced it as well as what lessons they learned about global interactions.	
In terms of class planning, is there any specific content material you review with the students before diving in? How much class time (if any) do you take? For example, do you take the first session in the lab to make sure everyone understands the software and how it works or do you just give written instructions? Do you do some kind of discussion or debriefing at the end? I believe I will be able to schedule some times in the lab if that		In terms of class planning, is there any specific content material you review with the students before diving in? How much class time (if any) do you take? For example, do you take the first session in the lab to make sure everyone understands the software and how it works or do you just give written instructions? Do you do some kind of discussion or debriefing at the end? I believe I will be able to schedule some times in the lab if that	session in the lab to make sure everyone understands the software and how it works I believe I will be able to schedule some times in the lab
Usually we do have an introductory session with our students where we briefly introduce the concept of groupware, hand out some readings on the topic and have a class discussion. We also briefly demonstrate the system to them and also provide detailed written instructions and a timeline.		Usually we do have an introductory session with our students where we briefly introduce the concept of groupware, hand out some readings on the topic and have a class discussion. We also briefly demonstrate the system to them and also provide detailed written instructions and a timeline.	the concept of groupware, readings on the topic briefly demonstrate the system to them
I have also been trying (together with Mats) the learning outcomes objectives for the project course from the Swedish perspective. We have the project in conjunction with the academic hospital here, and that creates another level of coordination.		I have also been trying (together with Mats) the learning outcomes objectives for the project course from the Swedish perspective. We have the project in conjunction with the academic hospital here, and that creates another level of coordination.	
(It's interesting that here in NZ, the word 'paper' means 'course' or 'subject' it is very confusing for everyone from outside the country!)		(It's interesting that here in NZ, the word 'paper' means 'course' or 'subject' it is very confusing for everyone from outside the country!)	
Re assignments Diana and I are working on a paper at present discussing issues here to do with motivating students and for our students they tend to be motivated by on topic issues. I think it may help to separate the joint collaborative task from the assignment task for each course as they probably need to differ between classes.		Re assignments Diana and I are working on a paper at present discussing issues here to do with motivating students and for our students they tend to be motivated by on topic issues. I think it may help to separate the joint collaborative task from the assignment task for each course as they probably need to differ between classes.	

Table 6.12: Establishment Episode Full –'Metastructures' and 'Professional' Culture

In this third message we see the weaving together of cultures. The educator's 'professional' *culture* is expressed through the *metastructure* of the *assessment* design (where requiring the educational *genres of* a "journal" and a "follow up paper" is a case of "explicit genre structuring" (Orlikowski &Yates, 1994, Clear, 2002c) in this context). A further *cultural* expression can be seen in the practice of tailoring the *assessment* to the 'student' *culture* by a "fun" *metastructure spirit* aimed at engendering *motivation* towards the *learning task*. The "grading" practice involves assessing not the *task* itself but the reflection on that *task*, which echoes the practice adopted at AUT. This further limits risk should the collaboration fail, either overall or at *GVT* level, but reflection on failure in a *research* project is still a perfectly valid *assessment task*.

The subsequent message sees Fred enquire about the 'professional' *culture*, the *scripting* processes, and the teaching practices engaged in at the AUT site: from introductory content introduced; role of lab sessions; time allocated; through to final debriefing session. Fred indicates a wish to align the 'professional' *culture* across sites for the benefit of his students, and needs to understand the AUT approach, so that he can book computer "labs" as a *facility* for demonstration of the *AITs* if necessary at St Louis. Diana's message in response indicates the nature of the first class session at AUT, where several *metastructures* are in evidence. The 'professional' educator *culture* unfolds through such metastructures as: "an introductory session"; "a class discussion"; "concept of groupware"; "readings" on the "topic"; a 'demonstration' of the *AIT*; "written instructions" and a "timeline", implicit in this model is a 'lab session'.

The next communication from Arnold gives the Swedish perspective, where he indicates a desire to tie together the course with a related course at Uppsala conducted in conjunction with the "academic hospital", a further *collaboration* which creates another level of coordination. Professionally associated *metastructures* are again evident in this communication, with: "learning outcomes"; "project course"; "project in conjunction with the academic hospital here"; all serving to shape the *collaboration*. So we see the influence of local and global tensions in aligning the 'professional' *cultures* within this *GVT* of coordinators.

In the next message from Diana we even see the need to clarify language across sites, where 'professional' terms for *metastructures* like 'course' or 'paper' or 'subject' can

have different meanings in each country. The final communication from me, discusses a paper I was writing with Diana at the time (Clear & Kassabova, 2005) on student *motivation*, a topic of clear concern to an educator in such an exercise. I had observed that the AUT 'student' *culture* was one of being motivated by "on topic issues", so it was probably best to separate out "the joint collaborative *task* from the *assignment task* for each course, as they probably need to differ between classes". The *metastructures* of 'professional' educator *culture* are again in evidence: 'topic' as a motivator; 'joint collaborative task' as a *learning task*; assignment task as an *assessment task*; 'each course' and 'classes' as key locally constraining structures. Consequently, the model for alignment with professional and student *cultures* at each site argued for acting locally to meet the needs of the *LT* context, but thinking globally to meet the wider concerns of the student and educator/researcher *GVTs*.

6.4.4.1.6 Metastructures and International Culture – Establishment Window Full

Fan (2000) has proposed that culture can be studied at the international (e.g. West vs. East level). In this analysis of table 6.13 below we see the multi-level cultural dynamic of North vs. South that unfolds in this international collaboration. This sequence of messages relates first to aligning the overall *collaboration* window, and then to conducting an introductory video conference session across the two hemispheres. The first message from Diana demonstrates the *scripting activity* of *trial planning* through the temporally based *metastructures* of "time frame" and "window" for the trial", and indicates that 4 to five weeks will be required, with the best time to begin in NZ being three weeks before the 'midsemester break' of two weeks, after which the semester resumes. The southern hemisphere timings represented by the *metastructures* of "semester" and the "midsemester break" imposed significant constraints on the international *collaboration* with northern hemisphere colleagues, meaning in effect that the collaboration had of necessity to be punctuated by a two week hiatus. For instance in Fred's Syllabus (separately reported) August 24 was advised as the first day of the St Louis course, and advice from Arnold (separately reported) indicated that Uppsala would have their first session on the 9th September. In the latter case however, it was not entirely clear from the NZ end whether this was the first day of the collaboration or first day of the semester.

Several levels of *culture* are in operation here: the 'international' level desired for the *collaboration* and within that the north/south split of seasons, "semesters" and

"semester breaks"; implicitly the 'national' level, with local holidays such as the "thanksgiving break" apparent in the *metastructure* of Fred's *syllabus* (separately reported); the 'institutional' level with each University having its local semester calendar; the 'professional' educator level of the course schedule expressed in some form of "syllabus" or handbook, and the *collaboration* "window" adapted to fit within that; southern hemisphere 'student' *culture* is also apparent in the following sentence, in which estimates of AUT participating student numbers are shared, with it being noted that "some students might choose a different option for this *assessment*" (as AUT students have an alternative *assessment task* option if they elect not to participate in the *research* project). This ability to "opt out" (cf. table 6.9a above) has been previously addressed in the discussion about research and voluntary participation. In the second message Fred discusses coordinating the 'technology' *metastructure* of a "videoconference" between US and NZ, but not at US "class" times (Tuesday and Thursday 2-4pm US central time – here an 'institutional' *metastructure*), which Fred surmised to be "in the middle of the night in NZ". Fred advocated holding a "special, additional, perhaps voluntary session" early in the evening at St Louis and the morning in NZ. In the third communication we see a *recovery plan* being developed by Fred in the event of a *breakdown* in arranging the videoconference across the north-south time-zone and *cultural* divides. For the *metastructure* of the "course" it was now a "positive addition rather than a central required element". Fred observed that it would be possible to conduct the "videoconference" across time-zones within the US, thus this 'technology' *metastructure* could be compatible at the 'national' if not the 'international' *cultural* level. The AUT response provides a counterpoint.

Excerpts	Institutional	Cultural	Technology
Before we start discussing the model and the logistics we believe that we need to find out what time frames each of you can consider for the exercise and whether we all can find the (window(needed for the trial. Our anticipation is that we will need at least 4 but more likely 5 weeks for the exercise. The best time for us to run the trial is starting in the week beginning on the 30th of August. Three weeks later we have a 2week midsemester break (20 September 3 October) before the semester resumes. We usually have 3 streams for this course, i.e. about 50 to 60 students, although some students might choose a different option for this assessment.	The best time for us to run the trial is starting in the week beginning on the 30th of August. Three weeks later we have a 2week midsemester break (20 September 3 October) before the semester resumes. We usually have 3 streams for this course, i.e. about 50 to 60 students, although some students might choose a different option for this assessment.	Before we start discussing the model and the logistics we believe that we need to find out what time frames each of you can consider for the exercise and whether we all can find the (window(needed for the trial. Our anticipation is that we will need at least 4 but more likely 5 weeks for the exercise. The best time for us to run the trial is starting in the week beginning on the 30th of August. Three weeks later we have a 2week midsemester break (20 September 3 October) before the semester resumes. We usually have 3 streams for this course, i.e. about 50 to 60 students, although some students might choose a different option for this assessment.	the exercise the (window(needed for the trial. We usually have 3 streams for this course, i.e. about 50 to 60 students, although some students might choose a different option for this assessment.
I was not necessarily envisioning the videoconference as or during a class session per se. Our classes will be from 2 to 4 p.m. on Tueday and Thursday US Central time I figure that is still the middle of the nightin New Zealand. I was hoping we might arrange a special, additional, perhaps voluntary session around 6 or 7 p.m. US Central time which might be around 8 a.m. (I haven't double checked the exact times) NZ time.	I was not necessarily envisioning the videoconference as or during a class session per se. Our classes will be from 2 to 4 p.m. on Tueday and Thursday US Central time I figure that is still the middle of the nightin New Zealand. I was hoping we might arrange a special, additional, perhaps voluntary session around 6 or 7 p.m. US Central time which might be around 8 a.m. (I haven't double checked the exact times) NZ time.	I was not necessarily envisioning the videoconference as or during a class session per se. Our classes will be from 2 to 4 p.m. on Tueday and Thursday US Central time I figure that is still the middle of the nightin New Zealand. I was hoping we might arrange a special, additional, perhaps voluntary session around 6 or 7 p.m. US Central time which might be around 8 a.m. (I haven't double checked the exact times) NZ time.	I was not necessarily envisioning the videoconference as or during a class session per se. Our classes will be from 2 to 4 p.m. on Tueday and Thursday US Central time I figure that is still the middle of the nightin New Zealand. I was hoping we might arrange a special, additional, perhaps voluntary session around 6 or 7 p.m. US Central time which might be around 8 a.m. (I haven't double checked the exact times) NZ time.
If we can't get this to work, we (here at SLU) can probably do a videoconfernce with folks in other US timezones, so this is a positive addition rather than a central required element of the course in my mind.	we (here at SLU) can probably do a videoconfernce with folks in other US timezones, so this is a positive addition rather than a central required element of the course in my mind.	If we can't get this to work, we (here at SLU) can probably do a videoconfernce with folks in other US timezones, so this is a positive addition rather than a central required element of the course in my mind.	we (here at SLU) can probably do a videoconfernce with folks in other US timezones,
2) re video conferencing options, we think we would have real trouble getting our students to attend a session that was at an unsociable hour and not in their normal class time. We are not a residential University and many of our students combine study with part or full time work.	2) re video conferencing options, we think we would have real trouble getting our students to attend a session that was at an unsociable hour and not in their normal class time. We are not a residential University and many of our students combine study with part or full time work.	2) re video conferencing options, we think we would have real trouble getting our students to attend a session that was at an unsociable hour and not in their normal class time. We are not a residential University and many of our students combine study with part or full time work.	2) re video conferencing options, we think we would have real trouble getting our students to attend a session that was at an unsociable hour and not in their normal class time.
It looks like a live videoconference is a dead issue. I've written in a message to everyone about the possibility of exchanging asyncronous videotape messages.		It looks like a live videoconference is a dead issue. I've written in a message to everyone about the possibility of exchanging asyncronous videotape messages.	It looks like a live videoconference is a dead issue. I've written in a message to everyone about the possibility of exchanging asyncronous videotape messages.

Table 6.13: Establishment Episode Full –'Metastructures' and 'International' Culture

In the fourth communication we see the AUT concerns relating to the 'international' impact of local 'institutional' and 'student' *cultures*. The contrast between AUT (as a non residential, central city campus, with a mobile student population) and the residential model of its northern hemisphere counterparts is apparent. Moreover this difference has both technology access and motivational impacts for students, who would typically be studying

alone at home, with variable levels of internet access – other messages in this episode have indicated via the 'technology' *metastructure* of a "dial-up modem" rather than a "fast broadband link" in a dorm with supportive study partners. In addition the culture of AUT's business IT students who tend to find their *motivation* in learning tasks that are formally assessed (Clear & Kassabova, 2005), militates against their undertaking additional tasks that are not assessed. Thus the temporal *metastructure* of a scheduled class "session" forms a regular and expected element in their study patterns, from which deviation is challenging. The final communication in this set is from Fred, acknowledging that the attempts to arrange a "live videoconference' had come to naught. In response to this *breakdown*, he suggested the *recovery* plan of exchanging "asynchronous videotape messages", an alternate form of 'technology' based *metastructure*, one capable of being transferred across hemispheres and viewed at will, without the need to arrange physical same-time presence for all student GVT members. Just to complete the picture this *recovery* plan was not put into action. Specific supporting data to explain why is absent, but my assumption is that the students did not engage sufficiently in the activity to do so.

In this next section, (as noted above in 6.4.4.) a further dominant group of data items was evident related to the category of "role". These are depicted in table 6.14 below.

establishment episode full	Role	socio-emotional group-bldg and mtce roles	Motivator (energizer, encourager)	Team leaders or session owners	Explainer (elaborator, coordinator, orienter, summarizer, amplifier)	Innovator	Formal (teaching~research assistants)	Purpose agents - teacher
	0	4	69	1	1	1	6	44

Researcher	Undergraduate Student	curriculum developer	Research Subject	external participant	paper coordinator	Graduate Student	standard~~user.	Broker
23	62	13	3	2	3	1	1	6

Coordinator	Offshore Technical Coordinator	Technical Co-ordinator	SCIS Resource coordinator	Content Facilitator	Developer	Officially sanctioned local developer	Programmer	Technologist
60	41	2	5	1	8	2	2	1

Testers.	Support and Maintenance Team representatives	Configurer	help desk staff	trainers	System Support Consultant	audiovisual unit - SLU	videoconference technicians	Supplier
5	12	1	2	2	2	2	1	1

IRB administrator	IRB	ISP
1	4	1

Table 6.14: Establishment Episode Full – Coded 'Roles'

6.4.4.2 Roles – Establishment Window Full

A clear pattern emerging from the data in table 6.14 above is the multiplicity of roles involved in this episode (37 independently coded roles). While some of these may be either duplicates or variants, (most have been identified from relevant literature on roles with instances in the data being coded against the categories as they warranted), the majority are specific and distinctive roles each contributing to the overall endeavour of establishing the collaboration. This section will touch on selected roles and how they are evidenced. Dominant roles are those of: *motivator; undergraduate student; coordinator; teacher; offshore technical coordinator; researcher; curriculum developer;* and *support and maintenance team representatives*. It is noteworthy that the '*motivator*' role, together with the more to be expected '*undergraduate student*' and '*coordinator*' roles, has the highest frequency of occurrence in this grouping.

The '*motivator*' role's significance is consistent with the taxonomy for team processes proposed by Marks et al., (2001), in which the "interpersonal processes" of "motivation and confidence building" together with "affect management" were identified as key processes in teams. Notably the latter reference made no specific mention of 'virtual teams'. We do see in the communications in this episode, numerous "social communications" consistent with the "swift trust" virtual team communications noted by Jarvenpaa & Leidner (1998). The later study investigating "swift trust" in courses delivered by "Asynchronous Learning Networks" (ALN's) by Coppola et al., (2004), applied a coding scheme which distinguished between "task and social maintenance", with positive and negative socio-emotional expectations and reactions being salient to the *student* experience of the course. By contrast the data analysed in this episode derives not from students but mostly from the *coordinators* of the collaboration, who themselves represent a distinctive global virtual team. We see evidence of the codes proposed by Coppola et al., (2004, p.98), for instance code 1 - "positive expectations about the course or system use, connoting enthusiasm, confidence, hopefulness", which maps closely to specific interchanges (such as those below) coded to the *motivator* role.

> Looking forward to getting the information about your students and starting the collaborative trial next week!
>
> I really appreciate your willingness to help and support us in our international collaborative project.
>
> It would be good to discuss your suggestions in the tutors forum, they sound interesting
>
> Hope we'll be able to actually start the collaboration now.
>
> Can't wait now to see the first contributions from your students!

> I can(t tell you how much I(m looking forward to working with you all on this,

The *undergraduate student* role is evident in numerous interchanges related to the course design at each site, assessment and relationship to the collaboration for each course, registering students to AUTonline, formation of GVTs, and student cultures as noted in 6.4.4 above. *External participant* is a sub role of student developed in the interchanges related to online registration of *external* or non AUT students to AUTonline.

The *coordinator* role is dominant in the coding scheme, with companion roles of *offshore technical coordinator (a role identified by DSDM, 2005 p. 12)*, *technical coordinator*, and *broker (Quinn 1988, cited in Roy, 2006)* also in evidence. This dominance is consistent with the "model of e-collaboration effects" proposed by Qureshi et al., (2005) in which "coordination" is a key pillar. Their study of virtual team collaboration between students at Erasmus University and the City University of Hong Kong identified three major categories within coordination episodes: 1) time zone difference; 2) group collaboration; and 3) involvement; with respective outcomes of: 1) response delay/waiting; 2) productivity; and 3) learning. In this episode coping with "time zone differences" and "response delay/waiting" are also evident in the examples below demonstrating the *coordinator* and *offshore technical coordinator* roles:

> Kitty and I will be working on the setup for this semester and the instructions tomorrow morning.

> After reading all our previous emails, Tony, Kitty and I considered the constraints of all character and nature and came to the conclusion that it will work best for all of us if we start the collaborative exercise in the week beginning on the 6th of September and aim at finishing by the 22nd of October.

> I think we may need a phone call to sort some of this out, so that we can agree a clear direction and manage our risks. Could you let me know your phone number there and we will try to synchronise for a suitable time.

> I'd like us to aim for Sept 7 (Tuesday) and Sept 8 (Wednesday) at 7 p.m. US central time (that should be 7 a.m. NZ time if my calculations are ok).

> My first meeting with students will be next Tuesday, 8/23, and I will look forward to formulating the groups and preparing the students to participate in the exercise.

The *teacher* role (Guzdial et al., 2000) is strongly in evidence, with interactions coded regarding: the objectives and design of courses, learning tasks and assessments; arranging access to the common VLE; *teacher* (instructor, lecturer, tutor) roles versus

undergraduate student rights and privileges within the VLE; planning the design of the collaboration and its components as a learning activity; establishment of student groups; synchronising of course schedules, and determining approaches to joint versus local delivery.

A rather expanded set of roles is also in operation for the team of Global Virtual online teachers involved in this episode. The teacher as *Team Leader* role is realised technically as an access privilege within AUTonline.

> I have created the Organisation, 407106_International, with yourself as Leader,

The teacher in the *Innovator and Technologist* roles can be seen in Arnold's proposals for a learning task design in which students selected and evaluated different CMC technologies. The teacher in the *curriculum developer* role is evident in the sequence of interchanges by Fred about his GIM course, in tandem with discussions about his *graduate student* acting as a *teaching- assistant* to help research and develop materials for the planned course. A directly related role is the teacher as *paper coordinator*, evident in the sequence of interchanges between Fred and Felix Tan (at that stage Head of School of Computer and Information Sciences at AUT and my superior). Here Felix acts in the *broker* role to facilitate the global linkages desired by Fred in his *curriculum developer* role, and links him with me as the relevant *paper coordinator (AUT term for course/subject coordinator, cf. table 6.12 above)* to negotiate a model for our respective papers/courses. Further roles associated with online course delivery are apparent – in the teacher as *standard user* we see the need for teachers to have a 'dummy' student account so that they can see the student view of the system. This facility supports teachers in their roles as *testers*, in which they try out various system features in order to familiarise themselves, manage risk or check facilities for the students – for instance in the three excerpts below Fred refers respectively to the AUTonline VLE, proposed videoconferencing technologies, and a combination of AUTonline and the Notes prototype database:

> I(ll want to test out the system a little before demonstrating it.
>
> probably will need a trial run to assure that our technologies are compatible.
>
> I have not had a chance to try out the websites themselves yet, but hope to this week.

In the *officially sanctioned local developer* role we see the teacher as creator of the learning environment through selecting and configuring chosen features of the VLE:

> BTW, today Kitty and I created group pages for each of the 9 Global Virtual Teams and within each page we created a couple of discussion forums: "Get to know each other

> First postings to the Global Virtual Team" and "GTV leadership Discuss group leadership: GTV leader or selfmanaged?" to get students started next week.
>
> These are only "shells" for the groups for now as there are no students in the online class. As soon as the students are uploaded each of us will have to add their students to the respective GTVs as indicated in the diagram I emailed you earlier.

In the *content facilitator* role we see the teacher as ongoing shaper and contributor to the learning environment by progressively adding content to the VLE:

> Please feel free to comment on what we have done so far and to add your own touch to the site, I believe we all will be developing it as we go through the exercise.

An associated role sees the Global Virtual Teacher as *trainer* helping peer teachers to become familiar with the features of the VLE, and how to best use them. This episode contains several instances of Diana actively engaged in the *trainer* role, communicating with Fred and Arnold over the use of the technology platform.

The role of *researcher* again is a multi-dimensional one. In this episode we see a wide ranging set of messages addressing research roles and topics, for instance, the goals of the research programme (cf. Appendix 9 for a copy of the "action research framework" I had interchanged with colleagues at each site). This document was shared in response to Fred's query about the research design when we were determining the GVT composition, to ensure that testing of any particular hypotheses from the research would be valid. The associated communication below aimed to both clarify the operative action research paradigm and methodology, and seek extensions if readily achievable.

> Re research design I guess it would be fair to say that the model is largely exploratory rather than confirmatory at this stage, and the goals of an exercise like this are multifaceted.
>
> We do capture quite a lot of questionnaire data though (check out [URL]) So a more focused analysis could be conducted, if you can see a means of validating a particular hypothesis or have any extensions to the question set, I'm pretty open to that

Other aspects of the *researcher* role, addressed such dimensions as the design of the research, the tasks and assessment items, the composition of student groups from a research perspective, the evaluation strategy and instruments, researcher as data analyst archivist and data manager, researcher as member of a research and teaching team and joint author, as conference attendee, presenter or panelist, as seminar presenter and as ethicist.

In one thread relating to arranging an introductory video-conference session we see the *research assistant* role in evidence. I had hoped to have Brendan Dobbs (a research assistant from AUT's Technology Park, with whom we had worked previously)

support us in conducting the collaboration. However, for various reasons Brendan did not join the team. Given the pressures on the teaching team at AUT this factor contributed to the decision not to proceed with a joint videoconference session.

The role of *research subject* had a highly significant impact on the collaboration. In tandem with the roles of *IRB* and *IRB administrator*, this framing of students as research subjects created a "problematic dichotomy" (Clear, 2007b). These roles occasioned a succession of interchanges, of which those below between Fred and I, are typical:

> Our IRB is very strict about approving anything that isn't nailed down to the last comma including the wording of in each question. On the other hand activities that occur in a teaching setting without an expectation of publication are not considered within the domain requiring approval.
>
> Unfortunately, our university does not automatically recognize the IRB approval of any other university, though the approval and the application would be very helpful in generating a proposal here.

This conversation generated an outcome where, in the absence of IRB approval, Fred was restricted to operating in the *teacher* and not the *researcher* role for this collaboration, and the St Louis students in turn were able to operate in the *undergraduate student* but not the *research subject* role, unlike their peer collaborators. This generated further discussions concerning group formation and segregating students' data, such as this excerpt:

> re excluding data from non participants that should be fine so long as we keep track of their status so we know to not count their contributions into the analysis

A final set of roles have a research dimension, namely the *developer* and *programmer* roles where both the *researcher* and *teacher* roles are extended. In the two excerpts below, we see the *developer* role in action, where I was actively devising the application which was to provide a technology platform to support the teaching and research activities. Initial instructions issued for the trial had only addressed phase one as I had not completed developing the Lotus Notes collaborative database to meet the needs of phase two of the trial.

> I have yet to design and finalise the tailoring of the Notes database for this trial, but Diana and I will be meeting shortly to resolve this.
>
> We are planning for the second phase students to make use of the database prototype that Tony has created (we want to integrate it in Blackboard) as it provides some functionality that should give some structure to the task. We are planning to work on this next week and then write up the instructions for the second task.

As noted in the first paragraph above addressing the *researcher* role and the action research paradigm and methodology, the "questionnaire data" was posted to the Notes

databases, which created a secure and persistent repository for the research data. Thus in combination with the AUTonline platform the Notes prototype was designed to support both research and teaching dimensions of the course. However the developer role in research is not without its risks. As can be seen the research design and the software in this model are closely coupled and there is limited leeway on deadlines, as trial dates are fixed beforehand. As an illustration of this, we see the *SCIS resource coordinator* role interacting with the *developer*, *teacher* and *researcher* roles. The communication below from Gordon Grimsey (the school's IT resources coordinator and link to the central IT Service function) required me to justify my use of the base Lotus Notes™ platform on which the application was being developed. In response I referred to the needs of the course associated with this project, plus uses in additional courses not mentioned below.

> Hi Tony,
> I have been asked to renew the IBM Scholar's programme which provides our Lotus Notes & Rational Rose licences.
>
> I use Notes in support of the B. Bus Intelligent Business Systems course, to demonstrate aspects of collaborative computing using prototype Lotus Notes collaborative databases.

Had this justification not proven adequate and the University decided not to continue support for the platform, my research programme would have been in tatters. Luckily the Lotus Notes platform was in production use elsewhere in the university and remained a supported environment.

In another incident in my *developer* role I was working from home late one evening (when I had found a moment) trying to access the prototype database via the Notes Designer application, and found I was unable to reach the server, as my virtual private network (VPN) access had expired. This meant I was unable to work that evening and this caused a delay until I was able to log a job and be duly allocated a new password by A. Pseudonym the support person in the University's internet service group. In a pressure situation this is another example of the intersection of institutional policies (automatic password expiration) and technology features (use of a VPN for secure access to sensitive resources), with the *researcher* and *developer* roles and the critical dependency in this experimental *teacher* mode upon timely and supportive responses from central *support and maintenance team representatives*. Luckily the problem was quickly resolved next day, but had I been working to a much tighter deadline, I would have been frustrated in my efforts.

The *Developer* and *programmer* roles also played a significant part in this episode in

ensuring that *external participant* data could be loaded to the AUTonline system. Unfortunately we had assumed in our prior discussions with Flexible Learning Services that entering external student data was supported by the AUTonline platform, but this was not the case as noted in my yellow "post-it"™ note from a conversation with Aterea Brown a *systems support consultant* in the University's Technology Services Group (Art dated 16/9/2004). By this time the collaboration was running almost two weeks late, Art had developed a subsystem with a set of scripts to convert the external student data and import it into the AUTonline platform, and they were to be entered that day.

The resulting communication from Art to Diana and the first two lines of the attached uploaded file are given below:

> They are in :)
> Attached is a file with usernames and passwords.
>
> Adding ahlstrom,john,ext000050,QV9EO4Ux7...success
> Adding arrenfeldt,henrik,ext000051,oaq5HROXN...success

As can be seen the file is not presented in a very user friendly format, and before sending it on Diana in her *coordinator* role "massaged" it into a tidier table in her email and attachment, for Arnold's consumption in his role as *offshore technical coordinator*, and communication to his *undergraduate students* in his role as *teacher*.

Sweden

Surname	**Name**	**Username**	**Password**
ahlstrom	john	ext000050	QV9EO4Ux7
arrenfeldt	henrik	ext000051	oaq5HROXN

Table 6.15: Swedish Student Access Details for AUTonline

Thus an apparently straightforward exercise, here ends up involving two weeks delay and a multiplicity of cooperating roles.

The final set of significant roles is that of the *Support and Maintenance Team Representatives.* This grouping includes several associated roles such as *configurer, help desk staff, system support consultant, audiovisual unit – SLU, videoconference technicians, Supplier and ISP*. In the *configurer* role Mark Northover communicated to Diana the process for individual *external participants* to *configure* for themselves a diversion email address. The *Support and Maintenance Team Representative* roles are heavily involved in the process of registering students into the AUTonline system, with dialogue about lists, their formats, their availability, completeness etc. The *supplier* role is also implicated in the same discussion, with Fred noting that conditions of the vendor contract at St Louis prohibited *external participant* access to their software.

In the interchange about arranging an introductory videoconferencing session across sites, the support of St Louis and AUT *videoconference units and technicians* is enlisted, and after some concerns about compatibility and logistics we see an interchange from me about a desktop videoconferencing option, which raises more questions about local support arrangements:

> But that brings its own technical challenges, requiring each institution to download the software onto the local client and have external access to bypass their firewalls. This would need local technical support, and I'm not sure how each site is set up for that,
>
> Fred and Mats/Arnold any thoughts on the desktop VC option? That would give more freedom for each group to arrange their own conferences, but would the required configurability and technical support be available at each of your sites?

In response to a highly complex local videoconferencing experience for Diana and me in the AUT Postgraduate Collaborative Computing course, and again with the lack of a supporting *research assistant* I later made the following observations about *support* and *helpdesk* roles:

> the thought of us being a global helpdesk is just too scary to contemplate. We are struggling a little with workload in coordinating and running many concurrent threads and lack of local support at the moment.

The *ISP* role relates to an email breakdown, where one of Fred's messages had bounced at AUT and he asked Arnold as an *offshore technical coordinator* to relay it on his behalf. The problem cleared itself and the surmise was that the *ISP* had resolved the issue. So we see that the instance of breakdown causes further roles to be brought into effect and those hitherto invisible roles to be revealed.

6.4.4.3 Duality of structure - Establishment Episode Full

In this episode the interplay between action, structures and technology as intertwined elements is evident. Once again "formal scripts" (Panteli & Duncan, 2004) play an important role, as noted in the previous episode (cf. section 6.3.4.1 above). The 'participant information sheet' in that instance was an indicator of the AUTEC process as a "formal script", but in this episode not only the AUTEC research ethics approval process is visible, but also the St Louis IRB approval as a variant research ethics approval process at a further institution, as in turn is the absence of such a "formal script" at Uppsala (cf. the discussion relating to institutional cultures in 6.4.4.1.2 above). Again these approvals can be framed as "formally scripted interactions" (Panteli & Duncan, 2004) playing a role equivalent to that of a 'contract', as noted below:

> "…the contract is a key script for the virtual team performance; it is important because it

> clarifies roles, triggers interactions and most importantly enables the interactions to continue" (Panteli & Duncan, 2004, p.436)

The existing AUTEC approval did enable the research interactions to continue at AUT, whereas the St Louis lack of IRB approval prohibited the research interactions continuing for St Louis students, and likewise for Fred as the researcher at the St Louis site. By contrast the issue had not even been framed in the nature of a "formal script" for Arnold at Uppsala. Nonetheless the collaboration was impacted across all three sites, in requiring that membership for GVTs be redefined to separate research eligible from non research eligible students. Thus institutional 'structures' interacted with both actual and permitted 'actions' of the coordinators at each site, and necessitated some to-ing and fro-ing over the GVT design. Factors to consider were: the numbers and balance of membership (cf. table 6.9a above), where prior group formation for assessment tasks had constrained teams at the AUT site; the ability of members to withdraw and be removed from GVTs, weighed against the desire to maintain viable LTs at each site in order to sustain a functional overall GVT; and the ability to retain data usable for research purposes, while being able to separate that out from ineligible data. This set of intertwined structures and metastructures had also to be realised through a further set of structures provided by 'technology', namely AUTonline the *AIT* for this collaboration. Realising the GVT design (once it had been agreed), required the coordinators to 'act' to load their students into their designated GVTs within AUTonline. Diana's interactions with Arnold and Fred on the issue are given below:

> I 'm not sure if you have used Black board before. Tutors have access to the Control panel from where you can access CONTROL PANEL MANAGE GROUPS. From there you can add your students to each of the GTVs click on Modify and then Add users. (AP 08/09 - DK)

> As soon as I see that your students appear in the system, I'll do my best to add your students to the first 3 GVTs in groups of 3 as you suggested and will email you. Arnold is going to add his students himself. (DK 13/09)

Thus the duality of structure is illustrated in this sequence with structures, technology and actions all working to mutually shape an outcome. The processes of TUM were actively in evidence as Diana indicated the process of loading members into their GVTs using the Blackboard™ 'Manage Groups' functionality, after students had first been loaded into the system. She confirmed that she would also load the students for Fred, and that Arnold would load his own, and thus share the TUM activities.

The role of "formal scripts" is again evident in the messages from Fred below.

Arising, in the process of determining the technology platform for the collaboration, they demonstrate the barriers to global collaboration that may erected by institutional IT vendor contracts in a University setting.

> Similarly with bulletin boards, etc. our systems are all password protected and apparently for contractual reasons cannot be opened up to participation by folks who are not enrolled. Thus we need to either use this sort of thing on your end, find some 3rd party software, or go to a vendor site such as Yahoo.group. ((FN10/06)
>
> Unfortunately, our software requires a login and password and for reasons of contract with the vendors we are not allowed to provide this for anyone not already enrolled as student, faculty, or staff. I knew this, but had forgotten when I wrote to you yesterday. Sorry about the slip up. (FN 18/08)

In effect the vendor contract barring external student access to the institutional system here acts not in the manner of a formal script that "most importantly enables the interactions to continue" (Panteli & Duncan, 2004, p.436), but rather in reverse to prevent interactions continuing.

A contrast is provided by the Uppsala context where Arnold noted the use of Open Source Products such as "gnomemeeting" and Internet Relay Chat ("IRC"), advocating IRC in particular based upon their "Runestone" (Daniels et al., 1999) experiences.

> I also have access to about 16 webcams, and so teams can be given a webcam and use machines with USB and run netmeeting or gnomemeeting on those. (AP 07/07)
>
> Our students have generally found IRC chat rooms to be a better and more easily managed alternative. There are good clients for Windows, Linux and Mac, and there seems to be more features with IRC in terms of expressing emotions and logging the discussions of a group of participants with proper attributions etc. Seems in general to be a nice tool and one that we have used in all Runestone offerings since 2000. (AP 07/07)

Although some form of software licensing can be assumed for use of the Microsoft proprietary product "Netmeeting" by Uppsala students, the advocacy for Open Source products obviated the need for such restrictive commercial contracts. It could be argued nonetheless that while relatively permissive, and with an underlying "spirit" definitely compatible with educational use, Open Source Licensing arrangements such as the "GNU General Public License" (GPL) still constitute "formal scripts" (cf. Raymond 1998a, 1998b and Gallivan 2001 for a broader discussion of the philosophy of the Open Source movement).

Continuing the licensing theme, as previously observed when discussing the "SCIS resource coordinator" role (6.4.4.2 above), the Lotus Notes product licence term at AUT was due to expire. Gordon had communicated to me requesting details to warrant its renewal.

> Hi Tony,

> I have been asked to renew the IBM Scholar's programme which provides our Lotus Notes & Rational Rose licences.
> Can you email me one or two sentences which describes how you use Lotus Notes.
> (GG 01/09)

Given the criticality of the Lotus Notes collaborative database to the trial, the licence renewal process had potentially serious disruptive potential for the planned collaboration, coming as it did in the week before the scheduled trial start date. As noted on p.218 above, had "the University decided not to continue support for the platform, my research programme would have been in tatters". Moreover, this was not the first time I had dealt with such a situation. In the 1999 trial in similar circumstances I had made the following observations:

> "However a different form of technical glitch became apparent shortly before the trial was due to begin. The terms of the Lotus Notes licence had changed, and the institute now had to pay a per semester fee to register a group of students for a Computer Aided Learning course, or alternatively sign a site licence. The Institute's commitment to Notes did not stretch that far…The option I was forced to adopt was to forego security for the duration of the trial, and have users access the database as unregistered anonymous web users, who would have to identify themselves through entry of their names in fields on the forms" (Clear, 2000, pp. 147-148).

In seeking to clarify the terms of the IBM agreement with Gordon, (while writing this section of the analysis), he sent me the most recent email correspondence defining the terms of the "Agreement for IBM Academic Initiative (formerly called 'Agreement for IBM Scholars Offering')", under which:

> IBM grants you a nonexclusive, nontransferable license to use Programs and Educational Materials solely for instruction and learning, as well as noncommercial research at the Institution.
>
> IBM provides Eligible Products under this Agreement at no charge. (IBM, 2006)

The agreement reflects a definite IBM move towards an open source licensing model in the educational context and permits liberal use of the software for instruction, learning and noncommercial research. Yet definitions within the agreement prove interesting:

> **Institution:** an accredited higher education institution approved by IBM to participate in this offering. (ibid.)

Is the precise interpretation then of "license to use…at the institution" (when external student contributions are included in the collaborative database) open to question? Since the Lotus Notes server was resident at the AUT site, we have taken the view that the licence did cover this extended learning and research context.

The formally scripted interaction of a "vendor contract" evidences here the 'duality of structure' (Pozzebon & Pinsonneault, 2005) in operation, as it provides the link between the actions of the individual coordinators, the structures afforded by the

differing institutional contexts and the possibility of the students having technology support for the collaboration, (without which any technology-use mediation would be rather moot). As noted earlier (in section 6.3.4.1), formal commercial or employment contracts, have been observed by Panteli & Duncan (2004, p.426) as:

"one of the main characteristics of virtual organizing (DeSanctis and Monge, 1999)".

In this instance the presence of the St Louis vendor contract actually inhibited technology support for virtual organizing, whereas in the Uppsala context a set of open source solutions operated on a distributed basis by individual students (rather than the institution) obviated the need for a contract as an organizing device. In the AUT context, while the Lotus Notes contract may have had potential to hinder the collaboration, the vendor contract for the Blackboard™ system was not even referred to as an inhibiting force for registering students who were, formally at least, external to AUT as an institution and the AUT course. However the absence of Blackboard™ functionality to support the loading of students external to the university proved problematic and caused a two week delay in establishing the trial. The discussion in section 6.4.4.2 above (relating to the developer and programmer roles invoked to develop the required functionality) has highlighted this deficiency, in addressing a need not envisaged by the original 'formal script' and establishment process by which AUTONline had been configured. The further discussions relating to student *online registration* including arrangements for *external participants* (e.g. sections 6.4.4.1.2, 6.4.4.2 above) highlighted the need for ongoing negotiation between the collaborating sites and their technical support groups over the selection of not only the most appropriate technology platform on which to host the collaboration, but also the platform that was permitted by the contractual arrangements in place at each institution. Thus AUT became the host site, with AUTonline as the technology platform for the three way collaboration, combined with the Lotus Notes collaborative database.

This investigation into the role of 'formal scripts' and 'commercial contracts', when considering the technology related dimensions of *online registration* of *external participants,* served to raise some wider issues about the nature of the relationship between students and their university.

- Firstly, what 'formally scripted' relationship did students have with their own institutions?
- Consequently, what 'formally scripted' relationship did students have with a

collaborating external institution?

- The same questions could equally be framed for the academics involved in the collaboration.

In her discussion concerning the nature of the legal relationship between students and tertiary institutes Varnham (2001) speaks primarily of the New Zealand context, but draws some legal parallels from United Kingdom (UK), Australian and U.S. jurisdictions. She draws the following conclusions:

> "Though there has been considerable debate over the years relating to the relationship between universities and students, it now seems beyond dispute that the relationship is to a large extent contractual…This view was accepted by Ellis J in the Victoria university case when he said
>
> > 'I think it is beyond argument that the relationship between a student (who is a member of the university: s163) and the University is partly based on contract and partly on the education act itself'" Varnham (2001, p. 312).

Varnham notes the potential coverage of education in New Zealand by the Fair Trading Act 1986, and the Consumer Guarantees Act 1993, although commenting that the coverage of education under the Fair Trading Act may have been to some extent unintended, since "in the education climate of the time, before the 1989 education reforms, the impact of consumerism would not yet have been felt'. A reflection upon the act's import in the more recent state of New Zealand education observes:

> > In any case given the increasing attention being given to full fee paying international students, can a serious argument be mounted that universities do not engage in trade and commerce?
>
> Educational services would seem to fit clearly within the definition of 'services' in the act (Varnham, 2001, p.308).

Likewise with the Consumer Guarantees Act, education is deemed to be a form of trade in services:

> "'consumer' is defined in S2 as a person who acquires from a supplier goods or services of a kind that are normally acquired for personal household or domestic use. The services must have been provided by a person who is in 'trade'. As with the fair trading act the definition of trade is sufficiently wide to encompass providers of higher education" (ibid., p. 313)

An interesting contrast is provided from the U.S. context, where Varnham further notes:

> "It is surprising that in the United States, where litigation has been termed a national sport, most allegations which relate to the quality of courses have been labeled 'educational malpractice' actions and the courts have declined liability on policy grounds" (ibid., p. 304)

I have canvassed similar themes previously, arguing the operation of two competing discourses, the "discourse of enterprise" and the "discourse of community" (Clear,

2002a).

> "In the discourse of enterprise humans are defined in a wholly economic frame, with individual lives as an enterprise of the self, like individual businesses engaged in developing their own human capital. The language of the market takes over, and civic culture becomes consumer culture. The citizen is reconceptualized as the sovereign consumer/customer. This discourse, for some time popular with western governments, has now permeated into the areas of social service provision. Patients, parents, passengers and pupils are re-imaged as customers. The power of this discourse is that it links the political, the technological and the ethical by aligning "the politico-ethical objectives of neo-liberal government…, the economic objectives of contemporary business and the self actualizing, self regulating capacities of human subjects" (Du Gay and Salaman, 1992).

Globalisation is part of this same discourse with the enterprise vision of capturing bigger markets, and the use of technology as a vehicle to deliver services on a global scale." (Clear, 2002a, p. 18)

The contrast between the US and the New Zealand legislative approaches to education here is illuminating. One speculative explanation might be the differing political developments in post Thatcherite neo-liberal economies (UK, Australia, New Zealand), which have all moved from a prior welfare state position. Perhaps deregulation of education and the social economy in such newly ideologically driven economies, is inherently less conscious of the dangers of leakage of market values into the social sphere. A more established and blatantly market aware society such the US may perhaps over time have built stronger checks and balances against excess. It will be interesting to see whether globalisation moves such as the World Trade Agreement prescribing rules for free trade in educational services (Bridgeman, Tiffin and Mosen, 1999) will bring significant changes to the US as well.

So returning then, to the questions concerning these students' relationship to their university, it appears that some 'formal script' of a quasi contractual nature does exist. Presumably this resides in the enrolment process through which students are formally registered to a course of study with their host institution, and for which fees may be due depending upon country of study. For each course or paper, the supporting elements would include the course syllabus, which outlines the contents of the course. Varnham for instance notes that institutions are potentially liable for misrepresentations relating to a course, in which the provision of "inaccurate or misleading information may be alleged" (Varnham, 2001, p.305). Hence in this case we see the academics at each institution working to maintain faith with their own students over the advised course content at each site (e.g. Fred via the GIM course *syllabus*, and AUT via the equivalent 'module handbook') while simultaneously striving to align a joint and global *learning task*. The problematic nature of *online registration* then perhaps

becomes more clear for those students external to the institution, as they appeared to have no 'formally scripted' relationship with the institution hosting the *AIT* involved.
On closer investigation however, this was not entirely the case. The individual academics at each site had built a mutually agreed, semi-formal collaborative relationship, into which the students had been drawn. Yet the extent to which each coordinator's institution had been drawn into this relationship appears to have differed. At AUT the module handbook made clear reference to the collaborative trial, as indicated by the defined *topic* groupings, the *learning* and *assessment tasks*, and the course *calendar*, excerpted below:

Weeks	**Topics**	**Content**	**Assessment**	**Outcome**
7-13	Collaboration, Communication and Enterprise Support Systems	Computer Supported Collaborative Work, Enterprise Support Systems, Internet based systems	Assignment 2 Collaborative exercise	1,2,3,4

Table 6.16: Intelligent Business Systems Collaborative Topic Grouping

Week	Week begin	Topics	Readings (Turban)	Assessments
7	30 Aug	Group Decision Support Systems Collaborative trial	Ch 7, 18	**Assignment 1 is due at 4pm on Tuesday, 31st of August** H/O Assignment 2: Groupware (part 1).
8	6 Sep	Group Decision Support Systems Collaborative trial	Ch 7, 18	
9	13 Sep	Seminar 1: Data Warehousing Collaborative trial	Ch 4, 18	**Assignment 2 Part 2: Handouts and presentation slides are due**
		Mid-Semester Break 20 Sep - 1 Oct		**on the day of the scheduled**
10	4 Oct	Seminar 2: Data Mining and OLAP Collaborative trial	Ch 4, 8, 18	**seminar.**
11	11 Oct	Seminar 3: Expert Systems Collaborative trial	Ch10-14, 18	**Research report is due on Tuesday in the week following the presentation.**
12	18 Oct	Seminar 4: Neural Networks	Ch 15,16,18	
13	26 Oct Tue	Seminar 5: Intelligent Agents Best Seminar Session Vote	Ch 17, 18	**Assignment 2 Part 1: Groupware Report is due at 5pm on Friday, 29th of October.**

Table 6.17: Course Calendar Excerpt Intelligent Business Systems

At St Louis the syllabus likewise made specific mention of the collaboration, as noted through the *learning* and *assessment tasks*, and the course *calendar*, excerpts below:

"Behavioral Objectives

At the end of this course each student will have:

5. Developed a proficiency at using groupware technology for pursuit of mutual goals with colleagues in another country

6. Experienced working in partnership with fellow students from another cultural setting for the completion of a joint task".

"Team Project

Students in teams will be asked to use groupware tools to communicate with students at a University in another country to complete a task (e.g. contrasting IT infrastructure, use, policy, etc. between countries). Deliverables will include the project results as well as addenda to include: discussion of the mechanics of using the technology for international teamwork and discussion of team, group processes.

Details regarding the project will be distributed separately".

The situation at Uppsala was less clear, but constraints were not obvious and the course layout/schedule and learning tasks were also being developed simultaneously to suit local needs.

> We need more input from Mats on the timing that he thinks will suit the hospital and the course layout/schedule for this year. (AP 17/08)

Thus at the course level, specific advice had been given to students across sites in which the international collaboration was a clear element of the course. At AUT the ethics committee approval (cf. table 6.9b above), was a further 'formal script' indicating institutional sanction for the course and the associated research, whereas by contrast at St Louis, while the research lacked formal sanction, the GIM course had gained explicit approval.

> It took a great deal of energy to go through all the official channels to get approval for the Global Information Management Course, however, everything now looks like a "go" for the Fall semester. (FN 10/06)

Again at AUT, students and academic staff (both internal and external) were able to be *registered online* to the AUTonline system, representing a further degree of formal institutional support via the Flexible Learning Services and Technology Services units. The process of *GVT Formation* as previously discussed in 6.4.4.1.5, had to be adapted to the ethics stipulations at both AUT and St Louis sites, and be flexible enough to accommodate students who later chose to drop out from the course, or opt out of the exercise. This in turn required me to modify the Lotus Notes drop down list of GVTs and LTs, and Diana to adapt the AUTOnline discussion forums accordingly.

Thus we see the evident contrast between the culture of individual academics as 'intrapreneurs', and the culture of their host institutions. We see academics operating as almost "autonomous business units", within their corporate institutions, which in turn were the guardians of the 'formal scripts' represented by new course approvals, student enrolments, online registration, ethics approval processes and vendor contracts. The relationship between the collaborating parties here, while extra-institutional is not supported at the institutional level by a set of inter-institutional 'formal scripts', and thus does not neatly fit the corporate university model. It illustrates the tensions between the university as an espoused locus of innovation in the research sphere, and as an experienced context for constraint as an educational service provider within a consumer society.

This exploration of the notion of 'formal scripts' as applicable to the establishment phase of the collaboration, demonstrates how the "duality of structure" again operates,

to recursively shape the use of technology, institutions and individual actions. Each of the above 'formal scripts can be regarded as a 'metastructure' mediating technology use, and through which technology use is constrained, shaped and realised by TUM actions on the part of the actors in this phase of the "virtual play" (Panteli & Duncan, 2004).

6.4.4.4 Time and Space – Establishment Episode Full

The episode has several coded items related to the concepts of time and space.

Concepts	Codes	Count	Subtotals
Space	Location	62	
Space	face to face	8	
Space	Uppsala	1	
Space	US	1	
Space	Sweden	2	
Space	absence	10	84
Time Pressure	busyness	1	
Time	daylight-saving	1	
Time	Runestone	2	
Time	schedule	3	
Time	experience	4	
Time	stages of scripting the project	10	
Time	time zone	7	
Time	holiday	10	
Time	Synchronize	74	
Time	Time	14	
Time	class schedule	19	
Time	delay	21	
Time	time separation	25	191

Table 6.18: Establishment Episode Full – Coded 'Space & Time'

As indicated by the frequency of coded occurrences, *Time* is a critical element in the collaboration as is the concept of *space*. *Space* appears in three primary guises: the notion of *Location*, with *Uppsala, US* and *Sweden* as more specific codes; the notion of *face-to-face*; and also *location* as negatively framed through the notion of *absence*. The pervasive references to *location* in this episode are evidenced in a very wide range of contexts. In some cases the term is merely indicative of the three *locations* which are parties to the collaboration, and result in groupings around topics highlighted in the

preceding analysis of appropriation moves and grounded data. *Locational* dimensions are implicit in such topics as *GVT formation, online registration, learning task, organization unit. AIT* is a further such topic where contact details such as email addresses and phone numbers are site specific – even to the extent of a distinction between home and office email addresses being significant, with Fred noting in relation to his potential *absence* from the university:

> Please note that I've included my home email address in the cc: section. During our summer I only come to the office 2 - 3 times a week, but don't want to be slow responding to your communications. (FN10/06)

The impact of *location* on *AIT* is also apparent within this group of codes. The discussions relating to arranging a joint videoconferencing session, address not only the notion of a videoconference as a virtual *location* and a substitute for a *face to face* meeting as proposed by Fred, but also as a site bound to a physical *location,* (and tenuously at that) as noted by Arnold:

> My reading of the virtual team literature suggests a facetoface meeting at the start of a virtual team increases its probability of successful outcomes significantly. Since we can't do facetoface, we might do a teleconference. (FN 02/07)

> Uppsala has a room set up with camera, and netmeeting software for group videoconference purposes. I am not 100% sure of the current state of that room, it was going to be relocated (AP07/04)

Diana further observed that an *AIT* suitable for group level interaction rather than for the full cohort, and thus offering greater flexibility in terms of *location*, brings its own *location* based restrictions:

> We think that there might be problems with using Net meeting from the campus because of all the security firewalls etc. (DK 07/07)

Diana again relating *AIT* to *location*, [as an alternative to Fred's thwarted proposal to host the collaboration on their system at St Louis (cf. pp.219 & 222 above)], referred to the site at which the work would now be hosted:

> The collaborative group work will be supported by AUTonline which is the name of Blackboard adopted by AUT, Auckland. (DK 24/08)

A more complex *AIT* related interchange between myself and Fred indicates the impact of both student *location* (multiple rather than single as for residential students) and *time* (unsociable and outside the standard *class schedule*) on the feasibility of engaging the AUT students in the videoconference session:

> 2) re video conferencing options, we think we would have real trouble getting our students to attend a session that was at an unsociable hour and not in their normal class time. We are not a residential University and many of our students combine study with part or full time work. (FN18/08 –TC)

> I certainly understand this concern. We do have a largely residential student population and I think we could get folks at 7 or 8 p.m., but doubt if we could at 6 or 7 a.m., so perhaps we should let this drop. (FN 18/08)

The *face to face* theme likewise shows a strong relationship with both *location* and *time*. Three distinct communications under this category relate to separate conferences, and attempts to arrange a face to face meeting. In the first interchange Fred and Felix had arranged to meet up at the "ICIS" conference, in the second I had been unable to meet with Fred at "AMCIS", but in the third Fred and I had arranged to meet to mutual advantage after the collaboration in St Louis:

> I hope all is going well and am looking forward to seeing you at ICIS in Seattle. (Tc 15/06 - FN 29/06/2003)

> I don't suppose you'll be at the AMCIS conference in New York in August. I'm on a panel there regarding Global Infomraiton Management courses. (FN 23/06)

> Unfortunately I won't be at AMCIS, and it is always good to meet face to face to talk thorough the details of such a collaboration, but I guess we'll have to work virtually!! I suppose that in itself is part of the fun and in terms of the whole issue of global virtual teams, part of what in the end we are enquiring into. (TC 23/06)

> On that note, I see that the SIGCSE Technical Symposium will be in St Louis next year on 23 27 February, and I hope to be there. Mats usually comes too, and maybe Arnold? So we could have a face to face event to follow up the cyber experience maybe?? (DK 29/07 - TC)

> I seem to recall that you are planning to come to a conference in St. Louis in February or March of 2005. I will very much look forward to seeing you. I wasn't planning to attend the conference, but if you can make a little free time. Since you are coming so far, I can look into the idea of some kind of research presentation on campus we don't have a budget for this sort of thing, but we can get 5-10 folks that would be interested in hearing about your research. (FN 24/08)

This series of interchanges goes some way to help in defining the nature of the GVT of coordinators in this collaboration, and to create a strong contrast between the educator/researcher GVT and the student GVTs. The series of continuing relationships inherent in this set of messages at least partly fulfils the conditions for what Poole (1981), from prior literature, has termed a "full fledged" group necessary "for realistic group studies", namely that:

> "(1) the decisions were important to members;
> (2) members had same prior experience with each other and a commitment to future work;
> (3) the task was not a simple open and shut case;
> (4) there was time pressure on the group" (p.19).

In this case the coordinator's GVT met all these requirements apart from (2) where they had had varying prior experiences with one another (for instance Mats and I had been collaborating since 1998, Fred and Felix had an established joint relationship, Fred and I had not met, although we had a commitment to future work, etc.). In

contrast, for the student GVTs these conditions were arguably not satisfied for (1) and certainly not for (2). This would no doubt have affected the functioning of the student GVTs. For instance as Massey et al., (2003) have observed:

> "Our focus was on time limited virtual project teams engaged in a decision-making task…we observed that these GVPTs tended to focus on the production function, with limited attention to member well being, or member support functions" (p. 152).

The implications of this differential classification of GVTs will be further developed later in the thesis in section 8.7.1.

To continue with the *absence* theme again a strong link with *time* is apparent (with holiday as one cause for absence), as is the relationship with *location*. One sequence of communications covers interactions with Flexible Learning Services, during which Diana (20/08) emailed a member of the team to discuss setting up the collaboration, referring to a positive conversation with Mark the unit manager some two months earlier. Diana commented on a lack of response from Mark to a recent email, and questioned whether Mark was away. Mark duly responded three days later (23/08) noting that he would be away for a six week period and nominating a member of the team with whom to communicate. As our champion for the collaboration, which demanded additional effort on his unit's behalf, Mark's support was critical to success of the venture. As Diana replied, with apparent relief:

> Thanks for your email, I was worried what would happen with our little project if you were away on holiday in Fiji or another nice and warm place :) (DK 23/08)

Thus we see time and space dimensions at play through the juxtaposition of an apparent *absence* causing a *delay* to *stages of scripting the project*, an impending *holiday* and an 'assumed exotic' *location*. I had experienced a similar situation recently in another research project involving dispersed collaboration, where prior to a scheduled Skype™ session that evening, we had been unable to access the software libraries supposedly transferred from the offshore location to a 'Concurrent Versions System' (CVS) server at AUT. Both our developer and the server administrator were *absent* on *holiday* so we had resorted to phone calls to their home (a *location* at which neither of them were present) to help resolve the issue. So it appears from these situations that dispersed collaborations may frequently present brief 'windows of possibility' then long lacunae causing *delay* if missed. More generally Herbsleb et al., (2000, p.321) have noted "*delay* in the resolution of work issues" as the most frequent consequence of cross–site coordination problems. Their study of globally distributed software development recorded a statistically significant difference in "cross site

delays" above "local delays", with "delays crossing sites taking almost a day and a half longer than single site cases", which led them to argue that "cross site work carries a heavy penalty by slowing work down" (p. 324).

Continuing the *absence* theme, again *time* is implicated with the desire to obviate *delay* apparent in the first two of these communications between trial coordinators, and *holiday* again apparent as a cause for absence:

> Kitty is away for a week but if you want you and I can catch up about the trial and when she comes back will discuss it with her too. (DK 23/06)
>
> As tony is leaving on Monday, may be we should meet in the afternnon (say 3pm) tomorrow. (DK 01/07)
>
> I have just come back form a conference as have some of you, and I know one or two of you are taking a break at the moment. (TC 14/07)

Notably these communications all came at the end of the AUT first semester, and within the three week inter-semester break period from 28th June to 19th July, a period when some academic staff had arranged to take a *holiday* break, or (since it is not officially a *holiday* period) to attend conferences for *face to face* meetings with colleagues. Both these reasons for *absence* are common across hemispheric *locations*, with the northern summer *holiday* season coinciding with this break, and some conferences such as the European ITiCSE conference also scheduled at this *time* of year.

A final set of communications from Fred concludes the topic of *absence*, already noted in his previous message in this section regarding the *holiday* period above:

> I'm in a conference for a couple of days but can send more detail by the end of the week. (FN 15/06)
>
> Just a few thoughts before I head out of town for a couple of weeks. (FN 09/07)
>
> Congratulations on finishing the semester! Always a great accomplishment. As mentioned above, I will be gone for about 2 weeks, then be working to get this project rolling. (FN 09/07)

The same coupling of *location* and *time* are visible in these messages, as is the peripatetic nature of academic life, with regular comings and goings from the home university within the aligned patterns of academic semesters and seasons. Fred's sensitivity to the North and Southern hemisphere differences is apparent in these communications where he seeks to either obviate or explain delays, and keep himself actively in the virtual frame. Cramton (2001) has noted the frequent "relative differences in speed of access to information" in a dispersed collaboration setting, and we see here action consistent with her recommendations: namely the need to

communicate the "availability of members (including identification of holidays) and constraints on availability such as competing responsibilities" (p.368). This behaviour is also consistent with actions recommended by Jarvenpaa & Leidner (1998) to facilitate trust later in a group's life, namely "predictable communication" and "substantial and timely responses".

The complex and multifaceted nature of *time* presents itself in numerous communications within the group of *time* related codes identified here. Arrow, Poole et al., (2004, p. 76) refer to a classification "that identifies five types of time: clock time, cyclical time (such as the succession of seasons), event time (subdivided into predictable and unpredictable), and life cycle time that refers to development progression within a finite lifecycle span. Two examples of predictable events that structure time are paydays and holidays". Orlikowski & Yates (2002) & Saunders, VanSlyke & Vogel (2004) also make the distinction between clock and event time, with the latter classing clock "time as a scarce commodity" (p.21), as opposed to event time being "cyclical, continuous (holistic), and epochal" (ibid.). Arrow, Poole et al., (2004) further note, that: "time is a fundamental (and often problematic) issue for theory and research" (p.79).

Yet addressing *time* independently of *space* (at least in this form of cross-site context) is analytically difficult. For instance Orlikowski & Yates (2002) have observed that for Giddens "one of the dominant characteristics of modernity is the separation of time from space made possible by the standardization of time across the world" (p.690), with "human efforts to standardize temporal frameworks inscribed in official time zones" (ibid.). From the preceding table 6.18 above, *Synchronize* (with a count of 74) stands out as the dominant *time* related code, yet inherently involves a cross site or *spatial* dimension.

Mapping the *time* related codes from table 6.18 against the 'five types' of Arrow, Poole et al., (2004) gives the following results.

Time Type	Concepts	Codes
Clock	Time	time zone
Clock	Time	Time
Clock	Time	delay
Clock	Time	time separation
Clock	Time Pressure	busyness
Clock, cyclical, event (predictable), event (unpredictable), lifecycle	Time	Synchronize
Clock, cyclical, event (predictable)	Time	daylight-saving
Clock, lifecycle	Time	schedule
Clock, lifecycle	Time	class schedule
Event (predictable), cyclical	Time	holiday
Lifecycle	Time	Runestone
Lifecycle	Time	experience
Lifecycle	Time	stages of scripting the project

Table 6.19: Establishment Episode Full – Codes and Time Classifications

Echoing the significance of *synchronize* related activities, from the literature, McGrath, Arrow & Berdahl (2000, p.100) have observed that: "executing the tasks that make up group projects often requires precise synchronization of the timing of different actions by the same member and of actions of different members…entrainment refers to the synchronization, in phase and periodicity, of multiple cyclical processes or behaviours". Consistent with this view, we see the processes of 'entrainment' within the GVT of coordinators represented here by the interactions coded as *synchronize*, wherein trial coordinators work to synchronize their activities distributed across *space* and *time*. Orlikowski & Yates (2002) augment the notion of 'entrainment' within their classification of event *time*, by defining types of events "designated by calendars e.g. birthdays, entrained to reified chronological rhythms" (p. 690). As the excerpts below indicate, Northern & Southern hemisphere semester patterns differ, but, in order to collaborate, a common window must be found, and the course schedules and assessment components need to be *synchronized*:

> BTW we still await confirmation of the collaborative window timings for Uppsala students. When does your course start?? (AP 17/08)

> With regards to timing and numbers it could well be only about 45 people in the course this year. We need more input from Mats on the timing that he thinks will suit the hospital and the course layout/schedule for this year. (AP 17/08)

In this brief interchange we see the intersection of several types of *time*. 'Predictable event' *time* designated by the separate course "calendars" or *schedules*, and as determined both by the related *schedule* for the overall collaboration and the embedded Uppsala project with the academic hospital; implicit 'clock' *time* with specific dates and course session (*class schedule*) times to be determined; 'cyclical' *time* with the succession of each academic year and each annual collaboration. 'Lifecycle' *time* is implicit in this interchange too, occurring as it does in the 'establishment phase', in itself a *stage of scripting the project*.

Attempts to *synchronize* activities also reflect failures and *delay*, such as the excerpt below, arising from earlier *delay* and difficulties in loading students into the AUTonline system:

> People here are getting a trifle frustrated with that, especially since the trial phase 1 is supposed to be concluded on the weekend. (AP 17/09)

In the above excerpt we see 'clock' *time evident* in the *delay*, with student frustration over the waste of their time 'as a resource' and the weekend as a deadline, causing *time pressure*. A further evident form of *time* is 'predictable event' *time* in the 'weekend' bounded *schedule* for 'trial phase 1', with the *delay* arguably shifting the schedule to 'unpredictable event' *time*, as also exemplified previously in this message from Diana:

> Lets hope that we 'll be able to start work on Tuesday. (DK 03/09)

The interchanges below evidence the five types of time of Arrow et al., (2004): 'cyclical'; 'clock'; 'predictable event'; 'unpredictable event'; and 'lifecycle' *time*. The southern hemisphere semester cycle and the northern hemisphere *holiday* season, represent both recurrent therefore 'cyclical', and 'predictable event' *time* (by their scheduled nature) in the first communication, with the *busy* semester finish and start periods indicative of *time pressure* and 'clock' *time* for Southern hemisphere academics, while Northern hemisphere academics by contrast were on *holiday* coinciding with their 'cyclical' summer season.

> We just finished the first semester, all our marking is over now and now we are on to the second semester. It starts in two weeks time and we are busy now preparing the courses. I hope you are having a good holiday but haven(t forgotten about our collaborative exercise :) (DK05/07)

> Please note that students form New Zealand have a two week break between the 20th of September and the 3rd of October. Members of GTVs are encouraged to carry on with the process icebreaking process using any of the above communication channels. (DK 24/08)

> Users will get to learn to meet deadlines, which is especially important when working internationally, taking in account of different time zones. (DK30/08)

'Predictable event' *time* and concrete 'clock' *time* are evident in the *schedule* for the semester and the courses, the two weeks until start *time*, the 'icebreaking phase' of the collaboration, the *holiday* break for New Zealand students (notably again offset from the Northern hemisphere academic *schedule*), and an exhortation to continue during the break to *synchronize* efforts within the student GVTs. The 'icebreaking phase' warrants classification against 'lifecycle' *time* too, reflecting its developmental role in the progression of the collaboration cycle. The third message recounts previous student feedback, which reflected upon the value of learning to *synchronize* work through 'predictable event' *time* regulated by 'deadlines' (designated as 'clock' *time* which itself is differentiated by *time zones).*

From the above discussion we see evidence of the temporal oppositions noted by Orlikowski & Yates (2002), specifically the opposition "between *universal* (global, standardized, acontextual) and *particular* (local, situated, context-specific) time" (p.100). Discussing the manner in which "calendars, have shifted from being particularistic and local (often associated with religious communities) to being universal and global (associated with the spread of trade, industrialization and capitalism)" (ibid.), raises interesting questions for this collaboration. Is a *Global Virtual Team* then, inherently a product of the trend towards universal time, wherein time is the scarce resource of 'clock' time (based on what might be termed a temponomic world view [McGrath & Kelly, 1986 p.61), or in the educational context are the local and particular forces and the roots of tertiary education in religious communities, the seasons of the year and 'cyclical' time too strong?

Certainly the marrying of the Northern and Southern hemisphere seasons and academic calendars, with their uneven workload peaks, differing breaks and holidays and even differing cultural approaches to holidays, creates challenges for North South collaboration, while the three site and disparate *time zone* collaboration adds a further challenge in finding a window of 'clock' *time* that is not highly antisocial for at least one party.

As a result we have not attempted to conduct a collaboration more than once a year, as the first semester in New Zealand Universities typically begins in March, after the second semester has ended in late November. Summer school is an option, but only a very brief window is available. Then too the New Zealand cultural attitude towards holidays has traditionally meant that from late December to January (summer time), practically the whole country has 'gone to the beach'. The depth of this appreciation of

an idyllic summer at the beach can be read in the iconic Katherine Mansfield short story "At the Bay" written in the 1920's (Mansfield, 1987). 'Cyclical' time in this instance wins over global and 'clock' time for GVTs.

In the group of further communications coded as *synchronize*, interchanges revolve broadly around linking people and activities across sites either in time or in sequence of events. Key topics echo those addressed earlier in the episode and include synchronization activities around: the *schedule* for the collaboration; Online registration of students; GVT formation; the learning task; the assessment task; scheduling planning meetings; sharing status of classroom activities at each site; resolving *delays*; design and configuration of the supporting technology platform; jointly developing instructions; IRB processes; arranging technology supported synchronous events; arranging face to face events. Both conversations and artefacts (e.g. course syllabus, module handbook, course assessments, draft instructions) are actively in use as coordinating mechanisms to synchronize activities between actors across sites, at specific times and in sequences over time.

One approach to analysing such a diverse set of time related topics is suggested by the notion of "time geography" an approach used "to analyze human actions across time-space" (Nandhakumar, 2002, p.252) which draws on prior work by social geographers, and Giddens (1984), who "argued that individuals carry out the recurrent activities of their daily lives in particular spatial contexts and through this repetition sustain the structure of social life" (Nandhakumar, 2002, p.252). The inseparability of time and space and the notion of a "time-space ecology" leads from this perspective. Time geography analysis highlights the saliency of "constraints over human activities deriving from the physical properties of bodies and their social context" (Nandhakumar, 2002, p.252). Three primary constraints are considered significant, and these will now be briefly addressed to the time related topics coded as *synchronize* above. The first type of constraint concerns "capability" where limits are set by the physical constitution of individuals (such as the indivisibility of the body, meaning people cannot be in two places at one time). The notion of a GVT confronts this paradox, with the aim of having a third 'virtual space' in which people can interact at the same time. The planned videoconference session to introduce the St Louis, Uppsala and New Zealand students to one another was an attempt to achieve this 'super corporeal' state on a global basis. Synchronizing such an event was however complex, as discussed previously (cf. table 6.13 above). In a less dramatic example at one point

a *delay* was occasioned by a physical absence necessitating a synchronizing communication:

> I was unfortunately at a course all yesterday, so I will do this today. (AP01/09)

The second type of constraint concerns "coupling" where limits are "set by the ability of people (and resources) to come together in particular places to interact with one another" (Nandhakumar, 2002, p.252). Again the videoconferencing issue stands out. The inability of students from each site to come together as a combined cohort across *time zones* and locations (note the extreme differences in the first message below, exacerbated by *daylight saving time* – a clear example of 'clock' time), led to attempts to split the cohort into two or three groupings, then into GVT groupings with self organized desktop videoconferencing. The messages below depict attempts to *synchronize* this activity given the *time separation* across sites:

> 1) re teleconferencing We checked out time zone differences plus 12 hours and ve 17 hours and a daylight saving change in the middle, so I think 2 sessions will be the best option (DK 29/07)
>
> 2) re video conferencing options, we think we would have real trouble getting our students to attend a session that was at an unsociable hour and not in their normal class time. We are not a residential University and many of our students combine study with part or full time work. (FN 18/08)
>
> I certainly understand this concern. We do have a largely residential student population and I think we could get folks at 7 or 8 p.m., but doubt if we could at 6 or 7 a.m., so perhaps we should let this drop. (FN 18/08)
>
> In case I haven't said clearly, my classes are Tuesday Thursday 2:15 to 3:30 p.m. US Central time. (FN 14/09)
>
> I will check later this week re. viability of desktop video conferencing which will enable each group to set their own session times, and get back to you with details. (DK 29/07)

A similar interaction where 'coupling' constraints were in evidence is given in the two following messages, where we were attempting to confirm a joint plan of action and synchronize a telephone conference:

> Diana and I had a talk today and came up with a tentative plan for you and Fred to consider before we arrange a telephone call to settle on our agreed approach. (TC18/08)
>
> I think we may need a phone call to sort some of this out, so that we can agree a clear direction and manage our risks. Could you let me know your phone number there and we will try to synchronise for a suitable time. (FN18/08)

The third type of constraint concerns "authority" where limits are "set by social power relationships, such as the permission to perform certain activities" (Nandhakumar, 2002, p.252). Authority constraints are strongly in evidence in several of the topics around which synchronization activities have occurred. In the online registration of

students for instance, the authorities for external students to access the institutional software platform varied across sites, with AUT accepting external students albeit with a complex process to bring that to fruition, and St Louis barring students due to vendor agreements. In the GVT formation process we see instructors having permissions to add members to groups, once the students had been pre-loaded to AUTonline by AUT support staff. The learning task had differing requirements for each site, and differing decision makers for the curriculum. The assessment task again varied across sites, with AUT students having an alternative option as dictated by AUTEC. The design and configuration of the technology platform had open and closed dimensions, with the Notes collaborative database under control of the AUT academic team (primarily the author) and the AUTonline environment under control of Flexible Learning Services and Technology services, with local configurability under the control of the coordinators who had all been given instructor access rights, and needed to request such additional rights as 'dummy student accounts'. The IRB and ethics approval processes required institutional level approval for St Louis and AUT participants, but not for Uppsala. Arranging technology supported synchronous events, involved institutional service units or access authority which could get through university firewalls, whereas telephone calls had a lower authority threshold. Arranging face to face events, such as joint attendance at conferences demanded local institutional support in release and funding to attend the event. These forces all shaped the process of the collaboration, and directly impinged upon jointly developing instructions for the trial.

Thus a time-geography perspective usefully demonstrates the functioning of time and space in shaping the use of technology and associated structures in this collaboration. In a similar vein Orlikowski & Yates (2002), argue for a practice based perspective "to show how the recurrent practices of social actors shape temporal structures that are experienced as 'time in daily life, and how these practices in turn are shaped by previously established temporal structures that influence expectations of time in organizations" (p.695). Therefore "By examining a community's repertoire of temporal structures we can understand the variety of ways in which community members actions (re) produce the different temporal structures they constitute through their ongoing practices (p.695.)". The above analysis illustrates the diversity of temporal structures active in this collaboration and the ways in which these have shaped, constrained or constituted the ongoing practices of the actors.

'Lifecycle' *time* is evident in the grouping coded as 'stages of scripting the project', where the development and progression of the project is apparent. The message below for instance indicates a set trajectory for the project, with elements fixed now that it has been initiated.

> I must say though that as we here have already handed out the assignment and explained the requirements to our students, it's unlikely that we would add more elements to it at a later stage. (DK 09/09)

By contrast prior stages of the project, while agreed had been less firmly designated:

> I very much like the split of the project into two parts the first beingthe icebreaking and the second the decision making task. (DK 27/08)
>
> We believe that the instructions for the second phase are best to be compiled once the icebreaking phase is underway. (DK 25/08)
>
> Based on the discussion Tony and Mats had a few months ago, we are suggesting that the icebreaking part of the exercise (2 weeks) should include a discussion within each virtual team in which they decide how they want to work (either selecting a leader or function as a group of equals. We believe that such a discussion should have a free format and would help students get to know each other. The video conferencing session would also contribute to the icebreaking. (FN 09/07 - AP)
>
> The second phase will be carried out in an online database that is going to be integrated (i.e. its URL made available) in AUTonline. We haven't finished the update of the database for this semester yet, but it will be available in a couple of weeks as planned for the second phase. (DK 13/09)

In the message referring to the discussion between "Tony and Mats a few months ago", Arnold creates a linkage back to the meeting held between Mats and I the prior November at FIE 2003, at which we had proposed a revised design for the icebreaking phase (cf. section 6.3.1 above). Here we see 'cyclical' *time* (a review at the end of an action research cycle) in combination with 'lifecycle' *time* (the 'icebreaking' phase of the collaboration), "predictable event" *time* (the FIE meeting) and 'clock' *time* (a few months ago). In a similar linkage with prior *experience* the *Runestone* project (Daniels et al., 1999) is referred to in a positive light, again demonstrating the operation of retrospective 'cyclical' *time* (the long standing collaborative research project) and a prospective of 'lifecycle' *time* (this collaboration at its inchoate stage).

> I hope you find this an interesting contrast to the Runestone experience, and look forward to working with you all. (TC 24/06)

A further dimension of time now warrants mention. While not predominant in the coding pattern (but perhaps due to quality and consistency of the coding process with such an extensive dataset), the category previously coded generically as *pressure* (cf. 6.2.4.4), has here been re-coded as *Time pressure* better reflecting its temporal nature. Time pressure is a code apparent in the literature: for instance Cramton (2001, Figure

2) cites *time pressure* as a task characteristic; Poole (1981, p.19) notes as a characteristic for a full fledged group that "there was *time pressure* on the group"; and Arrow, Poole et al., (2004, p.75) further classify it under the perspective of "*time pressure* (a resource shortage)". The message coded as *time pressure* below (reflecting the workload peaks experienced by the team at the beginning of the AUT semester) certainly meets this latter definition:

> We are hoping to gain some support here from a research assistant to get us out of our current workload trough. (TC 18/08)

The temporal analysis conducted in this subsection has highlighted elements consistent with several of the themes identified by Arrow, Poole et al., (2004). The notion of time as "socially constructed"; time as "a resource" and "how time pressure (as resource shortage) affects group processes and outcomes" (p.75), are present in this episode. In combination with the other dimensions explored, there is ample evidence supporting their claim that "time is a fundamental (and often problematic) issue for theory and research" (p.79).

6.4.4.5 Reflexivity of the actors – Establishment Episode Full

In this episode, discussions over such elements as the research framework and ethics approvals, the collaborative task, learning and assessment design, technology selection, viruses and firewalls, student registration, have all demonstrated ongoing active and conscious reflection on the part of the actors, as they worked to jointly design a meaningful technology enabled learning and research experience. The TUM activity of 'establishment' enacted in this episode, can be seen to inherently demand a reflexive mode of thought. These conscious TUM processes incorporate many elements of a design process, as expressed by Ehn and Kyng (1987) in which a future use process is consciously conceived.

> "Systems design reflects a fundamental division of labour, the division between conception and execution....in the design process the use process is conceptualised, ... In the use process work is executed given the constraints and opportunities set by the design process." (Ehn & Kyng 1987, pp. 34-35).

For instance the Action Research Framework (cf. Appendix 9), which I had initially developed to guide the research design, portrays a very conscious foreshadowing of the activities to be undertaken during the collaboration, from both a research and a teaching practice perspective. Thus we see how a related group of activity designs (e.g. research, task, teaching and learning, security, technology selection, student administration) are frequently marshalled in order to shape the technology use. So

TUM is not a process focussed on technology use alone, but on embedding that use within a variety of contexts and a web of constraints.

The dialogues over such other elements of the collaboration in this episode have also been well illustrated in the prior analyses in this section, where the consciously designed and negotiated sequences of actions demonstrate the actors engaged in highly reflexive processes.

6.4.4.6 Other key concepts from this episode – Establishment Episode Full

Tables 6.7a – 6.19 above have identified numerous concepts within this episode, the majority of which have been addressed within the above analyses. The role of *Socio-emotional* concepts has not been fully addressed, but as in prior episodes (6.2.4.4. and 6.3.4.4) this category is clearly in evidence as *socio-emotional* represents the third most frequently coded category in figure 6.16. A selective analysis highlights some key aspects of socio-emotional communication.

In the category of *other-directed emotions* we observe forms of communication in part consistent with the recommendations of Jarvenpaa & Leidner (1999, p.807) according to whom, "behaviors that facilitated trust early in a group's life" included "communication of enthusiasm". Typical examples expressing excited anticipation are:

> I hope you find this an interesting contrast to the Runestone experience, and look forward to working with you all. (TC 24/06)
>
> Can't wait now to see the first contributions from your students! (DK 17/09)
>
> I can(t tell you how much I(m looking forward to working with you all on this, (FN 09/07)
>
> It is a continuing pleasure to be working with you all and I look forward to this activity. (FN 17/08)

For a set of communications here at a relatively early stage in the group's life, we also see patterns that Jarvenpaa and Leidner (1999) have indicated helped to maintain trust *later* in a group's life, namely "substantial and timely responses" (p.807):

> Regarding Diana(s detailed and extremely helpful email that I received yesterday: (FN 09/07)

"Predictable communication" was a further positive pattern noted *later* in a group's life, and several cases of such communication are in evidence, for instance:

> just a quick note to let you all know that I am in the loop. (AP 23/06)
> As mentioned above, I will be gone for about 2 weeks, then be working to get this project rolling. (FN 09/07)

> We are talking with Fred over a three way collaboration. Just to keep you in the loop, a copy of his proposed course outline, (TC 16/06)
>
> as I have just observed to Arnold, we need to be flexible to work with each of our needs, but we will get there, (TC 21/08)

Despite the duration of this set of communications (over some four months), the relatively early development of these supposedly later communication patterns, is not wholly consistent with the findings of Jarvenpaa and Leidner (1999), as the group could not yet be considered a well established global virtual team. However this team did comprise a set of adult professionals, with considerable virtual team experience, as opposed to the latter's student subjects, so perhaps this is a more natural communication pattern for professional workers.

Other noteworthy patterns in this *other-directed emotions* grouping, are communications that express hope, regret or apologies and thanks.

> They will still have to let both the virtual team and their tutor know about that and hopefully there won't be many people doing this. (DK 19/08)
>
> lets also hope that by then I will have heard back from Mark or Julia. (DK 22/08)
>
> Unfortunately there was no interaction with those students, which would be interesting. (DK 30/08, FN)
>
> I know this is counterintuitive and goofy, but after an inordinant amount of discussion this I think is the only approach that would be approvable by our IRB. (FN 20/08)
>
> I appreciate your willingness to shift around the teaming to accommodate an unusually difficult IRB process here in the US. (FN 21/08)

In the category of *Self-directed emotions* we see some rather honest and self-revelatory communications:

> I knew this, but had forgotten when I wrote to you yesterday. Sorry about the slip up. (FN 18/08)
>
> We are struggling a little with workload in coordinating and running many concurrent threads and lack of local support at the moment. (FN 1808 - TC)
>
> The way that the distribution of students in teams is proposed, we would all have to refrain from using the results for research (or I would get in deep trouble) OR I would have to refrain from having our students participate. (FN 20/08)
>
> ...the end of the week is rushing towards me... and have a few words to deal with before that... "live" words in discussions with five groups in the IT in Society course.. and somewhat less "live" words in papers to review... (MD 17/09)

The above communications evidence a degree of trust built within the team, that enabled an open and honest expression of difficulties, or even feelings of the week to be surfaced. The latter communication was part of a regular exchange that Mats conducts every week to keep in touch with global colleagues.

In the category of *Context and technology-directed emotions* dual coded communications overlap to some extent with the set of *other directed emotions.* Generally *Context and technology-directed* communications tend to be more task focused. However in the first coded message Arnold notes his students' frustration:

> I need to check now, but on Wed no user accounts existed for Fred or My students. People here are getting a trifle frustrated with that, especially since the trial phase 1 is supposed to be concluded on the weekend. (AP17/09)

In the next message Diana observes her feelings about the challenges of student access to email accounts and messages.

> I hope this is clear, it's taken me awhile to get my head around this :([DK 16/09]

Messages within this category can also be related to the Jarvenpaa and Leidner (1999, p.807) set of "member actions that facilitated trust early in a group's life", namely "coping with technical uncertainty" as in Diana's above observation and "individual initiative". "Coping with technical uncertainty" spans a wide variety of situations, with a few examples cited below:

> hope you will be able to create threads in the forum. (DK 17/08)
>
> We would like to use autonline as a platform and I talked about this with Mark Northover a couple of months ago and he was very supportive (DK 20/08)
>
> I feel that we need to have a few days for preparation before we hand out the assignment to our students at the beginning of next week. (DK 30/08)
>
> One advantage of Notes is that I can run it from here without enforcing security, which is one less thing to worry about with forgotten usernames and passwords. (FN 18/08 – TC)
>
> A bit of work in setting up, but only has to be done once. (MN 05/07)
>
> One of the options was to consider using a videoconference to get the students together. It will cause some logistical challenges (classes on different days, times and time zones) so I'm not sure if this is a good option, but it would help first to know a little about the service we offer at AUT. (TC 01/07)

"Individual initiative" is evident in such messages as:

> Can you set me up with a BB account so I can poke around and see how it works? I(ll be very pleased to have the US students doing the same things as the other students with this SW. (FN 09/07)
>
> It looks like a live videoconference is a dead issue. I've written in a message to everyone about the possibility of exchanging asyncronous videotape messages. (FN 18/08)
>
> Unfortunately I won't be at AMCIS, and it is always good to meet face to face to talk thorough the details of such a collaboration, but I guess we'll have to work virtually!! I suppose that in itself is part of the fun and in terms of the whole issue of global virtual teams, part of what in the end we are enquiring into. (TC 23/06)

Further messages within this category can be related to the Jarvenpaa and Leidner

(1999, p.807) set of "member actions that helped maintain trust later in a group's life", namely "positive leadership" and "phlegmatic response to crises". In the first message below Fred shows an example of both responses, after the videoconference plans had come to naught, while in the subsequent messages we see a "phlegmatic response to crises":

> What would you think of videotaping small student segments digitizing and exchanging them so that students get a little taste of the people on the other end? On our side, this should be relatively easy (FN 18/08)
>
> It has taken a while to get students loaded so we are just getting going now about two weeks behind!! (TC 17/09)
>
> I know this is counterintuitive and goofy, but after an inordinant amount of discussion this I think is the only approach that would be approvable by our IRB. (FN 20/08)
>
> I appreciate your willingness to shift around the teaming to accommodate an unusually difficult IRB process here in the US. (FN 21/08)

For the category of *task-directed emotions* we see the importance of the socio-emotional communication in negotiating joint design and outcomes for the collaboration, especially given the use of email and attachments for file transfer as the primary communication mechanism. This technology choice was at variance with that suggested by media synchronicity theory (MST) (Dennis & Valacich, 1999), in which media synchronicity represents the "extent to which individuals work together on the same activity at the same time" (p.5). MST proposes that higher synchronicity media would be used to support the 'convergence' mode of communication, in which "participants strive to agree on the meaning of information and agree that they have agreed. This means that participants must understand each other's views. In general, high synchronicity is preferred for convergence" (p.5). Indicative of the process involved, in the first message below Diana advised me that Fred agreed with our proposal for the collaboration:

> he is quite happy with most of what we are suggesting (DK 09/07)

The process of task design and negotiation typically proceeded in an interchange of proposals and responses in a "technical problem solving mode" (Dennis & Valacich, 1999, p.3) until a consensus was reached, as in the following set of messages:

> I have been debating with myself how much detail to go into because on one hand I want to be open to shifts and changes that would improve the design but I also don't want to burden you with an overly vague concept. (FN 10/06)
>
> I very much like your assignment and would be pleased to have our students join in. (FN 23/06)

Please let us know if you are happy with the suggested grouping arrangements (DK 19/08)

Hi Fred,
I'm glad you are happy with the draft. (DK 27/08)

I very much like the split of the project into two parts the first being the icebreaking and the second the decision making task. (DK 27/08 – FN)

but in all honesty you've done a good job describing it in the draft of the assignment page you sent earlier. (FN 01/09)

The weighting for the assignment will be changed to 20%. That should be sufficient motivation to participate. Of course, I(ll have an alternative for those who don(t want to participate in the research. Could their data be excluded if they participate (in other words can they participate for education but not in the research)? (FN 09/07)

As can be seen the messages have a clear socio-emotional dimension which helps to express uncertainty and openness to improvement of ideas, which in turn helps generate a productive dialogue and promotes "member support" (Dennis & Valacich, 1999, p.5) or "relationships with others" within the group.

In the final category of *Performance-directed emotions* we see communications related to the progress of the project. These seem to encompass: 1) notifications of progress, with observations positive and negative; 2) messages of encouragement; 3) expressions of anticipation; and 4) an apology for delay. Examples of each are given below:

1)
I'll keep reminding my students to participate over the break but obviously can't guarantee that everyone will. (DK 17/09

I had a very productive meeting with our videoconference technicians this afternoon. (FN 17/08)

It has taken a while to get students loaded so we are just getting going now about two weeks behind!! (TC 17/09)

So there are a few things up in the air, but I'm sure we can work our way through them. (TC 23/06)

2)
Thanks for your email, I was worried what would happen with our little project if you were away on holiday in Fiji or another nice and warm place :) [DK 23/08]

Hi Bridgit,
Thanks a lot for your quick response. (DK 24/08)

Hi again,
We are moving forward now, (DK 25/08

Dear Tony,
Thank you for getting the ball rolling. (FN 02/07)

3)
Can't wait now to see the first contributions from your students! (DK 17/09)

> Users will get to learn to meet deadlines, which is especially important when working internationally, taking in account of different time zones. (DK 30/08)
>
> Otherwise, I'm looking forward to getting started! (FN 14/09)

> 4)
> Hi Fred,
> A belated response to your email, but here we go: (DK 29/07)

Performance-directed emotions might appear to be inherently oriented towards what McGrath (1991, p.153) has termed "Mode IV activity" or "execution of the performance requirements of the project (goal achievement)", but it appears from the above excerpts that these emotions play additional roles. In this stage of the project it is arguable which of McGrath's "mode II: technical problem solving" and "mode III: conflict resolution" (p.152) activities is more appropriately deemed to be the state of the project than the 'execution' mode. However the TUM roles assumed by the actors in this episode mean that the preparatory activity for this project constitutes in effect the "execution" mode for TUM, a somewhat ambiguous situation. These socio-emotional exchanges however, do appear to play a role in building trust and maintaining motivation within the group, in McGrath's terms aiding in group "member support" or maintaining relations between team members, and further in sustaining group "well being" through the interaction required for the "concrete interpersonal activities involved in the performance process of the project" (McGrath 1991. p. 156). This could be a fruitful area for further inquiry.

6.4.5 Visual Mapping – Establishment Episode Full

The radar charts in figures 6.18 – 6.22 below represent a set of visual 'maps' of selected aspects of the episode, as recommended by Pozzebon & Pinnsoneault (2005) for ST analysis. The *metastructures* depicted have already been explored to some degree in the above analysis. Here the six constituent elements of each *metastructure* are compared across the three sites, to illustrate the extent to which they serve to support this collaborative venture. This diagrammatic technique aids in showing a more dynamic picture of the structuring and metastructuring processes and can show a multidimensional 'visual map' of cross-site differences. These depictions are left at this stage to speak for themselves, with further analysis to be conducted in subsequent chapters. Nonetheless the picture presented by these few examples may provide insight into some issues underlying the pessimistic observation by Swigger et al., (2006), that

"technical barriers such as unreliable software and institutional regulations discourage most teachers from exploring distributed learning".

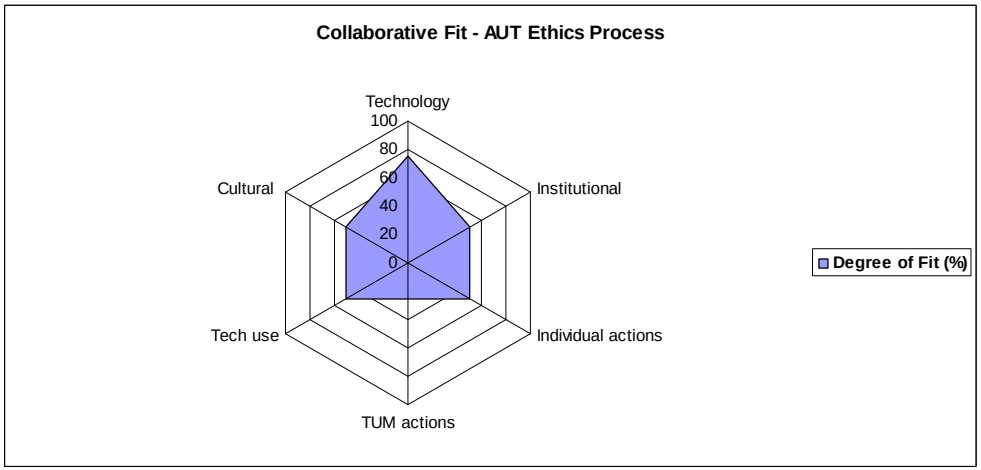
The first map depicts the operation of the *metastructure* represented by the institutional ethics process at each site. Each element is briefly tabulated in table 6.20 below.

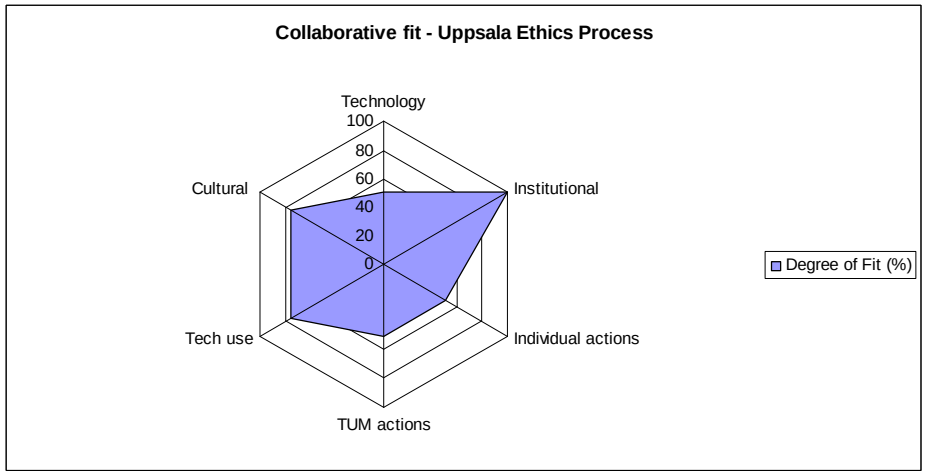
AUT
Technology - AUTonline GVT's and membership, email and Notes DB for collaboration
Institutional - AUT requires prior ethics approval for pedagogical research (in place)
Individual actions - students could opt out of collaboration, do alternative assessment
TUM - St Louis students grouped in non research GVTs
Tech use - AUTOnline, groups for GVTs, email and Notes DB for collaboration
Cultural - AUT medico-legal ethics model, volunteer students resist unassessed work, Bus IT students
St Louis
Technology - AUTonline GVT's and membership, email and Notes DB for collaboration
Institutional - St Louis requires prior ethics approval for pedagogical research (not in place)
Individual actions - students commit to collaboration as course assessment activity
TUM - St Louis students grouped in non research GVTs
Tech use - AUTOnline, groups for GVTs, email and Notes DB for collaboration
Cultural - St Louis medico-legal ethics model, sanctions & sharp research/teaching divide, IB students
Uppsala
Technology - AUTonline GVT's + membership, email + Notes DB for collaboration + pref for open source products
Institutional - Uppsala did not require ethics approval for pedagogical research
Individual actions - students could opt out of course
TUM - Uppsala students grouped in GVTs by Arnold, able to be removed
Tech use - AUTOnline, groups for GVTs, email and Notes DB for collaboration
Cultural - Uppsala professional ethics model, autonomy in pedagogical research, young CS students

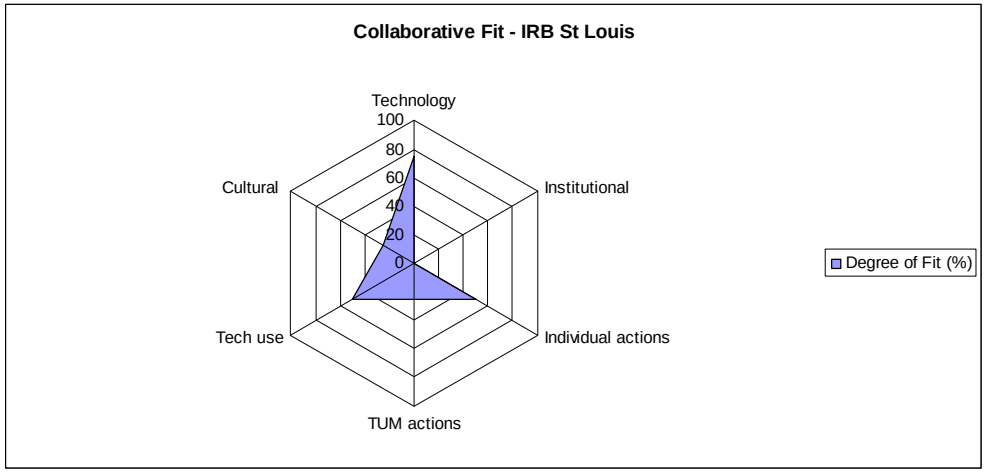
Table 6.20: Establishment Episode Full –*Metastructure* of *Research Ethics Approval Process*

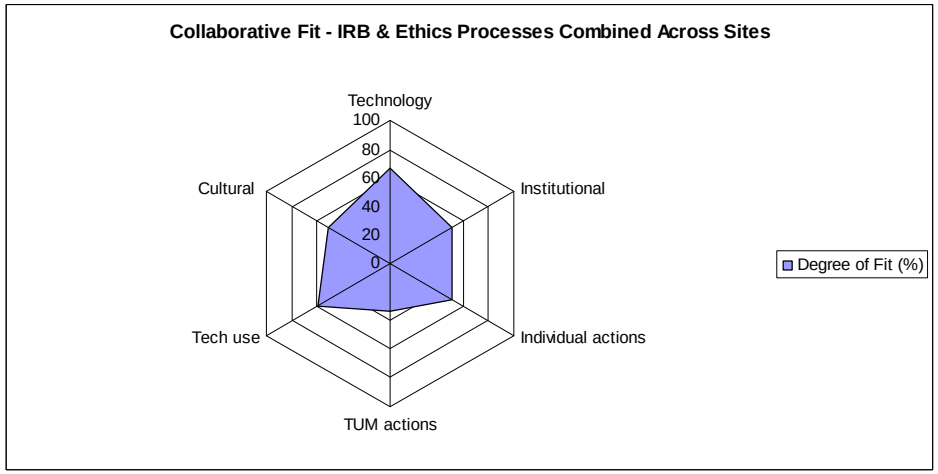
The contents of this table are further depicted below in the set of four radar charts portrayed in figure 6.18. Each of the six dimensions in table 6.20 above (*technology, institutional, individual actions, TUM, Tech. use and cultural*) is represented by a separate axis within each radar chart. The scales on the axes of the charts indicate the degree of collaborative fit, which is imputed by interpreting the data from the episode as summarized in table 6.20 above. A zero fit is represented at the origin, and a full collaborative fit for each dimension is represented at the extremities of each point on the radar chart. Intermediate points from 'no CF' have been defined as 'limited fit', 'moderate fit' and 'partial fit'. The precise terms may be argued with, but the assessment at this stage consists of making a personal judgement of fit on each dimension based upon experience. (A critique of this somewhat heuristic measurement approach is provided in section 8.5.2.1 below, where the need for greater systematization is acknowledged). The dynamics for each location are portrayed in the individual charts. The combined chart, which graphically depicts the means of the ratings across sites, (and gives a somewhat synthetic portrayal) is provided for broad comparison purposes.

Figure 6.18: Radar Charts – Establishment Episode Full – Metastructure *Research Ethics Approval Process*









Degree of Fit Scale (%)

100% - full collaborative fit (CF)

75% - moderate CF

50% - partial CF

25% - limited CF

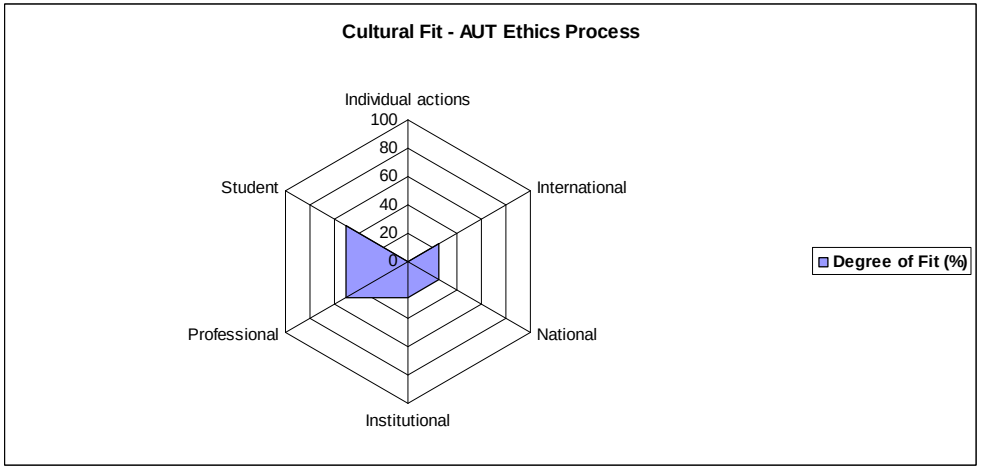
0% - no CF

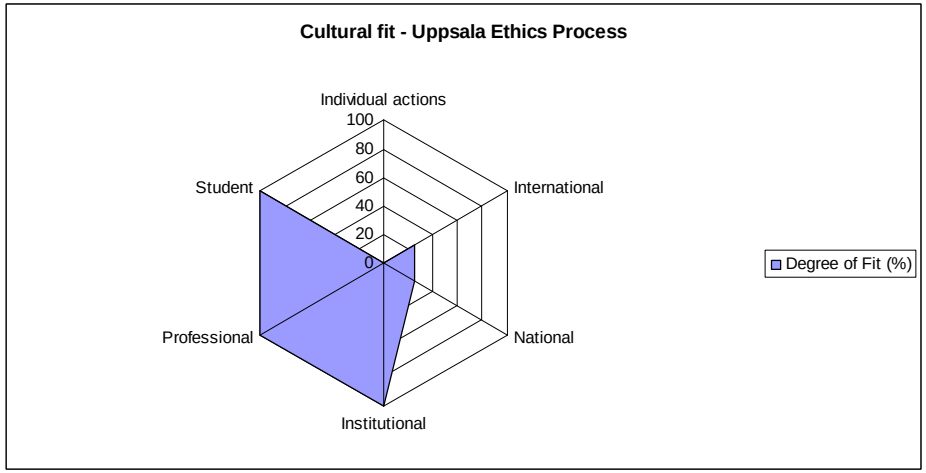
The second map extends the above map by depicting not so much the collaborative dimensions, but the *cultural* dimensions in operation for the *metastructure* represented by the *Research Ethics Approval Process* at each site. It draws upon the six cultural dimensions outlined in sections 6.4.4.1 – 6.4.4.1.6 above. Each element is briefly tabulated in table 6.21 below.

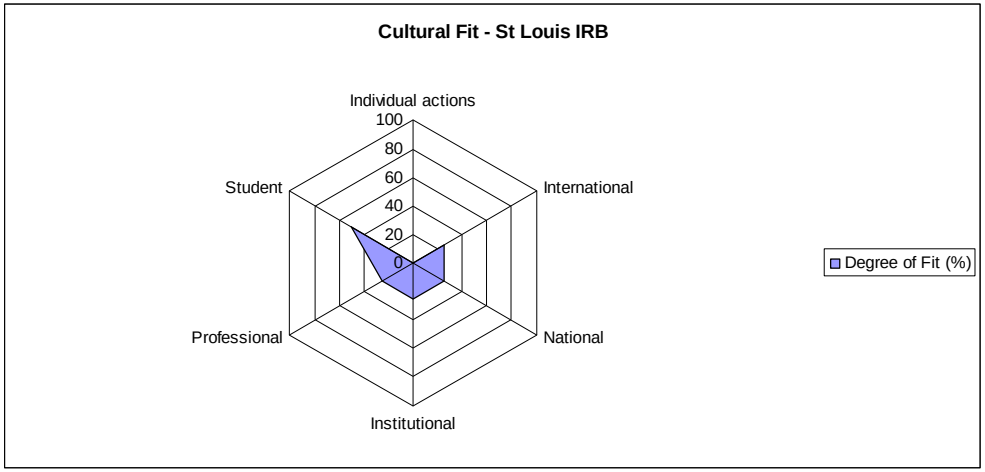
AUT
Individual actions - Herbert Green & medical ethics scandals International - medical ethics treaties instituted National - Patients rights legislation, HRC mandates ethics cttees Institutional - Ethics committee regulations Professional - medical paradigm, prior approval, ped. research & pub constrained, teaching not constrained Student - combined student/subjects, opt out ability, alternative assessment
St Louis
Individual actions - US & international medical ethics scandals International - medical ethics treaties instituted National - Public Health Act, FWA protection for Human subjects Institutional - Mandated IRBs for funded medical research, some medical research suspended, IRB regulations Professional - medical paradigm, no prior approval, ped. research & pub constrained, teaching not constrained Student - students only, no opt out ability
Uppsala
Individual actions - international medical ethics scandals International - medical ethics treaties instituted National - Research ethics legislation, mandates medical ethics cttees Institutional - Ethics committee limited to medical domain Professional - pedagogical research constrained by professional mores Student - combined student/subjects, privacy safeguards, opt out ability

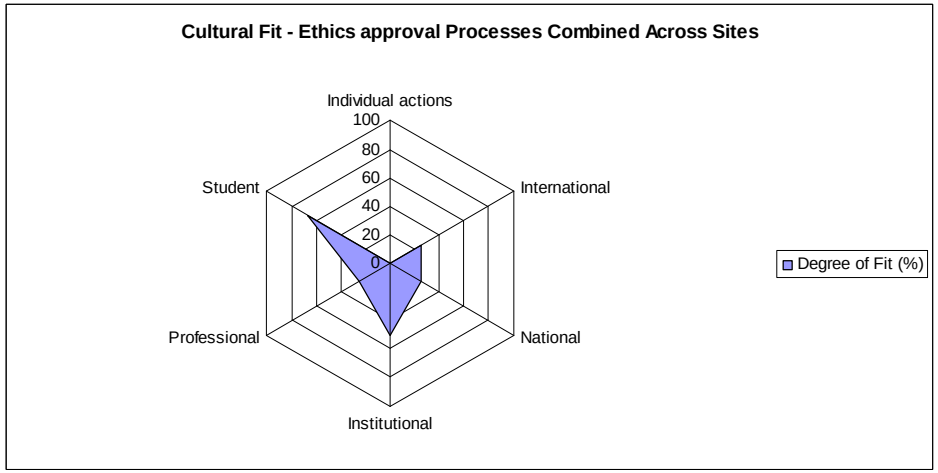
Table 6.21: Establishment Episode Full – Cultural dimensions for the *Metastructure* of *Research Ethics Approval Process*

Figure 6.19: Radar Charts – Establishment Episode Full – Cultural Dimensions for Metastructure *Research Ethics Approval Process*









Degree of Fit Scale (%)

100% - full cultural fit (CUF)

75% - moderate CUF

50% - partial CUF

25% - limited CUF

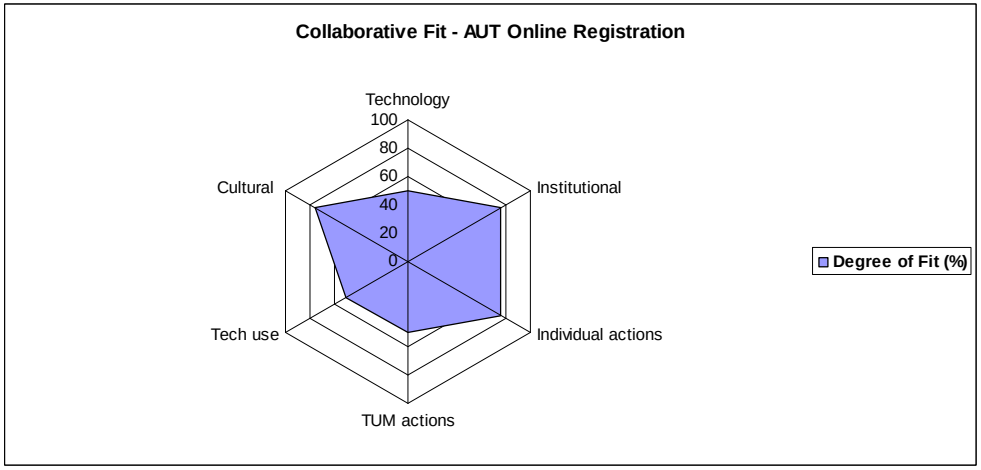
0% - no CUF

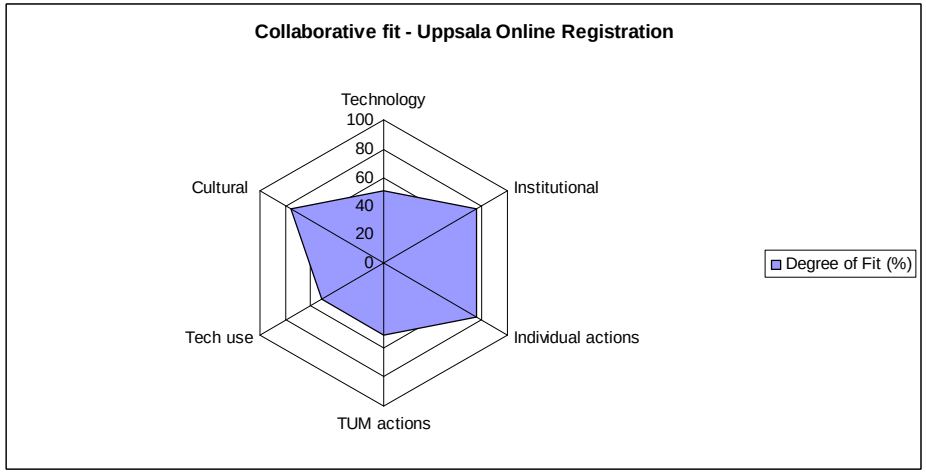
The third map reverts to the previous six dimensions of a metastructure, and depicts the operation of the *metastructure* represented by the *Online Registration* process, at each site. Each element is briefly tabulated in table 6.22 below.

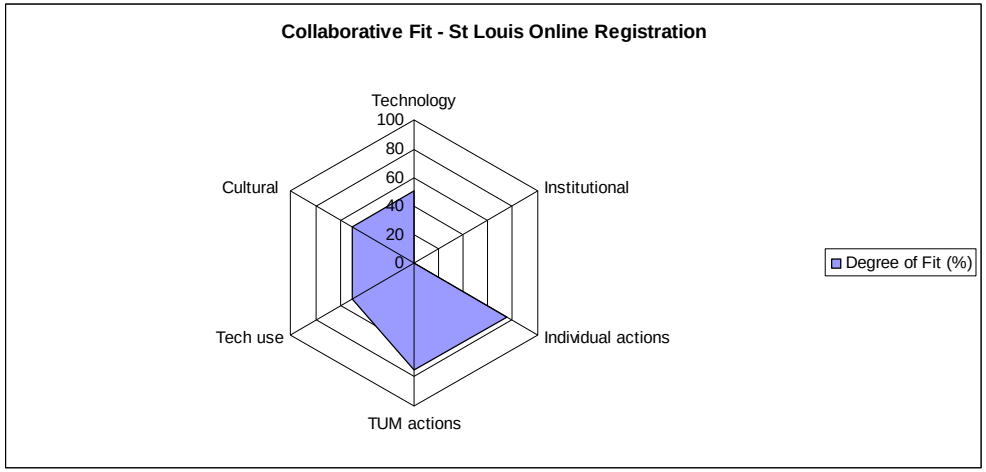
AUT Technology - Hosts service, AUTonline link for internal student but not external student import Institutional - accepting of external registrants, slow ITS service causes delays Individual actions - Diana coordinates, Mark & Bridgit liaise, ITS develop s/w TUM - Flex Lrng get ITS to develop linking s/w & provide file, Diana tidies & distributes Tech use - AUTOnline, CSV file - users & pwds, text table attachment, embedded table in email Cultural - professional support for global collaboration, variable support across units
St Louis Technology - AUTonline no link for external student import, email for student details Institutional - not accepting of external registrants, students enrolments unstable Individual actions - Diana coordinates, Fred provides details, some students enrol and drop out TUM - Fred provides student details, Diana arranges thru ITS usernames & pwds, reformats & advises Tech use - AUTOnline, email student details, CSV file - users & pwds, embedded table in email Cultural - professional support for global collaboration, institutional support lacking
Uppsala Technology - AUTonline no link for external student import, email for student details Institutional - students enrolments unstable, hard copy student details causes delays Individual actions - Diana coordinates, Arnold provides details, some students enrol and drop out TUM - Admin provide paper student details, Arnold requests & sends file, Diana arranges thru ITS usernames & pwds, reformats & advises Tech use - AUTOnline, initial hard copy of student details, then file to email student details, CSV file - users & pwds, text table email attachment Cultural - professional support for global collaboration, variable support across units

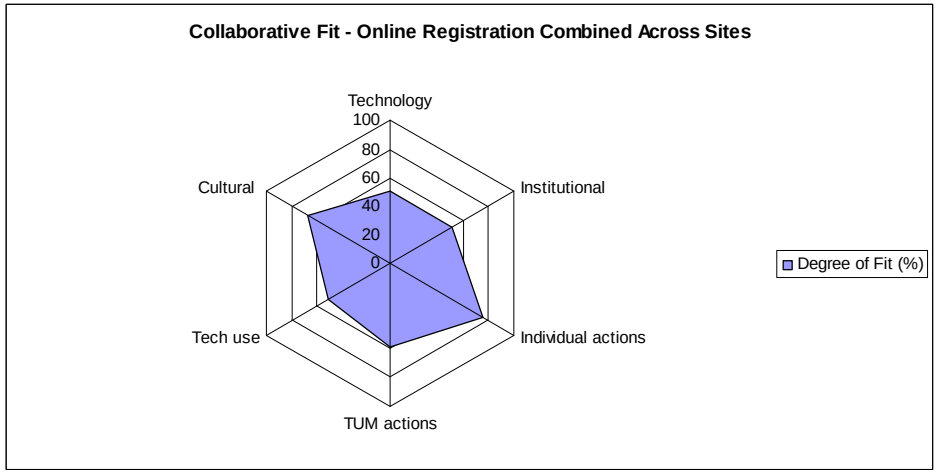
Table 6.22: Establishment Episode Full –*Metastructure* of *Online Registration* Process

Figure 6.20: Radar Charts – Establishment Episode Full – Metastructure *Online Registration* Process









Degree of Fit Scale (%)

100% - full collaborative fit (CF)

75% - moderate CF

50% - partial CF

25% - limited CF

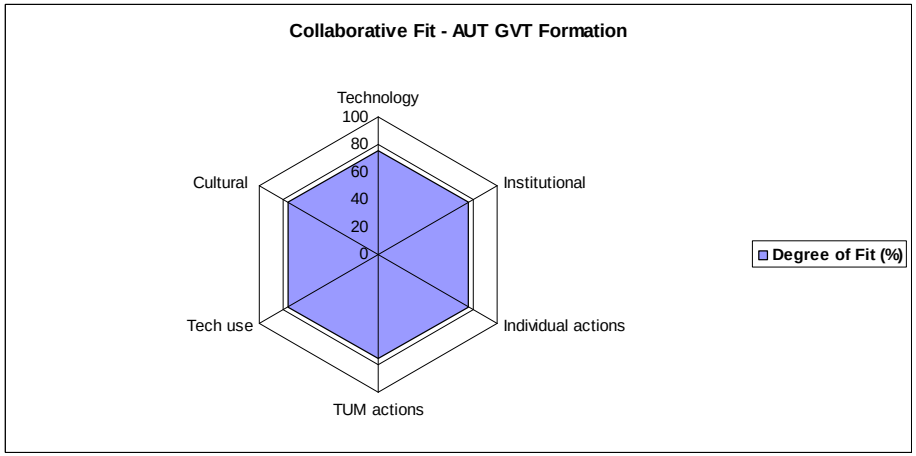
0% - no CF

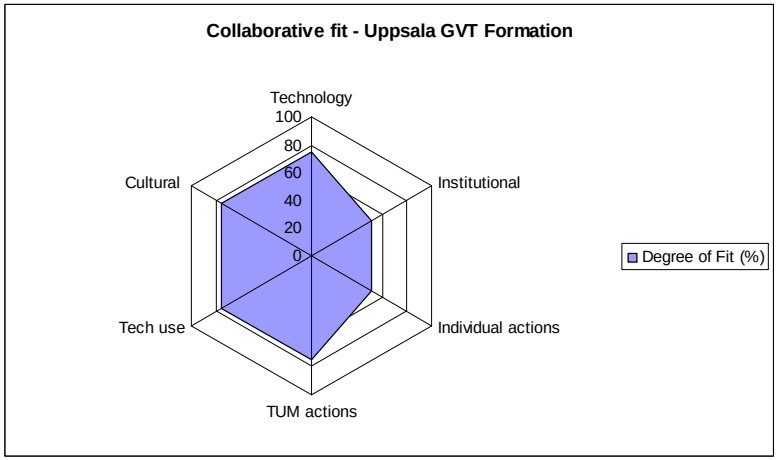
The Fourth map depicts the operation of the *metastructure* represented by the *GVT Formation* process at each site. Each element is briefly tabulated in table 6.23 below.

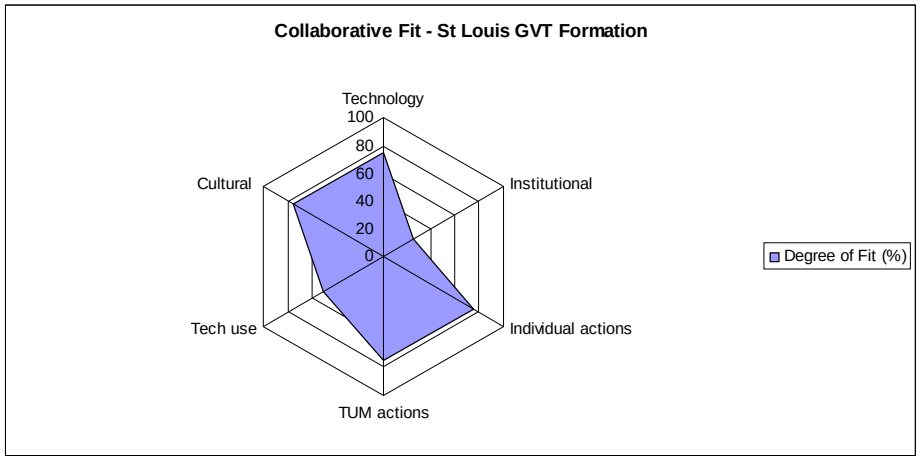
AUT Technology - Hosts service, AUTonline group pages, Lotus Notes DB, email, diagram attachment Institutional - accepting of external registrants, slow ITS service causes delays Individual actions - Diana coordinates, Fred proposes, Arnold advises student details TUM - Diana & I confirm GVT & LT nos, advise reg'n, set up GVTs for Fred, confirm abilty to remove Tech use - AUTOnline, group pages, manage groups, email + diagram attachment Cultural - AUT LTs based on earlier course groups, GVTs designed to support research + tchg
St Louis Technology - AUT Hosts service, AUTonline group pages, Lotus Notes DB, email, diagram attachment Institutional - not accepting of external registrants, students enrolments unstable, no IRB approval Individual actions - Diana coordinates, Fred proposes, Arnold advises student details TUM - Diana & I confirm GVT & LT nos, advise reg'n, set up GVTs for Fred, confirm abilty to remove Tech use - AUTOnline, group pages, [read mode], email + diagram attachment Cultural - AUT LTs based on earlier course groups, GVTs designed to support research + tchg
Uppsala Technology - AUT Hosts service, AUTonline group pages, Lotus Notes DB, email, diagram attachment Institutional - supportive but delayed details, students enrolments unstable Individual actions - Diana coordinates, Arnold advises student details (delayed), sets up GVTs TUM - Diana & I confirm GVT & LT nos, advise reg'n, confirm abilty to remove, Arnold sets up GVTs, Tech use - AUTOnline, group pages, manage groups, email + diagram attachment Cultural - AUT LTs based on earlier course groups, GVTs designed to support research + tchg

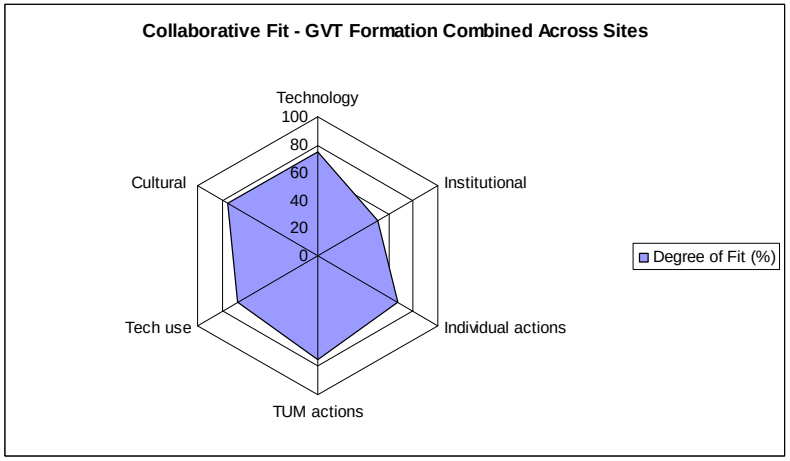
Table 6.23: Establishment Episode Full –*Metastructure* of *GVT Formation*

Figure 6.21: Radar Charts – Establishment Episode Full – Metastructure *GVT Formation* Process









Degree of Fit Scale (%)

100% - full collaborative fit (CF)

75% - moderate CF

50% - partial CF

25% - limited CF

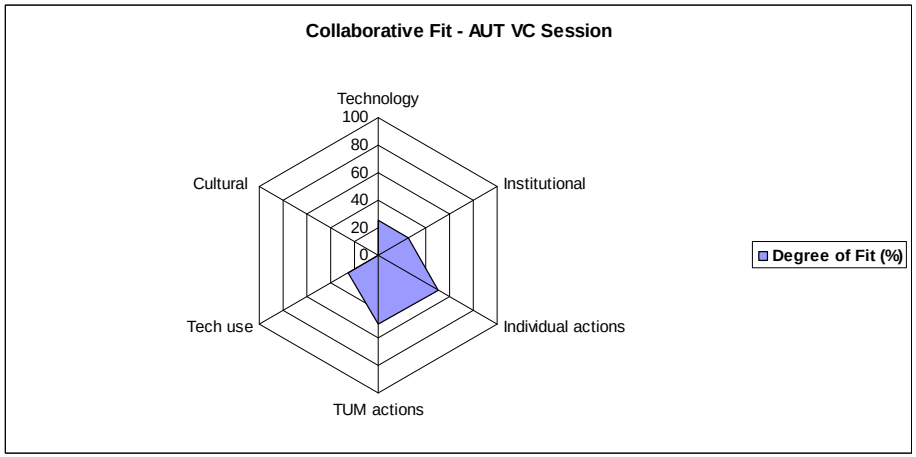
0% - no CF

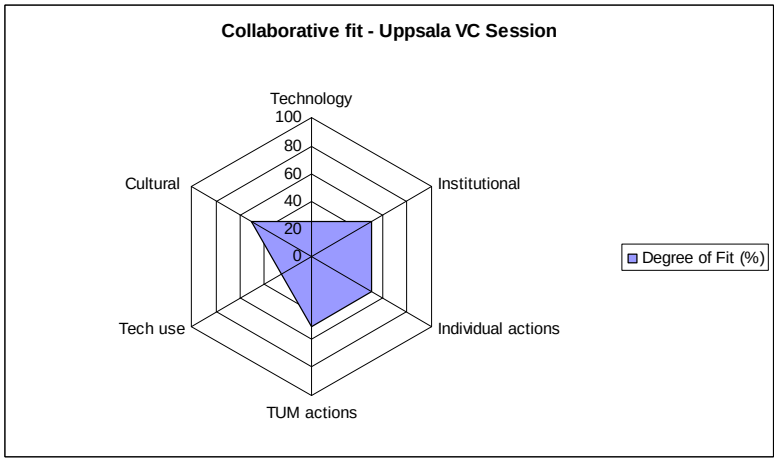
The Fifth map depicts the operation of the Technology (*AIT*) *metastructure* represented by a *VideoConference Session* at each site. Each element is briefly tabulated in table 6.24 below.

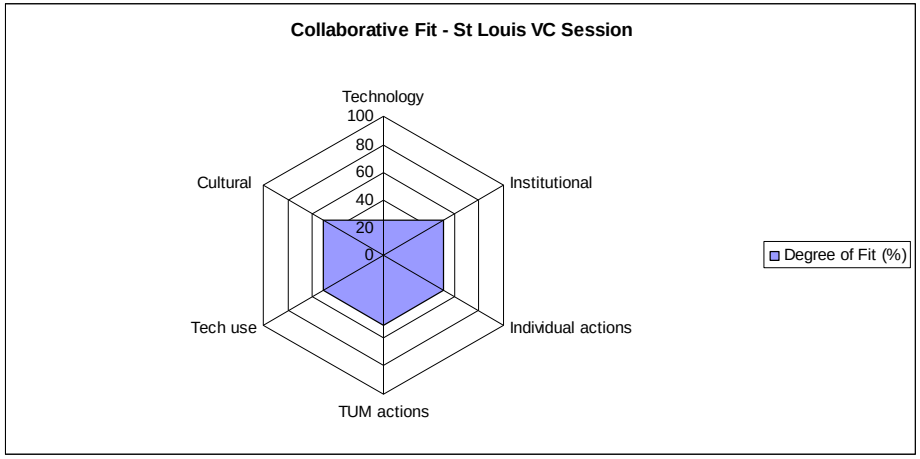
AUT Technology - email, Speak'nSee desktop VC s/w?, dial-up access only for some students Institutional - multiple small class sessions/times, tech support availability? Individual actions - Tony coordinates, Fred proposes, Arnold proposes, Tony gives up TUM - Tony checks AV support, liaises with Fred and Arnold, assesses sessions and tech options Tech use - email, VC alternatives only proposed Cultural - AUT non residential students reluctant to meet outside class hours
St Louis Technology - email, ISDN VC service, video segments WMF & Html Institutional - common session time, tech support availability? Individual actions - Fred proposes, Arnold proposes, Tony assesses & both give up TUM - liaises with Tech support, Tony and Arnold, proposes short video exchange & local VC sessions Tech use - email, videos?, US based common time zone VC? Cultural - residential students, but reluctant for early morning session, voluntary option?
Uppsala Technology - VC room for group conferences + netmeeting s/w, gnomemeeting, IRC chat with webcams Institutional - common session time available, tech support availability? Individual actions - Tony coordinates, Fred proposes, Arnold proposes, Tony & Fred give up TUM - liaises with Tony, proposes student driven Open Source tech options Tech use - email, VC alternatives only proposed Cultural - residential students, able to coordinate own schedules in groups

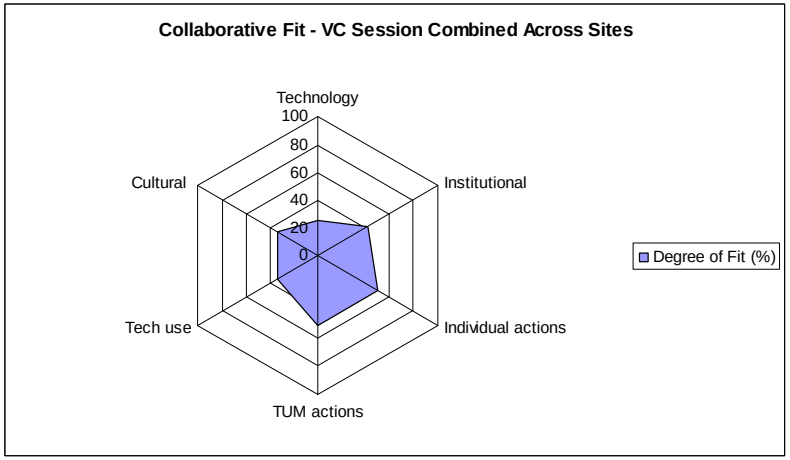
Table 6.24: Establishment Episode Full –Technology *Metastructure* of *Videoconference Session*

Figure 6.22: Radar Charts – Establishment Episode Full – Technology Metastructure *VideoConference Session*









Degree of Fit Scale (%)

100% - full collaborative fit (CF)

75% - moderate CF

50% - partial CF

25% - limited CF

0% - no CF

6.4.6 Temporal Bracketing – Establishment Episode Full

As a more extended episode than those previously analysed, there is a greater temporal dimension inherent in this episode itself, and since the establishment mode of TUM activity inherently represents a phase or a 'temporal bracket' in a collaboration, temporal bracketing is integral to this episode. Figure 6.23 below depicts the pattern of message exchanges that evolved in the major window of this episode between June and October 2004. The small group of messages exchanged in September 2003 is omitted from this figure to avoid scale elongation, but is developed below as a second bracket in figure 6.24.

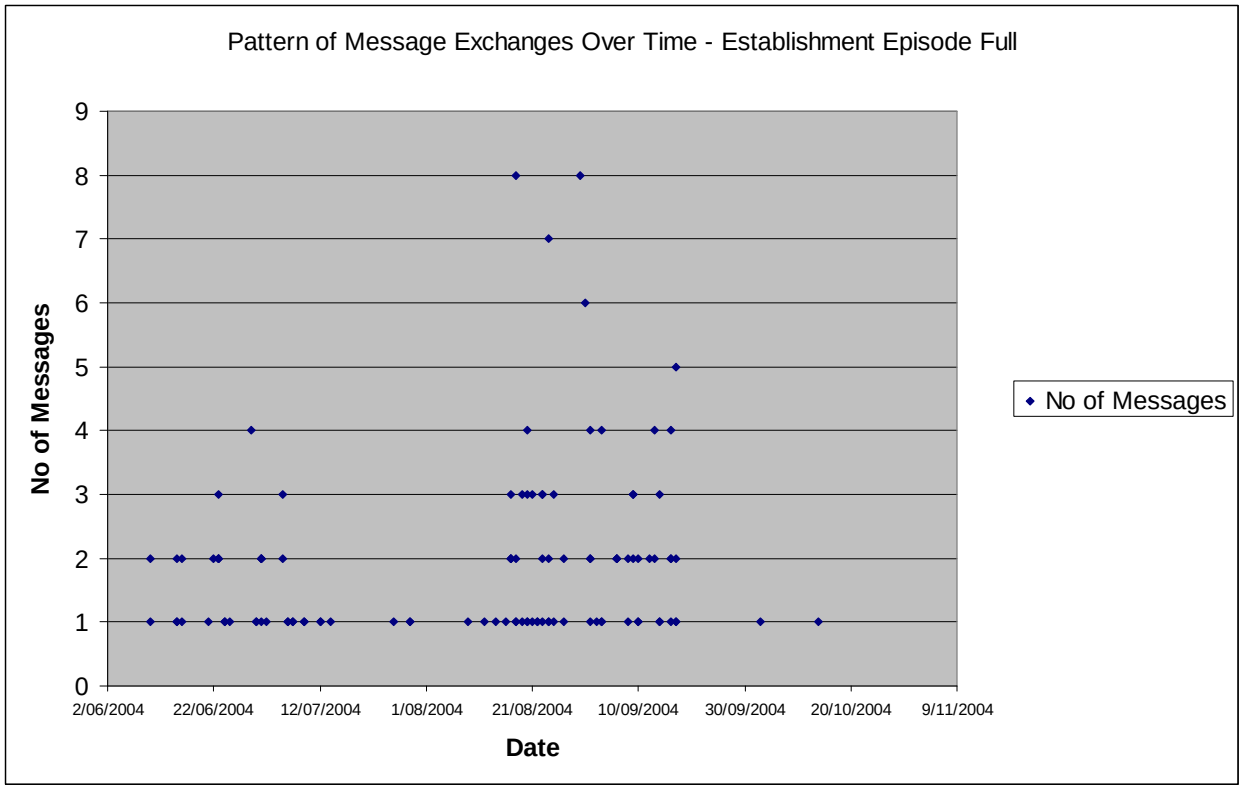


Figure 6.23: Temporal Bracket: Messages Patterns in Primary Window for Establishment Episode Full

As can be seen from this scatter diagram there are three primary peaks of activity in this bracket: one in June/July some ten to twelve weeks prior to the trial; then again in mid August four weeks prior to the planned collaboration; and finally in September immediately prior to and during the first week of the collaboration. Partly confounding this activity pattern is the fact that the original start date of the collaboration was planned for 6th September, but due to delays in registering students it effectively began on the 17th September – almost two weeks late. The completion of this bracket broadly at the start date of the collaboration is to be expected for an 'establishment episode', which would naturally occur before an event or phase under

investigation. The two October messages relate to an Uppsala student enquiry which indicated that his GVT was not effectively in operation yet, and another from Diana to an AUT student indicating that an email sent to Uppsala students should not use the AUTOnline email address as it would effectively go into "a black hole". As an alternative, to contact Swedish students their external email addresses had to be used. While both these messages could arguably be coded as instances of 'reinforcement' rather than 'establishment', they have been included in this episode given the start up nature of their content and their relation to a major 'email account' related conversation thread in this episode. Such a continuous thread revolving around the *metastructure* of a 'student email account' could be considered an analytical unit somewhat analogous to an 'activity track' (van DeVen & Poole, 1990, p.323).

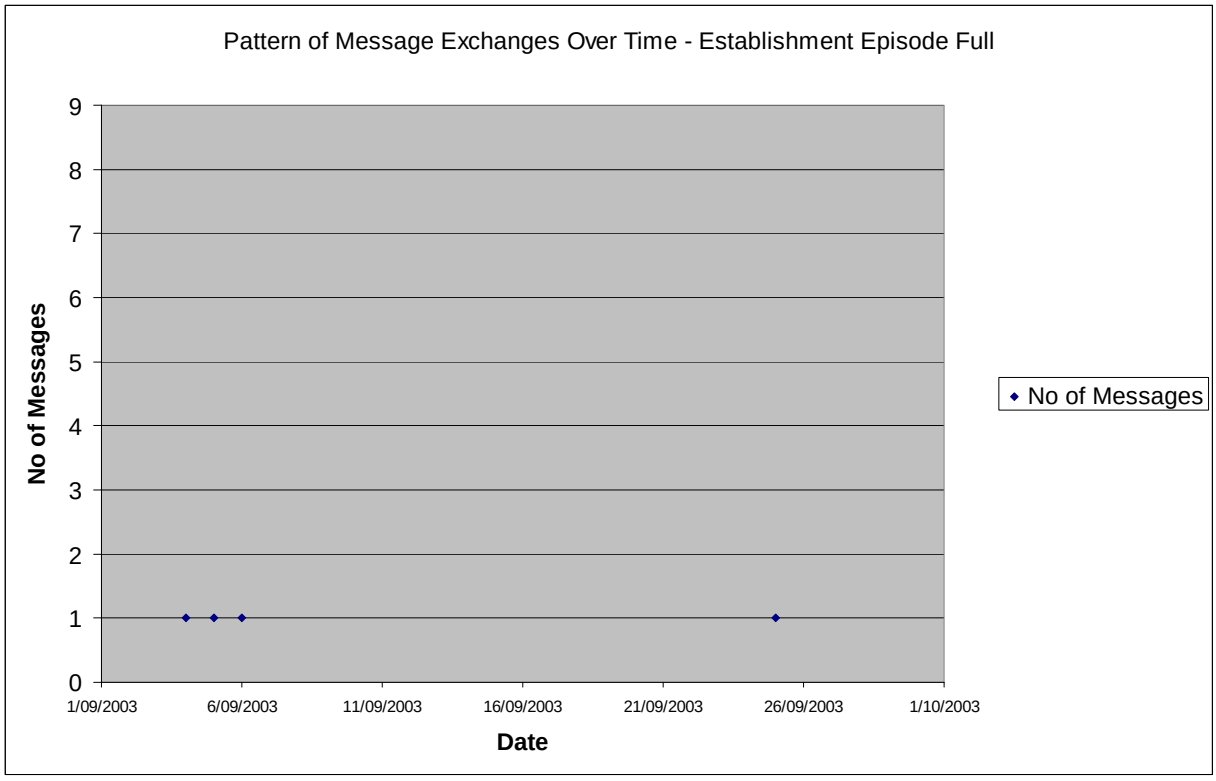


Figure 6.24: Temporal Bracket: Messages Patterns in One Year Prior Window for Establishment Episode Full

The brief exchange of messages in figure 6.24 above relates to a highly significant interchange one year prior to the collaboration, in which Professor Felix Tan (my Head of School at the time) and Professor Fred Niederman (who were colleagues within the IS community) exchanged information about a proposed course in Global Information Management which Fred was intending to introduce at St Louis University in Missouri. The topic was of particular interest to Felix as Editor in Chief of the Journal of Global Information Management, and given Fred's desire to introduce multinational team

work within the course, Felix referred Fred to me knowing of the programme of international collaborations that we had been conducting from AUT with the Swedish students. Felix exhorted Fred to *"start a dialogue with Tony and take it from there"*. The next email message to directly address the question is one forwarded from me about the course some nine months later (15/06/2004), with the history of further interchanges embedded within it. An additional message from Fred sent on 26/09/2003 had indicated that he would have his graduate student helping develop the course contact me about arrangements, and my response to Fred also on 26/09/2003 referred him to information about our work on the IS world site section on virtual teams and explicitly confirmed *"Hope this helps to get the ball rolling, and lets hope we can get something together"*.

The sequence demonstrates the operation of elements of 'swift trust' (Myerson et al., cited in Coppola, Hiltz & Rotter, 2004) namely:

> "vulnerability – the belief (hope) that others will care for what is being entrusted with good will; uncertainty – a willingness to suspend doubt in order to execute the task performance; risk – a willingness to take risks; and expectations – a positive expectation of benefit of temporary group activity" (Coppola, Hiltz & Rotter, 2004, p.95).

We also see in operation here another form of trust as highlighted in the distributed trust model of Li & Singhal (2007, p.47) which "defines two types of trust relationships: direct trust and recommender trust" and proposes a "recommendation based model in which recommendations from intermediaries set up the trust relationship between two strangers". In this case Fred and I had never met, so Felix's introduction was pivotal in creating the conditions of a global virtual team collaboration. Adding a third site to the international collaboration programme offered an additional dimension to both the learning and research processes and came for me as a welcome opportunity. However the venture lay fallow for some time, as it was not until 10/06/2004 (in the subsequent temporal bracket profiled in figure 6.24 above) that Fred was to send me an email to confirm that he had secured the necessary approval for the Global Information Management course at his university and "*everything now looks like a 'go' for the Fall semester*".

As a further instance of recommender trust Mats advised me at about the same time that the course would have a new coordinator, Arnold Pears.

> Hej Tony,
> ... I'm just including arnold.. he's the teacher this year..
> g'night
> Mats (MD 16/06)

While I had met Arnold at prior conferences, we had never worked with him previously, so again we see the trust relationship by referral, a notion also presented in a study by Pauleen (2003, p.159) as “referred trust” where the team leader trusted the team in another country to do their work because “she trusted “her primary Australian contact”. So here the establishment of the GVT occurs as a continuation and extension of existing relationship networks. Fittingly, at the beginning of the new ‘temporal bracket’ delineated by this collaborative cycle, we see the confirmation of the actors and the roles they are to play in the forthcoming episodes.

6.4.7 Chapter Summary

This chapter has presented three illustrative *episodes of interest*, one addressing each TUM phase, with this latter section being notable for its length, and for extending the visual mapping approach by the use of radar charts. The five remaining episodes (although arguably equally core to the thesis) have been relegated to appendix A.20 and again provide a rich micro-analytic picture of the patterns of data and activity within each episode. These static patterns of data are similarly complemented by the developments within each episode, the events which led up to it and how the patterns of practice evolved in each one. The reader interested in the rich detail of the micro level analysis, may productively turn to appendix A20-6.9 to see not only further episodes but, in a look to the future, how the subsequent 2005 collaboration has evolved in its own contrasting fashion.

Chapter seven will now move beyond the single episode level, to consider the cross-episode patterns of data and the evolving sets of practices for the differing modes of TUM activity.

Chapter 7: Cross Episode Analysis by TUM Activity Mode

7.1 Introduction

In this chapter the separate episodes of interest are grouped into their respective modes of TUM activity (*Establishment*; *Reinforcement and Adjustment* and *Episodic change*) for comparative analysis. Here the unit of analysis shifts from the episode to the "mode of TUM activity". Again differing levels of analysis are covered, necessarily reflecting the diverse data and accompanying analyses conducted within the independent episodes. As proposed in AST (DeSanctis & Poole, 1994) levels of analysis have ranged from the micro level (speech acts, meeting phases), through global (entire meeting, multiple meetings) to the institutional level (multiple groups, cross organizations).

Each comparative episode is ordered into subsections consistent with the structure of the original episode (appropriation analysis; other forms of grounded data; time and space; metastructures with their visual mappings; and evolution of practices). Much of the detail for each episode is tabulated in the accompanying appendix 17, whereas the comparisons based upon intra- and inter-episode groupings are covered within this chapter in more depth.

The grouping of episodes in this chapter is intended to uncover any patterns apparent across groups of episodes and highlight any differences within and between TUM activity modes.

7.2 Grouped episodes of interest – TUM establishment mode

This first grouping includes a single large episode incorporating *TUM activity* conducted in the *establishment* mode. For ease of cross episode comparison, a set of quantitative summaries tabulating the key elements present within the episode is first developed. As the number of data sources between episodes varies considerably, a normalised frequency measure *(F)* is used to aid within and between episode comparisons. This measure has been derived via the formula below, converting the code counts *(c)* (as the number of unique data sources *(S)* in which the code has been cited) into a simple percentage of the overall number of data sources for the episode:

$$F = ((c \div \sum_{i=1}^{n} S_i) * 100)$$

Tabulation of the *categories* of appropriation move, *concepts* and *codes* identified within each table is based upon this normalized frequency measure, representing their relative occurrences on a percentage basis for comparative purposes. These summaries are then augmented by a condensed profile of the key aspects identified in the episode which are less readily amenable to quantification. Quantification in this chapter takes advantage of the *NVivo7* ability to count coded data items, and is not intended to have rigorous import, but is used simply as a mechanism to aid in highlighting patterns across episode groupings.

Since the tabulations for this *establishment* grouping essentially recap the full analysis for the establishment episode in chapter 6.4 above, the summary tables are portrayed in section A17.2 of Appendix 17. In section 7.7 below the summary data from this grouping will be presented, in a fuller comparison with the other TUM activity groupings presented in this chapter.

7.3 Grouped episodes of interest – TUM adjustment/reinforcement mode episodes one - four

This grouping includes four *adjustment/reinforcement mode* episodes grouped for comparison. The summary for each individual episode is again ordered into subsections consistent with the structure of the original episode (appropriation analysis; other forms of grounded data; time and space; metastructures with their visual mappings; and evolution of practices). As provided for the establishment episode, and for ease of cross episode comparison within this grouping, a set of quantitative summaries tabulating the key elements present within each episode is first developed.

These summaries are then augmented by a condensed profile of the key aspects identified in the episode which are less readily amenable to quantification. Again, as these overview summaries essentially recap the full analysis for each of the four adjustment/reinforcement episodes in chapter 6 and the supporting appendices, the individual episode summary tables are portrayed in sections A17.3 – A17.6 of Appendix 17.

The next section of this chapter will compare TUM activity carried out in the *adjustment/reinforcement* mode, through an intra-group comparison of the four episodes contained within this grouping. That comparison will draw upon the normalized data from each individual episode as tabulated in appendix 17.

7.4 Intra Group Comparison: episodes of interest – TUM adjustment/reinforcement mode

7.4.1 Appropriation Analysis - Intra Group Comparison: TUM adjustment/reinforcement mode

Tables 7.1, 7.2, 7.3 and 7.4 below compare the set of appropriation moves coded across the full group of 'adjustment/reinforcement mode' episodes, using simple descriptive statistics, which serve to highlight some differences across episodes.

	Episode one		Episode two		Episode three		episode four			
App Move Category	**Norm Freq**	**Norm Freq**	**Norm Freq**	**Norm Freq**	**Norm Freq**	**Norm Freq**	**Norm Freq**	**Norm Freq**	**Mean**	**Std Dev**
Constraint	Adj %	Rein%	Adj %	Rein%	Adj %	Rein%	Adj %	Rein%		
6. Constraint - a. definition										
6. Constraint - b. command				50.0					50.0	
6. Constraint - c. diagnosis				25.0		50.0			37.5	17.7
6. Constraint - d. ordering	11.1			25.0					18.1	9.8
6. Constraint - e. queries	11.1	11.1							11.1	0.0
6. Constraint - f. closure										
6. Constraint - g. status report	11.1	11.1		25.0		50.0	40.0	20.0	26.2	15.8
6. Constraint - h. status request	11.1						20		15.6	6.3
6. Constraint - i. query response				50.0		50.0		40	46.7	5.8
6. Constraint - j. proposal	22.2	22.2			50.0				31.5	16.0
6. Constraint - k. future status	66.7	11.1				50.0			42.6	28.5
6. Constraint - l. set-up request	33.3	22.2							27.8	7.9
6. Constraint - m. diagnosis request	22.2	11.1							16.7	7.9
** % of sources in which category coded*										
No of source items	9		4		2		5			
TUM specific added moves										

Table 7.1: TUM Adjustment/reinforcement Mode Episodes - Normalised Frequencies for 'Constraint' Appropriation Moves

As can be noted from table 7.1 above, 'constraint' moves (where the structure is interpreted or reinterpreted) were prevalent across all episodes, with examples of each move except '*a. definition*' (showing the meaning of a structure or how it should be used) and '*f. closure*' (shows how use of a structure has been completed) being coded. These moves appear to have a TUM *reinforcement* dimension, but as activities associated in the former case with more direct use and explanation, and in the latter case with completed use, perhaps their omission was unremarkable in episodes characterized by indirect forms of use and a degree of future orientation. The matrix in table 7.1 was relatively sparse, but episode one contained a notably greater number of 'constraint' moves. 'Future status' and 'query response' appeared to be the most frequent across

episodes (taking the mean as a measure). *Query response* (Answering questions about the structure's meaning or how to use it) - an additional TUM specific code augmenting the original set of codes proposed by Poole & DeSanctis (1992) & DeSanctis & Poole (1994) - appears to naturally accompany the *reinforcement mode* TUM activities coded above. *Future status* (state what is being proposed to be done with - or to establish - the structure) – again an added TUM specific code to support intended appropriations, would on first thought have best accompanied *adjustment mode* TUM activities, but here was coded to both *adjustment* and *reinforcement* modes. *Status Report* (state what has been or is being done with the structure), appeared in every episode, in a combination of adjustment and reinforcement modes, which suggested this (although one of the original codes of Poole & DeSanctis, 1992), was a very natural appropriation move in support of TUM activities.

7.4.1.1 Appropriation Analysis - Intra Group Comparison: TUM adjustment/reinforcement mode – Direct Use

Table 7.2 below portrays the level of 'direct use' present in the episode grouping.

	Episode one		Episode two		Episode three		episode four			
App Move Category	**Norm Freq**	**Norm Freq**	**Norm Freq**	**Norm Freq**	**Norm Freq**	**Norm Freq**	**Norm Freq**	**Norm Freq**	**Mean**	**Std Dev**
Direct Use	Adj %	Rein%	Adj %	Rein%	Adj %	Rein%	Adj %	Rein%		
1. Direct appropriation - a. explicit										
1. Direct appropriation - b. implicit					50.0	50.0			50.0	0.0
1. Direct appropriation - c. bid										
** % of sources in which category coded*										
No of source items	9		4		2		5			
TUM specific added moves										

Table 7.2: TUM Adjustment/reinforcement Mode Episode - Normalised Frequencies for 'Direct Use' Appropriation Moves

As can be observed from table 7.2 only one episode contained an example of 'direct use', and this involved an 'implicit' appropriation move (use without referring to the structure), associated with a serendipitous telephone call from Arnold. The paucity of 'direct use' in these episodes may be inherent in the indirect forms of technology use represented by the TUM activities of *reinforcement* and *adjustment*, since TUM represents not so much "direct use", but "the shaping of others' use of technology" (Orlikowski et al., 1995, p.425).

7.4.1.2 Appropriation Analysis - Intra Group Comparison: TUM adjustment/reinforcement mode – Judgement

	Episode one		Episode two		Episode three		episode four			
App Move Category	**Norm Freq**	**Norm Freq**	**Norm Freq**	**Norm Freq**	**Norm Freq**	**Norm Freq**	**Norm Freq**	**Norm Freq**	**Mean**	**Std Dev**
Judgement	Adj %	Rein%	Adj %	Rein%	Adj %	Rein%	Adj %	Rein%		
7. Affirmation - a. agreement				25.0					25.0	
7. Affirmation - b. bid agree										
7. Affirmation - c. agree reject										
7. Affirmation - d. compliment	22.2	33.3		50.0		50.0			38.9	13.6
7. Affirmation - e. bid improve				25.0					25.0	
8. Negation - a. reject	11.1				50.0				30.6	27.5
8. Negation - b. indirect										
8. Negation - c. bid reject										
9. Neutrality - a. explicit						50.0	20.0		35.0	21.2
9. Neutrality - b. refer to authority						50.0	20.0		35.0	21.2
9. Neutrality - c. offer help								20.0	20.0	
** % of sources in which category coded*										
No of source items	9		4		2		5			
TUM specific added moves										

Table 7.3: TUM Adjustment/reinforcement Mode Intra Group Comparison: - Normalised Frequencies for 'Judgement' Appropriation Moves

As can be noted from table 7.3 above, 'judgement' moves (where actors express judgements about the structure) were more patchily represented across the four episodes, but covered both *adjustment* and *reinforcement* modes, perhaps naturally as expressing judgments about technology structures would be common to either mode . Absent were appropriation moves of type: 1) *affirmation* which "asked others to agree with appropriation of the structure" (*bid agree*), or where "others agree to reject appropriation of the structure" (*agree reject*); and of type 2) *negation* where actors "reject appropriation of the structure by ignoring it, such as ignoring another's bid to use it" (*indirect*) or suggest or ask others to reject use of the structure (*bid reject*). In this context these codes were not wholly applicable, as both the *affirmation* and *negation* moves would better relate to a context of 'direct use', as opposed to one of TUM activity targeted at reinforcing or adjusting the technology use of others. The most prevalent code and the code with the highest mean, was '*affirmation compliment*' (note an advantage of the structure), a natural code for a TUM episode where the focus was on reinforcing or adjusting use. Recommending certain technology features over others was inherent in such TUM activity. Coping with uncertainty was another significant coding theme in the episodes. Two TUM specific codes had been added in

this area, and were both coded in this grouping, namely "acknowledge uncertainty towards the use of the structure and need to consult an authority" (*neutrality refer to authority*) and "query uncertainty towards the use of the structure and offer assistance" (*neutrality offer help*). In the context of *reinforcing* technology use, and *adjusting* use, these 'uncertainty' related codes reflect the typical forms of TUM activity one would expect.

Table 7.4 below summarises the appropriation moves in the "relate" category, (where actors relate a structure to other structures – and the structure may be blended with another structure). This coding was less dominant than the prior codes, presenting a relatively sparse matrix. Both *adjustment* and *reinforcement* TUM modes were represented in this grouping. Codes not present in the grouping were the first three *substitution* moves *part*, *related* and *unrelated, (*where actors would "use *part of the structure* instead of the whole, use a *similar structure* in place of the structure at hand, or use *an opposing structure* in place of the structure at hand"*).* The absence of these codes again appeared understandable given the 'direct' nature of such moves whereas these episodes profiled more indirect TUM activities.

	Episode one		Episode two		Episode three		episode four			
App Move Category	**Norm Freq**	**Norm Freq**	**Norm Freq**	**Norm Freq**	**Norm Freq**	**Norm Freq**	**Norm Freq**	**Norm Freq**	**Mean**	**Std Dev**
Relate	Adj %	Rein%	Adj %	Rein%	Adj %	Rein%	Adj %	Rein%		
2. Substitution - a. part										
2. Substitution - b. related										
2. Substitution - c. unrelated										
2. Substitution - d. bid			25.0			50.0			37.5	17.7
2. Substitution - e. proposal bid					50.0				50.0	
3. Combination - a. composition	11.1	11.1							11.1	0.0
3. Combination - b. paradox										
3. Combination - c. Corrective	22.2							20.0	21.1	1.6
3. Combination-d. element request										
3. Combination-e. bid corrective										
4. Enlargement - a. positive										
4. Enlargement - b. negative										
5. Contrast - a. contrary										
5. Contrast - b. favored	11.1		25.0						18.1	9.8
5. Contrast - c. none favored	11.1	11.1							11.1	0.0
5. Contrast - d. criticism	11.1	11.1							11.1	0.0
** % of sources in which category coded*										
No of source items	9		4		2		5			
TUM specific added moves										

Table 7.4: TUM adjustment/reinforcement Mode Intra Group Comparison: - Normalised Frequencies for 'Relate' Appropriation Moves

The two additional *substitution* moves with a TUM focus were among the dominant moves represented in the episode. These two moves: 1) *bid* "propose use a similar structure in place of the structure at hand and seek confirmation"; and 2) *proposal bid*, where the actors would "request proposal(s) to use a similar structure instead of the structure proposed" reflected the types of 'indirect use' advocacy that one might have expected. Such interchanges were compatible with the *adjustment* or *reinforcement* modes of TUM activity, where alternate technologies and features might be proposed or requested. A few *combination* moves were evenly spread across *adjustment* and *reinforcement modes*, both *composition* where actors "combine two structures in a way consistent with the spirit of both", and *corrective* where actors "use one structure as a corrective for a perceived deficiency in another". No examples of *paradoxical* combinations were evident, where actors "combine contrary structures with no acknowledgement that they are contrary". Thus it appears that TUM activities combining technology components (whether naturally or to correct deficiencies), in this grouping respected the 'spirit' of the underlying technology. The more indirect *combination* moves (*element request* and *bid corrective*), although added as TUM specific moves for this category, were interestingly not present in the episode. However the first of these, being a "request for one structural element required in order to create a composite structure", may intrinsically be an uncommon move. The second move "proposing use of one structure to correct a deficiency in another" was supplanted by more directly *corrective* uses. Codes comparing and contrasting structures with others were present in the episode grouping, with three forms of *contrast* evident: *favored* "favouring one structure over the others"; *none favored* "structures are compared but with none favoured over the others"; and *criticism* "criticizing the structure but without an explicit contrast". These moves no doubt reflected the type of information sharing about the technology platform, almost a 'musing by email', that might commonly be engaged in by parties performing such TUM activities.

7.4.2 Other Grounded Data – Intra Group Comparison: TUM adjustment/reinforcement mode

Grounded data coded for the adjustment reinforcement mode episode grouping is profiled below, based upon the tables from the four original episodes. Table 7.5 below compares the set of concepts coded across the full group of 'adjustment/reinforcement mode' episodes, using simple descriptive statistics, which again served to highlight some differences in coding patterns across episodes.

		Episode one		Episode two		Episode three		Episode four					
		Norm Freq	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	**Mean**	**Std Dev**	**Mean**	**Std Dev**
Concepts	Codes	Codes %	Concepts %	Codes %	Concepts %	Codes %	Concepts %	Codes %	Concepts %	**Codes %**	**Codes %**	**Concepts %**	**Concepts %**
Activity	planning-meeting scheduling	22.2						40.0	40.0	31.1	12.6	40.0	
Activity	scripting	22.2	44.4							22.2		44.4	
Activity	trial planning			25.0	25.0					25.0		25.0	
AIT	AIT	100.0		100.0		100.0		100.0	100.0	100.0	0.0	100.0	
AIT	AIT Spirit	11.1		25.0		50.0	150.0			28.7	19.7	150.0	
AIT	attachment transmission	22.2	133.3	25.0	150.0					23.6	2.0	141.7	11.8
Breakdown	Breakdown	22.2		25.0	25.0	50.0		20.0	20.0	29.3	13.9	22.5	3.5
Breakdown	Recovery Plan	11.1	33.3			50.0	100.0			30.6	27.5	66.7	47.1
collaboration	collaboration			25.0	25.0					25.0		25.0	
competition	competition			25.0	25.0					25.0		25.0	
Control	authentication	11.1								11.1			
Control	authorization	33.3				100.0				66.7	47.1		
Control	Control	11.1				50.0	150.0			30.6	27.5	150.0	
Control	Online Registration			25.0						25.0			
Control	security	11.1	66.7	50.0	75.0					30.6	27.5	70.8	5.9
Culture	cultural issues			25.0		100.0				62.5	53.0		
Culture	Student culture			75.0	100.0	50.0	150.0	20.0	20.0	48.3	27.5	90.0	65.6
Data Source	diary note	33.3	33.3			100.0	100.0			66.7	47.1	66.7	47.1
Env Output	Formally scripted interactions	11.1	11.1							11.1		11.1	
GVT	Global Team Formation	11.1		25.0						18.1	9.8		
GVT	GVT	55.6	66.7	75.0	100.0	100.0	100.0	20.0	20.0	62.6	33.7	71.7	37.9
LT	LT	11.1	11.1	100.0	100.0	100.0	100.0	20.0	20.0	57.8	48.9	57.8	48.9
Metastructure	Instructions			25.0						25.0			
Metastructure	Metastructure	88.9	88.9	100.0	125.0	100.0		100.0	100.0	97.2	5.6	104.6	18.5
Metastructure	Metastructure Spirit					50.0	150.0			50.0		150.0	
Organization	Organization			25.0	25.0					25.0		25.0	
Research	data	11.1	11.1							11.1		11.1	
Research	research design			50.0	50.0			40.0		45.0	7.1	50.0	
Research	paper							40.0		40.0			
Research	research							20.0	100.0	20.0		100.0	
Socio-emotional	context & technology-directed emotions	22.2		50.0		50.0		20.0		35.6	16.7		
socio-emotional	motivation			50.0		50.0		20.0		40.0	17.3		
Socio-emotional	other-directed emotions			50.0		100.0		20.0	60.0	56.7	40.4	60.0	
Socio-emotional	performance-driven emotions	22.2	44.4	50.0		100.0				57.4	39.4	44.4	
Socio-emotional	Self-directed emotions			25.0	225.0	50.0	350.0			37.5	17.7	287.5	88.4
Task	Assessment			25.0						25.0			
Task	Each GVTs participants become acquainted			25.0						25.0			
Task	Learning task	11.1	11.1	75.0						43.1	45.2	11.1	
Task	select a leader or self-managed option for GVT			25.0	150.0					25.0		150.0	
TUM Activity	Adjustment	100.0		50.0		100.0	100.0	80.0		82.5	23.6	100.0	
TUM activity	episodic change							40.0		40.0			
TUM Activity	Establishment	55.6								55.6			
TUM Activity	Reinforcement	44.4	200.0	100.0	150.0	100.0	100.0	80.0	200.0	81.1	26.2	162.5	47.9

Table 7.5: TUM adjustment/reinforcement Mode Intra Group Comparison:- Normalised Frequencies for 'Concepts & Codes'

Table 7.5 above speaks for itself in demonstrating the frequency and relative consistency of key concepts and codes across the four TUM *adjustment* and *reinforcement* episodes. A brief review of the more prominent concepts highlights: the role of Technology and its *spirit* through *AIT;* the prevalence of *breakdown* and *recovery;* the influence of *control* and *security;* the impact of *culture* and *student culture;* the pervasiveness of the concepts of *GVT* and to a lesser extent *LT*; the significance of *metastructures* and their embedded *spirit*; the functioning of *research* as a driver for much of the activity; the dominant influence exerted by *socio-emotional* dimensions in every episode; and the significance of *task*.

While these episodes focused primarily on the TUM activities of *adjustment* and *reinforcement*, it is noteworthy that the *establishment* and *episodic change* modes of activity were each in evidence in separate episodes. In the former case the TUM activity was associated with initiating phase two of the collaboration (as an effectively delayed *establishment* activity); in the latter case the TUM activity was associated with planning my visit to St Louis and a new face-to-face experience, which would represent an *episodic change* in the mode of conduct for the GVT of trial coordinators. Thus it appears that TUM phases were not wholly distinct in the manner represented by Orlikowski et al., (1995), but to some extent were intertwined, with the seeds for one phase often being laid in prior phases, wherein another TUM activity mode was dominant.

While the concepts of time and space are yet to be addressed below, these circumstances seem reminiscent of the quote by Czarniawksa (2004, p.776) that "all important events happen at some other time, in some other place" and '*important events* become such in accounts". Perhaps one benefit of the form of TUM analysis undertaken in this thesis lies in capturing the evolution of action from its origin and as it develops. Methodologically it addresses the lament of Langley and colleagues over organizational decision making processes:

> "then tracing a decision process back into an organization becomes much like tracing the origin of a wave back into the ocean." (Langley et al., 1995, p. 264)

7.4.2.1 Other Grounded Data 'Roles' - Intra Group Comparison: TUM adjustment/reinforcement mode

Table 7.6 below addresses the further concept of 'roles', a dominant concept not only in each episode, but across episodes as indicated by the very high mean concept score

(greater than 400%: *Note: concept values in excess of 100% result from adding up the individual code scores*). The table is characterized not only by the diversity of roles, but by the concentration of some roles versus the more occasional contribution of others.

The dominant roles were largely unremarkable with: *coordinator; offshore technical coordinator; teacher; researcher; and undergraduate student roles* all evident.

A secondary grouping of roles was implicitly related to TUM activities in support of GVT activities, with *facilitator, process facilitator; motivator and socio-emotional group building roles* being examples.

A third grouping of roles had more of a technology focus on TUM activities, with examples being: *emergent central users (somewhat like webmasters), testers, developer, administrator, external consultants*; and *support and maintenance team representatives.*

On reviewing the operation of these roles in the *adjustment* and *reinforcement* modes of TUM activity, they appeared to address the three group functions proposed by McGrath (1991) in his TIP theory. The coordinative and technical support roles helped GVTs fulfill their "production" function of producing work. The defined organizational roles (teacher, researcher and student) helped meet the 'well-being" function of "developing and maintaining the group as a system" within its context. The facilitative and socio-emotional support roles aimed to shore up the "member support" function of helping individuals become embedded within their groups.

		Episode one		Episode two		Episode three		Episode four					
		Norm Freq	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	**Mean**	**Std Dev**	**Mean**	**Std Dev**
Concepts	Codes	Codes %	Concepts %	Codes %	Concepts %	Codes %	Concepts %	Codes %	Concepts %	**Codes %**	**Codes %**	**Concepts %**	**Concepts %**
Role	Central users - self selected, emergent (like a Coweb webmaster)	22.2		25.0		50.0				32.4	15.3		
Role	Coordinator	66.7		75.0		100.0		100.0		85.4			
Role	Developer	22.2						20.0		21.1			
Role	External consultants (infrastructural)							20.0		20.0			
Role	Facilitator			25.0						25.0			
Role	Formal (teaching - research assistants)	11.1								11.1			
Role	IRB	11.1								11.1			
Role	Lotus Notes administrator							20.0		20.0			
Role	Motivator (energizer, encourager)	22.2						40.0		31.1			
Role	Officially sanctioned local developer	11.1		25.0						18.1			
Role	Offshore Technical Coordinator	44.4		75.0		100.0		40.0		64.9			
Role	Process Facilitator	50.0				50.0				50.0	0.0		
Role	Purpose agents - teacher	44.4		50.0		100.0		20.0		53.6	33.6		
Role	Researcher							40.0		40.0			
Role	socio-emotional group-bldg and mtce roles							20.0		20.0			
Role	Support and Maintenance Team representatives							20.0		20.0			
Role	Technologist	11.1								11.1			
Role	Testers.	55.6						40.0		47.8	11.0		
Role	trainers			25.0						25.0			
Role	Undergraduate Student	33.3	355.6	75.0	375.0	100.0	500.0	20.0	380.0	57.1	37.0	402.6	65.8

Table 7.6: TUM Adjustment/reinforcement Mode Intra Group Comparison:- Normalised Frequencies for Coded ‘Roles’

Note: concept values in excess of 100% result from summing the individual code scores, and are therefore merely indicative of magnitude

7.4.2.2 Other Grounded Data 'Time & Space' – Intra Group Comparison: TUM adjustment/reinforcement mode

Table 7.7 below, provides normalized frequencies across the four episode grouping for the pervasive concepts of 'space and time'. As can be seen the three core concepts of *space*, *time* and *time pressure* were dominant as indicated by their high mean concept scores (between 70% and 340%).

For the concept of 'space' *location* was the primary code representing the separately situated *spaces* in which the actors resided, and with *face to face* and *absence* displaying the opposite poles of a paradoxical physical presence within this global virtual collaboration.

The predominant *time* related codes were: *day* where *day* was typically 'day of week', and contributed to cyclical temporal patterns (e.g. day of class session each week) that were not always apparent; *Runestone* representing a past experience of collaboration on Arnold's part and a significant reservoir of experience; *synchronize* present in each episode and a continual challenge for TUM with GVTs dispersed across time and space; *time* while a rather generic code typically denoting the 'clock time' of day or night; *time separation* a code denoting distance in time, typically between sites, but sometimes over durations; *time zone* present in each episode and a complementary code to *time separation* reflecting the significant time differences between sites, in turn impacted by *daylight saving time* which further impacted the time difference between sites, often asymetrically.

		Episode one		Episode two		Episode three		Episode four					
		Norm Freq	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	**Mean**	**Std Dev**	**Mean**	**Std Dev**
Concepts	Codes	Codes %	Concepts %	Codes %	Concepts %	Codes %	Concepts %	Codes %	Concepts %	**Codes %**	**Codes %**	**Concepts %**	**Concepts %**
Space	Absence			25.0						25.0			
Space	face to face							40.0		40.0			
Space	Location	55.6	55.6	100.0	125.0	100.0	100.0	60.0	100.0	78.9		95.1	28.9
Time	Class Schedule	11.1		75.0						43.1			
Time	day	44.4				100.0		60.0		68.1			
Time	daylight saving	11.1						40.0		25.6			
Time	Delay			25.0						25.0			
Time	experience			25.0		50.0				37.5			
Time	holiday	11.1		75.0				20.0		35.4			
Time	Runestone					50.0				50.0			
Time	Schedule			25.0						25.0			
Time	stages of scripting the project	55.6		25.0						40.3	21.6		
Time	Synchronize	55.6		25.0		100.0		100.0		70.1	36.7		
Time	Time	33.3		25.0		100.0		60.0		54.6			
Time	Time separation	33.3				50.0				41.7			
Time	time zone	11.1	266.7	25.0	325.0	50.0	500.0	20.0	300.0	26.5		347.9	104.2
Time Pressure	busyness					50.0		20.0		35.0			
Time Pressure	concurrent tasks					50.0	100.0	20.0	40.0	35.0	21.2	70.0	42.4

Table 7.7: TUM Adjustment/reinforcement Mode Intra Group Comparison:- Normalised Frequencies for Coded ‘Space and Time’

Note: concept values in excess of 100% result from summing the individual code scores, and are therefore merely indicative of magnitude

For the concept of *time pressure* codes of *busyness* and *concurrent tasks* were evident in two of the four episodes above. This notion of time as a scarce resource derives from the "temponomic" view of time (McGrath & Kelly, 1986 p.61). But this *pressured* notion of *time* resulting in our working on *concurrent tasks* may also have underlying links to notions of *place*. Czarniawska (2004, p.786) has reflected that 'modern organizing…takes place in a net of fragmented multiple contexts, through multitudes of kaleidoscopic movements. Organizing happens in many places at once, and organizers move around quickly and frequently". While her focus in that quote was on *place* and the mobility of actors, implicit in such situated *busyness* was the related notion of time as a limited resource and a source of *pressure*. Czarniawska has also ruefully remarked that "time and space are irreversibly intertwined in practice, but they become separated in theory" (ibid.). As table 7.7 above demonstrates, the two were indeed "intertwined", and the challenge for research is to avoid the artificial divide. For research in the context of global virtual teams, and for realistically unpacking TUM activity perhaps this is even more imperative.

7.4.2.3 Other Grounded Data 'Metastructures' – Intra Group Comparison: TUM adjustment/reinforcement mode

Table 7.8 below lists for comparison the 'metastructures', which were given particular attention in the original episodes. The treatment here is necessarily uneven, reflecting the approach taken in each episode, and does not support direct comparability in the manner of the above sections. Whereas some episodes have directly highlighted distinct sets of metastructures, others have been more implicit in their treatment. For instance, blending metastructures with other structures such as specific AITs and their features, was the approach adopted in episode one.

As can be seen in table 7.8, the *metastructures* highlighted in the body of the episodes made up a multi-faceted collection.

Episode one	Episode two	Episode three	Episode four
Metastructures (in body of chapter)			
(Metastructures implicit in tables A20-6.27a and A20-6.27b)			
AITs			
announcements		Announcements	
			Answerphone message
	Assignment		
	Attachment		
	AUTOnline	AUTOnline Group Page	AUTonline
	Class		
	Classroom		
			Collaborative computing topic
	Collaborative data base (2)		
		Collaborative teaching team (GVT)	
	Competition		
	"deliverables entire team must work towards"		
	Discussion		
	Email (3)		
	Exercise (3)		
	Experience		
features of applications			
		Firewalls	
			Fred's phone number
	Game		
		Global email list	
		Global Virtual Classroom	
	Groups (GVTs)		
GVT	GVT	GVT	GVT
GVT Groups (AUTonline)			
	Instructions (3)		
	international collaboration		
	Introduction		
	Lab		
LT	LT (2)	LT	LT
main navigator			
			Meetings
	Message		
			Minibreak
			Notes collaborative Database
	NZ/SW/USA Collaboration		
		Online questionnaires	
	Online registration		
	online synchronous chat meetings.		
	Optional task		
			Panel discussion
	Paper (2)		
	Phases		
	Prize		
	Project		
	Projector		
	Ranking		
	Ranking discussions		
	Required task		
	Research		
			Seminar
			Server upgrade
			Servers
			"Session here on campus"
	Set of questions		
	Site		
	structure of the exercises		
		Student web pages	
synchronous chat sessions			
			Testing and backup plans
tutors' discussion board			
two week break			
URL's			
		Video conference	
			Visit
VPN			
	Websites (2)		Websites

Table 7.8: TUM Adjustment/reinforcement Mode Intra Group Comparison: – Featured 'Metastructures'

Some patterns can be discerned within the overall collection. Only a few metastructures occurred across all four episodes, *GVT* and *LT* being notable examples (with the

collaborative teaching team itself distinguished as another form of *GVT). AUTOnline* then provided an example of a more 'technology focused' metastructure. Generally speaking the full collection of metastructures represented a set of activity patterns with varying foci.

Other 'technology focused' metastructures were recorded within two separate episodes: *announcements; Notes collaborative database, online synchronous chat sessions*; and *websites*. Several further technology-related metastructures were also evident in single episodes (e.g. *VPN, student web pages, projector, tutor's discussion board*).

'Institutional' and 'cultural' dimensions came to the fore in domain specific genres such as: *assignment; paper; collaborative computing topic; panel discussion; online questionnaires; structure of the exercises;* and *ranking discussion*.

'Spatial' metastructures were also evident in both the physical: *lab; site; session here on campus; classroom;* and more digital forms of space such as, *firewalls; URLs;* and *global virtual classroom.*

Accompanying the spatial were 'time-bound' metastructure forms such as the following: *two week break; midterms; minibreak; synchronous chat sessions; experience; phases*.

Metastructures encapsulating particular 'cultural' values within their 'metastructure spirit' were also noted: *collaborative teaching team (GVT); competition; prize; research; optional task, required task.*

Complementing the metastructures in the body of the episodes, were those specifically selected for attention in the visual map section of each analysis. Table 7.9 below depicts these.

Episode one	Episode two	Episode three	Episode four
Draft Phase 2 instructions for students			
	LT at each site		
			Server upgrade St Louis Panel session
		Synchronous chat sessions and technologies	

Table 7.9: TUM Adjustment/reinforcement Mode Intra Group Comparison: – 'Metastructures' from visual maps

This grouping contains only five different metastructures, but still shows a dispersed collection across the episodes, with patterns not dissimilar to the fuller collection in table 7.8 above. Again multiple dimensions were evident within this more compressed set of metastructures in table 7.9.

'Institutional' and 'cultural' patterns were inscribed in the 'Domain specific genres' apparent through the metastructures of *draft Phase 2 instructions for students, and St Louis Panel session.*

The previously prominent metastructure of an *LT* was again featured, this time including the 'spatial' dimension *at each site*, a dimension also apparent in the *St Louis Panel session*.

The 'time' dimension underpinned the metastructures of *synchronous chat sessions and technologies and draft phase 2 instructions for students.*

The 'technology' dimension presented itself in both *synchronous chat sessions and technologies* and the *server upgrade*, with the latter further incorporating an 'institutional' dimension.

Not all of the metastructures in table 7.9 related directly to the primary TUM activities of 'adjustment' and 'reinforcement' within this episode grouping. The *St Louis Panel session* for instance also reflected TUM activity in the 'episodic change' mode, and *the draft phase 2 instructions for students* reflected not only 'adjustment' and 'reinforcement' but also 'establishment' mode TUM activities.

Nonetheless, the general picture portrayed of metastructures across this episode grouping illustrates their multifaceted nature, and the significant role they have played in forming a focal point for TUM activities, by linking the realms of institution, action, technology, and its use (Orlikowski et al., 1995).

In this sense 'metastructures' may be seen as somewhat akin to the "shared object" of activity theory, where "the motive of a collective activity is in its shared object or more specifically what the object transforms into during the activity, i.e. the outcome" (Korpela et al., 2002). "Actors perform their individual actions of work on the shared object through mediating instruments or means of work which can be material (technology) or immaterial (language, skills, theories) (ibid.)", in a work process where "individual actions taken together form the process through which the object is transformed to the output" (ibid). Although perhaps more diffuse than the "shared object" of activity theory, certainly metastructures appeared to serve a role in these episodes, of supporting TUM activity aimed towards achieving the overall outcomes.

7.4.2.4 Evolution of Practices – Intra Group Comparison: TUM adjustment/reinforcement mode

Table 7.10 below portrays the evolution of practices within the extended temporal brackets augmenting the analysis for their episodes. However, this portrayal is presented more for the sake of comparing the unfolding of events related to each episode than to enable direct comparison, between TUM activity modes.

Episode one					Episode two					Episode three					Episode four				
Start Bracket	**End Bracket**	**Desired Practice**	**Realised Practice**	**Dominant AIT**	**Start Bracket**	**End Bracket**	**Desired Practice**	**Realised Practice**	**Dominant AIT**	**Start Bracket**	**End Bracket**	**Desired Practice**	**Realised Practice**	**Dominant AIT**	**Start Bracket**	**End Bracket**	**Desired Practice**	**Realised Practice**	**Dominant AIT**
23/08/2004	14/10/2004	Students free to choose communication software from AUTOnline features including AUTOnline email for external students	AUTOnline email communication not available for external students	AUTOnline Email accounts	11/11/2003	5/10/2004	Groups free to choose own software implicitly both asynchronous and synchronous	AUTOnline features and Lotus Notes DBs confirmed as technology platform	AUTOnline features	11/11/2003	30/10/2004	Groups free to choose own software implicitly both asynchronous and synchronous	AUTOnline lightweight synchronous chat features used only by LTs of AUT students (based upon few recorded sessions)	AUTOnline lightweight chat & recording features	28/09/2004	19/10/2004	Notes server software to be upgraded to version 6.5 for AUT Centre for Educational and Professional Development	University wide priorities took precedence	Lotus Notes Domino Server
			Have to use own Swedish email addresses					AUT students make some attempts	Lotus Notes Collab DB				Logistics of coordinating global chat sessions across time zones prove too daunting				We recommended ideal time after our global collaboration	Negotiated a testing and recovery plan with IT service providers	Lotus Notes Designer
31/08/2004	3/11/2004	AUT students to identify 5 key issues during trial, collect at least 5 pieces of evidence, could include chat session recording	Issues identified by students, discussion thread postings and Notes forms attached as appendices	AUTOnline Discussion threads				Uppsala students have accounts finally but no active partners		3/10/2004	4/10/2004	Global email list for communication with all participants	No overall email list set up on AUTOnline, logistics of setting up forwarding option (to be done individually by each external student) would take too long to build global list	AUTOnline email account (forwarding option for external students), external students home email accounts				External support consultant called in to conduct upgrade	Lotus Notes Clients
			No chat recordings	Notes Database forms, AUTOnline lightweight chat feature				US students don't work outside class		29/09/2004	30/10/2004	1) Proposed introductory global synchronous chat session for all GVTs be arranged	1) rejected as "too hard'	AUTOnline lightweight chat feature				Tests conducted satisfactorily and no disruption to collaboration	Email
28/09/2004	3/11/2004	Arnold proposed a joint chat session between members of each GVT	No chat sessions eventuated	AUTOnline Discussion thread AUTOnline Announcement AUTOnline lightweight chat feature	16/09/2004	22/09/2004	External students registered and freely able to use AUTOnline	St Louis students now set up for access and still to log on - 2 weeks after original start date	AUTOnline, AUTOnline student accounts			2) 3 way phone call of trial coordinators tba	2) decided to defer, timezones & limited time	telephone					
					22/09/2004	24/02/2005	External students, coordinators and local counterparts able to freely access and use AUTOnline and Lotus Notes DB	AUTOnline down frequently, Swedish collaborators and St Louis collaborators unable to access site during peak daylight hours.	AUTOnline			3) Proposed trial coordinators to convene synchronous chat sessions with three GVTs each	3) proposed students initiate sessions for each GVT and invite coordinators to join – did not eventuate						
								Able to advise Arnold due to scheduled overnight downtime for backups at AUT not advised to us	Lotus Notes DB										

Table 7.10: TUM Adjustment/reinforcement Mode Intra Group Comparison:– Evolution of Practices

A major theme in the excerpts from table 7.10 above is that of 'breakdown'. Perhaps this is a natural theme as each episode depicts a "TUM activity in focus", with the focus being occasioned by our attention being drawn to an event or sequence out of the ordinary. While the above four temporal brackets extended the original *adjustment/reinforcement* episodes, making comparisons questionable, on closer inspection they each focused on *adjustment/reinforcement TUM* activity. Therefore some discussion of the notion of 'breakdown' as it related to these temporal brackets is warranted.

In the words of Winograd & Flores (1997) a 'breakdown' is "a situation of nonobviousness, in which the recognition that something is missing leads to unconcealing…some aspect of the network of tools we are engaged in using (p. 165)" and "breakdowns must be understood in a larger network of conversation as well. The issue is not just whether the machine will stop working, but whether there is a sufficient network of auxiliary conversations about system availability, support, training, modification and so on" (p.173). They proceed to note that major system failures have resulted from breakdowns in this larger "web of computing" (Kling & Scacchi, 1992). This "web of computing" of course is the space of *TUM activity* and the focus in the above episodes, where *adjusting* to breakdown, *reinforcing* use in the face of breakdown, or engaging in *TUM activity* to prevent (or at least circumvent) breakdowns, were the activities portrayed.

To complement the contents of table 7.10 the *TUM activity in focus* for each of the above episodes is now briefly summarized. The focus of the first episode was on 'students' appropriation of asynchronous technologies during the collaboration'. The second episode had three separate foci: 'establishing AUTOnline as the technology platform'; 'registering students to AUTOnline'; and 'connectivity difficulties of a more intermittent nature'. The third episode again focused on 'the use of synchronous technologies during the collaboration'. In the fourth episode the focus was on 'the Lotus Notes server upgrade'.

Whereas the temporal brackets for episodes one and four were relatively short in duration, episodes two and three evolved over windows of a year and more in length. Episode two included a subsequent diagnosis of a breakdown shared with Arnold some four months after the event, and for both episodes two and three the November 2003 meeting with Mats reflected TUM activity in *episodic change* mode where we had revised the design of the collaboration aiming to prevent future breakdowns, even if this redesign subsequently proved not wholly successful in practice. For instance in episode two, the issues of differing student motivations had still not been fully resolved, the delays in getting started had severe impact and the intermittent and frustrating system outages had not been diagnosed until after the event. But as Winograd & Flores (1997) have observed, "It is impossible to avoid breakdowns by design, since it is in the nature of any design process that it must select a finite set of anticipations from the situation. But we can partially anticipate situations where breakdowns are likely to

occur…and we can provide people with the tools and procedures to cope with them (p. 158)". Thus episode four provides an example of pre-emptive TUM activity in adjustment mode, by ensuring a 'testing and recovery plan' were in place should the Lotus Notes server upgrade cause a disruption to our collaboration.

This form of analysis based upon the *TUM activity in focus*, thus appears to afford similar insights to those gained by Hettinga (2002) through breakdown analysis. The EVOLVE (*EVOLutionary aspects of Videoconferencing Explored*) model, which she applied to a videoconferencing context, is depicted below.

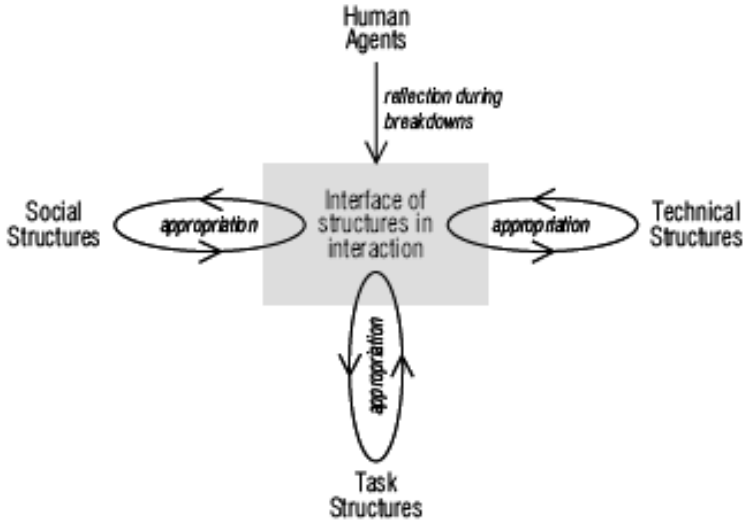


Figure 7.1: EVOLVE's Conceptual Model [ex. Hettinga 2002 p. 30]

In Hettinga's EVOLVE model for breakdown analysis she remarked that there is an "interface of structures in interaction" and "this interface becomes explicit during breakdowns when human agents reflect" (Hettinga, 2002 p. 30). In a similar way the inherent reflexive consciousness of *TUM activity* naturally generates this form of reflection, occasioned by the context and the inevitable occurrence of breakdown events. Turning again to Winograd & Flores (1997) "It is impossible to anticipate all of the relevant breakdowns and their domains. They emerge gradually in practice" (p. 171). Then once they emerge, the TUM activities of *adjustment* and *reinforcement* may be brought to bear on the situation, as the examples in table 7.10 above have depicted.

7.5 Grouped episodes of interest – TUM episodic change mode episodes one - three

This grouping includes three *episodic change mode* episodes grouped for comparison, with the exception that the second episode is a combined *episodic change/adjustment mode* episode. The summary for each individual episode is again ordered into subsections consistent with the structure of the original episode (appropriation analysis; other forms of grounded data; time and space; metastructures with their visual mappings; and evolution of practices). Again a set of quantitative summaries tabulating the key elements present within each episode is developed, and augmented by a condensed profile of the key aspects identified in the episode which are less readily amenable to quantification.

As with the earlier episode groupings, since these overview summaries essentially recap the full analysis for each of the three *episodic change mode* episodes in chapter 6 and the supporting appendices, the individual episode summary tables are portrayed in sections A17.7 – A17.9 of Appendix 17.

The next section of this chapter will compare TUM activity carried out in the *episodic change* mode, through an intra-group comparison of the three episodes contained within this grouping. That comparison will draw upon the normalized data from each individual episode as tabulated in appendix 17.

7.6 Intra Group Comparison: episodes of interest – TUM episodic change mode

7.6.1 Appropriation Analysis - Intra Group Comparison: TUM episodic change mode - Constraint

Tables 7.11, 7.12, and 7.13 below compare the set of appropriation moves coded across the full group of 'episodic change mode' episodes, using simple descriptive statistics, which serve to highlight some differences across episodes.

	Episode one	Episode two		Episode three		
App Move Category	**Norm Freq**	**Norm Freq**	**Norm Freq**	**Norm Freq**	**Mean**	**Std Dev**
Constraint	Episodic %	Episodic %	Adj %	Episodic %		
6. Constraint - a. definition						
6. Constraint - b. command						
6. Constraint - c. diagnosis				28.6	28.6	
6. Constraint - d. ordering				14.3	14.3	
6. Constraint - e. queries						
6. Constraint - f. closure						
6. Constraint - g. status report						
6. Constraint - h. status request						
6. Constraint - i. query response						
6. Constraint - j. proposal				14.3	14.3	
6. Constraint - k. future status	100.0	100.0	100.0	14.3	78.6	42.9
6. Constraint - l. set-up request						
6. Constraint - m. diagnosis request						
** % of sources in which category coded*						
No of source items	1	1	1	7		
TUM specific added moves						

Table 7.11: TUM Episodic Change Mode Episode Intra Group Comparison:- Normalised Frequencies for 'Constraint' Appropriation Moves

As can be noted from table 7.11 above, the pattern of 'constraint' moves (where the structure is interpreted or reinterpreted) was not consistent across episodes. The matrix in table 7.11 was relatively sparse, but episode three, with more source items than the single item episodes one and two, did contain a greater number of 'constraint' moves. Appropriation moves whose future orientation naturally belonged with an 'episodic change' episode, were the TUM specific additional codes *'proposal'* (suggesting how the structure should be used) and *'Future status'* (state what is being proposed to be done with - or to establish - the structure). The latter code was present in all three episodes and, taking the mean as a measure, was also the most frequent move across

episodes.

7.6.1.1 Appropriation Analysis - Intra Group Comparison: TUM episodic change mode – Judgement

	Episode one	Episode two		Episode three		
App Move Category	**Norm Freq**	**Norm Freq**	**Norm Freq**	**Norm Freq**	**Mean**	**Std Dev**
Judgement	Episodic %	Episodic %	Adj %	Episodic %		
7. Affirmation - a. agreement						
7. Affirmation - b. bid agree						
7. Affirmation - c. agree reject	100.0				100.0	
7. Affirmation - d. compliment		100.0	100.0	14.3	71.4	49.5
7. Affirmation - e. bid improve						
8. Negation - a. reject						
8. Negation - b. indirect						
8. Negation - c. bid reject						
9. Neutrality - a. explicit		100.0	100.0	14.3	71.4	49.5
9. Neutrality - b. refer to authority						
9. Neutrality - c. offer help						
** % of sources in which category coded*						
No of source items	1	1	1	7		
TUM specific added moves						

Table 7.12: TUM Episodic Change Mode Intra Group Comparison:- Normalised Frequencies for 'Judgement' Appropriation Moves

As can be noted from table 7.12 above, 'judgement' moves (where actors express judgements about the structure) while still relatively sparse, were more evenly spread across the three episodes, covering TUM activity in *episodic change* mode (and also *adjustment* mode in episode two). Noteworthy across these episodes was the absence of the three additional TUM specific codes: "request suggestions to improve the structure" *(affirmation bid improve)*; "acknowledge uncertainty towards the use of the structure and need to consult an authority" (*neutrality refer to authority*) and "query uncertainty towards the use of the structure and offer assistance" (*neutrality offer help*).

The most prevalent codes, and those with the highest mean across episodes, were "express uncertainty or neutrality towards use of the structure" (*neutrality explicit*), and note an advantage of the structure" (*affirmation compliment*). No doubt expressing uncertainty and preference were plausible moves within these episodes which involved TUM activity in 'episodic change' mode, but as previously noted (7.7.1.2), such moves were also consistent with TUM activity in the context of *reinforcing* technology use,

and *adjusting* that use. The final 'affirmation' move, (*agree reject*) where "others agree to reject appropriation of the structure" demonstrated how a lapse in use of a structure (in this case the 3D collaborative virtual environment) could constitute an 'episodic change'.

Table 7.13 below summarises the appropriation moves in the "relate" category, (where actors relate a structure to other structures – and the structure may be blended with another structure). This coding was less dominant than the prior codes, presenting a rather sparse matrix. Both *episodic change* and *adjustment* TUM modes were represented in this grouping (with the latter only in episode two).

	Episode one	Episode two		Episode three		
App Move Category	**Norm Freq**	**Norm Freq**	**Norm Freq**	**Norm Freq**	**Mean**	**Std Dev**
Constraint	Episodic %	Episodic %	Adj %	Episodic %		
Relate						
2. Substitution - a. part						
2. Substitution - b. related						
2. Substitution - c. unrelated						
2. Substitution - d. bid				14.3	14.3	
2. Substitution - e. proposal bid						
3. Combination - a. composition		100.0	100.0		100.0	
3. Combination - b. paradox						
3. Combination - c. Corrective						
3. Combination-d. element request						
3. Combination-e. bid corrective				14.3	14.3	
4. Enlargement - a. positive						
4. Enlargement - b. negative						
5. Contrast - a. contrary						
5. Contrast - b. favored	100.0				100.0	
5. Contrast - c. none favored						
5. Contrast - d. criticism						
** % of sources in which category coded*						
No of source items	1	1	1	7		
TUM specific added moves						

Table 7.13: TUM Episodic Change Mode Intra Group Comparison:- Normalised Frequencies for 'Relate' Appropriation Moves

The *substitution* move *bid* ''propose use a similar structure in place of the structure at hand and seek confirmation'', (one of the additional moves with a TUM focus), was evident in the third episode. Such a move was compatible with the *episodic change* mode of TUM activity, where alternate technologies and features might be proposed or

requested. The *combination* move (*bid corrective*), added as a TUM specific move for this category, was also present in the third episode. This move in "proposing use of one structure to correct a deficiency in another" again represented a natural move for TUM activity in 'episodic change' mode. The further *combination* move (*composition*), "combine two structures in a way consistent with both" indicated how structures (in this case the *metastructure* of the 'final evaluation questionnaire) might be augmented (here with an 'additional question') as part of TUM activity bringing about an 'episodic change' in the research programme. In the final move *contrast - favored* where "structures are compared with one favored over the others", preferences (here for technology options) were expressed and realized through TUM activity in 'episodic change' mode.

7.6.2 Other Grounded Data – Intra Group Comparison: TUM episodic change mode

Grounded data coded for the TUM 'episodic change' mode episode grouping is profiled below, based upon the tables from the three original episodes. Table 7.14 below compares the set of concepts coded across the full group of 'episodic change mode' episodes, using simple descriptive statistics and rankings, which served to highlight some differences in coding patterns across episodes.

As noted previously concept figures in excess of 100%, result from the summing of individual codes and are thus simply indicative of magnitude.

		Episode one		Episode two		Episode three		episodic grouping			episodic	episodic
		Norm Freq	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	**Mean**	***Std Dev***	**Mean**	**rank codes**	**rank concepts**
Concepts	Codes	Codes %	Concepts %	Codes %	Concepts %	Codes %	Concepts %	**Codes %**	***Codes %***	**Concepts %**		
Activity	configuration					14.3		14.3			38.0	
Activity	planning-meeting scheduling					14.3		14.3			38.0	
Activity	scripting	100.0				28.6	57.1	64.3	*50.5*	57.1	22.0	22.0
Activity	trial planning	100.0	200.0					100.0		200.0	1.0	7.0
AIT	AIT	100.0						100.0			1.0	
AIT	AIT Spirit	100.0	200.0			71.4		85.7	*20.2*	200.0	12.0	7.0
AIT	attachment transmission					14.3	85.7	14.3		85.7	38.0	16.0
Breakdown	Breakdown	100.0	100.0			42.9	42.9	71.4	*40.4*	71.4	19.0	19.0
collaboration	collaboration	100.0	100.0			28.6	28.6	64.3	*50.5*	64.3	22.0	21.0
Control	authentication					14.3		14.3			38.0	
Control	authorization					28.6		28.6			34.0	
Control	Control					28.6	71.4	28.6		71.4	34.0	19.0
Control	Freedom	100.0	100.0					100.0		100.0	1.0	13.0
Culture	cultural issues	100.0				14.3		57.1	*60.6*		27.0	
Culture	Student culture	100.0	200.0			28.6	42.9	64.3	*50.5*	121.4	22.0	12.0
Data Source	diary note					85.7	85.7	85.7		85.7	14.0	16.0
Environment	Environment					14.3	14.3	14.3		14.3	38.0	25.0
Env Output	Formally scripted interactions	100.0	100.0					100.0		100.0	1.0	13.0
Freedom	freedom					28.6	28.6	28.6		28.6	34.0	24.0
GVT	GVT	100.0	100.0	100.0	100.0	28.6	28.6	76.2	*41.2*	76.2	17.0	18.0
Metastructure	Genre					42.9		42.9			30.0	
Metastructure	Metastructure	100.0		100.0		85.7		95.2	*8.2*		9.0	
Metastructure	Metastructure Spirit	100.0	300.0	100.0	200.0	71.4		90.5	*16.5*	250.0	11.0	4.0
Metastructure	Runestone					42.9	242.9	42.9		242.9	30.0	5.0
Organizational unit	audiovisual unit - SLU					14.3		14.3			38.0	
Organizational unit	Inst för Informationsteknologi					14.3		14.3			38.0	
Organizational unit	IRB					14.3		14.3			38.0	
Organizational unit	Organizational unit					14.3	57.1	14.3		57.1	38.0	22.0
Research	data	100.0		100.0		14.3		71.4	*49.5*		19.0	
Research	diary note			100.0				100.0			1.0	
Research	paper	100.0						100.0			1.0	
Research	PhD Thesis					42.9		42.9			30.0	
Research	research design	100.0				85.7		92.9	*10.1*		10.0	
Research	Review	100.0	400.0					100.0		400.0	1.0	1.0
Research	research subject			100.0	300.0	14.3	157.1	57.1	*60.6*	228.6	27.0	6.0
socio-emotional	context & technology-directed emotions	100.0				42.9		71.4	*40.4*		19.0	
socio-emotional	motivation	100.0				28.6		64.3	*50.5*		22.0	
socio-emotional	other directed emotions					42.9		42.9			30.0	
socio-emotional	performance-driven emotions	100.0	300.0	100.0	300.0	42.9		81.0	*33.0*	300.0	15.0	2.0
socio-emotional	self-directed emotions					14.3	171.4	14.3		171.4	38.0	10.0
Task	Assessment	100.0				28.6		64.3	*50.5*		22.0	
Task	Icebreaker					28.6		28.6			34.0	
Task	Learning task	100.0				71.4	128.6	85.7	*20.2*	128.6	12.0	11.0
Task	Task	100.0	300.0					100.0		300.0	1.0	2.0
TUM Activity	Adjustment	100.0	100.0	100.0		28.6		76.2	*41.2*	100.0	17.0	13.0
TUM activity	episodic change			100.0		57.1		78.6	*30.3*		16.0	
TUM Activity	Reinforcement			100.0	300.0	14.3	100.0	57.1	*60.6*	200.0	27.0	7.0

Table 7.14: TUM episodic change Mode Intra Group Comparison:- Normalised Frequencies for ‘Concepts & Codes’

Table 7.14 above speaks for itself in demonstrating the frequency and relative consistency of key concepts and codes across the three TUM *episodic change* episodes. A brief review of the more prominent concepts (top 10 by ranking) highlights: the role of *Research* as a driver for many of the changes within the grouping; the significant influence exerted by *socio-emotional* dimensions in every episode; the dominance of *metastructures* and their embedded *spirit* across episodes; similarly the influence of Technology and its informing *AIT spirit* across the grouping*;* the prevalence of *activity* associated with *trial planning;* the significance of *task* in relation to *learning*, *assessment* and the collaboration phases; and the role of *TUM activity* in differing modes (*adjustment*, *episodic*, *reinforcement*) across the grouping, even though primarily one of TUM activity in 'episodic change' mode.

Highly ranked 'codes' in addition to this set of dominant 'concepts' were: *freedom* (which was coded within the concept *control*, but also more appropriately coded as a distinct and opposing concept*) and formally scripted interactions* – a natural complement to the dominant process of *scripting* within the concept *activity.*

Further 'concepts' with significant presence across the grouped episodes, but high variability (as indicated by their standard deviations), were: *breakdown, collaboration, culture,* and *GVT.* While these have been dominant concepts across prior groupings, and have appeared in at least two episodes within table 7.14 above, they were not immediately apparent from the statistical measures, save through their greater variability. This reinforced the point that the purpose of the descriptive statistics was purely to enable comparative analysis, and draw to attention any noteworthy patterns across episodes.

7.6.2.1 Other Grounded Data 'Roles' - Intra Group Comparison: TUM episodic change mode

Table 7.15 below addresses the further concept of 'roles', a dominant concept not only in each episode, but across episodes as indicated by the very high mean concept score (500%, *cf. note in table 7.15*). The table is characterized like prior groupings by the diversity of roles, and by the concentration of some roles versus the more occasional contribution of others.

The dominant roles (top 10 rankings) were characterized by a future orientation,

incorporating design and planning oriented roles such as: *developer; researcher; graduate student*. The objects of this planning activity included the student roles of: *undergraduate student; Uppsala IT student.* These roles were complemented by those involved in coordinating the collaborative process: *coordinator; teacher; GVT Leader; monitor; offshore technical coordinator.*

Less highly ranked roles also complemented the above, with more design and planning oriented roles such as: *curriculum developer; innovator, teaching-research assistants*. Further student roles were represented by: *SLU GIM students*., and coordinative roles were represented by: *paper coordinator*.

Finally two quite distinct roles were apparent, one technology support role: *support and maintenance team representatives*, and one personal role: *parental.* Both of these roles opened the project to a wider world. In the first case, the world was one of technical support teams standing by in the event of breakdown or need. In the second case, the world was that of home, with Arnold acting in a supportive role for his family, reinforcing the point that in our work lives we are not tidily separable from our home and family lives.

		Episode one		Episode two		Episode three				episodic
		Norm Freq	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	**Mean**	**Std Dev**	**rank codes**
Concepts	Codes	Codes %	Concepts %	Codes %	Concepts %	Codes %	Concepts %	**Codes %**	**Codes %**	
Role	Coordinator	100.0		100.0		28.6		76.2	41.2	4
Role	Curriculum Developer					14.3		14.3		11
Role	Developer			100.0				100.0		1
Role	Formal (teaching - research assistants)					14.3		14.3		11
Role	Graduate Student					28.6		28.6		10
Role	GVT leader	100.0				14.3		57.1	60.6	6
Role	Innovator					14.3		14.3		11
Role	Monitor			100.0	300.0	14.3		57.1	60.6	6
Role	Offshore Technical Coordinator					57.1		57.1		8
Role	paper coordinator					14.3		14.3		11
Role	parental					14.3		14.3		11
Role	Purpose agents - teacher					71.4		71.4		5
Role	Researcher	100.0				85.7		92.9	10.1	2
Role	SLU GIM student					14.3		14.3		11
Role	Support and Maintenance Team representatives					14.3		14.3		11
Role	Undergraduate Student	100.0	400.0			57.1		78.6	30.3	3
Role	Uppsala IT student					42.9	500.0	42.9		9

Table 7.15: TUM Episodic Change Mode Intra Group Comparison:- Normalised Frequencies for Coded ‘Roles’

Note: concept values in excess of 100% result from summing the individual code scores, and are therefore merely indicative of magnitude

7.6.2.2 Other Grounded Data 'Time & Space' – Intra Group Comparison: TUM episodic change mode

Table 7.16 below, provides normalized frequencies across the three episode grouping for the pervasive concepts of 'space and time'. As can be seen the three core concepts of *space, time* and *time pressure* were dominant as indicated by their high mean concept scores (between 150% and 270%, *cf. note in table 7.81*).

For the concept of 'space' *location* was the primary code, being present to the maximum degree in each episode, and representing the separately situated *spaces* from which the collaboration was being originated. Codes of *face to face* and *absence* displayed the opposite poles of physical presence within the global virtual collaboration, itself being embodied in some virtual limbo within an *international space*.

The predominant *time* related codes were: *stages of scripting the project* reflecting the essentially preparatory nature of these episodes, prior to the "virtual team performance" (Panteli & Duncan, 2004); *time* as a rather generic code typically denoted the 'clock time' of day or night; *synchronize* present in two of the episodes as a key challenge for TUM with GVTs dispersed across time and space; *experience* representing the contribution of past experiences of collaboration as a reservoir for future joint work; *time separation* a code denoting distance in time, over durations such as the coordinators planning for future periods of leave.

Busyness as an element of *time pressure* was also coded, reflecting the pressures on Arnold as an educator in managing and monitoring the exercise and keeping up with the progress of his students, while juggling the other dimensions of a busy academic life.

		Episode one		Episode two		Episode three					episodic
		Norm Freq	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	**Mean**	**Std Dev**	**Mean**	**rank codes**
Concepts	Codes	Codes %	Concepts %	Codes %	Concepts %	Codes %	Concepts %	**Codes %**	**Codes %**	**Concepts %**	
Space	Absence					14.3		14.3			11
Space	face to face	100.0				85.7		92.9	10.1		3
Space	international					28.6		28.6			9
Space	Location	100.0	200.0	100.0	100.0	100.0		100.0	0.0	150.0	1
Time	day			100.0		14.3		57.1	60.6		8
Time	experience					71.4		71.4			6
Time	stages of scripting the project	100.0						100.0			1
Time	Synchronize	100.0				71.4		85.7	20.2		5
Time	Time	100.0	300.0	100.0	200.0	71.4		90.5	16.5	250.0	4
Time	Time separation					71.4		71.4			6
Time Pressure	busyness					14.3	271.4	14.3		271.4	10

Table 7.16: TUM Episodic Change Mode Intra Group Comparison:- Normalised Frequencies for Coded ‘Space and Time’

Note: concept values in excess of 100% result from summing the individual code scores, and are therefore merely indicative of magnitude

7.6.2.3 Other Grounded Data 'Metastructures' – Intra Group Comparison: TUM episodic change mode

Table 7.17 below lists for comparison the 'metastructures', which were given particular attention in the original episodes. The treatment here is again necessarily uneven, reflecting the approach taken in each episode, without supporting direct comparability in the manner of the above sections. The episodes have taken variable approaches in highlighting metastructures, both in the body of the text and in subsequent visual maps. Table 7.17 below portrays the diverse grouping of *metastructures* highlighted in the body of this episode grouping.

Episode one	Episode two	Episode three
ethics approval process GVT collaboration information sheet international collaboration learning design	Addressing team performance outcomes (metastructure spirit) AUTOnline features Group pages for GVTs1-9 Phase 2 discussion threads Final evaluation questionnaire Lotus Notes database features Leader decision forms Posted website links Online evaluations Online form	collaborative spirit in wiki (metastructure spirit) Comparative collaboration icebreaker task Runestone project student GVTs wiki

Table 7.17: TUM Episodic Change Mode Intra Group Comparison: – Featured 'Metastructures'

This collection of metastructures represented a set of activity patterns with varying content, but inherent similarities in their focus. *GVTs* in various forms were visible in each episode, but otherwise, no specific metastructures were repeated across episodes. The design and future orientation within all episodes in this grouping was apparent. The desire to infuse a successful and collaborative *metastructure spirit* was a common theme, which traversed learning, technology and collaboration design.

More 'technology focused' metastructures related to both technology platforms such as *wikis*, *AUTOnline*, *Lotus Notes database*, and their component features, such as *discussion thread*, *online evaluations* and *online forms*.

'Institutional' and 'cultural' dimensions were to the fore in domain specific genres such as: *ethics approval process; information sheet; icebreaker task; leader decision forms; learning design; online evaluations*.

'Spatial' metastructures were not apparent in this grouping apart from the 'virtual spaces' inherent in the three collaborative platforms, and in such terms as: *posted website links*. 'Time-bound' metastructure forms were apparent in the *Runestone*

project as a *comparative collaboration* based upon prior experience.

Metastructures encapsulating particular 'cultural' values within their 'metastructure spirit' were also noted: *learning design; addressing team performance outcomes; collaborative spirit in wiki*.

Complementing the metastructures in the body of the episodes, were those specifically selected for attention in the visual map section of each analysis. Table 7.83 below depicts these.

Episode one	Episode two	Episode three
Assessments AUT specific learning goals Collaboration Courses Ethics approval Information sheet Notes Collab DB Trial design	Final evaluation questionnaire – additional question	Icebreaker Runestone Project

Table 7.18: TUM Adjustment/reinforcement Mode Intra Group Comparison: – 'Metastructures' from visual maps

This grouping depicts a subset of the previous content, portraying patterns similar to those of the fuller collection in table 7.17 above.

The set of 'Institutional' and 'cultural' patterns inscribed in the 'Domain specific genres' of the prior table: *ethics approval process; information sheet; and learning design;* were augmented in table 7.18 above with the additional genres of: *assessments, AUT specific learning goals; and courses.*

The design and future orientation in this episode grouping, was evidenced through an extension in the first episode from the notion of *learning design* to the broader notions of *collaboration* and *trial design*.

The 'technology' dimension presented itself in metastructures such as: *Notes Collab DB*, with its component features, such as *final evaluation questionnaire – additional question* and *icebreaker.* The latter components in turn represented further domain specific genres in which 'Institutional' and 'cultural' dimensions of the research and collaborative learning context were to the fore. At a broader level, the *Runestone project* as a comparative collaboration provided another example.

These metastructures from table 7.18 reflected the process of design and change within this teaching-learning and research project, and related directly to the primary TUM activities of 'episodic change' within this episode grouping.

The above summary, portraying the role of metastructures and of TUM activity in

shaping technology use, resonates with the views on social informatics espoused by Kling and colleagues, namely that:

> "from a social informatics perspective ICTs are highly interwoven in socio-technical networks in which software features, hardware elements, roles, people, social and organizational culture and structure, and norms and rules of use are intimately connected...This conceptualization focuses on computing as a complex activity that is tied together in a web of socio-technical practices and resources" (Kling et al., 2005, p. 146).

Complementing this view are the notions that: "ICTs have temporal and spatial consequences" (ibid. p.21); and that "ICTs are socio-technical networks that can be configured in ways that influence their uses and social consequences" (ibid.). The role of TUM activity then, is in configuring these socio-technical networks, with metastructures acting, as it were, as the 'glue' to link the many elements together.

7.6.2.4 Evolution of Practices – Intra Group Comparison: TUM episodic change mode

Table 7.19 below portrays the evolution of practices within the extended temporal brackets augmenting the analysis for their episodes. This portrayal is again presented primarily for the sake of comparing the unfolding of events related to each episode rather than to enable direct comparison, between TUM activity modes.

A brief summary of the brackets below now follows. In episode one the 'TUM activity in focus' was the proposed redesign of the collaborative trial. In the 2002 collaboration both 2D and 3D collaborative virtual environments had been employed, using assigned technology platforms, to support icebreaking activities (cf. Clear & Daniels, 2003). This collaboration had achieved some degree of success, but was not without some technical challenges related to the prototype 3D environment. For the 2003 collaboration, while students had been free to choose their own software environments, and the goal of investigating the role of avatars in enriching communication had been retained in the instructions, there was no actual evidence of 3D software use, but considerable Uppsala student dissatisfaction with the Lotus Notes 2D collaborative technology platform.

In episode two, from as early as the 1999 collaboration, groups had been tasked to choose the leader for their GVTs, but with mixed success in doing so and with some confusion between LT and GVT levels. For the 2004 collaboration the goal was to achieve successful outcomes for the collaboration at the GVT level. Again goals were achieved partly or not at all, with some confusion between LT and GVT levels. In the midpoint of the 2004 trial a further question had been added to the final evaluation to

gain students perceptions of whether the full GVT had been successful in its goals. At the time of reporting this bracket, students had yet to post final evaluations, but the icebreaker evaluations had been mostly from AUT students. A further support for GVT collaboration was the AUTOnline synchronous chat facility, but while some chat sessions had been recorded, they included only postings from members of the AUT LTs.

In episode three the goal for the 2004 collaboration had been for the collaborative task to promote collaborative activity and motivate GVTs to work together fruitfully. The US teams did not gain support from the LT structure, found the design of the website ranking activity too open, and seemed to need a competition element to motivate active participation. In the 2005 internal collaboration the introduction of the quiz as a task (together with some adjustments to the icebreaker) appeared to significantly improve student motivation and outcomes. It was noted that working in the same time zone had made a big difference. For the 2005 international collaboration, the assessment instructions for AUT students had to be amended to remove the requirement for each GVT to successfully complete a quiz (as this was beyond the local students control), but a fallback option at the LT level was available. The collaboration resulted in all 9 GVTs successfully posting their quizzes, with a couple of outliers but evidence of cross-site collaboration in each case. Several final evaluations were posted, but the Swedish student postings were very low in number, perhaps indicating a limited motivation on their part to complete the task?

One major theme in the excerpts from table 7.19 below was that of 'breakdown'. As observed within the prior intra-episode analysis (cf. section 7.7.2.4), breakdown was a natural theme as each episode depicted a "TUM activity in focus", where the focus arose from our attention being drawn to an event or sequence out of the ordinary. While the above three temporal brackets extended the original episodic change episodes, they each nonetheless focused on TUM activity in the episodic change mode. The future orientation of this episode grouping, extended the focus on 'breakdown' to include a focus on design, and on TUM activity in 'episodic change' mode which aimed to avoid future or remedy past 'breakdowns'.

In episode one below, the removal of the 3D environment from the collaboration had been occasioned by a desire to avoid breakdowns due to the instability of a prototype technology platform (cf. Clear & Foot, 2002, Clear & Daniels 2003). However the 2D collaborative platform (again a prototype) had occasioned student upset in 2003. The addition of the AUTOnline platform and additional features such as synchronous chat,

had aimed to address these concerns, but as noted in the brackets for episode two, not with notable success. In the episode three brackets, the focus on redesign of the collaborative task appeared to bear considerable fruit with the internal collaboration and had proven generally successful in the international collaboration. A deeper analysis still indicated levels of dissatisfaction and some remaining motivational issues for Swedish students, but overall the process of TUM activity in episodic change mode appeared to have some effect in remedying or avoiding breakdowns.

Episode one					Episode two					Episode three				
Start Bracket	**End Bracket**	**Desired Practice**	**Realised Practice**	**Dominant AIT**	**Start Bracket**	**End Bracket**	**Desired Practice**	**Realised Practice**	**Dominant AIT**	**Start Bracket**	**End Bracket**	**Desired Practice**	**Realised Practice**	**Dominant AIT**
Semester 2/2002	11/11/2003	Students use 2D and 3D icebreaking modes in GVTs Students compare 2D & 3D icebreaking modes	Students used & compared 2D and 3D icebreaking modes Teamlink issues, some technical glitches. slow response, frozen screen, mixed icebreaking success (Reported at FIE2003 in a research paper)	Teamlink 3D CVE cybericebreaker with avatars Lotus Notes Collab DB Notes 2D icebreaker email	20/09/1999	27/05/2000	groups to choose leader for GVTs	Variable outcomes some students confused, some leaders assumed, some lacked a leader, some leaders at LT level only (Reported in M. Phil, 2000)	Lotus Notes Collab DB - various features email	20/10/2004	22/10/2004	Collaborative task promotes collaborative activity and motivates GVTs to work together fruitfully	LTs fail to support US team activity, design of (website ranking) task too open, needed competition element to motivate US teams, students only do what is required	AUTonline, Notes collab DB
Semester 2/2003	11/11/2003	Students investigate role of avatars to enrich communication, investigate 3D interfaces in collab workspace Students free to choose own s/w, implicitly both synch and asynch Potentially with avatars	Notes Collab DB used in 2003 collaboration Caused upset for Uppsala students 2D interface only No evidence of 3D s/w used	No 3D collaborative technology Lotus Notes Collab DB Notes 2D icebreaker	1/09/2004	1/02/2005	Goals to be achieved for global collaboration at GVT level	Goals achieved partially or not at all Some students confused LT vs. GVT levels	Lotus Notes Collab DB - various features email	20/10/2004	3/06/2005	Collaborative task promotes collaborative activity and motivates GVTs to work together fruitfully	Students happier this time, task easier to follow, same time zone a big difference [AUT internal collaboration]	AUTonline, open source quiz s/w, VTeam Notes collab DB
					13/10/2004	13/10/2004	Amend online final evaluation questionnaire to record GVT level performance All students to post icebreaker online evaluations	Final questionnaire amended Students yet to post Mostly AUT students post icebreaker online evaluations	final evaluation online questionnaire Notes forms icebreaker online evaluations	20/10/2004	9/09/2005	Collaborative task promotes collaborative activity and motivates GVTs to work together fruitfully	Assignment amended removed assessment requirement for each GVT to submit a complete quiz, goal but LT as a fallback?	AUTonline, open source quiz s/w, VTeam Notes collab DB
					20/10/2004	30/10/2004	GVT synchronous chat sessions recorded via AUTOnline lightweight chat	Sessions recorded GVT5 only in AUTOnline Several solo sessions Several active sessions Local (Akl'd) member LT only, no offshore participants	AUTonline chat Chat recording feature	20/10/2004	26/10/2005 – 3/11/2005	Collaborative task promotes collaborative activity and motivates GVTs to work together fruitfully	All 9 GVT quizzes completed and posted to Notes Collab DB, plus extras [international collaboration Uppsala & AUT]	AUTonline, open source quiz s/w, VTeam Notes collab DB
										20/10/2004	26/10/2005 – 7/11/2005	Collaborative task promotes collaborative activity and motivates GVTs to work together fruitfully	26 final evaluations completed and posted to Notes Collab DB, only 6 Swedish evaluations	AUTonline, open source quiz s/w, VTeam Notes collab DB

Table 7.19: TUM Episodic Change Mode Intra Group Comparison:– Evolution of Practices

Interestingly with the six year duration covered by the brackets in this group, the "two steps forward, one step backward" nature of the progression indicated the challenges in this work. While we had noted different areas to be addressed and had a vision of what we wished to achieve, actually succeeding in that endeavour appeared more easily said than done. Key insights appeared to be: the role of the collaborative task as a motivator, the need to design a task with the appropriate level of "interdependence" (Maznevski & Chudoba, 2000) to encourage collaborative activity; the role of the technology as a motivator (with the third party quiz software being relatively simple but having some innate interest for students); the value of a stable technology platform; the role of an effective icebreaking process and the need to generate a leadership structure within the teams.

Much of this experimentation was also shaped by the differing student cultures at each site and the need to shape a mutually engaging and motivating task, when student motivations inherently differed. For instance Berglund (2005, pp. 180-195) had observed the different attitude towards assessment and grading displayed by US and Swedish students, with the US students being motivated by assessment, competition and GPA scores and the Swedish students more concerned with personal achievement and the performance of the group. As Berglund has observed, "The mechanisms that motivate students to do a good job are complex and diversified" (ibid., p. 194). In the bracket for episode three above, we saw the value of competition for US students being asserted again. In episode one there were barriers created for Swedish students by a rather clumsy Lotus Notes prototype, and for AUT students by an unstable 3D collaborative environment. In episode three the combination seemed to have gelled, with sufficient challenge in the technology, task, assessment and process structure to motivate teams, both locally for the internal collaboration and globally for the international collaboration.

7.7 Inter group comparison for episodes of interest – All TUM modes

This section builds on the previous analysis, where individual episode characteristics have been tabulated, followed by comparison within the same TUM activity mode groupings. In this section the comparison expands to encompass the different modes of TUM activity.

This comparative grouping includes the eight individual episodes compared across the full three groupings of TUM activity: *establishment*; *adjustment-reinforcement;* and *episodic change* groupings. This comparison across the full grouping of episodes reflects the four differing modes of TUM activity.

7.7.1 Appropriation Analysis – All TUM modes

Tables 7.20, 7.21 and 7.22 below portray the patterns of appropriation analysis for the combined episode groupings. Similar normalized frequency tables are employed in this analysis. To aid inter group comparison, mean scores for moves in each of the three groupings, complemented by intergroup ranks and mean ranks across groupings have been tabulated.

	Establishment	Adjustment/reinforcement								Episodic Change				Episodic grouping		Adj-Rein grouping		adj-rein	estab	episodic	ranks
		Episode one		Episode two		Episode three		episode four		Episode one	Episode two	Episode two	Episode three								
App Move Category	Norm Freq	Norm Freq	Norm Freq	Norm Freq	Norm Freq	Norm Freq	Norm Freq	Norm Freq	Norm Freq	Norm Freq	Norm Freq	Norm Freq	Norm Freq	Mean	Std Dev	Mean	Std Dev	rank	rank	rank	mean
Constraint	Est%	Adj %	Rein%	Adj %	Rein%	Adj %	Rein%	Adj %	Rein%	Episodic%	Episodic%	Adj %	Episodic%								
6. Constraint - a. definition	8.3																		6		
6. Constraint - b. command	6.5				50.0											50.0		1	7		4
6. Constraint - c. diagnosis	18.1				25.0		50.0						28.6	28.6		37.5	17.7	4	2	2	3
6. Constraint - d. ordering	14.8	11.1			25.0								14.3	14.3		18.1	9.8	8	4	3	5
6. Constraint - e. queries	14.4	11.1	11.1													11.1	0.0	11	5		8
6. Constraint - f. closure	0.9																		12		12
6. Constraint - g. status report	27.8	11.1	11.1		25.0		50.0	40.0	20.0							26.2	15.8	7	1		4
6. Constraint - h. status request	5.1	11.1						20.0								15.6	6.3	10	8		9
6. Constraint - i. query response	4.6				50.0		50.0		40.0							46.7	5.8	2	10		6
6. Constraint - j. proposal	5.1	22.2	22.2			50.0							14.3	14.3		31.5	16.0	5	8	3	5
6. Constraint - k. future status	15.7	66.7	11.1				50.0			100.0	100.0	100.0	14.3	78.6	42.9	42.6	28.5	3	3	1	2
6. Constraint - l. set-up request	2.3	33.3	22.2													27.8	7.9	6	11		9
6. Constraint - m. diagnosis request	0.5	22.2	11.1													16.7	7.9	9	13		11
** % of sources in which category coded*																					
No of source items	216	9		4		2		5		1	1		1								
TUM specific added moves																					

Table 7.20: All TUM Modes Inter Group Comparison:– Normalised Frequencies for ‘Constraint’ Appropriation Moves

7.7.1.1 Appropriation Analysis - Inter Group Comparison: All TUM modes – Constraint

Table 7.20 above has portrayed some difference in appropriation patterns between the three episode groupings. Patterns discernable for 'constraint' appropriation moves from table 7.20 above include: all 'constraint' moves were present in the *establishment* (*Est*) episode and only two moves ('definition' and 'closure') were absent from the *adjustment and reinforcement* episode (*A-R*) grouping; 'status report' had the highest mean and ranking for *Est* but in contrast while prevalent in *A-R* was lower ranked. The additional TUM specific moves (i-m) were all represented in both *Est* and *A-R* groupings; 'query response' was the second highest ranked move in the *A-R* grouping, but tenth ranked for *Est*; 'queries' while having a low mean difference (-3.24) between groupings, nevertheless had a marked difference between ranks (fifth for *Est* and eleventh for *A-R*).

In contrast, within the 'episodic change grouping' (*E-C*) only some 30% (4/13) of the constraint moves were present, and moves ranked 1 and 2 in the above two groupings were absent entirely. Two of the TUM specific moves were present however, with 'future status' the most common in the 'episodic grouping', as well as sharing a high mean ranking of 2 across all three TUM activity mode groups. Of the remaining two moves the 'diagnosis' move shared a high mean ranking of 3 across episodes.

These patterns suggested that 'constraint' moves were common across the first two groupings, but less so for the 'episodic change' grouping. TUM specific moves were well represented across all groupings, as might have been expected. Patterns further suggested that specific moves were more closely associated with one form of TUM activity than another, e.g. 'status report' (state what has been done or is being done with the structure) as particularly important during TUM activity in the *establishment* mode, and 'future status' (state what is proposed to be done with - or to establish - the structure) important for TUM activity in the *episodic change* mode grouping. The importance of the latter move, not only in this mode but also across episodes, argues for it being a key TUM move (perhaps in combination with 'diagnosis' moves), in planning for future technology use.

	Establishment	Adjustment/reinforcement								Episodic Change				Episodic grouping		Adj-Rein grouping		adj-rein	estab	episodic	ranks
		Episode one		Episode two		Episode three		episode four													
		Episode one		Episode two		Episode three		episode four		Episode one	Episode two	Episode two	Episode three					rank	rank		
App Move Category	Norm Freq	Norm Freq	Norm Freq	Norm Freq	Norm Freq	Norm Freq	Norm Freq	Norm Freq	Norm Freq	Norm Freq	Norm Freq	Norm Freq	Norm Freq	Mean	Std Dev	Mean	Std Dev			rank	mean
Judgement	Est%	Adj %	Rein%	Adj %	Rein%	Adj %	Rein%	Adj %	Rein%	Episodic%	Episodic%	Adj %	Episodic%								
7. Affirmation - a. agreement	5.6				25.0											25.0		5	1		3
7. Affirmation - b. bid agree	5.1																		3		3
7. Affirmation - c. agree reject	0.9									100.0				100.0					9	1	5
7. Affirmation - d. compliment	4.6	22.2	33.3		50.0		50.0				100.0	100.0	14.3	71.4	49.5	38.9	13.6	1	5	2	3
7. Affirmation - e. bid improve	4.2				25.0											25.0		5	6		6
8. Negation - a. reject	1.4	11.1				50.0										30.6	27.5	4	8		6
8. Negation - b. indirect																					
8. Negation - c. bid reject	0.9																		9		9
9. Neutrality - a. explicit	5.6						50.0	20.0			100.0	100.0	14.3	71.4	49.5	35.0	21.2	2	1	2	2
9. Neutrality - b. refer to authority	5.1						50.0	20.0								35.0	21.2	2	3		3
9. Neutrality - c. offer help	1.9								20.0							20.0		7	7		7
* % of sources in which category coded																					
No of source items	216	9		4		2		5		1	1		1								
TUM specific added moves																					

Table 7.21: All TUM Modes Inter Group Comparison:– Normalised Frequencies for ‘Judgement’ Appropriation Moves

7.7.1.2 Appropriation Analysis - Inter Group Comparison: All TUM modes – Judgement

Table 7.21 above has again portrayed some difference in appropriation patterns between the three episode groupings. Patterns discernable for 'judgement' appropriation moves from table 7.21 above included: all 'judgement' moves were present in the *Est* episode except for 'negation indirect', which was also absent from the *A-R* grouping, as were three other moves ('affirmation bid agree', 'affirmation agree reject', and 'negation bid reject'); in contrast only some 27% of moves (3/11) were evident in the *E-C* grouping.

The specific moves 'affirmation agreement' and 'affirmation bid agree' were highly ranked in *Est*, as were 'neutrality explicit' and 'neutrality refer to authority'; additional TUM specific moves ('neutrality offer help' and affirmation bid improve) were equally but not highly ranked in both *Est* and *A-R* groupings, but the TUM move 'neutrality refer to authority' was highly ranked in both; the move 'negation reject' had a high mean difference, but only moderate difference in rankings; the move 'affirmation compliment' had the highest mean and ranking for *A-R* and while having a large mean difference, was nonetheless ranked fifth in the *Est* grouping, second for the *E-C* grouping, and third overall.

These patterns suggested that 'judgement' moves were overall more prevalent within the *Est* grouping. TUM specific moves were again represented, but less highly ranked than in the prior 'constraint' moves, apart from "neutrality refer to authority' (acknowledge uncertainty towards use of the structure and need to consult an authority) which was indicative of a degree of confusion and seeking for help. In the circumstances, the dominance of this move was to be expected across both groupings. The more generic move 'neutrality explicit' (expressing uncertainty or neutrality towards use of the structure), again indicating confusion, was the highest ranked move across the three episodes, and suggested the triggering value of such confusion for all forms of TUM activity.

The significance of 'affirmation compliment' (note an advantage of the structure) for the *A-R* grouping was consistent with moves in this mode to *reinforce* use by pointing out positive features, or to *adjust* use by adapting to a preferred technology form. Likewise for the *E-C* grouping a similar significance was evident in 'affirmation

compliment' moves, paving the way for introducing future changes in technology use. The absence of 'negation indirect' moves (reject appropriation of the structure by ignoring it, such as ignoring another's bid to use it) in all three groupings, is suggestive of a degree of courtesy between sites. While such behaviours were no doubt present, they were probably converted into more courteous forms between the trial coordinators, or perhaps not readily amenable to coding in this way. This code was more likely to have been experienced in cases of more direct use, perhaps by students. The research design of course had not been tailored to investigating this specific question, so at this stage these conclusions remain something of a conjecture. The alternative affirmation code 'agree reject' (others agree to reject appropriation of the structure), present in both *Est* and *E-C* groupings, indicated more of a consensus approach in operation when deciding not to use a structure - whether in setting up the technology or a particular feature for initial use, or in a deliberate change process of moving away from its use.

7.7.1.3 Appropriation Analysis - Inter Group Comparison: All TUM modes – Relate

Table 7.22 below portrays a stronger difference in appropriation patterns between the three episode groupings. Whereas the *Est* grouping includes all but two of the 'relate' appropriation moves, in contrast the *A-R* grouping presents a set of codes for less than half of the moves, and the *E-C* grouping for only a quarter. When considering additional TUM specific moves, the two 'substitution' moves of ('bid' and 'proposal bid') were well represented across both *Est* and *A-R* groupings, being ranked first and second within each group, (even though the mean difference between the 'substitution proposal bid' move across groupings was marked). When including the *E-C* grouping, 'substitution - bid' was the highest ranked move (at 2) across all three groupings, suggesting in this context the universal nature of TUM activity where actors (propose use a similar structure rather than the one at hand and seek confirmation).

The further TUM specific codes ('combination element request' and combination bid corrective') present a contrast, with neither present in the *A-R* grouping, while the second of these moves was again ranked second for the *Est* grouping, and third for the *E-C* grouping. The more general 'combination' move 'composition' (combine two structures in a way consistent with the spirit of both), was present across all three groupings, but with considerable variability in means and rankings. The contrast move

‘favored’ (structures are compared with one favored over the others), was evident across all three groupings, and had a high mean rank of 3, suggesting its common role in TUM activity when expressing a preference for a use of technology.

These marked differences suggested that specific ‘relate’ appropriation moves were more closely associated with the *Est* form of TUM activity than with the *A-R or* the *E-C*. Perhaps they have indicated that the *establishment* mode was more complex in its process of relating structures to one another, and melding together a working constellation of components through actively comparing, combining, substituting and even contradicting (through paradoxical use) a variety of structures to achieve an outcome.

	Establishment	Adjustment/reinforcement								Episodic Change				Episodic grouping		Adj-Rein grouping		adj-rein	estab	episodic	ranks
		Episode one		Episode two		Episode three		episode four		Episode one	Episode two	Episode two	Episode three								
App Move Category	Norm Freq	Norm Freq	Norm Freq	Norm Freq	Norm Freq	Norm Freq	Norm Freq	Norm Freq	Norm Freq	Norm Freq	Norm Freq	Norm Freq	Norm Freq	Mean	Std Dev	Mean	Std Dev	rank	rank		
Relate	Est%	Adj %	Rein%	Adj %	Rein%	Adj %	Rein%	Adj %	Rein%	Episodic%	Episodic%	Adj %	Episodic%							rank	mean
2. Substitution - a. part																					
2. Substitution - b. related	1.9																		8		8
2. Substitution - c. unrelated																					
2. Substitution - d. bid	5.6			25.0			50.0						14.3	14.3		37.5	17.7	2	1	3	2
2. Substitution - e. proposal bid	4.6					50.0										50.0		1	2		2
3. Combination - a. composition	0.9	11.1	11.1								100.0	100.0		100.0	0.0	11.1	0.0	5	12	1	6
3. Combination - b. paradox	0.5																		13		13
3. Combination - c. Corrective	1.4	22.2							20.0							21.1	1.6	3	11		7
3. Combination-d. element request	3.7																		6		6
3. Combination-e. bid corrective	4.6												14.3	14.3					2	3	3
4. Enlargement - a. positive	1.9																		8		8
4. Enlargement - b. negative	1.9																		8		8
5. Contrast - a. contrary	3.7																		6		6
5. Contrast - b. favored	4.2	11.1		25.0						100.0	100.0	100.0		100.0	0.0	18.1	9.8	4	5	1	3
5. Contrast - c. none favored	0.5	11.1	11.1													11.1	0.0	5	13		9
5. Contrast - d. criticism	4.6	11.1	11.1													11.1	0.0	5	10		8
* % of sources in which category coded																					
No of source items	216	9		4		2		5		1	1		1								
TUM specific added moves																					

Table 7.22: All TUM Modes Inter Group Comparison:– Normalised Frequencies for ‘Relate’ Appropriation Moves

7.7.1.4 Appropriation Analysis - Inter Group Comparison: TUM establishment and adjustment/reinforcement modes – Direct Use

Direct use' appropriation moves were only in evidence in one adjustment-reinforcement episode, so have not been tabulated above. As noted previously (7.4.1.1 above), TUM activity tends to focus on more indirect forms of technology use, so the absence of "direct use" moves across these groupings was not wholly unexpected.

7.7.2 Other Grounded Data – Inter Group Comparison: All TUM modes - concepts and codes

Table 7.23 below portrays the patterns of 'concepts and codes' for the combined episode groupings. Again normalized frequency tables are employed in this analysis. To aid inter group comparison, mean differences between the two groupings, complemented by rank differences between groupings have been tabulated. As can be noted from the table, a few differences have been highlighted, where the ranks between episode groupings have diverged, or the mean differences are notable. Also notable in table 7.23 was the prevalence of codes in the *establishment* grouping that were absent in the subsequent *adjustment/reinforcement* grouping, with the converse being true but to a lesser extent. At the level of specific concepts and their associated codes, those present only in the *establishment* grouping were: significant concepts such as *organizational unit;* and *trust;* and miscellaneous concepts including, *communication; economic issues; measures; facility;* and *informating up.* A similar pattern of differences was apparent with the *episodic change* grouping, save for the presence of the unique concept of *freedom* and some additional codes including under the concepts of *activity, metastructure, research* and *task.* Unlike the *A-R* grouping the *E-C* grouping included several coded *organizational units,*

The dominance of organizational unit as a concept in the *Est* grouping, no doubt reflected the number of parties involved in establishing the collaboration, less prevalent during adjustment and reinforcement modes, but again re-entering the picture when considering episodic change. Departmental units at each site included not only *academic departments* but the supporting units such as *audiovisual units, flexible*

learning services, technology services etc. Then institutional units with significant influence on the collaboration such as *IRBs* featured, as did associated units with influence such as the *academic hospital*, with whom Uppsala was collaborating. Invisible units also featured with *ISPs* being cited, becoming unconcealed as a result of a breakdown and diagnostic incident. *Trust* may be an inherently more dominant concept in the *establishment* phase, in this case with Arnold and Fred being introduced to the collaboration via existing trust networks through a form of *recommender trust*. The more miscellaneous concepts appeared to operate at a more generic level, *communication* was clearly significant, but it was not until the notion of *informating up* was introduced, that it took a more concrete form related to TUM activity in *establishment* mode, namely in a design that enabled "instructor feedback concerning student understanding of class material in a timely fashion so that the instructor could clarify misunderstandings and misinterpretations" (Leidner & Jarvenpaa, 1995, p. 275). The remaining concepts appeared to have a resource related focus, a *facility* as a concrete resource, *economic issues* as resource constraints and *measures* as resource related performance indicators. Perhaps these reflected the "broker role" (Roy et al., 2006) inherent in *establishment* mode, where resource constraints needed to be overcome.

At the level of specific codes some minor inconsistencies were noted, perhaps naturally with such a large body of data. This issue is discussed further in section 9.2 below. For instance under the concept of *control* the counter concept of *freedom* was coded in the *Est* and *E-C* groupings, and *freedom* also appeared (more appropriately) as a distinct concept under the *E-C* grouping.

Usernames were coded in the *Est* episode, reflecting their significance in the *online registration process*, but less likely to appear in subsequent TUM activities. Several ethnicities appeared under the concept of *culture*, where the diversity of the New Zealand students was shared at the outset. From a TUM perspective, having shared this information, perhaps this issue faded into the background, and would only have been apparent subsequently if the focus shifted directly to student use of the *AIT* during collaboration. Under the concept of *metastructure*, codes such as *format*, *pedagogic patterns* and *syllabus sample* were specific to the establishment grouping. These related to the process of design and its informing spirit, whether of technology with specific *formats*, courses with *syllabi* and *patterns of pedagogy* as recognizable patterns of use. The *E-C* grouping shared the notion of *genres* with the *Est* grouping, again reflecting

patterns of use. A specific difference for the *E-C* grouping was the inclusion of the *Runestone project* as a comparative *metastructure*. Other codes had readily understandable variations across groupings. *Research subject* in the establishment episode, reflected the need for precise role definitions from the outset and the linear nature of research approval processes, while in the E-C grouping *PhD thesis* and *review*, related to a more reflective form of *research* activity. A more detailed breakdown was given for *other directed emotions* (perhaps due to greater number of source data items). Under the concept of *task*, two *icebreaking tasks* were quite specific to the activity conducted within the adjustment reinforcement phases, although the design would have occurred earlier, for instance in the episodic change mode, where they were subsumed under the grouped *icebreaker* code.

TUM activity itself warrants mention – no *establishment* codes as such were present for the *Est* episode (I had not specifically coded for this code which was implicit across the whole set); the *Est* episode also contained some evidence of *episodic change* and *reinforcement* modes (reflecting the frequently mixed and evolving nature of TUM activity); supporting the latter view were the presence of *establishment* and *episodic change* modes respectively in separate episodes within the *A-R* grouping, and *adjustment-reinforcement* modes within the *E-C* grouping.

All Tum Modes		Establishment		Adjustment/reinforcement								Episodic Change						episodic grouping			adj-rein grouping			adj-rein	estab	episodic	mean Ranks
				Episode one		Episode two		Episode three		Episode four		Episode one		Episode two		Episode three												
		Norm Freq	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	**Mean**	***Std Dev***	**Mean**	**Mean**	**Std Dev**	**Mean**	**rank codes**	**rank codes**	**rank codes**	**mean codes**
Concepts	Codes	Codes %	Concepts %	Codes %	Concepts %	Codes %	Concepts %	Codes %	Concepts %	Codes %	Concepts %	Codes %	Concepts %	Codes %	Concepts %	Codes %	Concepts %	**Codes %**	***Codes %***	**Concepts %**	**Codes %**	**Codes %**	**Concepts %**				
Activity	configuration															14.3		14.3								38	38
Activity	planning-meeting scheduling	9.3		22.2						40.0	40.0					14.3		14.3			31.1	12.6	40.0	19	12	38	23
Activity	scripting	9.3		22.2	44.4							100.0				28.6	57.1	64.3	*50.5*	57.1	22.2		44.4	35	12	22	23
Activity	trial planning	1.4	19.9			25.0	25.0					100.0	200.0					100.0		200.0	25.0		25.0	25	33	1	20
AIT	AIT	38.9		100.0		100.0		100.0		100.0	100.0	100.0						100.0			100.0	0.0	100.0	1	2	1	1
AIT	AIT Spirit			11.1		25.0		50.0	150.0			100.0	200.0			71.4		85.7	*20.2*	200.0	28.7	19.7	150.0	24		12	18
AIT	attachment transmission	8.3	47.2	22.2	133.3	25.0	150.0									14.3	85.7	14.3		85.7	23.6	2.0	141.7	34	16	38	29
Breakdown	Breakdown	20.8		22.2		25.0	25.0	50.0		20.0	20.0	100.0	100.0			42.9	42.9	71.4	*40.4*	71.4	29.3	13.9	22.5	23	9	19	15
Breakdown	Recovery Plan	14.4		11.1	33.3			50.0	100.0												30.6	27.5	66.7	20	8		14
Breakdown	Technical Issues	0.5	35.7																						47		47
collaboration	collaboration	0.5	0.5			25.0	25.0					100.0	100.0			28.6	28.6	64.3	*50.5*	64.3	25.0		25.0	25	47	22	31
communication	communication	0.5	0.5																						47		47
competition	competition					25.0	25.0														25.0		25.0	25			25
Control	authentication	11.1		11.1												14.3		14.3			11.1			41	10	38	30
Control	authorization	0.5		33.3				100.0								28.6		28.6			66.7	47.1		5	47	34	29
Control	Control	0.5		11.1				50.0	150.0							28.6	71.4	28.6		71.4	30.6	27.5	150.0	20	47	34	34
Control	Freedom	0.5										100.0	100.0					100.0		100.0					47	1	24
Control	Online Registration	18.5				25.0															25.0			25	4		15
Control	security	0.9		11.1	66.7	50.0	75.0														30.6	27.5	70.8	20	37		29
Control	usernames	0.5	32.4																						47		47
Culture	Asian	0.5																							47		47
Culture	cultural issues	0.9				25.0		100.0				100.0				14.3		57.1	*60.6*		62.5	53.0		8	37	27	24
Culture	European	0.5																							47		47
Culture	Maori	0.5																							47		47
Culture	Pacific Island	0.5																							47		47
Culture	Pakeha	0.5																							47		47
Culture	Student culture	6.9	10.2			75.0	100.0	50.0	150.0	20.0	20.0	100.0	200.0			28.6	42.9	64.3	*50.5*	121.4	48.3	27.5	90.0	12	20	22	18
Data Source	diary note			33.3	33.3			100.0	100.0							85.7	85.7	85.7		85.7	66.7	47.1	66.7	5		14	10
Economic	economic issues	1.4	1.4																						33		33
Environment	Environment															14.3	14.3	14.3		14.3						38	38
Env Output	Formally scripted interactions	7.9	7.9	11.1	11.1							100.0	100.0					100.0		100.0	11.1		11.1	41	18	1	20
Facility	Facility	0.9	0.9																						37		37
Freedom	freedom															28.6	28.6	28.6		28.6						34	34
GVT	Global Team Formation	16.7		11.1		25.0															18.1	9.8		37	6		22
GVT	GVT	17.6	34.3	55.6	66.7	75.0	100.0	100.0	100.0	20.0	20.0	100.0	100.0	100.0	100.0	28.6	28.6	76.2	*41.2*	76.2	62.6	33.7	71.7	7	5	17	10
informating up	informating up	0.9	0.9																						37		37
LT	LT	7.9	7.9	11.1	11.1	100.0	100.0	100.0	100.0	20.0	20.0										57.8	48.9	57.8	9	18		14
Measures	Measures	0.5	0.46																						47		47
Metastructure	format	6.9																							20		20
Metastructure	Genre	0.5														42.9		42.9							47	30	39
Metastructure	instructions					25.0															25.0			25			25
Metastructure	Metastructure	70.8		88.9	88.9	100.0	125.0	100.0		100.0	100.0	100.0		100.0		85.7		95.2	*8.2*		97.2	5.6	104.6	2	1	9	4
Metastructure	Metastructure Spirit	0.5						50.0	150.0			100.0	300.0	100.0	200.0	71.4		90.5	*16.5*	250.0	50.0		150.0	11	47	11	23
Metastructure	Pedagogic patterns	0.5																							47		47
Metastructure	Runestone															42.9	242.9	42.9		242.9						30	30
Metastructure	syllabus sample	0.5	79.6																						47		47
Organization	Organization					25.0	25.0														25.0		25.0	25			25
Organizational unit	Academic Hospital [Uppsala]	0.5																							47		47
Organizational unit	audiovisual unit - SLU	0.9														14.3		14.3							37	38	38
Organizational unit	Flexible Learning Services	9.3	22.2																						12		12
Organizational unit	Inst för Informationsteknologi	0.5														14.3		14.3							47	38	43
Organizational unit	IRB	1.9														14.3		14.3							30	38	34
Organizational unit	ISP	0.5																							47		47
Organizational unit	IT Services	0.9																							37		37
Organizational unit	Organizational unit	1.4														14.3	57.1	14.3		57.1					33	38	36
Organizational unit	School of Computer & Information Sciences	2.8																							25		25
Organizational unit	Technology Services	3.7																							23		23
Research	data	2.3		11.1	11.1							100.0		100.0		14.3		71.4	*49.5*		11.1		11.1	41	27	19	29
Research	diary note													100.0				100.0								1	1
Research	paper	0.9								40.0		100.0						100.0			40.0			16	37	1	18
Research	PhD Thesis															42.9		42.9								30	30
Research	research	2.8								20.0	100.0										20.0		100.0	36	25		31
Research	research design	3.7				50.0	50.0			40.0		100.0				85.7		92.9	*10.1*		45.0	7.1	50.0	13	23	10	15
Research	Review											100.0	400.0					100.0		400.0						1	1
Research	research subject	1.4	11.1											100.0	300.0	14.3	157.1	57.1	*60.6*	228.6					33	27	30
socio-emotional	context & technology-directed emotions	11.1	22.2		50.0		50.0		20.0		35.6	100.0				42.9		71.4	*40.4*		16.7			40	10	19	23
socio-emotional	motivation	0.5			50.0		50.0		20.0		40.0	100.0				28.6		64.3	*50.5*		17.3			39	47	22	36
socio-emotional	other directed emotions	12.0			50.0		100.0		20.0	60.0	56.7					42.9		42.9			40.4	60.0		15	9	30	18
socio-emotional	I-s-he emotion	0.9																							37		37
socio-emotional	I-them emotion	0.5																							47		47
socio-emotional	us-them emotion	0.5																							47		47
socio-emotional	performance-driven emotions	8.8	22.2	44.4	50.0		100.0				57.4	100.0	300.0	100.0	300.0	42.9		81.0	*33.0*	300.0	39.4	44.4		18	15	15	16
socio-emotional	self-directed emotions	2.3			25.0	225.0	50.0	350.0			37.5					14.3	171.4	14.3		171.4	17.7	287.5	88.4	38	27	38	34
socio-emotional	task directed emotions	8.3	44.9																						16		16
Task	Assessment	5.6				25.0						100.0				28.6		64.3	*50.5*		25.0			25	22	22	23
Task	Each GVTs participants become acquainted					25.0															25.0			25			25
Task	Icebreaker															28.6		28.6								34	34
Task	Learning task	15.3		11.1	11.1	75.0						100.0				71.4	128.6	85.7	*20.2*	128.6	43.1	45.2	11.1	14	7	12	11
Task	select a leader or self-managed option for GVT					25.0	150.0														25.0		150.0	25			25
Task	Task	2.31	23.15									100	300					100.0		300.0					27	1	14
task outputs	task outputs	0.9	1.4																						37		37
Trust	trust	0.5																							47		47
Trust	recommender trust	1.9	2.3																						30		30
TUM Activity	Adjustment			100.0		50.0		100.0	100.0	80.0		100.0	100.0	100.0		28.6		76.2	*41.2*	100.0	82.5	23.6	100.0	3		17	10
TUM activity	episodic change	0.9								40.0				100.0		57.1		78.6	*30.3*		40.0			16	37	16	23
TUM Activity	Establishment			55.6																	55.6			10			10
TUM Activity	Reinforcement	1.9	2.8	44.4	200.0	100.0	150.0	100.0	100.0	80.0	200.0			100.0	300.0	14.3	100.0	57.1	*60.6*	200.0	81.1	26.2	162.5	4	30	27	20

Table 7.23: All TUM modes Inter Group Comparison:– Normalised Frequencies for ‘Concepts and Codes’

7.7.3 Other Grounded Data – Inter Group Comparison: All TUM modes - Roles

Table 7.24 over page portrays the patterns of 'roles' for the combined episode groupings. Again normalized frequency tables are employed in this analysis. To aid inter group comparison, means and ranks for each grouping, complemented by mean ranks across groupings have been tabulated. Two notable features of table 7.24 were the large number of roles (47) identified, and the limited degree of overlap between roles across the first two pairs of episode groupings (15/47 or 32% in common). While the *Est* episode had the larger proportion (37/47) of the roles, a further 5 roles were evident in the *A-R* episode grouping, complemented by another 5 in the *E-C* grouping. The *E-C* episode grouping likewise had a limited degree of overlap with the *Est* episode (11/47 or 23% in common). Surprisingly the roles common across all three episodes numbered only 7/47 or 15%.

A comparison of the top 10 *Est* ranked roles across groupings resulted in a closer match, with 5 of the codes also found in the top 10 codes for *A-R* and *E-C* (*coordinator; offshore technical coordinator; teacher; researcher; and undergraduate student*). The further code *motivator* was also present in the top 10 for both *Est* and *A-R* groupings. The code *developer* was in the top 10 for both *Est* and *A-R* groupings, and ranked 12th in the *A-R* grouping. Other noteworthy roles ranked in the top 10 within at least one grouping were: *curriculum developer (Est and E-C); teaching-research assistants; support and maintenance team representatives; testers (A-R & Est).* The *curriculum developer* was a role more associated with the design and change oriented TUM activities of the *Est* and *E-C* groupings. In comparison *testers* seemed to be a role more actively associated with the *A-R* episode grouping, with rank differences for this role supported by the differences between the *Est* and *A-R* grouping means.

The roles not present in the *Est* grouping were: *emergent central users; external consultant (infrastructure); facilitator and process facilitator; and Lotus Notes administrator*. These roles appear to have arisen naturally out of the process of technology use and its *reinforcement* and *adjustment* during the collaboration.

		Establishment	Adjustment/reinforcement				Episodic Change						Episodic		adj-rein		adj-rein	estab	Episodic	Mean
			Episode one	Episode two	Episode three	Episode four	Episode one		Episode two		Episode three									
		Norm Freq	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	**Mean**	**Std Dev**	**Mean**	**Std Dev**	**ranks**	**ranks**	**ranks**	**ranks**
Concepts	Codes	Codes %	Codes %	Codes %	Codes %	Codes %	Codes %	%	Codes %	Concepts %	Codes %	Concepts %	**Codes %**	**Codes %**	**Codes %**	**Codes %**	**codes**	**codes**	**codes**	**codes**
Role	audiovisual unit - SLU	0.9																18		18
Role	Broker	2.8																10		10
Role	Central users - self selected, emergent (like a Coweb webmaster)		22.2	25.0	50.0										32.4	15.3	8.0			8
Role	Configurer	0.5																26		26
Role	Content facilitator	0.5																26		26
Role	Coordinator	27.8	66.7	75.0	100.0	100.0	100.0		100.0		28.6		76.2	41.2	85.4		1.0	3	4	3
Role	curriculum developer	6.0									14.3		14.3					7	11	9
Role	Developer	3.7	22.2			20.0			100.0				100.0		21.1		12.0	9	1	7
Role	Explainer	0.5																26		26
Role	External consultants (infrastructural)					20.0									20.0		13.0			13
Role	external participant	0.9																18		18
Role	Facilitator			25.0											25.0		10.0			10
Role	Formal (teaching - research assistants)	2.8	11.1								14.3		14.3		11.1		18.0	10	11	13
Role	Graduate Student	0.5									28.6		28.6					26	10	18
Role	GVT leader						100.0				14.3		57.1	60.6					6	6
Role	help desk staff	0.9																18		18
Role	Innovator	0.5									14.3		14.3					26	11	19
Role	IRB	1.9	11.1												11.1		18.0	14		16
Role	IRB administrator	0.5																26		26
Role	ISP	0.5																26		26
Role	Lotus Notes administrator					20.0									20.0		13.0			13
Role	Monitor								100.0	300.0	14.3		57.1	60.6					6	6
Role	Motivator (energizer, encourager)	31.9	22.2			40.0									31.1		9.0	1		5
Role	Officially sanctioned local developer	0.9	11.1	25.0											18.1		17.0	18		18
Role	Offshore Technical Coordinator	19.0	44.4	75.0	100.0	40.0					57.1		57.1		64.9		2.0	5	8	5
Role	paper coordinator	1.4									14.3		14.3					16	11	14
Role	parental										14.3		14.3						11	11
Role	Process Facilitator		50.0		50.0										50.0	0.0	5.0			5
Role	Programmer	0.9																18		18
Role	Purpose agents - teacher	20.4	44.4	50.0	100.0	20.0					71.4		71.4		53.6	33.6	4.0	4	5	4
Role	Research Subject	1.4																16		16
Role	Researcher	10.7				40.0	100.0				85.7		92.9	10.1	40.0		7.0	6	2	5
Role	SCIS Resource Coordinator	2.3																12		12
Role	SLU GIM student										14.3		14.3						11	11
Role	socio-emotional group-bldg and mtce roles	1.9				20.0									20.0		13.0	14		14
Role	Standard user	0.5																26		26
Role	Supplier	0.5																26		26
Role	Support and Maintenance Team representatives	5.6				20.0					14.3		14.3		20.0		13.0	8	11	11
Role	System Support Consultant	0.9																18		18
Role	Team leaders or session owners	0.5																26		26
Role	Technical Coordinator	0.9																18		18
Role	Technologist	0.5	11.1												11.1		18.0	26		22
Role	Testers.	2.3	55.6			40.0									47.8	11.0	6.0	12		9
Role	trainers	0.9		25.0											25.0		10.0	18		14
Role	Undergraduate Student	28.7	33.3	75.0	100.0	20.0	100.0	400.0			57.1		78.6	30.3	57.1	37.0	3.0	2	3	3
Role	Uppsala IT student										42.9	500.0	42.9						9	9
Role	videoconference technicians	0.5																26		26

Table 7.24: All TUM modes Inter Group Comparison:– Normalised Frequencies for ‘Roles’

Roles not present in the *A-R* episode grouping were more diverse, encompassing institutional roles such as *IRB administrator* and *research subject*; initiator roles such as *innovator, curriculum developer*; resource oriented roles such as *broker, SCIS resource coordinator*; design oriented roles such as *programmer and configurer*; and technical support oriented roles such as *systems support consultant; help desk staff; videoconference technicians*.

In contrast, the *E-C* grouping was characterized more by the absence than the presence of roles, perhaps reflecting the discrete nature of such triggers to TUM activity. While a common core set of roles was evident in the *E-C* grouping, (as noted in the top 10 discussion above), the additional roles had a focus on: innovation and change (*innovator, graduate student, paper coordinator*); process facilitation (*process facilitator, monitor, GVT leader*); students by location and course (*Uppsala IT student, SLU GIM student*) and a wider personal role (*parental*), which would have a bearing on the forthcoming collaboration. Thus the roles reflected the specifics of each occasion for TUM activity in the *episodic change* mode, and a general orientation towards innovation and change.

In a similar fashion, the broader set of roles for the *Est* grouping appeared to have a logical focus on the preparatory dimensions of the wider institutional context, the initiation of the venture, design of the process and supporting technology, and securing the necessary resources and technical support for *establishment* of the collaboration. Therefore the group of roles called upon at that stage of proceedings would naturally differ from that smaller set of roles typically called upon for TUM activities in the *adjustment* and *reinforcement* mode, at a later stage when the collaboration would be underway.

7.7.4 Other Grounded Data – Inter Group Comparison: All TUM modes – Time and Space

Table 7.25 below portrays the patterns of 'Time and space' for the combined episode groupings. Again means and ranks for each grouping, complemented by mean ranks across groupings have been employed in this analysis.

		Establishment	Adjustment/reinforcement				Episodic						Episodic	adj-rein	adj-rein	estab	episodic	ranks
		Establishment	Episode one	Episode two	Episode three	Episode four	Episode one		Episode two		Episode three							
		Norm Freq	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	*Norm Freq*	**Mean**	**Mean**	**rank codes**	**rank codes**	**rank codes**	**mean ranks**
Concepts	Codes	Codes %	Codes %	Codes %	Codes %	Codes %	Codes %	Concepts %	Codes %	Concepts %	Codes %	Concepts %	**Codes %**	**Codes %**				
Space	Absence	4.6		25.0							14.3		14.3	25.0	16	7	11	11
Space	face to face	3.7				40.0	100.0				85.7		92.9	40.0	9	10	3	7
Space	international										28.6		28.6				9	9
Space	Location	28.7	55.6	100.0	100.0	60.0	100.0	200.0	100.0	100.0	100.0		100.0	78.9	1	2	1	1
Space	Sweden	0.9														14		14
Space	Uppsala	0.5														16		16
Space	US	0.5														16		16
Time	Class Schedule	8.8	11.1	75.0										43.1	6	5		6
Time	day		44.4		100.0	60.0			100.0		14.3		57.1	68.1	3		8	6
Time	daylight saving	0.5	11.1			40.0								25.6	15	16		16
Time	Delay	9.7		25.0										25.0	16	4		10
Time	experience	1.9		25.0	50.0						71.4		71.4	37.5	10	12	6	9
Time	holiday	4.6	11.1	75.0		20.0								35.4	11	7		9
Time	Runestone	0.9			50.0									50.0	5	14		10
Time	Schedule	1.4		25.0										25.0	16	13		15
Time	stages of scripting the project	4.6	55.6	25.0			100.0						100.0	40.3	8	7	1	5
Time	Synchronize	34.3	55.6	25.0	100.0	100.0	100.0				71.4		85.7	70.1	2	1	5	3
Time	Time	6.5	33.3	25.0	100.0	60.0	100.0	300.0	100.0	200.0	71.4		90.5	54.6	4	6	4	5
Time	Time separation	11.6	33.3		50.0						71.4		71.4	41.7	7	3	6	5
Time	time zone	3.2	11.1	25.0	50.0	20.0								26.5	14	11		13
Time Pressure	busyness	0.5			50.0	20.0					14.3	271.4	14.3	35.0	12	16	10	13
Time Pressure	concurrent tasks				50.0	20.0	35.0		6.0					35.0	12			12

Table 7.25: All TUM modes Inter Group Comparison:– Normalised Frequencies for ‘Time and Space’

The notable feature of table 7.25 above was the very high degree of overlap between 'time and space' related codes across the first two episode groupings (16/22 or 73% in common). Independently the *Est* episode and the *A-R* episode grouping each contained greater than (18/22 or 82%) of the codes. The *Est* and *E-C* comparison produced a reduced but comparable result (9/22 codes or 41% in common, and 11/22 or 50% of the codes within the *E-C* grouping). This comparison was impacted by the fewer overall *E-C* grouping codes, yet 8/11 *E-C* codes were present across all three groupings.

Comparing the top 10 *Est* ranked roles resulted in a high match across groupings, with 6 of the codes also found in the *A-R* and *E-C* top 10 (*face to face; location; stages of scripting the project; synchronize; time and time separation).* The code *class schedule* was also shared across *Est* and *A-R* groupings. In contrast the top five were less consistent across groupings, although the two dominant codes *synchronize* and *Location,* were each ranked one and two within *Est* and *A-R* groupings, and fifth within the *E-C* grouping.

Codes with the largest mean differences between *Est* and *A-R* groupings (*Location* and *time*) nonetheless were closely ranked, but *Runestone* did show a solid differential between groupings, no doubt due to inflation by the small number of *A-R* source items. Major additional codes for 'space' within the *Est* grouping were specific geographical locations for each site (Sweden, Uppsala, and US), and for the *E-C* grouping the 'virtual space' code of *international* was added.

In summary, 'Time and space' appeared as critical (perhaps even universal) dimensions of TUM activity, whether in *Establishment, adjustment, reinforcement,* or *episodic change* modes. Similar patterns of dominant codes were apparent across the three episode groupings.

7.7.5 Other Grounded Data 'Metastructures' – Inter Group Comparison: All TUM modes

Table 7.26 below lists for comparison the 'metastructures', which were given particular attention in the original episode groupings. The treatment here is again necessarily uneven, reflecting the approach taken in each episode, which was far from exhaustive and varied in the granularity of the 'metastructures' under scrutiny. This data therefore did not support direct comparison in the manner of the prior coded sections. Whereas some episodes have directly highlighted distinct sets of metastructures, others have been

more broad brush or implicit in their treatment. For instance, the *cultural* theme was to the fore in the *Est* grouping, with high level '*cultural metastructures*' being explored, whereas blending metastructures with other structures such as specific *AITs* and their features, was the approach adopted in episode one of the *A-R* grouping.

As can be seen from table 7.26 below, the comparison between episode groupings was not readily apparent, other than an apparently differential focus on *culture* and associated *cultural metastructures* within the *Est* grouping. However, more detailed analysis of those *cultural metastructures* (cf. tables 6.8ff. above) revealed several metastructures in common when viewed at a lower level of specificity (e.g. *GVT, LT, AUTOnline, exercise, groups (GVTS), two week break, paper, tutors' space*).

With this deeper analysis then, some consistent patterns can be discerned within the overall collection. Only a few metastructures occurred across all eight episodes. *GVT* was a notable example (with the *collaborative teaching team* itself distinguished as another form of *GVT,* as were *student GVTs, group pages for GVTs and GVT collaboration). AUTOnline* provided an example of a more 'technology focused' metastructure.

LT as a metastructure occurred across all episodes in the *Est* and *A-R* groupings, as did in fewer episodes the notion of *international collaboration, GVT collaboration, and comparative collaboration* across the *Est* and *E-C* groupings. The *collaborative database, Notes collaborative database* and *Lotus Notes database* provided an example of a more 'technology focused' metastructure, common across some episodes within the *Est* and *E-C* groupings.

	Adjustment/Reinforcement				Episodic Change		
Establishment	**Episode one**	**Episode two**	**Episode three**	**Episode four**	**Episode one**	**Episode two**	**Episode three**
Metastructures (in body of chapter)							
	AITs (Metastructures Implicit in tables 6.27a and 6.27b)						
						Addressing team performance outcomes (metastructure spirit)	
	announcements		Announcements				
				Answerphone message			
		Assignment					
		Attachment					
		AUTOnline	AUTOnline Group Page	AUTonline		AUTOnline features	
						Group pages for GVTs1-9	
						Phase 2 discussion threads	
		Class					
		Classroom					
				Collaborative computing topic			
		Collaborative data base (2)					
							collaborative spirit in wiki (metastructure spirit)
			Collaborative teaching team (GVT)				
							Comparative collaboration
		Competition					
Cultural Metastructures (National)							
Cultural Metastructures (National/Institutional)							
Cultural Metastructures (Student)							
Cultural Metastructures (Professional)							
Cultural Metastructures (International)							
		"deliverables entire team must work towards"					
		Discussion					
		Email (3)					
					ethics approval process		
		Exercise (3)					
		Experience					
	features of applications						
						Final evaluation questionnaire	
			Firewalls				
				Fred's phone number			
		Game					
			Global email list				
			Global Virtual Classroom				
		Groups (GVTs)					
	GVT	GVT	GVT	GVT			
					GVT collaboration		
	GVT Groups (AUTonline)						
							icebreaker task
					information sheet		
		Instructions (3)					
		international collaboration			international collaboration		
		Introduction					
		Lab					
					learning design		
						Lotus Notes database features	
						Leader decision forms	
						Posted website links	
	LT	LT (2)	LT	LT			
	main navigator						
				Meetings			
		Message					
				Midterms			
				Minibreak			
				Notes collaborative Database			
		NZ/SW/USA Collaboration				Online evaluations	
						Online form	
			Online questionnaires				
		Online registration					
		online synchronous chat meetings.					
		Optional task					
				Panel discussion			
		Paper (2)					
		Phases					
		Prize					
		Project					
		Projector					
		Ranking					
		Ranking discussions					
		Required task					
		Research					
							Runestone project
				Seminar			
				Server upgrade			
				Servers			
				"Session here on campus"			
		Set of questions					
		Site					
		structure of the exercises					
							student GVTs
			Student web pages				
	synchronous chat sessions						
				Testing and backup plans			
	tutors' discussion board						
	two week break						
	URL's						
			Video conference				
				Visit			
	VPN						
		Websites (2)		Websites			
							wiki

Table 7.26: All TUM modes Inter Group Comparison: – Featured 'Metastructures'

As previously remarked for the *A-R* grouping, generally speaking the full collection of metastructures represented a set of activity patterns with varying foci. The addition of the 'cultural' focus from the *Est* grouping merely complemented this set of patterns. Moreover the *cultural metastructures* were not inconsistent with the patterns previously identified in the *A-R* and *E-C* groupings (cf. 7.7.2.3 & 7.12.2.3), where 'cultural', 'institutional', 'technology', 'time' and 'spatial' foci had been discerned. The additional dimensions lay in the unpacking of culture within the *Est* grouping into several discrete layers, such as the 'professional' the 'student' and the 'international'.

Again, complementing the metastructures in the body of these episode groupings, were those specifically selected for attention in the visual map section of each analysis. Table 7.27 below depicts these.

Establishment	**Adjustment/reinforcement**				**Episodic change**		
Establishment	**Episode one**	**Episode two**	**Episode three**	**Episode four**	**Episode one**	**Episode two**	**Episode three**
Cultural dimensions of institutional ethics process	Draft Phase 2 instructions for students	LT at each site	Synchronous chat sessions and technologies	Server upgrade St Louis Panel session	Assessments AUT specific learning goals Collaboration Courses Ethics approval Information sheet Notes Collab DB Trial design	Final evaluation questionnaire – additional question	Icebreaker Runestone Project Synchronous chat sessions and technologies
GVT Formation Process							
Institutional ethics process							
Videoconference session							

Table 7.27: All TUM modes Inter Group Comparison: –'Metastructures' from visual maps

This grouping contains 21 different metastructures, but again shows a dispersed collection across the episodes, with patterns not dissimilar to the fuller collection in table 7.26 above. Again multiple dimensions and varying levels of granularity were evident within this more compressed set of metastructures in table 7.27.

The *Est* metastructure grouping, complemented the *A-R* and *E-C* sets of 'Domain specific genres' (represented by *draft Phase 2 instructions for students, St Louis Panel session, assessments, AUT specific learning goals, courses)* with the *institutional ethics process* and its accompanying *cultural dimensions.* This was in turn echoed by *ethics approval process* and *information sheet* within the *E-C* grouping. Thus both 'cultural' (at many levels) and 'institutional' aspects were again prominent across groupings.

The ‘time’ dimension underpinned the metastructures of *synchronous chat sessions and technologies, videoconference session* and *draft phase 2 instructions for students.*

The ‘technology’ dimension presented itself in *synchronous chat sessions and technologies, Notes collab DB, server upgrade,* and the *videoconference session.* The latter two further incorporated an ‘institutional’ dimension, and the videoconference session an aspect of virtual ‘location’ and ‘international’ dimension.

The *Est* grouping metastructures in table 7.27 related directly to the primary TUM activities of ‘establishment’ within this episode grouping. Surmounting the ‘institutional’ barriers of the ‘*institutional ethics process*’, investigating resources, technology dimensions and logistics surrounding an introductory ‘*videoconference session*’, assigning members to groups via the ‘*GVT Formation*’ process, were all necessary precursors to the collaboration. In contrast the *A-R* grouping could be said in part to depict a set of metastructures which arose naturally from the conduct of the collaboration itself. *LT* of course was a more persistent core metastructure evident across groupings as discussed in table 7.26 above. There was some ambiguity in the metastructure represented by *the draft phase 2 instructions for students,* which reflected not only ‘adjustment’ and ‘reinforcement’ but also ‘establishment’ mode TUM activities. The *E-C* grouping metastructures shared elements of the *Est* grouping: in navigating the ‘institutional’ process of ‘*ethics approval*’ and generating the associated ‘*information sheet*’; investigating the technology dimensions and logistics surrounding ‘*synchronous chat technologies’*; ‘*trial design’;* which all constituted necessary precursors to a planned future collaboration. The role of *Runestone* as a comparative *collaboration* and the requirements of differing *courses* in the design of *assessment*, the role of the *Notes collab DB* technology platform, the *icebreaker* task design and the *evaluation questionnaire - additional question* all demonstrated the interwoven nature of TUM activity in ‘episodic change’ mode.

In summary, a multifaceted and multi layered picture of metastructures has been developed across these episode groupings, and distinctions were evident in the roles of metastructures supporting the TUM activities in each mode, whether preparatory, mid collaboration, or triggered by some identified need or change event.

By viewing metastructures in this way, supported by the concentrating power of the ‘TUM activity in focus’, one can gain insight into the subtle ways through which the processes of TUM are enacted. This enables us to move beyond the activities of the “user” to those of technology-use mediators who engage in the “shaping of other users’ activities of use, a process we designate as metastructuring” (Orlikowski et al., 1995).

This approach bears a relationship to that of Lamb & Kling (2003), who have introduced the term 'social actor" and an associated research framework to replace the commonplace but hugely unsatisfactory term "user".

> "The social actor framework provides a way to tie in related studies - to gain their insights and apply them to a specific focus of interest in a systematic way - without being overwhelmed by the complexity of trying to understand the whole thing and without resorting to reductionist approaches…in the process by relying on institutional concepts (e.g. professional and cultural values) and illustrating how these are carried at various levels though social structures (e.g professional hierarchies and interorganizational networks), IS researchers can address the social actor as an organization member who is representing the interests of the firm or department (as well as her own interests) rather than as a user" (Lamb & Kling, 2003, p.223).

The approach adopted here has similar aims, in trying to unravel the complexities of a dynamic and multilayered set of actions, and address a broader notion of technology use, which links the shaping and support of that use to its cultural and institutional contexts.

7.7.5.1 Evolution of Practices – Inter Group Comparison: All TUM Modes

Tables 7.28a and 7.28b below portray the evolution of practices within the extended temporal brackets which augmented the analysis for their episode groupings. As previously remarked, since these extensions often incorporated further TUM activity modes within the selected bracket, this portrayal does not readily support direct comparison between modes of TUM activity. However as observed in section 7.4.2.4 above, the A-R episode grouping did have a primary focus on *adjustment/reinforcement TUM* activity, the two September 2004 – October 2004 brackets within the *Est* grouping directly related to the *establishment* mode of activity, while the earlier bracket originating in September 2003, also incorporated an *episodic change* element, by extending the collaboration to a new triadic configuration across three countries.

The *E-C* brackets, which covered the longest duration, extended back as far as May 2000 to a prior *episodic change* activity occasioned by the Sept 1999 collaboration, through to post *episodic change* brackets from October 2004 extending as far forward as November 2005. These brackets were inherently mixed but, as observed in section 7.6.2.4 above, essentially again depicted the '*episodic change*' mode together with the unfolding of its impact.

The following analysis separately presents the data tables 7.28a and 7.28b, where the former presents the extended *Est* and *A-R* groupings and the latter portrays the extended *E-C* mode brackets. These groupings have already been independently analysed in

sections 7.4.2.4 and 7.6.2.4 above, and the tables are repeated below for ease of reading. The focus in this analysis is on the variations between the groupings and their meaning (as far as possible) when taken across the full set of TUM activity.

A summary of each episode grouping is repeated below to help frame the analysis. Within table 7.28a three featured brackets ranged over a full year period. The first bracket within the *Est* grouping, and the first bracket within the second and third episode of the *A-R* grouping. Each of these had its origins in prior events, which constituted instances of TUM activity in *episodic change* mode. In the *Est* grouping the correspondence between Felix, Fred and me in September 2003 had initiated the triadic collaboration, which had successfully concluded in October 2004. In the A-R grouping the November 2003 meeting between Mats and I had set the scene for the 2004 collaboration, which had resulted among other things in a wider set of technology platforms supporting both synchronous and asynchronous communication modes. However, the limited use of the synchronous features by students (despite active *adjustment* and *reinforcement* activities on the part of coordinators and some GVT leaders) had been a disappointing outcome.

The outcome of two out of these three significant *episodic changes* had then been successful (the triadic collaboration had taken place and a wider technology set had been made available). The less than satisfactory outcome of the final *episodic change*, with limited student adoption of synchronous technologies, better accords with the majority of excerpts.

A brief summary of the brackets in table 7.28b is now given. In episode one the 'TUM activity in focus' was the proposed redesign of the collaborative trial. In the 2002 collaboration both 2D and 3D collaborative virtual environments had been employed, using assigned technology platforms, to support icebreaking activities (cf. Clear & Daniels, 2003). This collaboration had achieved some degree of success, but was not without some technical challenges related to the prototype 3D environment. For the 2003 collaboration, while students had been free to choose their own software environments, and the goal of investigating the role of avatars in enriching communication had been retained in the instructions, there was no actual evidence of 3D software use, but considerable Uppsala student dissatisfaction with the Lotus Notes 2D collaborative technology platform.

In episode two, from as early as the 1999 collaboration, groups had been tasked to choose the leader for their GVTs, but with mixed success in doing so and with some confusion between LT and GVT levels. For the 2004 collaboration the goal was to

achieve successful outcomes for the collaboration at the GVT level. Again goals were achieved partly or not at all, with some confusion between LT and GVT levels. In the midpoint of the 2004 trial a further question had been added to the final evaluation to gain students perceptions of whether the full GVT had been successful in its goals. At the time of reporting this bracket, students had yet to post final evaluations, but the icebreaker evaluations had been mostly from AUT students. A further support for GVT collaboration was the AUTOnline synchronous chat facility, but while some chat sessions had been recorded, they included only postings from members of the AUT LTs.

In episode three the goal for the 2004 collaboration had been for the collaborative task to promote collaborative activity and motivate GVTs to work together fruitfully. The US teams did not gain support from the LT structure, found the design of the website ranking activity too open, and seemed to need a competition element to motivate active participation. In the 2005 internal collaboration the introduction of the quiz as a task (together with some adjustments to the icebreaker) appeared to significantly improve student motivation and outcomes. It was noted that working in the same time zone had made a big difference. For the 2005 international collaboration, the assessment instructions for AUT students had to be amended to remove the requirement for each GVT to successfully complete a quiz (as this was beyond the local students control), but a fallback option at the LT level was available. The collaboration resulted in all 9 GVTs successfully posting their quizzes, with a couple of outliers but evidence of cross-site collaboration in each case. Several final evaluations were posted, but the Swedish student postings were very low in number, perhaps indicating a limited motivation on their part to complete the task?

Establishment					Episode one					Episode two					Episode three					Episode four				
Start Bracket	**End Bracket**	**Desired Practice**	**Realised Practice**	**Dominant AIT**	**Start Bracket**	**End Bracket**	**Desired Practice**	**Realised Practice**	**Dominant AIT**	**Start Bracket**	**End Bracket**	**Desired Practice**	**Realised Practice**	**Dominant AIT**	**Start Bracket**	**End Bracket**	**Desired Practice**	**Realised Practice**	**Dominant AIT**	**Start Bracket**	**End Bracket**	**Desired Practice**	**Realised Practice**	**Dominant AIT**
Sep-03	Oct-04	Triadic Global Collaboration including St Louis University, AUT & Uppsala	Triadic Global Collaboration including St Louis University, AUT & Uppsala (with a new coordinator at each offshore site)	email	23/08/2004	14/10/2004	Students free to choose communication software from AUTOnline features including AUTOnline email for external students	AUTOnline email communication not available for external students	AUTOnline Email accounts	11/11/2003	10/2004	Groups free to choose own software implicitly both asynchronous and synchronous	AUTOnline features and Lotus Notes DBs confirmed as technology platform	AUTOnline features	11/11/2003	30/10/2004	Groups free to choose own software implicitly both asynchronous and synchronous	AUTOnline lightweight synchronous chat features used only by LTs of AUT students (based upon few recorded sessions)	AUTOnline lightweight chat & recording features	28/09/2004	19/10/2004	Notes server software to be upgraded to version 6.5 for AUT Centre for Educational and Professional Development	University wide priorities took precedence	Lotus Notes Domino Server
								Have to use own Swedish email addresses					AUT students make some attempts	Lotus Notes Collab DB				Logistics of coordinating global chat sessions across time zones prove too daunting				We recommended ideal time after our global collaboration	Negotiated a testing and recovery plan with IT service providers	Lotus Notes Designer
1/06/2004	1/10/2004	Students registered for 6th Sept scheduled start to collaboration	Students registered by 17th Sept for late start to collaboration	AUTonline student account registration	31/08/2004	3/11/2004	AUT students to identify 5 key issues during trial, collect at least 5 pieces of evidence, could include chat session recording	Issues identified by students, discussion thread postings and Notes forms attached as appendices	AUTOnline Discussion threads				Uppsala students have accounts finally but no active partners		3/10/2004	4/10/2004	Global email list for communication with all participants	No overall email list set up on AUTOnline, logistics of setting up forwarding option (to be done individually by each external student) would take too long to build global	AUTOnline email account (forwarding option for external students), external students home email accounts				External support consultant called in to conduct upgrade	Lotus Notes Clients
								No chat recordings	Notes Database forms, AUTOnline lighweight chat feature				US students don't work outside class		29/09/2004	30/10/2004	1) Proposed introductory global synchronous chat session for all GVTs be arranged	1) rejected as "too hard'	AUTOnline lightweight chat feature				Tests conducted satisfactorily and no disruption to collaboration	Email
1/06/2004	1/10/2004	Students email accounts set up by 6th Sept scheduled start to collaboration	External students email accounts not functional for collaboration	AUTonline student email accounts	28/09/2004	3/11/2004	Arnold proposed a joint chat session between members of each GVT	No chat sessions eventuated	AUTOnline Discussion thread AUTOnline Announcement AUTOnline lighweight chat feature	16/09/2004	22/09/2004	External students registered and freely able to use AUTOnline	St Louis students now set up for access and still to log on - 2 weeks after original start date	AUTOnline, AUTOnline student accounts			2) 3 way phone call of trial coordinators tba	2) decided to defer, timezones & limited time	telephone					
										22/09/2004	24/02/2005	External students, coordinators and local counterparts able to freely access and use AUTOnline and Lotus Notes DB	AUTOnline down frequently, Swedish collaborators and St Louis collaborators unable to access site during peak daylight hours.	AUTOnline			3) Proposed trial coordinators to convene synchronous chat sessions with three GVTs each	3) proposed students initiate sessions for each GVT and invite coordinators to join – did not eventuate						
													Able to advise Arnold due to scheduled overnight downtime for backups at AUT not advised to us	Lotus Notes DB										

Table 7.28a: All TUM Modes Inter Group Comparison:– Evolution of Practices for *Est* and *A-R* Groupings

Episode one					Episode two					Episode three				
Start Bracket	**End Bracket**	**Desired Practice**	**Realised Practice**	**Dominant AIT**	**Start Bracket**	**End Bracket**	**Desired Practice**	**Realised Practice**	**Dominant AIT**	**Start Bracket**	**End Bracket**	**Desired Practice**	**Realised Practice**	**Dominant AIT**
Semester 2/2002	11/11/2003	Students use 2D and 3D icebreaking modes in GVTs Students compare 2D & 3D icebreaking modes	Students used & compared 2D and 3D icebreaking modes Teamlink issues, some technical glitches. slow response, frozen screen, mixed icebreaking success (Reported at FIE2003 in a research paper)	Teamlink 3D CVE cybericebreaker with avatars Lotus Notes Collab DB Notes 2D icebreaker email	20/09/1999	27/05/2000	groups to choose leader for GVTs	Variable outcomes some students confused, some leaders assumed, some lacked a leader, some leaders at LT level only (Reported in M. Phil, 2000)	Lotus Notes Collab DB - various features email	20/10/2004	22/10/2004	Collaborative task promotes collaborative activity and motivates GVTs to work together fruitfully	LTs fail to support US team activity, design of (website ranking) task too open, needed competition element to motivate US teams, students only do what is required	AUTonline, Notes collab DB
Semester 2/2003	11/11/2003	Students investigate role of avatars to enrich communication, investigate 3D interfaces in collab workspace Students free to choose own s/w, implicitly both synch and asynch Potentially with avatars	Notes Collab DB used in 2003 collaboration Caused upset for Uppsala students 2D interface only No evidence of 3D s/w used	No 3D collaborative technology Lotus Notes Collab DB Notes 2D icebreaker	1/09/2004	1/02/2005	Goals to be achieved for global collaboration at GVT level	Goals achieved partially or not at all Some students confused LT vs. GVT levels	Lotus Notes Collab DB - various features email	20/10/2004	3/06/2005	Collaborative task promotes collaborative activity and motivates GVTs to work together fruitfully	Students happier this time, task easier to follow, same time zone a big difference [AUT internal collaboration]	AUTonline, open source quiz s/w, VTeam Notes collab DB
					13/10/2004	13/10/2004	Amend online final evaluation questionnaire to record GVT level performance All students to post icebreaker online evaluations	Final questionnaire amended Students yet to post Mostly AUT students post icebreaker online evaluations	final evaluation online questionnaire Notes forms icebreaker online evaluations	20/10/2004	9/09/2005	Collaborative task promotes collaborative activity and motivates GVTs to work together fruitfully	Assignment amended removed assessment requirement for each GVT to submit a complete quiz, goal but LT as a fallback?	AUTonline, open source quiz s/w, VTeam Notes collab DB
					20/10/2004	30/10/2004	GVT synchronous chat sessions recorded via AUTOnline lightweight chat	Sessions recorded GVT5 only in AUTOnline Several solo sessions Several active sessions Local (Akl'd) member LT only, no offshore participants	AUTonline chat Chat recording feature	20/10/2004	26/10/2005 – 3/11/2005	Collaborative task promotes collaborative activity and motivates GVTs to work together fruitfully	All 9 GVT quizzes completed and posted to Notes Collab DB, plus extras [international collaboration Uppsala & AUT]	AUTonline, open source quiz s/w, VTeam Notes collab DB
										20/10/2004	26/10/2005 – 7/11/2005	Collaborative task promotes collaborative activity and motivates GVTs to work together fruitfully	26 final evaluations completed and posted to Notes Collab DB, only 6 Swedish evaluations	AUTonline, open source quiz s/w, VTeam Notes collab DB

Table 7.28b: All TUM Modes Inter Group Comparison:– Evolution of Practices for *E-C* Grouping

As previously noted (section 7.6.2.4) the prevalence of 'breakdown' within these brackets was natural enough in that each episode depicted a "TUM activity in focus". The focus was typically occasioned by our attention being drawn to an event or sequence out of the ordinary, by some breakdown or potential breakdown in the natural flow of events. While many brackets were retrospective, some looked to the future and addressed activity aimed at remedying or preventing future breakdowns. The role of breakdown here can be seen as a useful trigger for reflection, and in the context of an action research project can be seen as a natural aspect of the research cycle. In fact Carr & Kemmis (1983) have referred to reflection as one of the "moments" of action research, situated within a four step cycle of: 1) plan, 2) act, 3) observe and 4) reflect. The "reflect" step they considered an activity "retrospective on observation" within this overall cycle.

The ongoing nature of the interventions within these brackets was apparent, particularly in the persistent challenges in distinguishing local and global team structures, and in coordinating global synchronous events. The gradual process of achieving a more effective joint process and a viable common task, likewise persisted over several collaboration cycles. This continuity across episodes and modes of TUM activity, suggests that knowledge about mediating effective global virtual collaborations has been emergent over the course of the research programme. Yet while these continuous series of events may have served to illustrate "structuring's ceaseless flow" (Barley, 1986, p.82), they also served to generate triggers for reflection and action at natural junctures, based on abrupt or envisaged cessations in that very flow. These sequences of continual intervention and adaptation were also consistent with the notion of TUM as a "sensemaking" process as proposed by Bansler & Havn (2006) in the following excerpt:

> "the practice of technology-use mediation is much more complex than prior research suggests. Because advanced CSCW technologies are equivocal and open-ended, ongoing sensemaking is an essential, but usually overlooked, aspect of the mediation process. The notion of sensemaking draws attention to the fact that the practice of technology-use mediation is highly situated, contingent, and conditioned by the knowledge, experience, and identity of the mediators. It is a process of learning, exploration and construction, which is essentially open ended and indeterminate" (Bansler & Havn, 2006, p.87).

The focus will now turn briefly to the three highlighted areas in which persistent efforts have been expended over time and across TUM modes. The challenges of distinguishing between local and global teams surfaced at an early stage, as evident in

the 1999 collaboration of episode two in table 7.28b above. Various interventions (not expounded here) had been applied over time to improve the students' identification with their broader GVTs, but with variable degrees of success. In the 2004 collaboration again in episode two, while the goals had been set, a specific addition to the evaluation process was made, by adding a question to gain insight into student perceptions of the level at which they had succeeded. This data would complement the more objective performance data. As noted for both the internal and international 2005 collaborations of episode three, the achievement of a successful outcome at the GVT level had been observed based upon performance data, but the student perceptions of GVT success complemented this with a more nuanced view (noted in section A20-6.9.6.2 below). Here the intersection between TUM activity in *episodic change* mode was apparent in the challenging process of designing the GVTs more actively into the process. In the 2004 collaboration of episode three for instance, the US LTs did not support the process, which may have detracted from GVT performance. This however, was not an experience common to this collaboration alone. Berglund (2005) has observed from the literature that:

> "a distributed learning environment invites misunderstandings, low trust and assumptions about the (low) achievement of members at a distance…students in the local sub-team are perceived as making a better contribution than their distant colleagues" (p. 188).

The revised process and use of a quiz as a "reciprocal" task (Maznevski & Chudoba, 2000, p.485) during the 2005 collaborations of episode three demonstrated not only the effectiveness of TUM activity in *episodic change* mode, but also in the three accompanying modes (*establishing* the collaboration, *adjusting* and *reinforcing* technology use) which together contributed to a more successful outcome.

The continual attempts to facilitate effective use of synchronous technologies to support global collaboration, was evident across several episodes and TUM activity modes. Episodes one, two and three of the *A-R* grouping in table 7.28a touched on the issue in various ways, as did episode two of the *E-C* grouping in table 7.28b. Thus all four modes of TUM activity were implicated in this challenge, which persisted in this set of episodes over a duration which extended from late 2003 until late 2004 and still remains to be resolved. The only consolation lies in the words of Treinen and Miller-Frost (2006) that:

> "Anyone who has tried to schedule a truly global meeting knows that it is

impossible to find a time that is acceptable for all participants" (p.777).

In this context, when dealing with a globally distributed group of academic coordinators and student GVTs, the challenge of scheduling meetings for 'teams of teams' becomes magnified.

Thus the picture that appears from these extended temporal brackets is one of TUM as an ongoing process of "sensemaking" (Bansler & Havn, 2006), in which TUM activities in all four modes have criss-crossed episodes and triggering events, with some successes and some stubbornly resistant challenges. The model of "social actors" proposed by Lamb & Kling (2003) also appears to fit the situation, in which the TUM activity is grounded in the context and illustrates how "institutional concepts (e.g. professional and cultural values)…are carried at various levels though social structures (e.g professional hierarchies and interorganizational networks)" (p.224). To this we can add the further dimension of 'technology' as a vehicle for the conduct of social structures, by applying the conceptualization of Kling and colleagues of "computing as a complex activity that is tied together in a web of socio-technical practices and resources" (Kling et al., 2005, p. 146).

Chapter 8: Synthesis

8.1 Introduction

In this chapter some prominent strands from the diverse threads of the research will be drawn together. As is evident from chapter seven above, certain patterns and regularities have emerged, but the overall picture is one of dynamic interaction between many elements that defy simple analysis or interpretation. Inevitably therefore, any resulting conclusions or theoretical frameworks will not be ones of simple cause and effect, but more subtle insights or conceptual models of how things might interrelate, as befits a largely interpretivist investigation.

This chapter begins with reviewing the different perspectives which have been suggested by the work: perspectives on technology and society; perspectives on groups; perspectives on task-technology fit; and 'classic' perspectives on technology alignment. These perspectives are then combined with the insights gained from analysing the 'episodes of interest', in chapters six and seven above. This combination gives rise to a new "Theory of Collaborative Technology Fit", presented here for the first time as a direct outcome of this study. Accompanying this theorisation is a brief discussion on the multi-layered nature of 'culture' and the relationship between the concepts of "collaborative technology fit" and "cultural fit", a notion proposed by Leidner & Kayworth (2006). The chapter then takes up the question of "culture" within the research context, through a critical exploration of the operation of 'culture' across national boundaries in human subjects ethics review processes. The chapter concludes with a brief commentary on the tensions between control and sharing in global virtual collaborations, and the significance of "trust" within the study.

8.2 Perspectives on Technology and Society

The structurational perspective on technology adopted in this study, essentially posits an interactionist view of technology, one in which actors, technology and institutions engage in processes of mutual shaping. This perspective leads to a view of the "IT artifact" as "embedded" (Orlikowski & Iacono, 2002), within what Kling & Scacchi (1982) have termed a "web of computing".

Writing more recently, Kling and Colleagues (2005) have presented a model of Information Technology as firmly rooted in its context, within a perspective they term "social informatics". Figure 8.1 below, depicts the elements of that "social informatics" view of computing.

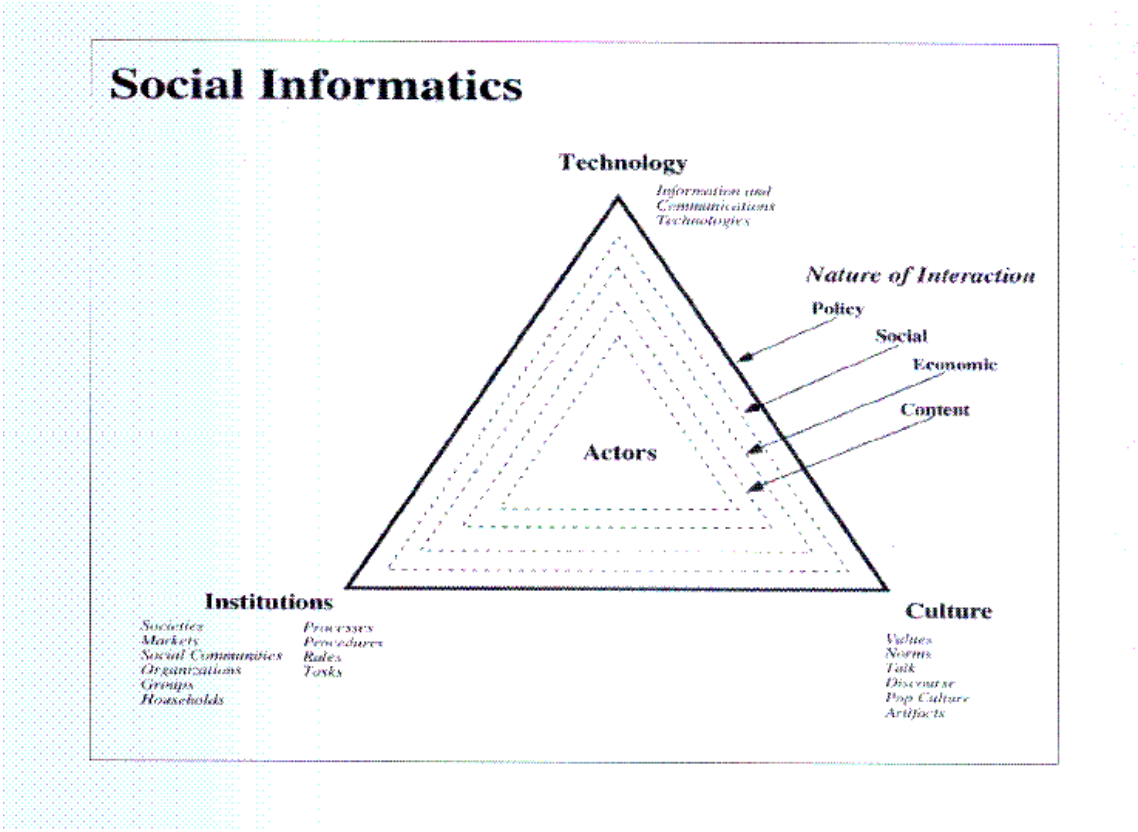


Figure 8. 1: A Social Informatics View of Computing (Ex. Kling et al., 2005 p. 193)

As can be seen from figure 8.1 above, many of the elements either theorised or identified in this thesis are present. The "technology", "actors" and "institutions" of Orlikowski's (1992) model of "technology structuring" are essential dimensions, but they have been augmented by the core concept of "culture", a concept that has been pervasive in this study, (although perhaps differently defined). The "interactions" at several levels (*policy, social, economic, content*) have likewise been identified within the thesis, as have most of the separate components within institutions and culture (e.g. *organizations, groups, procedures, roles, tasks, values, norms, discourse etc.*).

Accordingly Kling and colleagues have argued that:

> "it is helpful for analytic purposes to move beyond the conceptualization of ICTs as discrete objects and view them instead as configurable "socio technical networks' made up of tangible and intangible components…" (Kling et al., 2005 p. 54).

To understand ICT-based systems as "configurable" entities then, brings to the fore the notion of "configuration", which Kling and colleagues have defined as follows:

> "By configurational, we mean that an ICT-based system's uses are not fully inscribed in its design…To configure an ICT-based system typically means to make compromises between idealised and enacted views of what is being supported. Moreover, configuration is ongoing and continuous, as it is part of designing, implementing and using ICTs" (Kling et al., p. 35).

The activities of *technology-use mediation* addressed in this study have certainly been demonstrated to take place within the phases of "designing, implementing and using ICTs", and thus could be seen to fall within this category of "configurational" activities. At a more general level, this process of "*configuration*" of technology, complements the very "*embeddedness*" (Orlikowski & Iacono, 2002) of technology in its context, and the mutually constitutive nature of technology and social structures through the "*duality of technology*" (Orlikowski & Robey, 1991). These three key themes in Social Informatics (Kling et al., 2005), are depicted in figure 8.2 below.

Embeddedness: ICTs do not exist in social or technological isolation – their cultural and institutional contexts influence their development, implementation, use and role in organizational change.
Configuration: ICTs are socio-technical networks that can be configured in ways that influence their uses and social consequences.
Duality: ICTs have both enabling and constraining effects on groups, organizations and larger scale social orders

Figure 4.1 Key Social Informatics Themes

Figure 8. 2: Key Social Informatics Themes (Ex. Kling et al., 2005 p. 54)

Thus Kling and colleagues have presented a picture of technology and society compatible with the findings of this study. The global virtual collaborations were inevitably *embedded* in *cultural and institutional contexts*. The process of configuring

the technology platforms, to suit such collaborative use, has been realised through a dynamic and ongoing *configurational* process of *technology-use mediation.* This TUM process has had both *enabling and constraining effects on the groups* involved.

8.3 Perspectives on Groups

At the group level a further set of dynamics were in operation. In their interdisciplinary review of perspectives on small groups Poole & Hollingshead (2005), have discriminated between approaches to the study of small groups. Two perspectives with a bearing on this study have been selected for discussion below. The first of these is the "temporal perspective" (Arrow et al., 2005) on groups, and the second is the "symbolic-interpretive perspective" (Frey & Sunwolf, 2005).

8.3.1 Temporal perspective on groups

In this research perspective the focus lies with:

> Research that has either time or change as its main object of study, or considers time as a mediator or moderator of other phenomena" (Arrow et al., 2005 p. 316)

Arrow et al., (2005, p.317) have outlined the characteristics of studies based upon this perspective:

- they "yield the greatest information when studying groups that have a history and future"
- research methodologies include: "longitudinal studies of naturally occurring groups"; "longitudinal laboratory simulations"; "fine grained study of real-time interaction including short term ad-hoc groups"
- they assume that "time is socially constructed"; is both a "resource" and a "problematic issue for theory and research"; and that "groups are complex systems" which "change systematically over time", with "group processes" having "temporal patterns"
- structuration theory is one of the "key theories" informing the perspective

Structuration theory as a progenitor of the *AST* and *TUMAST* theories applied in this study, has played an underpinning role in the thesis as have the related notions of '*time*' and '*space*'. *Temporal* analysis has been a major element in reviewing the evolution of each episode through: 1) grounded theoretic structurational analysis; 2) the application of visual mapping; and 3) *temporal* bracketing strategies.

8.3.2 Symbolic-interpretive perspective on groups

In this second research perspective the concern is with:

> Understanding the nature, practices and consequences of symbol usage within groups, as well as how groups and group processes are themselves products of symbolic activities" (Frey & Sunwolf, 2005 p. 188)

Frey & Sunwolf (2005, pp.189-190) have outlined the characteristics of studies based upon this perspective:

- they address "naturally occurring, bona fide groups" studied in "their natural contexts"
- research methodologies operate within a "naturalistic paradigm" with a "goal of holistic understanding of patterns and behaviors"
- they assume that "a group is a significant symbol", itself "created through members' symbolic activities" which "include predispositions, practices, processes and products" influenced by the environments in which groups are embedded
- structuration theory is one of the "key theories" informing the perspective

These "*group predispositions, practices, processes and products*" are depicted below.

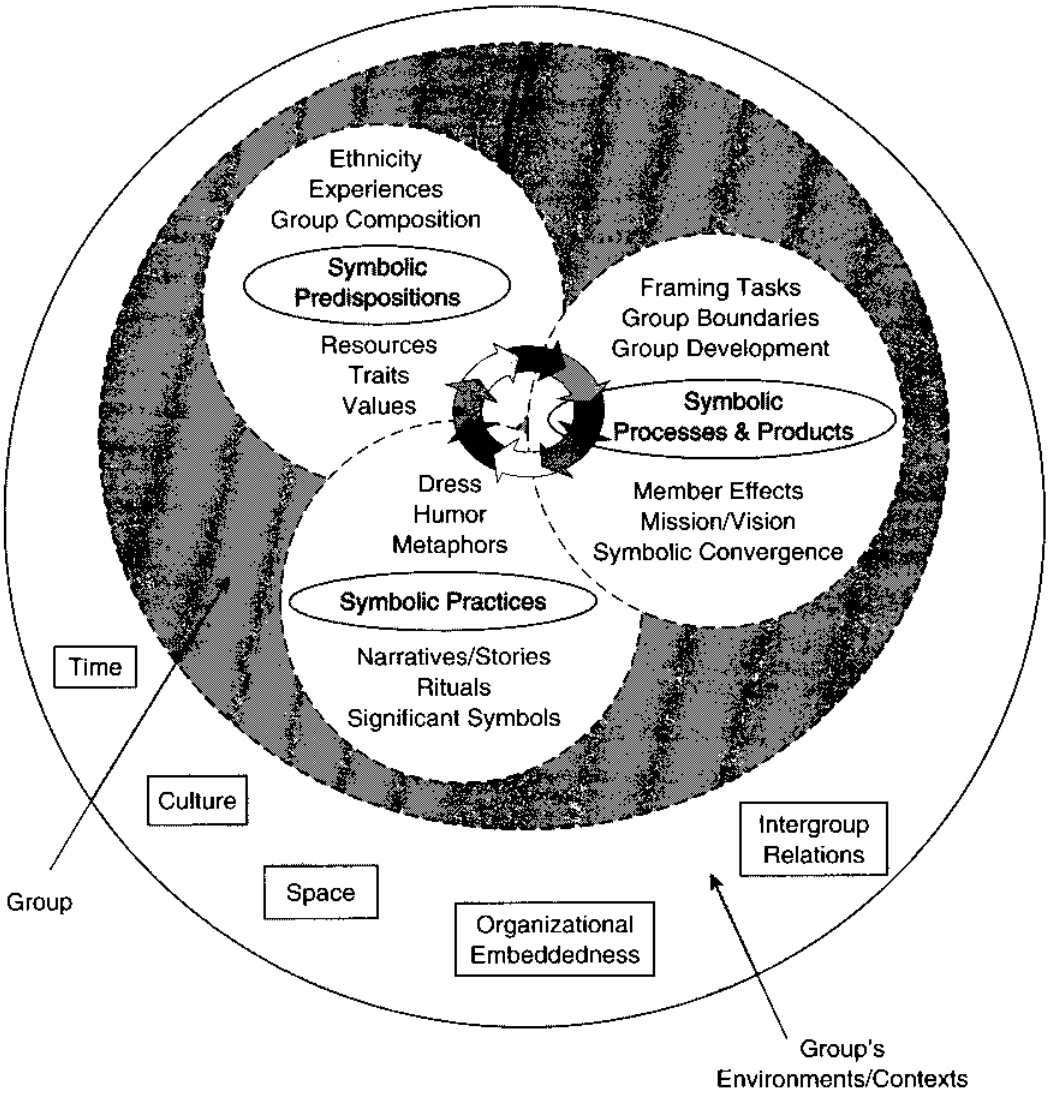


Figure 6.1 Symbolic-interpretive model of group predispositions, practices, processes, and products

Figure 8. 3: Symbolic-interpretive model of group predispositions, practices, processes and products

(Ex. Frey & Sunwolf, 2005 p. 190)

This "symbolic-interpretive model" of figure 8.3 depicts several concepts associated with the "*group's environment/contexts*" consistent with those that have emerged in this study. The concepts of *Time, space, culture, organizational embeddedness, intergroup relations* have all been evident in the analysis of the episodes comprising this study. Several of the more *group* specific concepts in figure 8.3 have been apparent in the detail of the 'within-episode' and 'cross-episode' analyses of chapters six and seven, (this despite the focus of *TUM* being on activities which often occurred outside the *group).* The "symbolic" aspects of the interrelated elements of *group predispositions, practices, processes and products* have been emphasised in figure 8.3, which has not been the approach adopted in this study. The extent to which a *GVT* and a *group* differ for instance is a relevant question. The "authoritative definition" of "global virtual teams" has been said (Davison, Fuller & Hardin, 2003, p.519) to have been provided by Maznevski & Chudoba (2000), who noted that:

> "global virtual teams are groups that (a) are identified by their organization(s) and members as a team; (b) are responsible for making and/or implementing decisions important to the organization's global strategy; (c) use technology-supported communication substantially more than face-to-face communication; and (d) live and work in different countries".

Yet it seems highly arguable whether the restrictive condition b) is warranted for all global virtual teams. Furthermore, in this study the autonomy of academics within the tertiary education setting does not fit the definition quite as neatly as might teams embedded within the hierarchical corporate context implicit in (a) and (b) above, but the definition otherwise broadly correlates with the *GVTs* studied in this thesis. The Frey & Sunwolf (2005) model does not appear wholly transferable to the virtual setting, for instance the group aspects such as "dress" and "humour" of figure 8.3 above may be less readily realised. Yet other group aspects such as *framing tasks, ethnicities, group composition, group development, group boundaries, rituals* (such as genres) and *significant symbols* (e.g. the global collaboration), do appear to have had their realisations in this study.

8.3.3 Combining perspectives on groups

The above two perspectives on groups (*symbolic-interpretive* and *temporal*), share certain aspects with the research conducted in this study. The informing role of *structuration theory* is a common dimension, through *Adaptive Structuration Theory* (*AST*) as a key informing theory. Subsequent developments through this work have resulted in the evolution of *Technology-Use Mediated Adaptive Structuration Theory*

(*TUMAST*) as a key theory guiding the study. Dimensions common to each perspective on groups have been shared in a *longitudinal study of naturally occurring groups with both a history and a future*. The goals of the study borrow from the "symbolic perspective" through the *holistic goal of understanding patterns and behaviors*. Finally the *symbolic activities of groups* have been investigated through *fine grained study* of interaction. This study of "*TUM in GVTs*" therefore can best be aligned with the above two broad perspectives on groups.

8.4 Technology Alignment

8.4.1 Introduction to Technology Alignment

The next perspective which bears on this study comes from the literature on IT Strategy and in particular the concept of "strategic alignment of IT" as developed within the MIT90s framework (Venkatraman, 1991). This perspective shares some similarities with Kling and Scacchi's (1982) "web of computing", through acknowledging an interactionist and even an "embedded" (Orlikowski & Iacono, 2001, Kling et al., 2005) model of technology in some form. As figure 8.4 below depicts, "technology" sits within a broader context of organizational culture and interacts with other components of the organization.

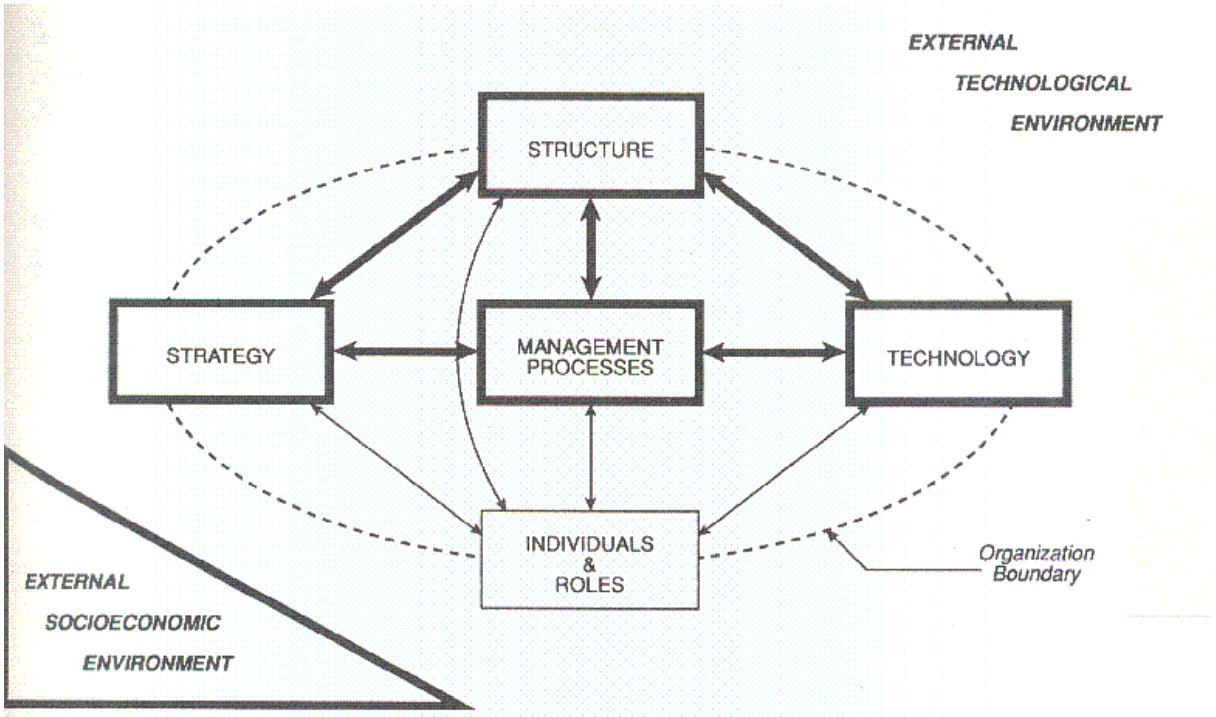


Figure 5-1. MIT90s framework—Chapter 5 emphasis.

Figure 8.4: MIT90s Framework (Ex. Venkatraman, 1991 p. 123)

Despite its interactionist perspective, the model presented in figure 8.4 above, is far from consistent with the structurational underpinnings of this study. The portrayal of business "structure" as a static entity derives from the era of the work, where the classic strategic management literature defined structure as a "hard" element of an organization's culture, as made clear in the quote below:

> "One method for dealing with corporate culture was developed by McKinsey and Company, a management consulting firm. The McKinsey seven-S framework was introduced by Pascale and Athos's *The Art of Japanese Management* in 1981[43] and popularized by Peters and Waterman, who contend that corporate strategy tends to centre on the hardware of organization[44]. The "hard" elements are considered to be structure, strategy and systems. Pascale and Athos argue that four additional elements must be considered as integral components of the organization in order to achieve success. The McKinsey seven-S model provides the framework to view corporate culture" (Pindur et al., 1995, p.73)

Nonetheless there are some echoes of the key elements of this study in figure 8.4 above. *Technology, individuals and roles* are evident, and the combination of *Structure* and *Management Processes* may bear some relationship to the structurational processes of 'institutional structuring'?

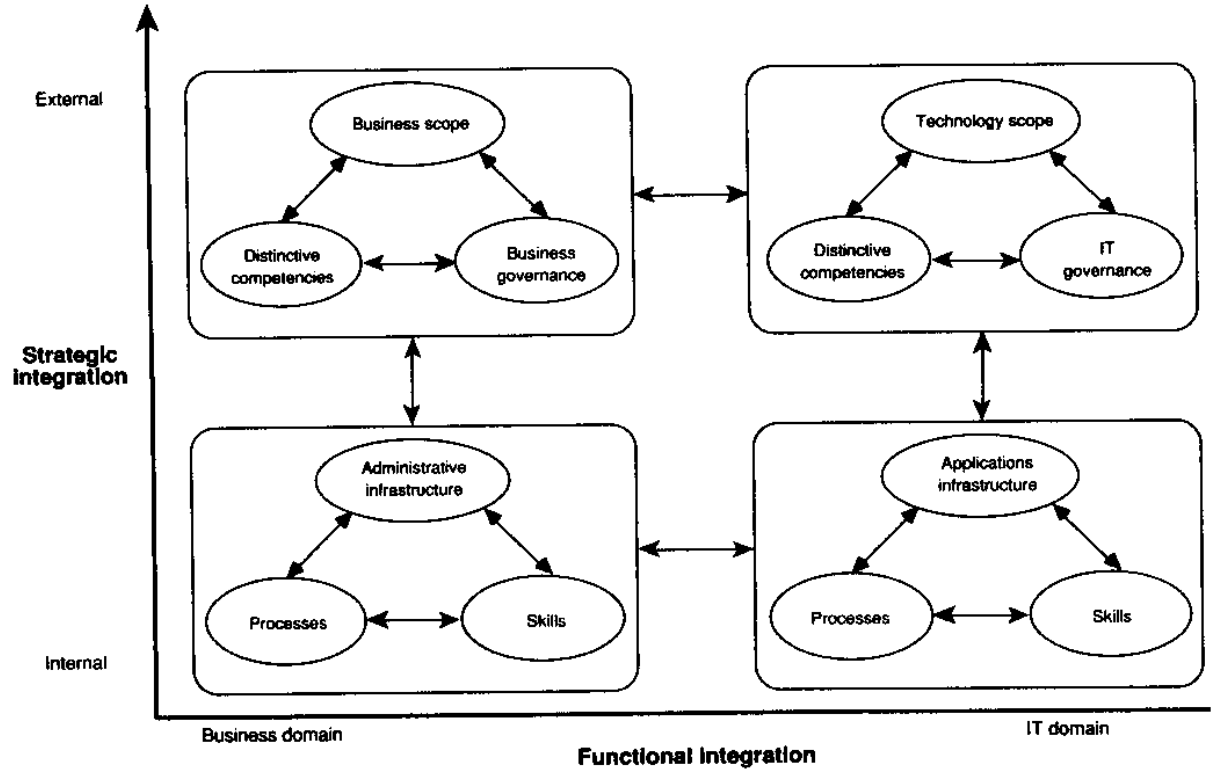


Figure 5-24. The strategic alignment model.

Figure 8.5: Strategic Alignment Model (Ex. Venkatraman, 1991 p. 155)

As portrayed in figure 8.5 above, the notion of "IT strategic alignment" asserts the critical importance of the 'alignment' of business and technology dimensions, when developing IT strategy, and the interrelationships between the Business and Technology scope and the administrative and applications infrastructures. Elements of each of the above have figured in this study.

While mainly focused on the 'administrative infrastructure' and the 'applications infrastructure', issues of "business scope" (in that the universities were extending beyond their traditional institutional boundaries in this collaboration) and of "IT governance" (in the variable contractual and security policy support for cross-institutional collaboration) were evident in the study. At various times it was apparent that there was a lack of "alignment" between the collaborative team and both the "business" and "IT" dimensions of our institutions. This lack of "alignment" or "fit" has been depicted in several of the visual maps in chapter six and the appendices (e.g. figures 6.21-6.25, figure A20-6.42 etc.). The notion of "fit" is a further concept which Zigurs & Buckland, (1998) have discussed in the following terms:

> "Although the term fit is widely used in a variety of models that deal with contingencies among variables, its precise nature and meaning are rarely stated...One exception to this lack of clarity is the strategic management literature, where fit (typically between strategy and structure) has been examined in some detail. Different definitions of fit in three distinct approaches to structural contingency theory have been identified: fit as congruence, fit as interaction, and fit as internal consistency" (p.322).

They added that Venkatraman (1989) had extended those three approaches "to identify six unique perspectives on fit in the strategy literature". Table 8.1 below depicts these.

Table 5. Perspectives on Fit (From Venkatraman 1989)

Perspective	Underlying Conceptualization	Description	Example Proposition (From Venkatraman)
1. Fit as matching	Matching	A match between two theoretically related variables is defined, without reference to a criterion variable.	The match between strategy and structure enhances administrative efficiency.
2. Fit as covariation	Internal consistency	A pattern of covariation or internal consistency among a set of underlying theoretically related variables is defined, without reference to a criterion variable.	The degree of internal consistency in resource allocations has a significant effect on performance.
3. Fit as gestalts	Internal congruence	Gestalts are defined in terms of the degree of internal coherence among a set of theoretical attributes, involving many variables, but not specified with . reference to a criterion variable	The nature of internal congruence among a set of strategic variables differs across high and low performing firms.
4. Fit as moderation	Interaction	The impact that a predictor variable has on a criterion variable is dependent on the level of a third variable, which is the moderator.	The interactive effects of strategy and managerial characteristics have implications for performance.
5. Fit as mediation	Intervention	A significant intervening mechanism (i.e., an indirect effect) exists between an antecedent variable and the consequent variable.	Market share is a key intervening variable between strategy and performance.
6. Fit as profile deviation	Adherence to a specified profile	A profile of theoretically related variables is specified and related to a criterion variable.	The degree of adherence to a specified profile has a significant effect on performance.

Table 8. 1: Perspectives on Fit (Ex. Zigurs & Buckland, 1998 p. 322)

8.4.2 The Theory of Task/Technology Fit

In the GSS context Zigurs and Buckland (1998) have built upon this broader notion of "fit" and adopted the idea of a "fit profile", in order to produce a "Theory of Task/Technology Fit". Their general model is portrayed in figure 8.6 below.

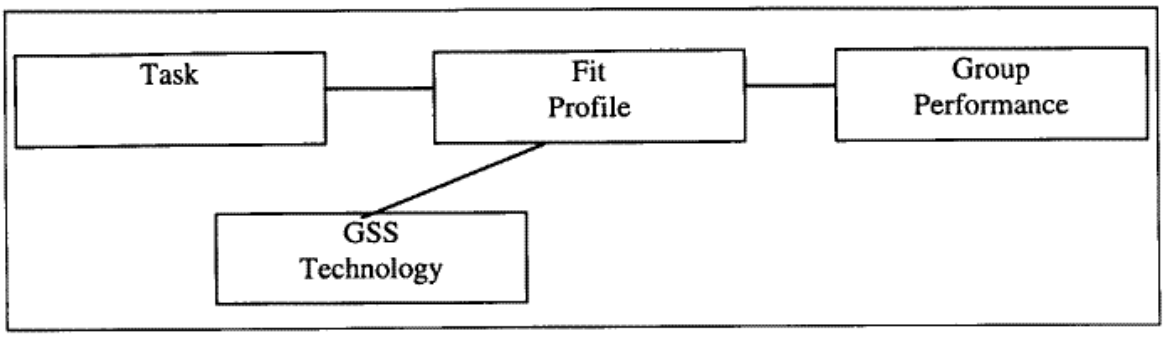


Figure 1. General Model of Task/Technology Fit

Figure 8.6: Task/Technology Fit Model (Ex. Zigurs & Buckland, 1998 p. 325)

In their application of this general model in the GSS domain, Zigurs & Buckland (1998) have cross-tabulated different "task categories" and "technology dimensions" to produce distinct "fit profiles". As can be seen from table 8.2 below the five task categorisations and three GSS technology dimensions have been mapped to produce a set of "fit profiles" proposing the best matched set of GSS features to support different types of tasks.

Table 6. Fit Profiles of Task Categories and Technology Dimensions

	Communication Support Dimension	Process Structuring Dimension	Information Processing Dimension
Simple Tasks	High	Low	Low
Problem Tasks	Low	Low	High
Decision Tasks	Low	High	High
Judgment Tasks	High	Low	High
Fuzzy Tasks	High	Medium	High

Table 8.2: Fit Profiles of Task Categories and Technology Dimensions
(Ex. Zigurs & Buckland, 1998 p. 326)

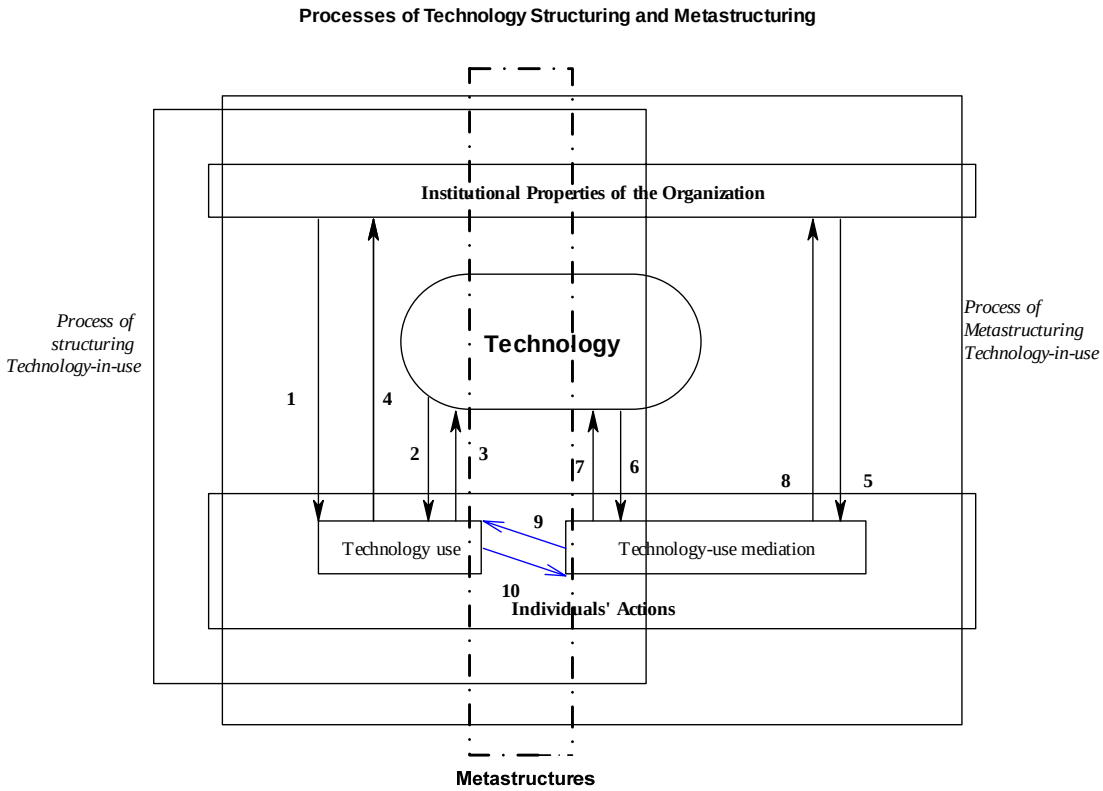
Starting from these concepts then, of "strategic alignment" and "fit", this study has adapted and applied them in this domain of 'global virtual teams', where a particular characteristic of the work has been the need for the parties involved to work "collaboratively".

In the global virtual collaborations which have been the subject of this study, a key challenge has been achieving some degree of collaborative "fit" between the many dimensions operative within each collaboration. The visual maps of chapter six (e.g. the earlier noted figures 6.18-6.22, and later figures A20-6.47 etc.), have depicted the

degree of "collaborative technology fit" at each site, in order to aid cross site comparisons.

8.5 A Theory of Collaborative Technology Fit

A further theorisation (explained for the first time in this section) was developed from the grounded data analysis conducted for the series of episodes in this study. In the process of developing a "visual mapping" strategy (Pozzebon & Pinnsonneault, 2005) for each episode, certain core elements were identified from figure 6.5, (repeated below for ease of reading).



Arrow 1: Institutional conditions for use

Arrow 2: Technological conditions for use

Arrow 3: Technological consequences of use

Arrow 4: Institutional consequences of use

Arrow 5: Institutional conditions for mediation

Arrow 6: Technological conditions for mediation

Arrow 7: Technological consequences of mediation

Arrow 8: Institutional consequences of mediation

Arrow 9: User consequences of mediation

Arrow 10: User conditions for mediation

Note: Arrows 9 and 10 are dotted to indicate that the interactions are mediated through the institutional properties. We show a direct relationship for expository convenience. (Orlikowski et al., 1995)

Figure 8.7: *Metastructures* in the processes of technology structuring and metastructuring *(Adapted from Orlikowski et al., (1995, Figure 6), and replicates figure 6.5 of this thesis)*

As noted earlier in the thesis, (section 6.2.4.1) "*a metastructure serves to link the six elements of institutional properties, [culture as an additional element discussed below], technology, individual actions, technology use and technology-use mediation"*. In an illustrative example "the blend of institution, technology and culture (as a form of group agency) come together in the notion of a global virtual classroom as a *metastructure*".

Thus the concept of "culture" constitutes an additional element in this "metastructuring" model. The six core elements then of the "structuring and metastructuring realm" (as depicted in the first two dimensional 'visual' depiction of an episode in figure 6.6) were provided by the following set:

- institutional,
- cultural
- technology,
- technology use
- individual actions, and
- technology-use mediation

[As an aside, I remember being less than satisfied at the time with the bare two dimensional tabulation of figure 6.6 under these headings, as my initial attempt at a representation of a "visual map". In discussions with colleagues Professor Carmel McNaught and Dr David Kennedy while visiting them in Hong Kong (24 August 2007), I discussed alternative ways of producing a 'visual map' for an episode, and we concluded that some form of depiction like a 'radar chart' could provide a better visual representation. Carmel also advised that the elements which I had identified should be recorded as an 'outcome' of the work and not an 'input' to it, which was a very helpful insight.]

Analytically the application of a *metastructure* here can be seen as a form of unifying notion or 'thread' analogous to the concept of an "activity or construct track", as applied by Van de Ven, & Poole (1990) in the Minnesota innovation studies:

> "The phase analysis method requires one to conceptually define discrete phases of innovation activity and then analyze their sequences and properties. A phase is a period of unified and coherent activity that serves some innovation function. Therefore a phase is defined by a meaningful set of co-occurring activities on coded constructs or tracks of events. So one phase for the five MIRP tracks might be "concept refinement," indicated by a change in some innovation idea, occurring at a meeting of three experts (people) engaged in discussion and conflict (transactions) during a period of low resources (context) and resulting in high tension and morale (outcomes). The phase would be indicated by the co-occurrence of this pattern (change in idea; experts; discussion and conflict; low resources; high tension and high morale) in a consecutive series of events. In general, phases can be defined in terms of conceptually coherent patterns on any number of coded constructs or tracks" (p. 330).

The original conception of this model of "collaborative alignment" or "collaborative technology fit" was envisaged in the form of the hexagon in figure 8.8 below,

containing the six elements of the "structuring and metastructuring realm", with the *metastructure* (in this case, of a *global virtual team*) as the unifying element.

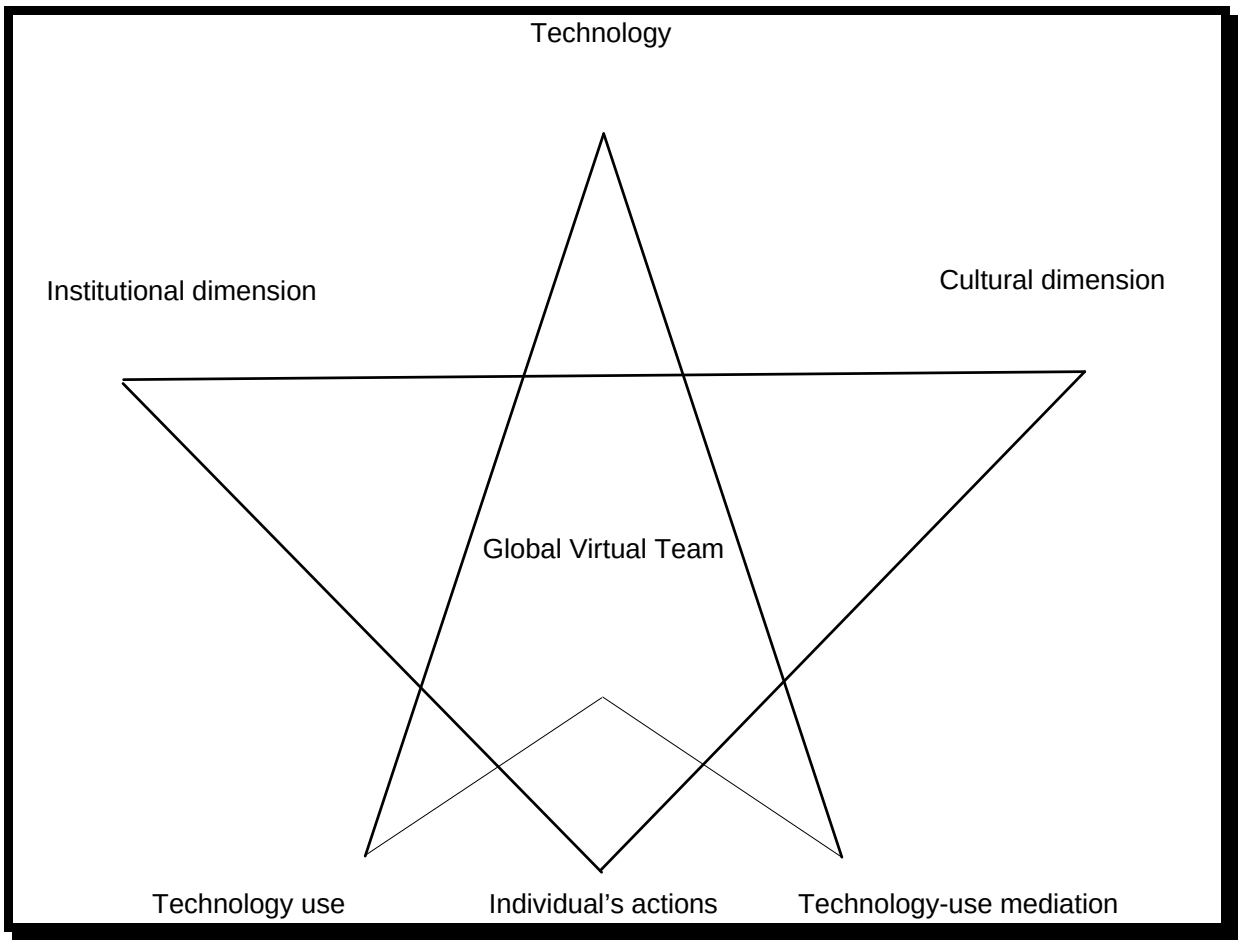
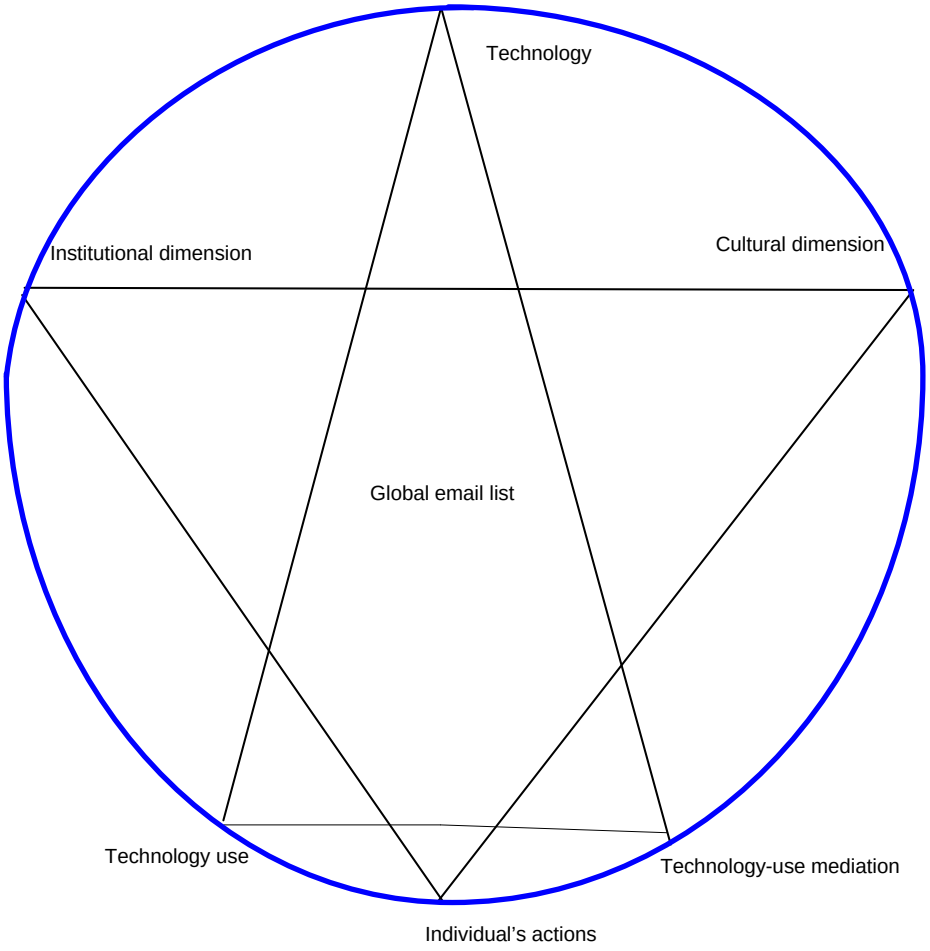


Figure 8.8: A Global Virtual Team as a *Metastructure* - the Hexagon of Alignment

This portrayal was subsequently extended by the use of "radar charts" (Wheeler et al., 1999), with a scale indicating degree of "collaborative fit" on each dimension. In the first set of radar charts to move beyond simple tabulation to implement the visual mapping strategy (figures 6.21-6.25 above), the above six core elements of the "structuring and metastructuring realm" were retained as the six axes of the charts, and the thematically unifying *metastructure* element became fully embedded as the focus of each chart (e.g. *Research ethics approval process, videoconference session, online registration process*). From that point each visual map effectively represented these seven dimensions.

In developing this mechanism for visualising the degree of "collaborative technology fit", I had drawn the model in figure 8.9 below, in which a 'micro-level' *metastructure*

(the “Global email list”) was portrayed, as opposed to the macro-level (“Global Virtual Team”) of figure 8.8 above. The figure was used to provide a ‘visual map’ of the degree of “collaborative alignment” exhibited by the selected *metastructure* on each of the six dimensions.



Metastructuring and Collaborative alignment [micro level] - The circle of collaboration

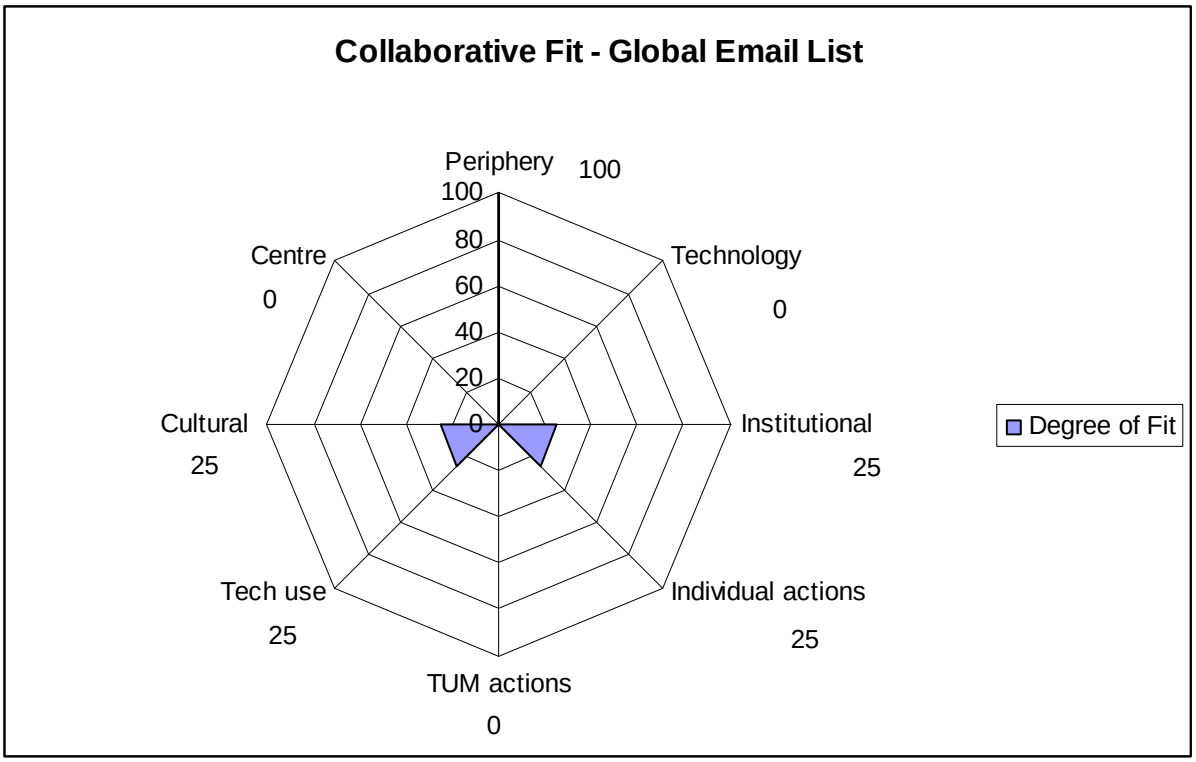
Figure 8.9: Metastructuring and Collaborative Alignment (micro level) - The circle of Collaboration

This “micro-level” metastructure had been selected from the first episode analysed (*Adjustment-Reinforcement Episode Three - 6.2.4.1*) as a suitable example to illustrate the level of “collaborative alignment/fit”. I had noted during the analysis of the episode, that the ‘global email list’ represented an instance in which collaborative alignment/fit had not been achieved. The table of characteristics below reviews the “fit” for each of the six elements:

Technology - no global list avail via AUTonline
Institutional - AUT does not support external emails
Individual actions - students could redirect to own email addresses but requires individual action,
TUM - ruled out by coordinators, advocated use of global announcements
Tech use - Arnold posted exhortatory announcement, 1 AUT LT used online chat to any effect
Cultural - student GVTs failed to act on Arnold's request - 1 AUT LT used online chat to any effect

Table 8. 3: Global Email List - Collaborative Technology Fit Dimensions

The initial graphical depiction of these results was provided by the radar chart below, where the 'periphery' represented 100% *collaborative fit*, and the 'centre' 0% *collaborative fit*, with the scale below recording the gradations in between.



Scale (%)
100% - full collab fit (CF)
75% - moderate CF
50% - partial CF
25% - limited CF
0% - no CF

Figure 8.10: Initial Radar Chart for Collaborative Technology Fit - Global Email List

At this point I had recorded the note below to myself:

> **"Note**: requires episode level of analysis to derive diagnostic"

By that note I meant that this 'visual map' of the *metastructure* as a diagnostic for the achievement of "collaborative technology fit", had been able to be derived only after analysis at the level of the episode had been completed. At the same time I had posed the question to myself whether this visual image represented an outcome after a progression of time, was it merely a snapshot, or both? In the course of incidental discussions with my colleague Dr Russel Pears (31/07/2007), we concluded that this depiction technique could also be used for visualising temporal brackets, with the snapshots tracking alignment over time, and highlighting misalignments at different points charted against the six axes of the hexagon which represented the "circle of collaboration" (figure 8.9 above).

8.5.1 Theorisation of Collaborative Technology Fit

The mapping process itself served to demonstrate the grounded and emergent nature of theory development in this thesis. The original conceptualisation of a *metastructure* in figures 6.5/8.7 above, led to a need for its depiction through the visual mapping strategy applied within each episode. While the depiction of the "structuring and metastructuring realms" (figures 6.5/8.7 and 6.6 above) may be considered applicable generically across Information Technology domains, here it has been applied to the domain of 'global virtual collaboration'. Collaborative computing on a global scale has brought its own sets of challenges (Clear & Kassabova, 2008), informed as it is by the inherent *spirit* of *collaboration.* Both the notion of technology '*spirit*' (DeSanctis & Poole, 1994) and *collaboration* have come through as strong themes in this study.

Wood & Gray (1991) have provided the following general definition of collaboration:

> "Collaboration occurs when a group of autonomous stakeholders of a problem domain engage in an interactive process using shared rituals, norms and structures to act or decide on issues related to that domain" (p.146).

They have further reported that collaboration in itself raises many challenges and tensions:

- between control and complexity in collaborative alliances
  - organizations seek to reduce the complexity of their environments and gain more control over environmental factors, but new dependencies are introduced by collaboration, which may act to increase "environmental complexity and turbulence";
- between "shared versus individual control";
- between "self-interests and collective interests" (Wood & Gray, 1991, pp.158-160).

These tensions were each evident to some extent in this study situated within an educational context. Higher education is not a domain which escapes these tensions of control and autonomy versus shared contribution, which are inherent in collaboration. For instance, Hämäläinen et al., (2006) have noted the need for active scripting of collaborative activities to facilitate collaborative learning in a 'Computer Supported Collaborative Learning' (CSCL) context, and have made the following observations about *collaboration* itself:

> "Collaboration is a less frequent feature of learning than is commonly assumed…Learning through collaboration is not something that simply takes place whenever learners come together. Therefore designing a collaborative virtual environment is a demanding task" (p.49).

It should by now be clear from the preceding discussion, that a rationale developed in this study for a model to profile collaboration, in order to diagnose misalignments in the collaborative process, from which approaches to rectify those misalignments could be developed. Any such model needed to have a clearly defined unit of analysis. In this study, the 'episode of interest' constituted the core unit of analysis, but this needed a tighter focus in order to address the notion of "collaborative technology fit". Therefore a *metastructure* was adopted as the "unit of analysis" representing a unifying concept within the episode, which encompassed all the elements of "the structuring and metastructuring realm" within this 'global virtual collaboration'.

The centring of a *metastructure* in the model enabled focussed investigation of its operation at each location, and gave the ability to map the relative positioning of each dimension of collaborative technology fit, in order to develop a "fit profile", such as the initial attempt in figure 8.9 above and as further developed in figures 6.18 - 6.22 etc. (figure 6.22 repeated below as figure 8.11 for ease of reading).

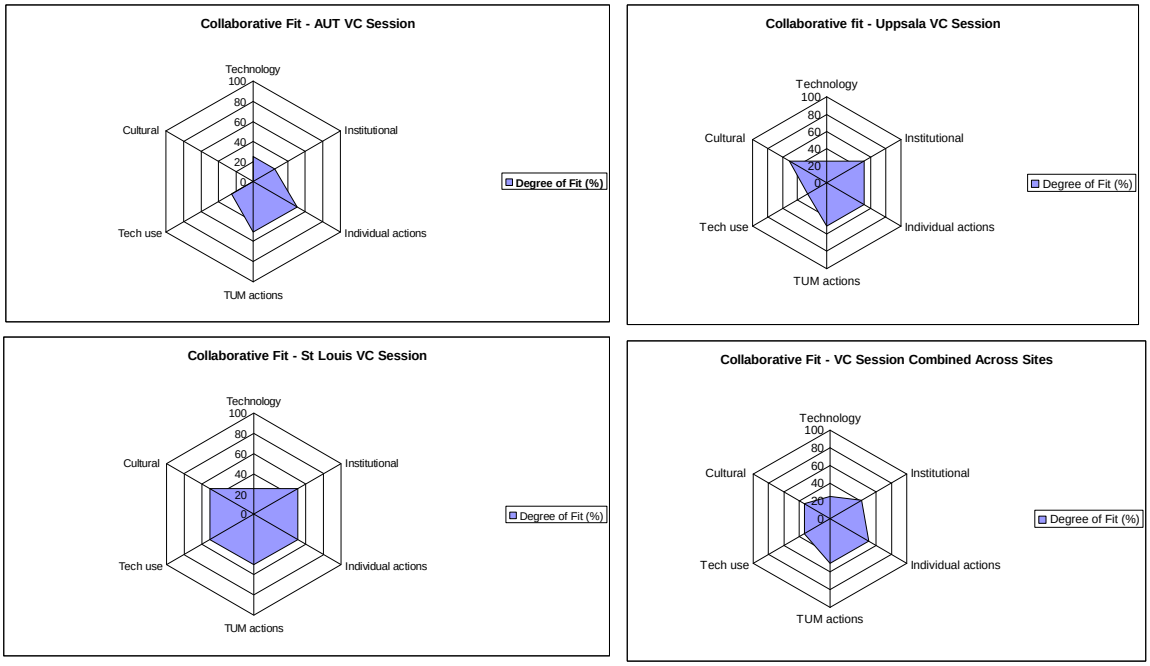


Figure 8.11: Radar Charts – Establishment Episode Full – Technology Metastructure *VideoConference Session (replicates figure 6.25 above – scale 100% for full fit, 0% no fit)*

The very depiction of a *metastructure* in itself revealed the further significant and embedded concept of "culture", operative within the *metastructure* concept. The initial 'two dimensional visual maps' generated for the first two episodes analysed in chapter six (e.g. figure 6.6), were deficient in not making obvious the specific *metastructures* involved. The hexagonal model of figure 8.8 above did not support ready depiction of the level of support for collaboration along each axis. The tabulation and depiction of a micro-level metastructure (figure 8.9), indicated that the model could operate at both 'macro' (figure 8.8) and 'micro' levels of analysis. The radar chart initially conceived in figure 8.10 above and as subsequently tailored and expanded to grouped sets of charts, which mapped the dimensions for each site (from figure 6.18 onwards), addressed these gaps.

The different patterns at each site have been depicted in the visual maps for each episode in chapter six above. These have enabled a profile demonstrating the degree of "collaborative technology fit" to be identified for the selected *metastructure(s)* at each location. This "fit profile", although very differently presented, can be seen as analogous to the "Fit Profiles of Task Categories and Technology Dimensions" presented in table 8.2 above. The concept of a "collaborative technology fit profile" presented here is consistent with the perspective of Venkatraman (1989 - cited in table

8.1 above), on "fit as deviation" by advocating "adherence to a specified profile". In this study the "collaborative technology fit profiles" have been focused by their concentration on a specific unifying *metastructure*. Demonstrating "adherence to a specified profile", has required a further abstraction which is represented within the set of propositions in table 8.4 below.

These elements in combination, then led to a theorisation of the concept of "Collaborative Technology Fit". The key propositions of the theory are tabulated in table 8.4 below.

No.	Propositions for a Theory of Collaborative Technology Fit
1	A "collaborative technology fit profile" for an aspect of a global virtual collaboration can be developed based upon six elements surrounding a core selected metastructure within an 'episode of interest'
2	These six elements are represented by the following set of dimensions: • institutional • cultural • technology • technology use • individual actions • technology-use mediation
3	It is possible to map the degree of 'collaborative technology fit' of a 'global virtual collaboration' across locations, by selection of one or more dominant or otherwise appropriate metastructure(s) and for each of the six dimensions map the level of collaborative fit at each location.
4	Distinct profiles of collaborative technology fit should emerge for each selected metastructure at each location
5	There is a relationship between the collaborative technology fit profile(s) and the outcomes of a global virtual collaboration
6	An ideal profile would demonstrate a full collaborative technology fit for each metastructure at each location (suggesting a high likelihood of successful collaboration)
7	A worst case profile would demonstrate no collaborative technology fit for each metastructure at each location (suggesting no likelihood of successful collaboration)

Table 8. 4: Key Propositions for a Theory of Collaborative Technology Fit

In the process of applying 'collaborative technology fit profiles' to selected episodes, it became apparent that the dimension of "culture" was to some degree a misnomer and oversimplification as it represented a multilayered conception. As Fan (2000) has observed:

> "Culture is complex and multidimensional. It is in fact too complex to define in simple terms" (p.3).

In a "collaborative technology fit profile" the element of culture could fruitfully be restated as "cultural dimension[s]" (as studied at different levels – international, national, institutional, professional, student), and was analysed in this multi-levelled way particularly in the establishment episode (cf. 6.4.4.1 above). Leung et al., (2005) arguing the dynamic nature of culture in a "global" context, have noted how both top down and bottom up processes exerted by local and global forces - such as Multi-National Corporations (MNCs) - can act to shape culture:

> "Given the dominance of Western MNCs, the values that dominate the global context are often based on a free market economy, democracy, acceptance and tolerance of diversity, respect of freedom of choice, individual rights, and openness to change" (Leung et al., 2005, p.363)

The diagram in figure 8.12 below depicts this dynamically layered model of culture:

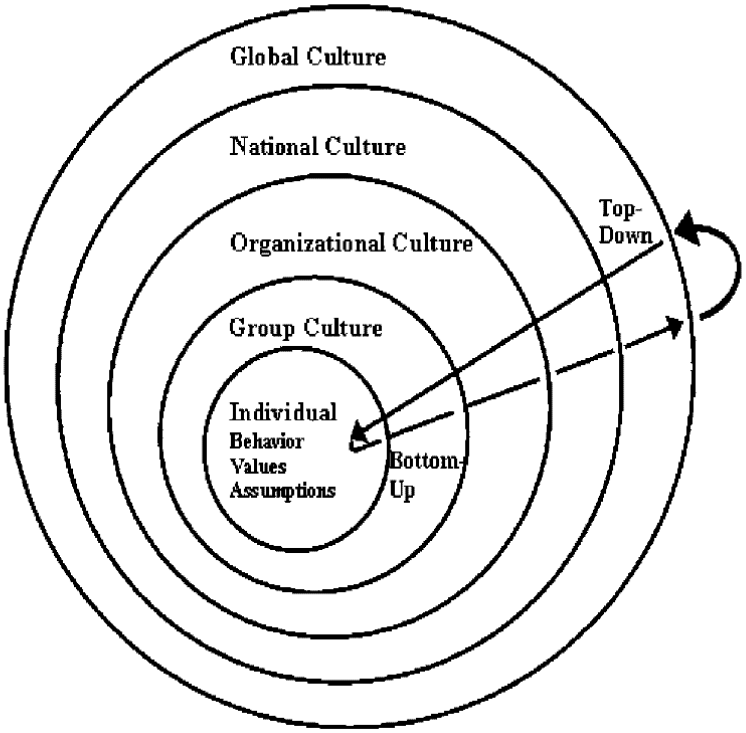


Figure 8. 12: The dynamic of top-down-bottom-up processes across levels of culture (ex. Leung et al., 2005 p. 363)

In the Establishment episode the multi layered analysis of figures 6.18 and 6.19 for instance, have independently portrayed the "*Metastructure of the Research Ethics Approval Process*", with figure 6.18 addressing "collaborative technology fit" and figure 6.19 separately addressing "cultural fit". The idea of culture being multi-layered has been addressed in depth earlier in the thesis (e.g. section 6.4.4.1ff.), but Guzman and colleagues (2008) in their study of IT occupational culture have further distinguished between the levels of a) an "*occupational culture of IS/IT personnel*" and b) an "*occupational subculture*" within a single organization, as depicted in figure 8.13 below. This notion of a "subculture" loosely equates to the distinct "professional cultures" of academics in their roles as *researchers* and *educators* or of *IT* and other *supporting professional personnel* and of the "student cultures" represented by students in their different courses at each site. The multilayered model portrayed in figure 6.22 (/8.15 over page) portrays these distinct layers in operation.

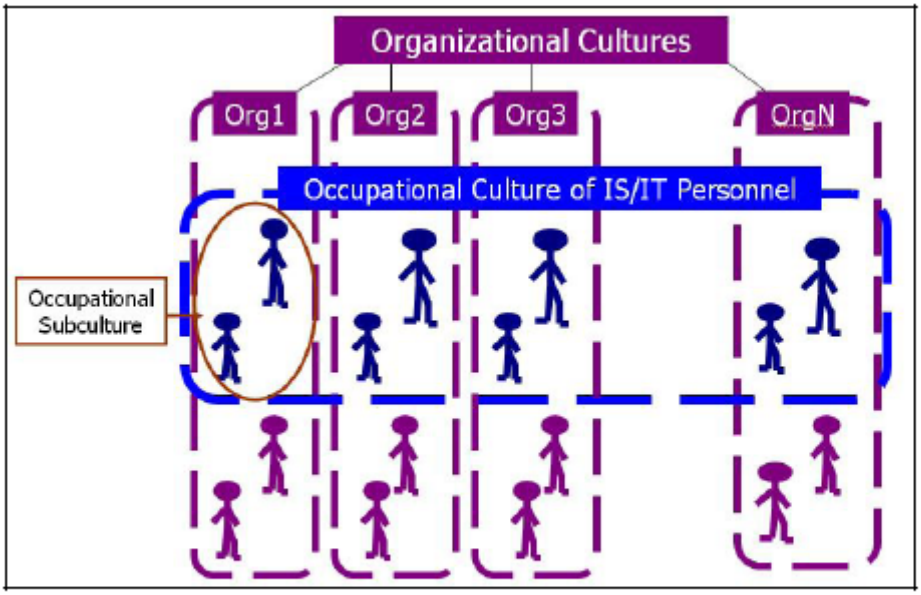


Figure 8.13: Occupational Cultures and Subcultures of IS/IT Personnel
(Ex. Guzman et al., 2008 p. 36)

A further model from Leidner & Kayworth, (2006) portraying cultural layers traverses sets of both: "IT issues" in the separate spheres of IT development and use and IT management and strategy; and "IT values" whether embedded in the technology or the people. Figure 8.14 below portrays that model with the concept of "cultural fit" being used to illustrate linkages across the several layers.

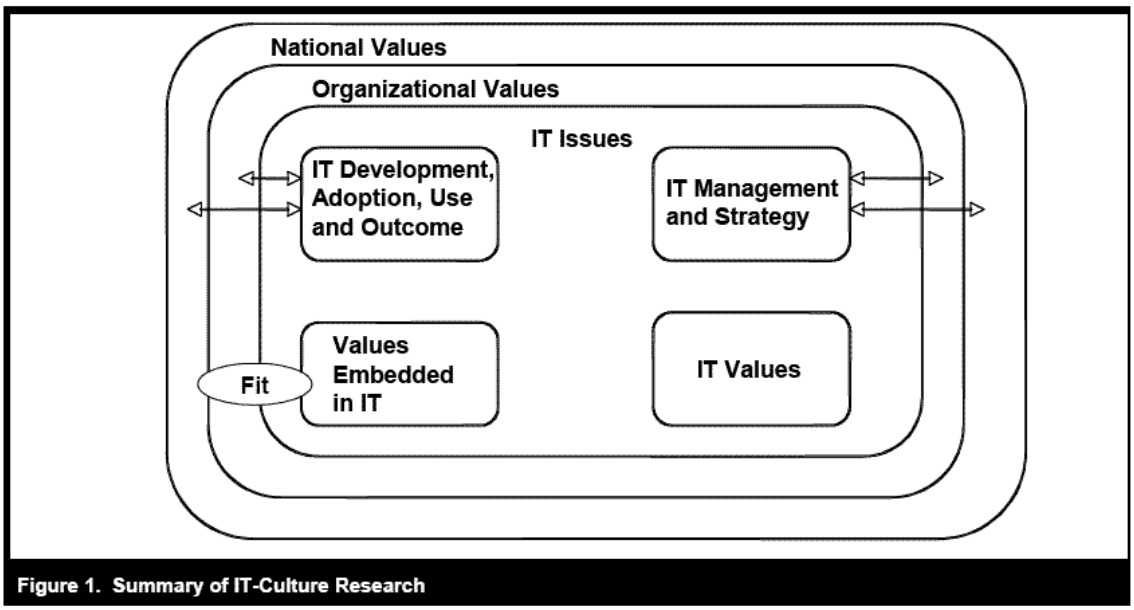


Figure 8.14: Multilayered Nature of Culture in IT Research - Cultural Fit
(Ex. Leidner & Kayworth, 2006 p. 372)

The portrayal of "cultural fit" in the radar charts from chapter six (repeated as figure 8.15 below), augments the concept of "collaborative technology fit" from the preceding figure (cf. fig. 6.18 above), and demonstrates the several layers of culture (or distinct "subcultures") in operation within the selected *metastructure*. A multi-dimensional model of "cultural fit" at each site is depicted. The "combined" chart is a synthetic averaging of scores across all sites, in an attempt to provide an overall pattern, but it can be questioned whether it provides more information or simply loses information by the process of averaging out.

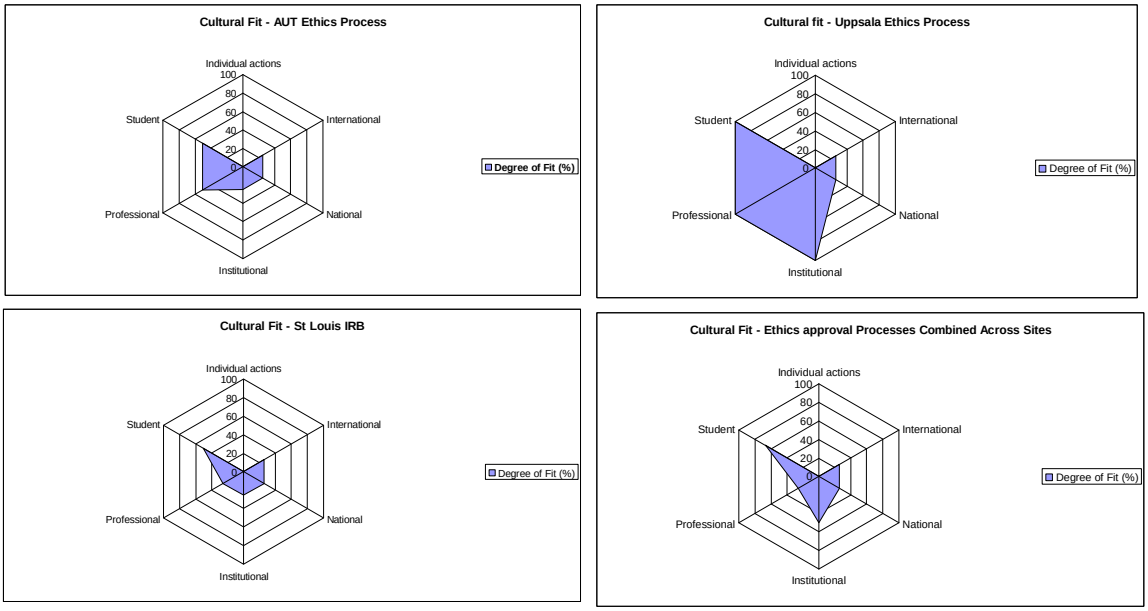


Figure 8.15: Radar Charts – Establishment Episode Full – Cultural Dimensions for Metastructure
Research Ethics Approval Process (replicates figure 6.19 above)

In the above model it may actually be the mismatches that are the key, rather than the overlaps, apart perhaps from the need to achieve some core capabilities in common.

This approach to analysing "cultural fit" may afford a concrete strategy for analysing the further "context" and "practice" bound notion of "situating culture" proposed by Weisinger & Salipante (2000) and Weisinger & Trauth (2002, 2003). In that framework 'culture' is perceived as:

> "fluid, contextually dependent, and created by actors within a group who may hold conflicting assumptions and worldviews. In other words 'culture is what culture does'" (Weisinger & Trauth, 2002, p.309).
>
> "this perspective leads to a view of lived culture as a socially negotiated, dynamic, practical and locally situated process" (ibid.)

In a global virtual context the 'local' may also become 'global' and new models for investigating "cultural fit" across time and space are needed, if this more dynamic "situating culture" framework, with its appropriate view of "culture as doing" (Weisinger & Trauth, 2003, p.27) is to be applied to the study of global virtual teams.

The model of "collaborative technology fit" outlined above (with its extension model of "cultural fit"), is intended as a tool to provide diagnostic information in support of effective global virtual collaboration. As portrayed it is designed to provide a map of "collaborative technology fit" for a selected metastructure(s) at the end of an episodic analysis. Thus it provides something of an "after the event" picture, which can be used for designing a subsequent collaboration. It may have wider applicability but that has yet to be proven. This concept of "collaborative technology fit" then provides a broad diagnostic mapping of an episode. It can be seen to capture something akin to the "collaboration readiness" of Olson & Olson (2000, p.164). However the data driven form of "collaborative technology fit" analysis conducted in this study does not readily lend itself to the type of "before the event" analysis, which might pre-diagnose the degree of "collaboration readiness". Olson & Olson (2000), reflecting on ten years of fieldwork into collocated and distributed synchronous groupwork, reviewed the characteristics of collaboration and drew the following conclusions about "collaboration readiness":

> "Using shared technology assumes that the coworkers need to share information and are rewarded for it. Different fields and work settings engender a willingness to share. If the strategy for progress or productivity involves "knowledge management" in which people are to give information and seek it from others, a dictate from on high to collaborate will fail unless it aligns with the incentive structure" (Olson & Olson, 2000, p.164).

They cited cases and communities in which collaboration had succeeded and failed:

> "For instance, the space physicists had a long tradition of collaboration before they began using the Internet to support their long-distance interactions. On the other hand, our early efforts to engage several biomedical communities ran afoul of their inability to find collaborations with distant players of value. Incentive systems in these various fields made them more or less willing to share and to seek or avoid collaboration technologies.
> The failure at the consultancy to adopt Lotus Notes is the classic example of this phenomenon in the realm of asynchronous tools (Orlikowski, 1992). Consultants even reported avoiding learning Lotus Notes because there was no account to which to bill their learning time. In our research, as well, people at the computer company did not learn TeamRoom® (a Lotus Notes application) because they were too busy; they claimed they would learn it if they were paid overtime or could go home for a day and figure it out. It is interesting to note that not only was there no time to learn it, there was no training in how to use it, the mechanics, or how it should be used in their work" (ibid., p.164).

Finally concluding with the following recommendation:

> "…one should not attempt to introduce groupware and remote technologies in organizations and communities that do not have a culture of sharing and collaboration. If it is decided that the organization needs to collaborate more, that more knowledge needs to be shared, then one has to align the incentive structure with the desired behaviour" (ibid.).

The essential point of the argument made here is that fruitful collaboration requires a set of conditions to be in place, which transcend the mere availability of technology, to facilitate its occurrence. The "collaborative technology fit" model aims at providing a diagnostic which will illuminate the presence (or absence) of those conditions.

8.5.2 Application of Theory of Collaborative Technology Fit to Normative Models

In this section a brief exposition of the theory is applied to two examples from the literature, one representing a case of lack of collaborative alignment and the other a case of fully aligned collaboration.

8.5.2.1 Collaborative Misalignment

In the first example we see a case of 'misalignment', based on the paper by Guzdial et al., (2002) "*When Collaboration Doesn't Work*" and in the later report on the *CoWeb wiki* platform by Rick & Guzdial (2006). The degree of "collaborative technology fit" is first summarised in table 8. 5 below, and then depicted in the accompanying charts of figure 8.16. These radar charts graphically portray an assessment of the extent to which a degree of alignment or "collaborative technology fit" has been achieved on each dimension. The scales on the diagram represent a continuum from zero fit to full fit, where full fit reflects an ideal situation.

More work remains to be carried out to confirm the scales applied in assessing the degree of CTF. Currently the scales represent a continuum from 'no collaborative fit' to 'full collaborative fit'. Intermediate points from 'no CF' have been defined as 'limited

fit', 'moderate fit' and 'partial fit'. The precise terms may be argued with, but the assessment at this stage consists of making a personal judgement of fit on each dimension based upon experience. This of course does not readily support common understandings and consistent application of the CTF analysis across different raters. Feedback from reviewers of this research at several venues (post submission for examination), suggests that further work will be required to quantify and systematize these assessments of fit in such a manner that researchers and practitioners can more reliably apply the scales. While simple quantification of points on the scale appears elusive, some rubric based measurement approach may well be viable.

Chemical Engineering & Mathematics
Technology - coweb wiki, equation applet
Institutional - highly competitive "curved" class so students lose out if peers do well
Individual actions - Chem eng studs generated data from simulations, 60% maths studs analyzed & gave results
Faculty used & praised equation applet , not one student did
TUM - CoWeb tailored for ease of use and admin, Designed applet for equation posting to web
Tech use - coweb wiki, equation applet (faculty only)
Cultural - 40% maths students accepted zero on assgt rather than collaborate with Chemical Engineers
student perception of single answer to questions so no need to collab
students actively avoided collaboration
some faculty favoured single answer questions at UG level
Computer Science
Technology - coweb wiki, mid term exam review discussion pages
Institutional - highly competitive "curved" class so students lose out if peers do well
Individual actions - 22 of 340 studs contributed to discussion pages, limited posting of mid term review solutions
some faculty severely criticised student postings
TUM - CoWeb tailored for mid term exam review, workshops, support doc'n, CoWeb hosting offers
Tech use - coweb wiki, mid term exam review activity postings
Cultural - 22 of 340 students contributed to discussion pages
posting mid term review solutions considered useful, but many students confused or not confident enough
faculty criticism of student postings an inhibitor, not a help-oriented environment, no faculty take up of CoWeb
no models of how to collaborate or what to do in CoWeb
English Composition (also Rick & Guzdial 2006)
Technology - coweb wiki, collaborative close reading threaded discussions
Institutional - not highly competitive "curved" class so students do not lose out if peers do well
Individual actions - studs annotated original source text phrases and created new annotated pages
performed significantly better with more variation than comparison section
concentrated more on task and content than looks - therefore a plus that CoWeb difficult for developing website "frills"
TUM - CoWeb, hands -off approach, did little to train or guide for faculty in use of CoWeb
teacher first time user of CoWeb, conceived online assgts for class, first to use close readings in CoWeb
teacher imported web crossing chat sesssions into CoWeb
Tech use - coweb wiki, collaborative close reading threaded discussions, annotated phrase & new pages, web crossing chat
comparison section (off line essays and close reading in newsgroup style discussion board)
Cultural - students enjoyed collaborating in English, but same students not in calculus!
student perception of no single answer to questions, open ended discussion support so collab valuable?
faculty valued collaboration (prior use of web crossing for chat & discussion boards)
collaboration not as core to field as architecture
CoWeb users more positive towards collab than comparison section (off line essays and close reading in threaded discussion env't)

Table 8.5: CoWeb Misalignment - Lack of "Collaborative Technology Fit"

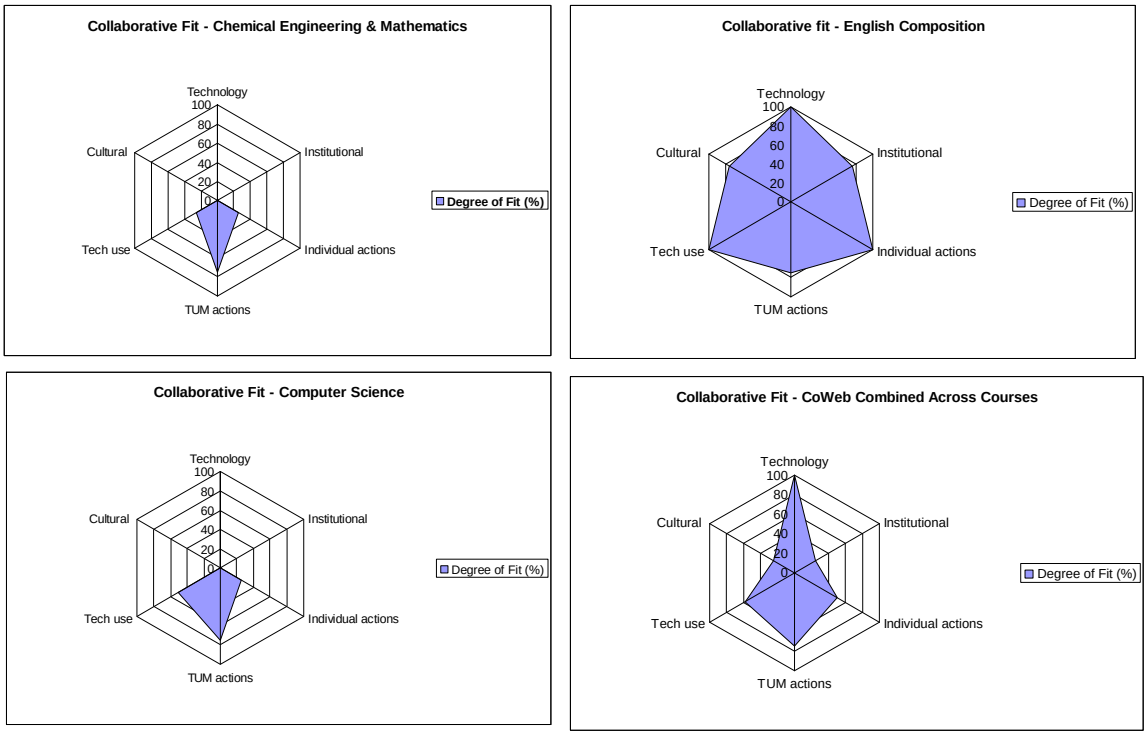


Figure 8.16: Radar Charts – CoWeb Misalignment - Lack of "Collaborative Technology Fit"

As is apparent from figure 8.16 above, the *Chemical Engineering and Mathematics* and the *Computer Science* courses showed a significant collaborative misalignment in comparison with the *English Composition* course. This portrayal illustrates the ability of the "collaborative technology fit" model to provide a graphic diagnostic for a collaborative situation, whether in a single location or distributed context. In this case the data informing the diagnostic has been derived from two academic articles reflecting upon a situation of "failure" after the event. Similar situations have been reported in Leidner, Alavi & Kayworth, (2006), and by Nikas and Poulymenakou, (2008). The '*CoWeb wiki*' in this portrayal has been selected as the common *metastructure* for the comparison, which has been conducted across '*courses of study*' as "cases" rather than the 'sites' or 'locations' previously depicted in the global virtual team context. But figure 8.16 may not represent a true mapping of the situation, since the analysis required some degree of "reading between the lines" from the articles describing the situation. For instance the TUM activities performed by the faculty may have been understated for the less successful courses. However this illustration does indicate the applicability of the model in different situations, when suitable data describing a collaborative context has been made available.

8.5.2.2 Collaborative Alignment

In the next case we see a portrayal of a situation in which the collaboration process was successful. Again using data drawn from the literature, the study by Redmiles et al., (2005) "*What Ideal End Users Teach Us About Collaborative Software*" is tabulated in table 8.6 below and depicted in the supporting chart of figure 8.17.

Collaborative software suite
Technology - workflow, instant messaging, web conferencing, email, telephone, white board
off-the-shelf tools - IBM Domino, IBM Websphere, Plumtree Portal, Team Studio, Microsoft Sharepoint, Macromedia Dreamweaver
Macromedia Flash, Oracle and Microsoft SQL Server
Institutional - multi site US organization, tight knit specialist collaborative computing group, regular customer satisfaction surveys of software
conduct fixed price software projects for clients, budget allocation for training and experimenting with new software
supportive management, physical proximity, small group units
Individual actions - full range of sw dev't tasks performed, continually evolving work env't,
work on many concurrent projects to enable multi-tasking when stuck
TUM - software upgrades to servers, change requests for improvements,adapting process tools, transitioning products to new platforms
traning and experimenting with new software
Tech use - email, web conferencing, chat, IM, two types of process tools, phone, f-t-f interactions, group meetings
to communicate, coordinate and collaborate, tools "ready to hand"
typically multiple technologies used in sequence interchangeably
conspicuous absence of "workarounds"
Cultural - group was "collaboration ready" and "collaboration technology" ready
had used Lotus Notes for collaboration for many years
aggressive and early adopters of technology, IT savvy, occupational subculture as IT professionals
Learners by nature (enhancing IT skills, aversion to routine, curiosity, personal challenge, fun)
largely tacit uses of technology resulted in limited reflective abilities? (lack of "breakdowns" as an occasion to reflect?)

Table 8.6: Collaborative Software Suite Alignment – A Case of full "Collaborative Technology Fit"

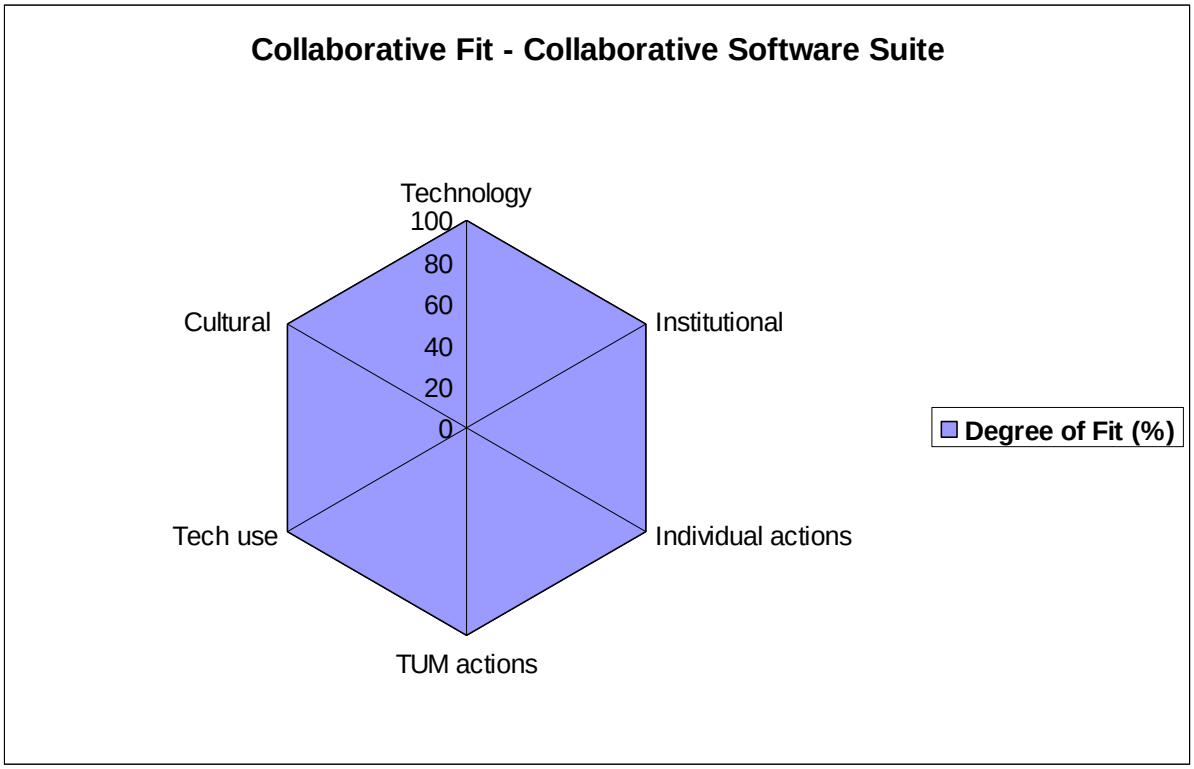


Figure 8.17: Radar Chart – Collaborative Software Suite Alignment – A Case of full "Collaborative Technology Fit"

In contrast to the other comparative portrayals this chart shows one "site" or "case" only, but in a positive sense does illustrate another use of the approach.

This portrayal has necessarily reflected the single "site" of the study in question. Although the unit serviced other locations across America, the interactions across sites were not covered in the article, so the analysis can only work with the data available. Nonetheless this study by Redmiles et al., (2005) has portrayed an exemplary situation of effective alignment between a collaborative team and its "tool set". [As an aside, while I do not personally favour the word "tool" in relation to software (and especially collaborative software), since it presumes the "tool" view of the IT artefact (Orlikowski & Iacono, 2001), Redmiles and colleagues here have used the term "software tools". I am however more comfortable with "toolkit" or "tool set" as a closer approximation of the "ensemble view" of IT generally promoted in this study]. The *metastructure* of the "collaborative software suite" selected for the profile in figure 8.17 above, was in itself a collective form of a 'technology' *metastructure*. Akin to a "genre repertoire" (Orlikowski & Yates, 1994, Yates et al., 1999), this collection represented a *macro level metastructure* as an "ensemble" of technologies marshalled in support of collaboration.

The team profiled in this study, represented a "tightly knit software services group of a large aerospace company with campuses across the US" (Redmiles et al., 2005, p.261). As a co-located small team, with incentives both to deliver working collaborative software and to experiment to maintain themselves at the leading edge of their field, they could be argued to represent a highly atypical team as users of collaborative technologies. As combined *developers*, *supporters* and *users* of collaborative technologies, they had resources at their command which would not be available to the more constrained "normal user" (Alexander, 2005).

Nonetheless the ability to profile the successful alignments achieved in this context, further demonstrates the viability of the "collaborative technology fit" model as a diagnostic and profiling mechanism, able to paint a graphic picture of best and worst case situations.

Of interest to this study is the extent to which the co-located context for the team profiled in figure 8.16 above, was a key element of their success. For instance section A20-6.9.6 below has compared the differences in outcomes between the 2005 internal and international collaborations. As Kraut et al., (2002) have reported, a specific set of affordances are necessary to support the "important collaborative tasks of initiating conversation, establishing common ground and maintaining awareness of potentially

relevant changes in the collaborative environment" (p.157). For instance they noted "the features and affordances" of "physical proximity" were helpful for "initiating communication", since "it takes relatively little effort" to start interacting:

> "Physical collocation has consequences for the frequency of encounters, the likelihood that chance encounters lead to conversation, people's comembership in a community and the common ground they develop due to repeated encounters" (ibid. p.142)

Carmel and Abbott (2007) in a similar vein have reported that:

> Proximity is critical to the development of group interaction, and social relationships. And that technology alone is often insufficient to re-create the same facilitating environment in distributed teams that is present in co-located settings" (Carmel & Abbott, 2007, p.42).

Linking these comments to the "Agile Software Development Movement" (Highsmith, 2002), some particularly pertinent observations have been made by Cockburn:

> "the most effective form of communication is interactive and face to face, as at a whiteboard. Two people at the whiteboard employ many communications mechanisms simultaneously (proximity, gesture, drawing, vocal inflection, cross-modality timing, real-time question and answer). As their communication moves to phone, email, and paper, they progressively lose access to these mechanisms. The principle does not imply that a few people sitting in a room can develop all software. It does imply that a methodology designer should emphasize small groups and lots of personal contact if productivity and cost are key issues" (Cockburn, 2003, p. 45).

> "The power of proximity and informal communication has been validated repeatedly…Currently it is both being revived and challenged. The revival is coming through what are being called the "agile" methodologies and the "Agile Alliance"…The agile methodologies uniformly call for proximity and informal communication…The challenge is that distributed workgroups are a reality in many companies. Fortunately, "Characterizing people as first-order, non-linear components in software development" (Cockburn 2000 SCI), Agile Software Development (Cockburn 2002 ASD), and "Proximity matters" (Olson 2000) all isolate properties of the proximate, informal situation and discuss how faster, better communication technology can improve communication-at-a-distance, even if not matching proximate communication. Now that we have isolated several key characteristics of proximity-based communication, it is a natural that technologists will work to invent and deploy technologies to capture some number of those characteristics" (ibid. p. 72).

While better technology design which captures the affordances of "proximity" may help and duly improve "communication-at-a-distance", it is clear from this thesis that I consider the technology dimensions to be far from the sole challenge in that quest. While agreeing with Olson & Olson (2000) that "Distance Matters", the analysis in chapters six and seven has already demonstrated that (in addition to the dimensions highlighted in these cited passages), 'physical proximity' and 'distance' possess 'temporal' aspects as well as aspects of 'space'. There may also be little choice but to use a dispersed group for many varied and valid reasons. Achieving "collaborative

technology fit" (whether locally or at a distance) requires a holistic approach to the issues associated with collaboration. This model of "collaborative technology fit" argues that *TUM activities* are a key dimension within that set of issues.

The next section of this chapter returns the focus to the wider context, to illustrate how international, institutional and cultural dimensions in this study have acted to constrain global virtual collaboration at both the macro and micro-levels.

8.6 Cultural Dimensions of Human Subjects Ethics Review Processes

The analysis in chapter 6 above has frequently noted the impact of the 'human subjects' ethics review' process on the collaboration (e.g. Table 6.9b and related discussion in section 6.4.4.3). As a surprisingly pervasive and embedded theme, with different realisations at each site and requiring intensive TUM activity to resolve, this phenomenon occasioned considerable reflection on my part. The analysis which follows unpacks the cultural and historical interplay through which this "institutional metastructure" was separately realised, shaped by different forces at each site. This multi-layered analysis of the cultural dimensions, reviews "the intersection and tension between different social systems" (Whittington, 1992, p.693) where the 'human subjects ethics review process' serves as an illuminating *metastructure*.

8.6.1 Individual Actions and Wider Impacts

The analysis discussed here is portrayed in Figure 8.18 below, which depicts the complex relationships between the intersecting cultural layers. Initially three significant *individual actions* have played their part in driving the evolution of the ethical review processes in the three countries involved in the collaboration. Woodward (1999) has observed that:

> "The US regulations that govern federally supported research derive in part from 2 *international codes* promulgated after World War II in reaction to grossly unethical experimentation by Nazi physicians. These are the Nuremberg code (1947) and the declaration of Helsinki (1964; since revised several times)" (p.1947).

Woodward further noted that, whereas the Nuremberg code was devised by the US judges who tried the Nazi physicians, the Helsinki declaration was the work of the World Medical Association. These important codes have formed the basis for both *national* legislation governing the ethical conduct of medical research, and *professional codes* globally regulating medical researchers by stipulating that:

> "Adherence to the standards set by the Declaration of Helsinki is required by more than 500 medical journals in the "Uniform Requirements for Manuscripts Submitted to Biomedical Journals" (Woodward, 1999, p.1947).

Further individual actions with impacts in the New Zealand context can be seen in the controversy surrounding the work of Dr Herbert Green in New Zealand, and his 'unfortunate' experiment into the effects of cervical carcinoma at National Women's

Hospital. Negative outcomes of the study were judged by a Committee of Inquiry into the affair conducted in 1988 as:

> "a failure to treat a number of women during the research programme resulting in persistent disease, the development of invasive cancer and in some cases death" (Hyde, 2000, p.221).

The Inquiry concluded that "Green had been technically in error in his beliefs about cervical cancer and that he had breached ethical codes in his practice of medicine" (p.230), and furthermore "had far reaching effects on the practice of medicine in New Zealand" (ibid.). Among several recommendations the Inquiry led to:

> "changes in the practice of medicine and research to ensure patient rights…and the reform of ethical processes for research. Some of these measures imposed a much higher degree of surveillance over the medical profession's mediation of the clinical and moral elements of medicine" (ibid).

The implementation of these measures can be seen in the stipulation that "Under the requirements of the Health Research Council Act 1990, every application for funding received by the HRC must be subjected to independent ethical assessment" (HRC, 2005, p. 8). Then further relating that stipulation to an institutional context:

> "research originating in a tertiary educational institution will be reviewed by an ethics committee of that institution, if that committee is accredited by the HRCEC [HRC Ethics Committee] to review HRC funding applications" (ibid, p. 10).

A decade later in the US, similar forces seem to have been at work. A system of 'assurances' was in place - agreements that define:

> "an institution's obligations to comply with the federal regulations governing the conduct of research…Multiple Project assurances (MPAs) were issued to institutions participating in larger volumes of research that had Institutional Review Boards (IRBs) and systems in place to ensure the protection of human subjects and the ethical conduct of research" (Newgard & Lewis, 2002, p.1426).

A review by the U.S. Office of Human Research Protections (Newgard & Lewis, 2002).was conducted from 1998 - 2000, in reaction to a complex system that had become bogged down in its own weight of protocols, as the number of projects and amount of federal funding had increased. Woodward (1999, p.1428) has reported on a 1996 study finding that "the sheer number of studies necessitates that the IRBs spend only 1 or 2 minutes of review per study", and also reported for the year 1999 that:

> "intensified oversight by OPRR [Office for Protection from Research Risks] has produced new evidence of misjudgement or misstatement of risk. In little more than a year, research activities have been restricted or suspended at 8 institutions" (ibid.).

Woodward further observed that a particular study of 'hyperactive' children was reported to have "exceeded the limits of minimal risk", and for normal participants in the study, the research was "impermissible under federal regulations" (p.1429).

The Federal regulatory framework appears to originate from the Public Health Service Act which requires that "medical institutions that receive federal funding must have IRBs" (Hirshon et al., 2002, p. 1417), while the "Office for Human Research Protections (OHRP), under the auspices of the U.S. Department of Health and Human Services (DHHS) was the agency designed to protect human research subjects" (Newgard & Lewis, 2002, p.1426). A system of Federal Wide Assurances (FWAs) was introduced from 2000 onwards under which "the responsibility for human subjects protection was being shifted from a centrally-based system to individual institutions and investigators" (Ibid., p.1427). Among other requirements of the FWA system, institutional IRBs had to be registered.

Thus at least in the New Zealand and US contexts, we see the framing of the research process and ethical approval mechanisms strongly driven by the needs of government, funding bodies and institutions to manage the ethical risks of medical research projects. As a result accredited ethics committees or IRBs tend to have a mindset orientated towards medical research, and procedures directed towards the dominant scientific paradigm and research techniques applied by medical researchers (Zeni, 1998). A similar point of view is presented by the Swedish Research Council:

> "In the natural sciences, medicine and other fields, in Sweden and elsewhere, the work of research groups tends to be quite strongly method-driven, being based on a methodology developed within the group and forming a unifying link between a number of different projects in which it is employed" (Gustafsson et al., 2006, p. 32).

As Zeni also observes, a set of perspectives and tools dominates, which not only omits many issues relevant to methods not common to medical researchers (such as action research or a range of qualitative or critical methods), but may even fail to adequately address the real ethical issues inherent in such alternative research approaches. The US and New Zealand institutional ethics review processes appear to have derived from similar origins.

Yet the picture in Sweden appears to have developed in quite a different manner. The Nuremberg code and the Declaration of Helsinki do appear to have informed the ethical position of Swedish medical researchers. Eriksson (2007) observes that:

> "The growth of ethics codes eventually led to the creation of regional research ethics committees, which assembled voluntarily and were generally not supported in Swedish law or statute".

More recently however the position has changed with the European Community exercising influence, as Eriksson (2007) notes through

> "the Council of Europe's Convention for the protection of human rights and dignity of the human being with regard to the application of biology and medicine (this convention has led to Sweden's etikprövningslagen - law on ethical review".

As a result:

> "On 1 January 2004, the Lag (2003:460) om etikprövning av forskning som avser människor (law on ethical review of research involving humans) came into effect...According to the law, applications for the ethical review of research are to be reviewed by regional committees, which comprise authorities. There is even to be a central committee for ethical review of research, which also plays a supervisory role...It is a punishable offense to perform research covered by this law without approval" (Eriksson, 2007).

Yet the scope of this legal sanction appears tightly circumscribed:

> "Under this Act, all research on humans which, expressed in fairly broad terms, (1) concerns sensitive data and is conducted without informed consent, or (2) is designed to exert a physical or psychological influence, must be assessed from an ethical point of view by a regional ethical review board" (Gustafsson et al., 2006, pp. 84-85).

Eriksson (2007) further notes the influence of EU directives on the ethical conduct of clinical trials, once again in the medical research sphere. Uppsala University at an institutional level has a research ethics committee which has been reported to review the conduct of certain forms of medical research at an institutional level, such as the sensitive study on Chlamydia reported in Low et al., (2006). In an investigation to determine whether this was a duly constituted 'regional ethics committee' as provided for in the 2004 Swedish law on ethical review noted above, it was unclear to me whether this was so, or whether it represented a local initiative by the university to govern the conduct of medical research studies and enable the university's medical researchers to meet the publication requirements of the Helsinki declaration as mandated by the "uniform requirements for biomedical journals" (Woodward, 1999) referred to earlier. Further confusing the regional versus institutional question, from the Uppsala university website, one research project referred to approval by the "research ethics committee at the Faculty of Medicine" a sub institutional structure, (cf. http://www.pubcare.uu.se/care/care/eng/researchprojects/child1.htm). The key point however, is that medical projects at Uppsala University do appear to be subject to an institutional level of scrutiny by a research ethics committee. .

As a more general statement of a Swedish view on research ethics, the following excerpt is illuminating:

> "The Swedish Research Council's ethical principles for research in the humanities and social sciences…Research is required to satisfy both (1) the research criterion, i.e. the research involved must be important and of a high quality, and (2) the criterion of protection of the individual, i.e. participants, subjects and informants must not be harmed. The latter criterion is spelt out more clearly in rules requiring information, consent and confidentiality, and stipulating how research data may be used. To obtain funding from the Swedish Research Council or the Swedish Council for Working Life and Social Research (FAS), a humanities or social science project has to meet the criteria set out in this document. The two councils can therefore require a grant applicant to submit his or her project to a regional ethical review board for ethical scrutiny in this respect. Such a review is advisory, i.e. the resulting assessment constitutes advice (in this case, to the research funder)" (Gustafsson et al., 2006, p.83).

Relating all this more directly to the collaboration reviewed in this thesis, the *professional* and *student* impacts are of most significance. Three primary professional groupings were involved in the 'human subjects ethics review process' impacting this collaboration –medical researchers, computing educators and computing education researchers. At a general level medical researchers as the target high risk professional group, are constrained by the protocols and requirements of ethics review processes. However the jurisdiction of the accredited institutional ethics committees in the New Zealand context and IRBs in the US context, extends beyond medical research to all other forms of research in the institution. In the Swedish context it appears to be more constrained to the medical discipline.

In the case of this collaboration I had secured the necessary ethics committee approval for the project at AUT University, as an extension of an original approval gained in 1999. Arnold operated on a professional educator/researcher basis without the need to submit the project to a formal institutional ethics review at Uppsala. Fred was unable to navigate his IRB process at St Louis in the limited time available, and thus his students were only permitted to participate as 'students', since the teaching sphere was differently construed as 'not research' (cf. Clear, 2007b), and therefore not subject to the research ethics protocols. Since the St Louis students were now excluded from consideration as 'research subjects' this in turn constrained our future ability to publish results based on St Louis student data. The primary student impact of this set of forces, was that: Uppsala students were free to participate on a voluntary basis, with both the option to withdraw and to have their privacy safeguarded in any publications; AUT students were free to act as both 'research subjects' and students in a mode of joint enquiry (Clear & Kassabova, 2008), but given the generic research stipulations of 'informed and voluntary consent' and the 'right to withdraw at any time', had the option to 'opt out' from the international collaboration at any time. (To support this

choice, AUT students were offered the alternative assessment option of a more academic study report). St Louis students had the right to privacy as students only and to non publication of data related to their contributions.

These requirements in turn, led to a design for the trial which could accommodate the differing elements (cf. section 6.4.4.3 above) and which linked directly to the process of GVT formation and configuration of the technology to support the GVT structures and membership as finally determined. Here we see the complex processes of technology-use mediation in operation through this linkage from the macro level operation of 'culture': through multiple layers of individual actions; global and national impact; to the micro level of: student impact; subsequent GVT formation; and technology configuration, in order to meet the needs at each site. The "principle of the hermeneutic circle" (Klein & Myers, 1999, p.72), with tightly reinforced links from the broadest global perspective to the most specific local aspects is most strikingly in evidence.

The diagram of figure 8.18 below provides a graphic illustrating this complex set of interrelationships within a multi-level model of culture. The arrows indicate imputed paths of impact of policies and frameworks at differing levels.

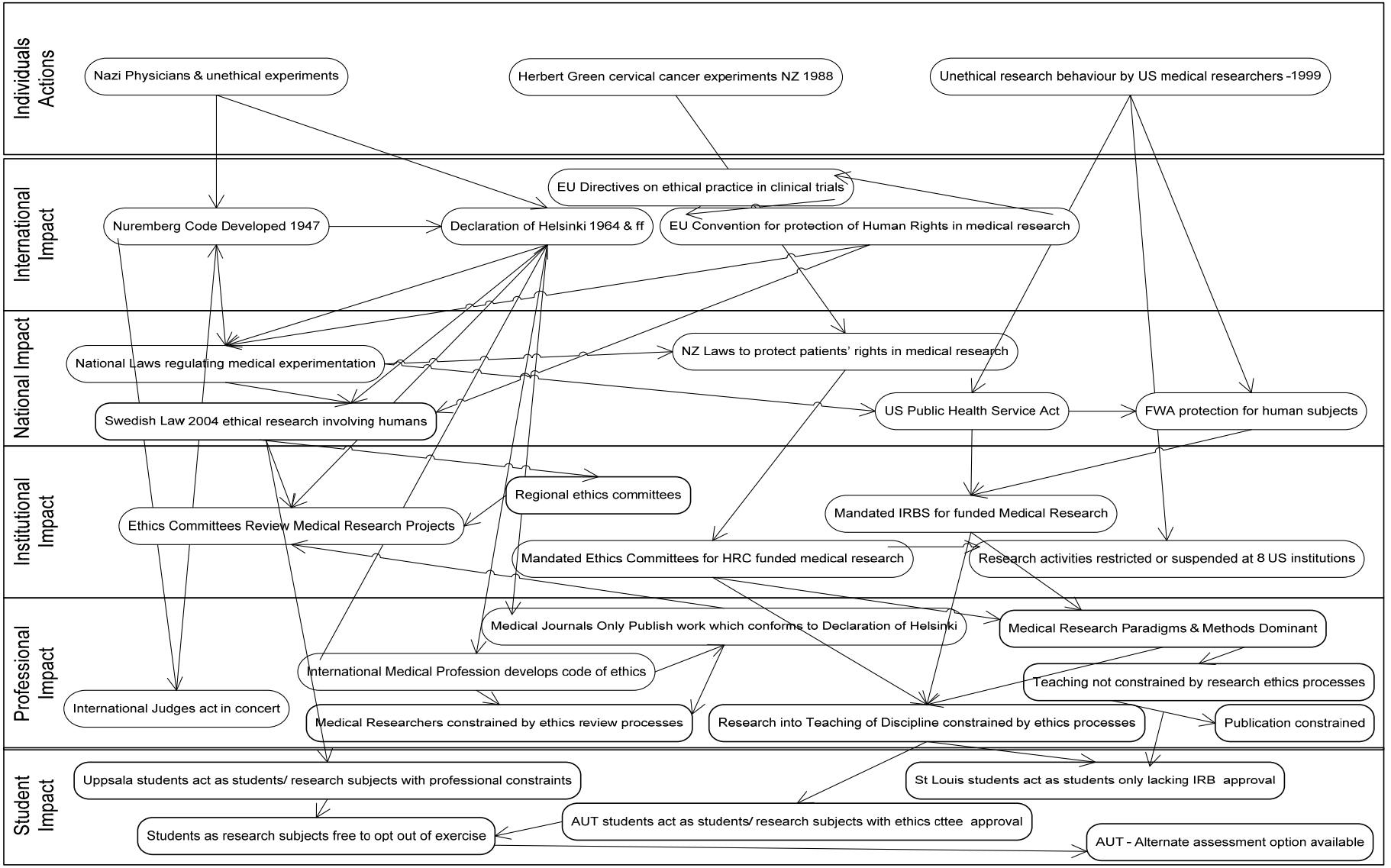


Figure 8.18 – Cultural Dimensions of the 'Institutional Metastructure' of "Human Subjects Ethics Review"

8.6.2 Related Guidelines from Another Jurisdiction

Of additional relevance to this study are the recently published and updated Australian Government set of guidelines, the "National Statement on Ethical Conduct in Human Research" (NHMRC, 2007). This set of guidelines developed jointly by the National Health and Medical Research Council, the Australian Research Council and the Australian Vice Chancellors' Committee promulgates a set of national standards within Australia on the basis outlined below:

> "Research often involves public interaction between people that serves a public good. There is, therefore, a public responsibility for seeing that these interactions are ethically acceptable to the Australian community. That responsibility is acknowledged and given effect in the wide-reaching authority of this National Statement, which sets out national standards for the ethical design, review and conduct of human research. Its content reflects the outcome of wide consultation with Australian communities who participate in, design, conduct, fund, manage and publish human research" (NHMRC, 2007 p. 4).

In the same manner as the United States of America and New Zealand jurisdictions, Australian approaches to ethics approval have their origins in legislation aimed at medical research (The National Health and Medical Research Council Act 1992). These guidelines expand beyond the health sphere to require that research (apart from prescribed categories) be approved via institutional ethics committees:

> "Human research may be conducted only with ethical approval. Section 5 describes the processes that institutions may use to provide that approval. Those processes include ethical review by Human Research Ethics Committees (HRECs) or other ethical review bodies, according to the risks of the research…Ethical review by an HREC is required for any research that involves more than low risk" (NHMRC, 2007 p.25).
>
> "Research is 'low risk' where the only foreseeable risk is one of discomfort. Where the risk, even if unlikely, is more serious than discomfort, the research is not low risk" (NHMRC, 2007 p.18).

Under these guidelines had the research conducted within this study involved collaboration with an Australian University, a submission to a HREC would have been required by the Australian partner. The research would have been categorised as research involving "people in dependent or unequal relationships", who are considered:

> "vulnerable to being overresearched because of the relative ease of access to them as research populations"
> "These relationships may compromise the voluntary character of participants' decisions, as they typically involve unequal status, where one party has or has had a position of influence or authority over the other. Examples may include relationships between:
> - teachers and their students;
> - …
>
> Those mentioned first in each of these examples will sometimes be involved as researchers, as well as being involved in facilitating or implementing the research. (NHMRC, 2007 p.59)

8.6.3 A Critical Perspective on Human Subjects Ethics Review Processes

To adopt a more critical perspective on these dynamics, a cynic might view this as all being driven by the 'bad doctor syndrome', where the infamous Nazi Doctor Mengele comes to mind.

One could readily develop a cautionary narrative in which the past sins of the few in a single discipline, have caused to be visited, on future researchers in many disciplines, a cumbersome and bureaucratic surveillance apparatus. Without wishing to dwell too long on the issue, a critical analysis based upon the perspective of Habermas (1984), as outlined in Myers & Young (1997), might argue that the "lifeworld" of non medical researchers (in this case computing education researchers) has been inappropriately "colonised" by the steering mechanisms designed to control medical research and researchers. The mechanisms for controlling research risks in the US and New Zealand academic institutional contexts are typically realised through their institutional ethics committees or IRBs. From their origins in overseeing work in the medical research sphere the remits of these committees has now spread to encompass all research projects and disciplines in the institution. The Australian NHMRC (2007) guidelines provide another example of this extension.

In my analysis a medical world view has been privileged in the whole process of managing the risks of unethical research projects, which is unwarranted and inappropriate for many other forms of research. A depiction of this process based on Myers & Young (1997, fig.1) is given in figure 8.20 below.

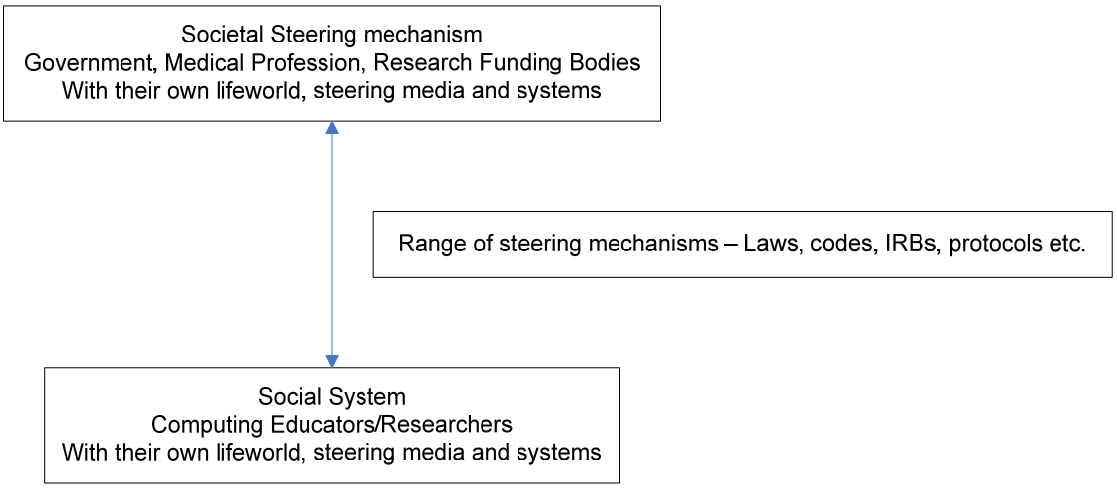


Figure 8.20: Colonization of the Lifeworld - Privileging the Medical Perspective in Research

The contrasting Swedish perspective where the research disciplines have retained a degree of professional autonomy, starkly highlights the differences across cultures and disciplines.

In the New Zealand context a further case drawn from a colleague's research within a New Zealand Maori community, supports my argument of these medically imported mechanisms constituting a "colonization of the lifeworld" for other researchers. The excerpt below illustrates the tensions and frustrations inherent in these processes:

> "the consent process which followed was that dictated by the AUT ethics committee, in which it is necessary to gain the consent of all those who are impacted by the data gathering phase of a study. This process is designed to protect all likely stakeholders during and after the study, but it is a particularly western-centric approach to a demotic system of approval (in previous discussions with the kaumatua and marae committee approval had been granted on behalf of those who might attend, however this did not satisfy the committee's protocols). One of those who appeared in the video refused to give their consent as is their right, and therefore the video footage cannot now be used. The transcript, partially completed analysis and any evidence of it have been removed from the study" (Litchfield, 2005 p. 24).

Of particular note in the above case is the fact that the privileging of the individualistic "western-centric" approach inherent in these ethics protocols (overriding the mana of the elders), actually operated in violation of the Treaty of Waitangi signed in 1840 between the Crown and the New Zealand Maori peoples in which the Maori people were guaranteed preservation of their culture within a model of partnership with the Crown (cf. Gotterbarn et al., 2006 for a further discussion of these issues). This small case demonstrates how through such "societal steering mechanisms" as *ethics approval processes*, the process of "colonization' remains ongoing for New Zealand Maori. As I have argued above, these *ethics approval processes* operate in a similar fashion by imposing a linear 'medico-legal' model of research, which constrains and encumbers researchers in the non medical disciplines.

One could investigate in far greater depth why the clear distinction between the Scandinavian and the US/NZ/Australian legal framework for research ethics has developed. The individualistic and litigious nature of American society and the influence of insurance companies may no doubt be further driving factors. For a fuller review of critical theory and the work of Habermas the reader is referred to Clear (2004a).

For now however the demonstration of the interlinked nature of the cultural elements and their impact in the process of TUM is sufficient for the thesis. The pervasive influence of the ethical approval processes at the Auckland and St Louis sites, impacted

in several ways: upon the design of the teaching/learning process; the design and evolution of the collaboration itself; the design of the software; the instructions to students and the legitimate expectations that could be imposed; the analysis and reporting of the data. In contrast for our Uppsala colleagues the issue was merely an annoyance and seen as our particular problem.

As a postscript to this critique I could add that while conducting the analysis for this study I made the following note:

> *Note: Fred's email 4/11/2004 (hard copy from sent messages folder) where Fred asked if we wanted to use St Louis data for research he would start process for archival data.*

I cannot find a response to the message so it looks as though this offer hung in abeyance, no doubt lost in the general busyness of academic life, which had the result that the St Louis student data was not available for use in this study.

8.7 Tensions between Control and Sharing in Global Virtual Collaborations

A key tension in collaborative ventures as noted in 8.5.1 above is between the separately perceived needs for sharing and control. These tensions give rise to a number of related issues at the individual and group level. In global virtual collaborations these issues not only persist but become accentuated, as strongly evident in the "e-Research" domain (e.g. Sargent, 2006, OSI 2006b p. 33) and evident from some of the themes isolated in the grounded analysis conducted within this study. In section 7.7.2 the concepts of *trust, freedom, competition, collaboration* and *control* were all present. The concept of *control* in turn encompassed a full range of *security* related issues such as *access* and *authorization*.

To that extent the general findings of this research, conducted some two years earlier, have echoed the sets of issues facing the "e-Research community" and outlined in such documents as the series of UK Government reports (OSI, 2006a; 2006b; 2006c) and the Australian e-Research Strategy (Sargent, 2006). Positively, the commonality in these themes does suggest some generalizability for this work. International research on the topic of "virtual research communities" cited in OSI, (2006b) has noted the work of "collaboratories" (Barua, Chellapa & Whinston, 1995), the "term…used commonly in the USA to denote virtual research environments and communities". The OSI working group concluded the following:

> "The collaboratories have had mixed success, reflecting the natural tendencies of scientists in those disciplines to collaborate, or not". (OSI, 2006b p. 33)
>
> "The results of early experiences with all these collaboratory projects has identified the following issues (see http://www.nsf.gov/statistics/seind02/c8/c8s3.htm):
> - Collaboratories do not replace the richness of face to face interaction and generate concerns about trust, motivation, data access, ownership and attribution of input and results
> - There are major challenges in supporting complex work in virtual settings; most existing work has been carried out in relatively simple scenarios to allow the researchers to concentrate on making things work. Scaling up to big inter-disciplinary research will create new problems to overcome.
> - Collaboratories appear to help graduate students and 'casual' researchers the most, since they can get access to resources otherwise unavailable. By contrast, outside involvement by junior or non-professional participants in collaboratories can prove a distraction to top researchers" (ibid.)

As is evident from the above excerpts, *sharing* and *control* have been key themes within virtual collaborations in the scientific domain. Likewise the need for mechanisms to

secure valuable resources and provide reliable means of access to those resources has been a common thread in the e-science field. The *e-Science Institute* in Edinburgh for instance, has a specific theme on its website relating to "Trust and Security in Virtual Communities", with the following introduction:

> "In many scientific disciplines, the models, data and methods have significant commercial value. Scientists in these sectors are often unwilling to exploit the full potential of distributed computing because, despite substantial developments in the area of usable security, there remains a "Trust Gap" between the scientists' requirements and present technological capabilities. Submitting data or computations to grid resources means trusting that acceptable standards of security will be upheld by every system – and every administrator. This is a barrier to take-up of e-Science technologies in significant sectors such as bioinformatics, drug discovery, industrial engineering and finance: the cost entailed in a breach of confidentiality is simply too great" (e-SI, 2008).

The online magazine quote below complements these views on e-science:

> "Even though the buzz about eScience often focuses on massive hardware, user interfaces, storage capacity and other technical issues, in the end, the ability of eScience to serve the needs of scientific research teams boils down to people: the ability of the builders of the infrastructure to communicate with its users and understand their needs and the realities of their work cultures.
> The builders of eScience infrastructure "need to talk about fostering, rather than building infrastructure," said Alex Voss of the National Center for e-Social Science in Manchester, UK, and research theme leader at the e-Science Institute in Edinburgh, UK. There are social aspects to research that must be recognized -- from understanding how research teams work and interact to realizing that research often does not involve the kinds of large, interdisciplinary projects engaged in by virtual organizations, but rather individual work and ad-hoc, flexible forms of collaboration within wider communities" (HPCwire, 2007)

To better picture the implications of these broad statements, an ideal scenario of use from the report of the working group on *Middleware, AAA (authentication, authorization, accounting) and DRM (digital rights management)* is given below:

> "First thing in the morning I log in to my office computer at home using my usual username and password. Since the network at work knows where I am and what system I am using, that allows me to access everything I need for my normal work: e-mail, internal files, company calendar and so on. If I were working from a hotel then I would also need to give the one-time password from my keyring. I receive an e-mail asking me to update information regarding a project I manage on the institutional finance system, so I switch to my role as system administrator. To get administrator access I need to enter the password from my keyring. When I have updated the relevant information I drop back to normal user access. At lunchtime I need to work on an essay for a course I am studying at another university, so I drop into my student role (the university checks with my employer that I have already logged in, so I don't need to enter any passwords) which lets me contact my tutor and run a couple of searches on a commercial database. As part of my research I need to run a visualisation simulation and so I submit a job to the National Grid Service. I am allowed to submit this job as I have credit available in my institutional account, which controls Grid usage. I receive confirmation of the job request on my mobile phone and that evening I receive another notification that my job has completed. In the afternoon I get a call from a colleague I met at an international conference who would like me to join a quick video-conference he has set up. Since I

> am already logged in the collaboration system recognises me and allows me to join the conference and add comments to a document we are developing together. When the paper is finished next week, I will submit it to my institutional repository along with the relevant supporting research data." (OSI, 2006c, p.6).

While the above excerpts represent a rather lengthy series of quotes, they do provide a strong balancing perspective from which to view this study. It is clear from the latter excerpt that this seamless world of supported interactions, (for a peripatetic user, enabling ready access on a secure basis to needed services across institutions, and the ability to swap roles and technology platforms on an ad-hoc basis at will), is far from the reality experienced in this study and chronicled in chapters six and seven above. Furthermore, while some improvements in technology have occurred during the period since the study, many of these issues extend well beyond technical considerations and will require concerted and planned efforts. The OSI report noted in its recommendations for instance that:

> "the working group has identified a series of requirements to enable e-Infrastructure provision to move closer to this theoretical ideal over the next five years" (OSI, 2006c p. 14)
> "The 'Options for the Future' appraisal makes 28 fine-level recommendations for future development activities". (OSI, 2006c p. 23)

The scope of recommendations in the report addressed four general themes:

Theme	Recommendation references
Work to inform development requirements	7,9,11,12,13,25,26,27
Technology and service development	1,3,4,6,14,16,18,21
Changing practise	2,5,8,10,17,19
Social and impact studies	15,20,22,23,24,28

Figure 8.21: AAA, DRM and Middleware Themes and Recommendations (ex. OSI 2006c p. 23)

Among these recommendations were the following categories:

A) Strong federated access management system within the UK with institutionally centralised authentication
B) Support for levels of assurance for applying appropriate authentication to resources
C) Integration of existing access management systems within UK education
D) Delegated authorisation
E) Ability to work across federations in both academic and commercial domains
F) Personal/multiple identity management tools and training
G) Accounting auditing and diagnostics tools
H) Embedding and support for production middleware
I) Provide sustainable routes for required services
J) Tools for both inter- and intra- grid requirements

K) Organizational take up across user communities

L) DRM workflow across international boundaries

M) Commons

N) Open access and RAE

O) DRM and authorisation

P) IPR and Virtual Organization (OSI 2006c pp. 14-22)

Consistent with this study, these issues from the UK virtual research community context traversed the *cultural*, *institutional*, *technology* and *individual* domains, and were unlikely to be achieved without "the vital but often invisible mechanisms" (ibid. p5) constituted by *technology-use mediation*.

Firstly, the Intellectual Property Rights ("IPR") and "Commons" headings raised concerns over *institutional* versus shared ownership and the rights to ideas and data. They illustrated the operation of "formal scripts" (Panteli & Duncan, 2004) as highlighted in this study. Then, the notion of "Federated access management" which challenged *institutions* to reposition "themselves as service providers sharing data securely with partners", was a challenge for the *institutions* in this study. The "ability to work across federations in both academic and commercial domains" raised the issues of global standards and *international* interoperability encountered in this study. "Organizational take-up of Grid and e-research technologies" again raised the question of scientific *culture* within discipline and research groups, as discussed above with regard to "collaboratories". Digital rights management and authorisation raised the issues about access to data, encountered in this project during the *collaboration*, (mainly in terms of *educator* and *student access* to applications), but latterly in terms of *restricted researcher access* to the repository of St Louis student data.

Technology solutions to the "access issue" as Sargent (2006) has advised, are being progressively proposed and implemented in separate countries and domains:

> The UK recently announced that it will adopt a technological solution using an ICT system termed 'Shibboleth"…The twin approaches of developing both Shibboleth and PKI are intended to provide Australian researchers with services comparable to those being engineered in the US and Europe. (Sargent, 2006 p. 29)

The principles behind the Shibboleth approach involve the use of "federated identity technology", which as Morgan et al., (2004, p.13) have explained:

> "Allows organizations using disparate authentication and authorization methods to interoperate, extending the capabilities of each organization's existing services rather than forcing their replacement…helps users by taking advantage of their familiarity with existing sign-on systems and reducing the number of passwords they have to remember".

In their brief profile of the Shibboleth system Morgan et al., (2004) painted four different scenarios of use, which are relevant to this study. The first scenario gave a subscribed group of students at Pennsylvania State university access (via their normal university login credentials) to an external Napster service for music download. The second scenario related the arrangements between a professional organization which published academic journals employing a federated access approach which allowed researchers, faculty, librarians and staff at particular institutions access to the archive, without using the potentially insecure access method of sharing network addresses. The fourth scenario depicted a virtual organization of researchers with sophisticated computing resources wishing to share data and gain access from multiple academic institutions preferring to use standard institutional access facilities and a project to integrate Shibboleth and grid technologies. The final scenario concerned access for campus staff to externally hosted services such as procurement, charitable giving and benefits management, in which credentials and roles were readily shared between institutions. If implemented on a global scale between participating academic institutions, models such as these, as proposed in the above OSI working group report (2006c), (albeit with their strong focus on the technology dimensions) may better support the type of global virtual collaboration conducted in this study.

8.7.1 Trust and Team Development in Global Virtual Collaboration

Control, security, access and authorization issues were definitely challenging in this collaboration, but in a sense they represented one pole on a continuum. The other pole concerned the development of trust and group cohesion within this study. Trust is a very large topic in the collaborative computing context, so this discussion will touch on a few key points only.

A clear distinction between “ongoing teams” and “temporary teams” has been made by Saunders and Ahuja (2006), who argued that ongoing teams “anticipate future interaction with each other beyond the imminent deadline” (p.668), and are “concerned with long-term efficiency of the processes and with accomplishing an effective imminent outcome” (ibid.). They further argued that time limits impact group interaction and performance, with temporary teams being of necessity more focused on task completion, and ongoing teams more focused on interpersonal interaction. Moreover most studies of distributed teams to date have been focused on:

> “samples of student teams who met on the average for 4 to 5 weeks”.

> "only a few studies of long-term virtual teams have been conducted and most of these involved field based teams" (Saunders & Ahuja, 2006, p.691)
> "To our knowledge there have been no studies of the interaction of processes and structure in ongoing distributed teams" (ibid., p.670).

In contrast to the prior studies referred to above, the primary GVT investigated in this study was the GVT of coordinators of the global virtual collaboration, and the supporting parties with whom they interacted. This longitudinal study has a primary window of analysis with a duration exceeding one year, and with extended analyses the study covers more than three years in duration. The student distributed virtual teams ran alongside these professional teams, as the focus for the work in which the professionals were engaged. The professional team had a varying history of working together, including in some cases no prior history, but those members had typically been introduced to the project via trust networks on a model of "referred trust" (Pauleen, 2003). Therefore the team was best considered as an "ongoing team" (Saunders & Ahuja, 2006) with "an expectation of future events and interactions" (p.679). The prevalence of "socio-emotional" codes in the data (cf. 7.13.2) may support this contention, with such codes being consistent with the "Framework of Performance of Distributed Teams" proposed by Saunders & Ahuja (2006) and depicted in figure 8.22 below.

Figure 1
Conceptual Framework of Performance of Distributed Teams

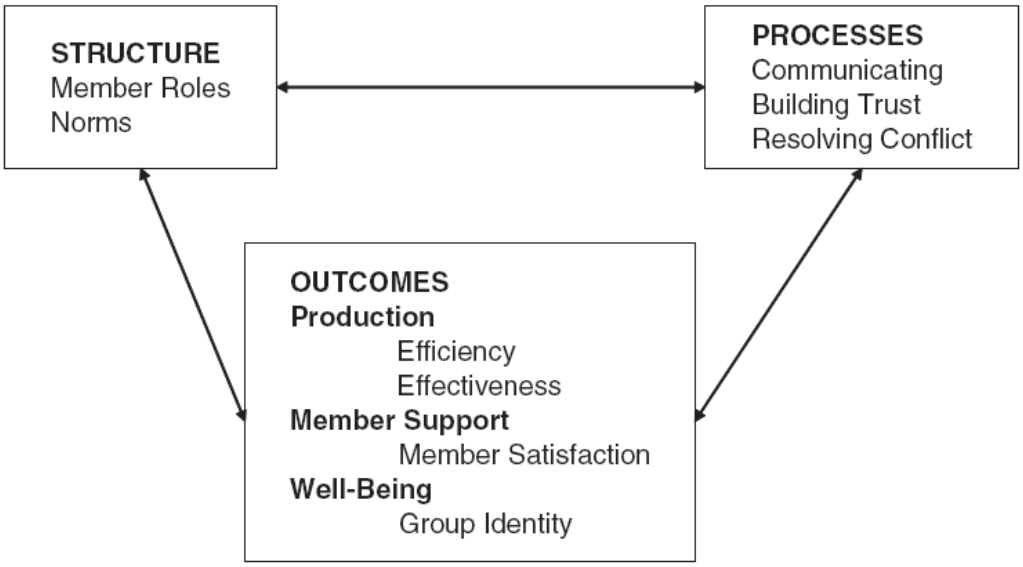


Figure 8.22: Conceptual Framework of Performance of Distributed Teams"
(ex. Saunders & Ahuja, 2006 p. 670)

These socio-emotional codes would accordingly have represented contributions to figure 8.22's group "well being" and "member support", with "member satisfaction" and "group identity" themselves forming intended "outcomes" of the collaboration, in addition to the task related outcomes of "efficiency" and "effectiveness". Thus performance in the distributed team context requires a multidimensional view involving both the team and the task, with the process of "building trust" being an integral element.

A broadly compatible model relating trust development to team cohesion and performance in two distinct phases of team development the "early" and the "late" phase, has been presented by Jarvenpaa and colleagues (2004) in figure 8.23 below.

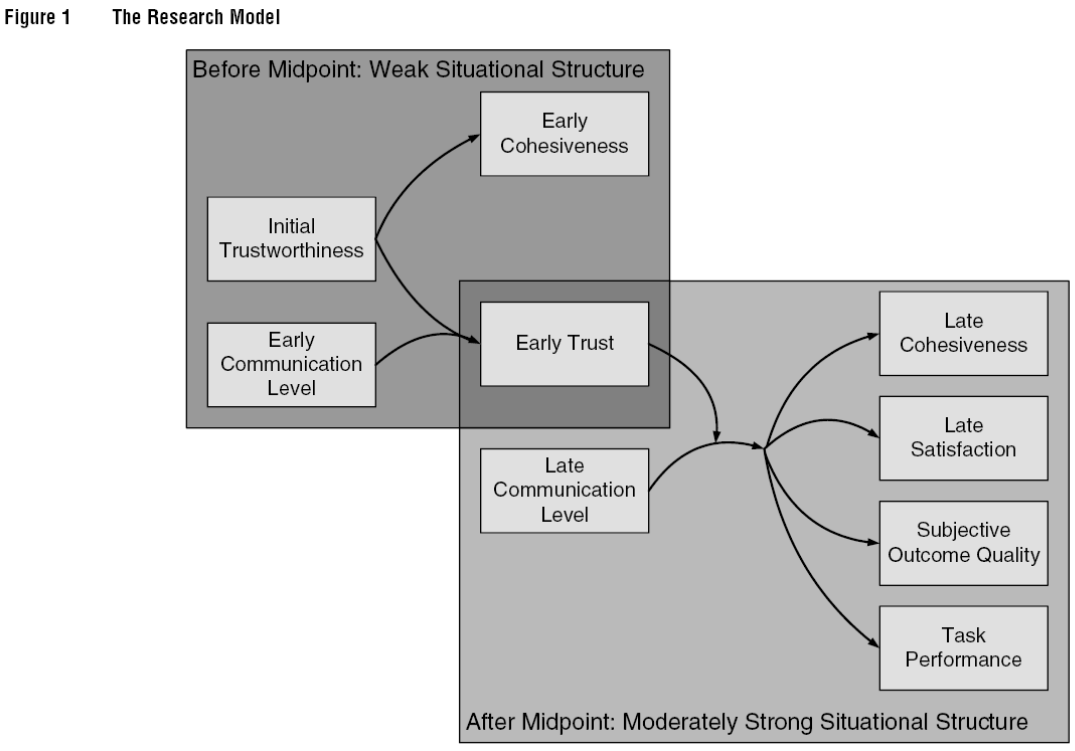


Figure 8.23: Trust in Global Virtual Teams" (ex. Jarvenpaa et al., 2004 p. 254)

In the above model based upon Gersick's (1988) "punctuated equilibrium" model, the authors have theorised about trust development in GVTs, specifically:

> "how the initial trustworthiness of one's team members affects subsequent trust before the team's midpoint (i.e., early trust) and how this early trust affects attitudes and performance at the end. We argue that before the transition point, trust has a direct effect on attitudes because the situation (or condition) is weak in structure, but after this point trust has a moderating effect on attitudes and performance because the situation (or condition) is moderately strong in structure" (Jarvenpaa et al., 2004, p.253).

The set of two studies against which this situational "early" and "late" trust model was tested, involved multiple student global virtual teams across several countries. Distinct levels of "structure" provided by the situation were identified.

1) Weak structure

- "where individuals lack clear guidance or other powerful factors of how to interpret others' behaviors"

2) Moderately strong structure

- "there is some guidance and information to assess the behavior of others, but still some ambiguity about what the other party's behavior means"

3) Strong structure

- "external cues such as norms and rules "over determine" how others will behave. Such situations involve little uncertainty and ambiguity, and there is little role for trust to help make sense of others' behavior" (Jarvenpaa et al., 2004, p.253).

The study concluded that trust is very situation specific, varies over time, does not relate to task performance, and that initial communication is a key element in developing trust. The model of trust development in figure 8.23 above appears to be supported by the data in this study, where "trust" figured as an explicit concept in the establishment episode (cf. 7.7.2 above) but not in later episodes. Such conclusions may only be tentatively drawn, given the different design of the studies, but it seems a plausible data driven argument that the "early trust" was built in the *establishment* phase of this study, and the situational structure was stronger in the later phases of the collaboration, thus enabling "trust" as a concept to fade into the background.

In contrast to this positive picture, a rather different perspective on trust has been provided in the study into "technology facilitation" in virtual teams by Thomas, Bostrom & Gouge (2007), where a lack of trust was shown to be a contributor to "relationship breakdowns". Figure 8.24 over page indicates the prevalence of such 'triggers" in virtual team interaction, where cases were recorded of

> team members not getting along; members "going dark" and refusing to respond (p.89)

These cases contributed to "relationship breakdowns" and demanded "technology facilitation", or a form of *technology-use mediation,* using the terminology applied in this study. Similar "relationship breakdowns" (e.g. appendix A20-6.6.6) were observed within some of the student GVTs in this study.

Prevalence in Data	Trigger	Defining Characteristics	Impacted Higher-level Change(s)
1	External to the team interfering	Organizational policies that restrict ICT choice and permissions or pressure for changes exerted by higher management or the client on project team members.	External but can impact both.
2	Tool inadequacies	Missing but needed ICT features, information overload in ICTs such as email, and inadequate ICT accessibility and reliability.	Information processing capacity: all dimensions Participation: Communication
3	Trust and relationship breakdowns	Team members not getting along; members "going dark" and refusing to respond.	Participation: Cooperation
4	Interference of group structure	Team membership turnover, organizational or international culture issues, and physical distances and time-zone dispersion issues.	Participation: Coordination
5	Member knowledge	Team members do not know enough to use one or more ICTs effectively.	Participation: Communication

Figure 8.24: Problem Triggers for Technology Facilitation in Global Virtual Teams" (ex. Thomas, Bostrom & Gouge, 2007 p. 89)

In this study while the data shows no examples of "team members not getting along", it does evidence instances of team members or other technology use mediators (e.g. the Head of Flexible Learning Services) "going dark", without responding (even if not actually "refusing" to do so). Frequently these cases were occasioned by team members being "absent" or on "holiday" (cf. the instances in section 6.4.4.4 above), without colleagues at the other site being informed, providing an instance of Cramton's (2001) "mutual knowledge problem". Yet these instances did not contribute to "relationship breakdown" in this study, perhaps because a base of trust had been built, through "referred trust" (Pauleen, 2003), through active early communication and by establishing early trustworthiness. For instance Fred's communication in relation to his potential *absence* from the university:

> Please note that I've included my home email address in the cc: section. During our summer I only come to the office 2 - 3 times a week, but don't want to be slow responding to your communications. (FN10/06)

Such behaviours again appear consistent with the model of Jarvenpaa and colleagues in figure 8.23 above, who reported from their studies that:

> "trust provides important benefits for IT-enabled relationships. For example, high early trust buffered members from the leaky, incomplete, unpredictable, and at times chaotic processes that are characteristic of global virtual team interaction" (Jarvenpaa et al., 2004, p. 262).

Not only did a base level of trust carry the collaboration through periods when colleagues had apparently "gone dark", but more generally Jarvenpaa's statement

certainly resonated with the unpredictability and level of chaos experienced at times in the collaboration reviewed in this study. The "phlegmatic response to crises" advocated in the earlier study by Jarvenpaa & Leidner (1999, p.807), was certainly a useful habit in carrying us through the chaotic patches.

The role of *technology-use mediation* (TUM), over and above communication between the parties involved, has been illuminated through the responses to the absences quoted in section 6.4.4.4 above. This TUM activity was significant in developing the base level of trust, in sustaining the collaboration and in maintaining the progress towards the overall goals of the collaboration. "Technology facilitation interventions" as depicted in figure 8.25 below, encompass many aspects of TUM as conceived in this study. The figure expands upon the "problem triggers" of figure 8.24 above, to indicate how such 'breakdowns" constituted inputs to a "technology facilitation" model. In many respects figure 8.25 echoes the largely input- process-output frameworks of figures 8.22 and 8.23 above, where outcomes relating to "task performance" and team "well-being" or team "cohesiveness" are common to all.

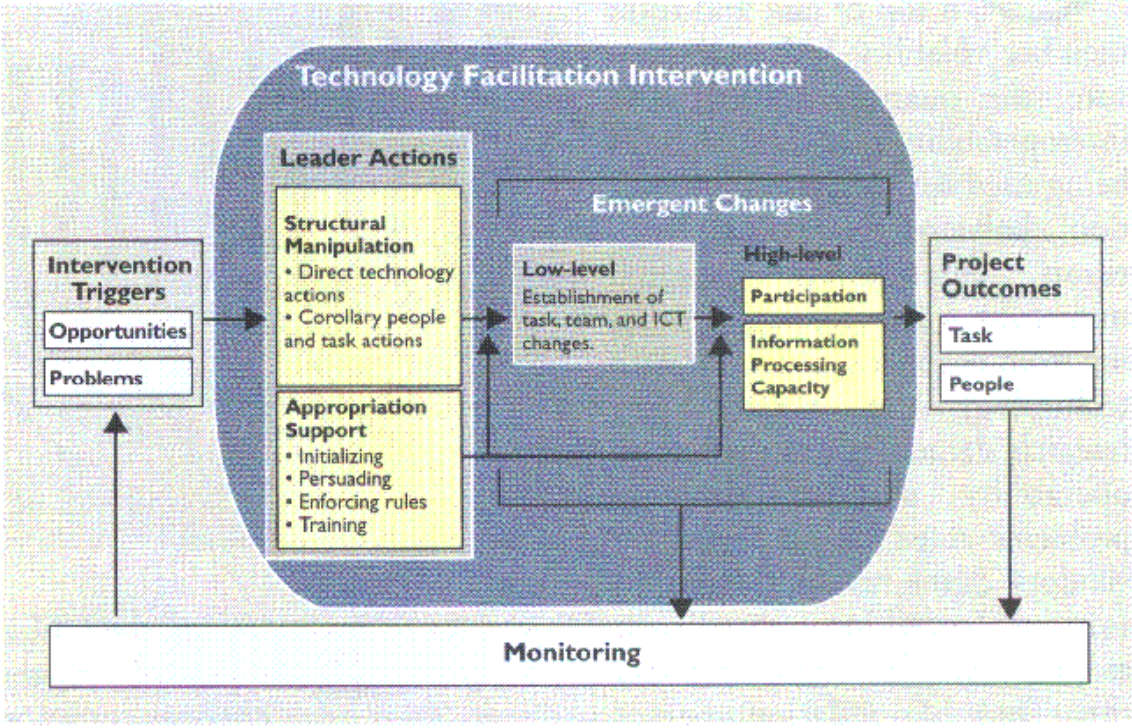


Figure 8.25: the Nature of Successful Technology Facilitation Interventions"
(ex. Thomas, Bostrom & Gouge, 2007 p. 88)

8.8 Chapter Summary

This chapter has augmented the individual episodic analyses of chapter six and the cross episode analysis conducted in chapter seven, with a broader review of selected elements arising from the study.

Starting with a broad review of the different perspectives which have been suggested by the work, the chapter has addressed perspectives on technology and society and noted similarities with the "social informatics" model of Kling et al., (2005). It has noted the relevance of the "symbolic-interpretive" (Frey & Sunwolf, 2005) and "temporal perspectives" (Arrow et al., 2005) on groups, and the applicability of structuration theory and subsequent developments through this work. It has reviewed relevant literature on strategic and technology alignment or "fit" (Zigurs & Buckland, 1998), and applied the insights from the data of prior chapters six and seven. This combination has given rise to a novel "Theory of Collaborative Technology Fit", presented here for the first time as a direct outcome of this study. An extension of that theorisation has presented a discussion on the multi-layered nature of 'culture' and the relationship between the concepts of "collaborative technology fit" and "cultural fit" (Leidner & Kayworth, 2006).

The chapter has then explored the question of "culture", as directly experienced in this research, through a critical exploration of the operation of 'culture' across national boundaries in human subjects ethics review processes. A review of the inherent tensions in collaborative ventures between the separate needs for sharing and control has followed. Noting that in global virtual collaborations these issues not only persist but become accentuated, the "e-Research" domain (Sargent, 2006) has been taken as a comparable context in which many of the issues encountered in this study are now being addressed through policy and research initiatives across several countries. After addressing the control and security issues in these "virtual research communities" (OSI, 2006b; 2006c), the chapter has turned its focus to issues associated with trust and team development in global virtual teams, as experienced in this work. It has concluded by linking a recent study of "technology facilitation" (Thomas, Bostrom & Gouge, 2007) to the core topic of *technology-use mediation* in this study.

Chapter 9: Evaluation

9.1 Introduction

This chapter takes a critical overview of the thesis, in an attempt to assess its strengths and weaknesses, and identify gaps and limitations. Specific evaluation frameworks are applied in order to structure that assessment, and enable readers to draw their own conclusions. This chapter should be read in combination with chapter 10 below, to gain an overall perspective on the quality and rigour of the research conducted within this study. Where this chapter focuses mostly on the conduct of the research, chapter 10 concentrates more on its outcomes.

9.2 Limitations

As might be expected in a study of this size and nature, several limitations have been identified. Some of these arose as an inherent result of the study being conducted towards the award of a doctoral qualification, others related more to issues associated with the research design and its conduct.

9.2.1 Inconsistency of coding

The data reviewed in the study was voluminous and the process of coding data was time consuming, which presented challenges as discussed in chapter five above. I have a sense that the coding conducted for earlier episodes in the study was less consistent and produced a smaller set of codes. These were smaller episodes however selected for that very reason. My sense also is that the coding process improved over time. But it may be that the sheer volume of data (e.g. for the 'establishment' episode) precluded consistent micro level coding. Yet the notes recorded below as the analysis proceeded, indicates that there was some inherent check on coding accuracy provided through the analysis process. As the first note recorded below indicates, and as discussed in chapter five above, a further check was provided through the "grounded theoretic" (Glaser & Strauss, 1967) research design with its "constant comparative" coding method and the limits imposed through reaching "theoretical saturation". This innately demanded some level of backtracking and recoding as the analysis proceeded, to resolve inconsistencies. Specific notes I made to myself as inconsistencies in coding became apparent are given below:

> [Noted 8/11/2007 (Notebook) miscoding for 8 appropriation moves establishment full relate combination e corrective recoded as relate combination e bid corrective since mostly intentions or proposal rather than actions. So analysis process provided a check. Overall "theoretical saturation" (Glaser & Strauss, 1967) a further remedy].
>
> [06/02/2008 writing up episode five noted missing role "*developer*", missing technology *AIT* (coded within metastructure), missing *location* (in a 47 word source), GVT progress checking not coded "*appropriation direct*" (tho. arguable), summary only of GVT progress checking in Nvivo source, meant had to go to original diary note to find notes re AUT icebreaker evaluations predominant.]
> [17/02/2008 writing up episode 6 noted missing code *absence* under category *space*, and new code *future* under category *time*]
>
> [30/03/2008 writing up episode 8 noted missing code "*constraint c.diagnosis"* for interchange with Arnold over AUTonline overnight outages, also missing code "*episodic change"* for same diary note?]
>
> [07/04/2008 writing up episode 8 noted "graduate student' code for two excerpts – not valid, so removed. Also noted LT not coded for one excerpt so added]
>
> [08/04/2008 writing up episode 8 noted "time' code a bit weak and meaningless – too general
>
> [1/05/2008 writing up episodic intra group comparison, noted the concept *control* with a code of "freedom" and also "freedom" as a separate concept]

As indicated in 9.2 above there are some inherent limitations in conducting doctoral studies. In this study I did not have the benefit of a team of research assistants or colleagues to assist in coding and analysing the data. Thus as an individual I provided my own cross checks on the data and coding consistency. Addressing such situations in their recommendations for researchers conducting meta-analytic studies Rosenthal and DiMatteo (2001) have advised that:

> "Rater's reliabilities should be reported using Spearman-Brown 'upped' (the reliability of a set of K raters) as well as Spearman-Brown 'downed' (the reliability of a single rater)"

In this study then the 'reliability' (should we adopt that model of reliability) can be stated formally as Spearman-Brown "downed". As an aside, Poole (1983) has suggested for multiple rater reliability assessments that an interrater reliability figure of .80 is a "normally acceptable level".

However as observed in chapter 5.6 above, Lacity & Janson (1994) have contrasted the *positivist* models of text analysis, with the *linguistic* and the *interpretivist*, and drew the following distinctions:

> "Positivist text approaches assume that understanding comes about by identifying nonrandom variations in a text…Linguistic approaches assume understanding comes from studying the type and structure of utterances…Interpretivist methods assume understanding comes from intrusive methods in which researchers try to understand how culture and experience influence text interpretations" (Lacity & Janson, 1994).

Interrater reliability calculations are of particular importance for rigour in studies which use "positivist text approaches". In this study the combination of 'interpretivist'

and 'grounded theoretic' approaches offsets the lack of cross validation of the coding, to some extent. In chapter five I have argued that the volume of data analysed has supported achieving "theoretical saturation" (Glaser & Strauss, 1967), and the combination of inductive and deductive forms of analysis within a broader structurational framework has served as a hybrid data and theory driven methodology, which provided a "self triangulating set of techniques to support robust and valid forms of analysis". Given the broad range and exploratory nature of the study I would also judge that any variability in coding was of less importance than it might have been in a more tightly framed study, such as that of Clear, Whalley, Lister et al., (2008), in which the more specific SOLO taxonomy was applied as a coding scheme to assess the performance of introductory programmers, and statistical assessments of interrater reliability were conducted to assess the validity of the instruments.

Notwithstanding those arguments, a further phase of analysis with multiple coders which developed a consensus on the emerging codes could strengthen this work. Applying the procedures suggested in Van de Ven & Poole (1990, p. 319), of distinguishing between "an incident (a raw datum) and an event (a theoretical construct)", and assessing their reliability and validity while proceeding with the coding and analysis process, could perhaps be one approach. But I would see the main benefit of such analysis with multiple coders coming from a more prescribed study into a specific aspect of TUM (e.g. an in depth analysis of *metastructures* across a set of episodes).

As a final note on coding consistency, I had made the following observation in an earlier draft (cf. A17.7.2.3 below) when comparing the grounded data coded '*metastructures'* across the grouped *episodic change* episodes:

> "The 'metastructures coded within the body of the original episode, were not drawn out very explicitly in the text. As the first episode of the eight coded, this may have been a result of the analysis process, as much as the limited scope afforded by the single data source for the episode. I have a sense that I got better as I progressed and analytical episodes were more tightly covered towards the end".

So it is likely that an experience effect was in operation, not only in the coding process, but perhaps also in the more consistent emergence of codes from the data, as 'theoretical saturation' was approached. This process of emergence encourages us not to rely too directly on the numerical values in the analysis within chapter seven, but on the trends, patterns, differences and insights of a more qualitative form.

9.2.2 Missing Electronic Data Items

I had made a few notes as the analysis progressed about "some electronic items missing from the corpus". As evident in appendices four and five below, the NVivo7 coded data represented a small subset of the overall sources of data collected during the study. Chapter five above also describes some of the further sources of data for the study. The notes below referred to additional data items referenced from the electronically coded (mostly email) source documents, as the need to augment the electronic sources arose in the course of the analysis:

> e.g. Diana's email to Julia Hallas (22/08/2004) and mine to Fred (23/10/2004), and some diary notes in East-Lite folder 24/06 & 2/07. [noted in adj-rein episode 2 21/02/2008]
>
> Sent messages not always in corpus (esp. if not copied to self) and Fred's email to me 4/11/2004 re his ability to apply for IRB approval for data from US groups to be made available as archival data?

For the data analysis of extended temporal brackets in each episode, as noted below, these data sources frequently augmented the NVivo7 electronic sources:

> Episode 7 extended data sources all outside corpus in NVivo – diary notes and Eastlite folder email sequences (28/09/2004 & 29/09/2004 Diary Notes & 30/09/2004 emails) [noted 24/03/2008]

As these extended brackets served an illustrative role in the analysis of each episode, (and their inclusion in some cases helped to flesh out the initial data for the episode), this absence from the main electronically coded corpus was not necessarily an issue, but did raise the risk of missing data when conducting such extended analyses. The multiple sources of data, the complementary data analysis methods employed, and the level of triangulation provided by the research design, in my view largely mitigated this risk.

9.2.3 Size of Episodes

The large size of the *establishment* episode presented significant challenges in its analysis. However it did constitute a logically consistent episode, as a phase delimited both by time and by TUM activity mode, and was in accord with the definition of an 'episode of interest' (cf. 3.3.5.8.1 above), and could thus be considered as a "datum", in the terminology of Van de Ven & Poole (1990, p.319). The summary in appendix seven and the week by week breakdown in appendix eight illustrate some strategies adopted to enable a full perspective on the episode to be achieved. However as noted in 5.5.2 above "combining micro and macro level analysis on the grounded data for the

episode proved challenging". Yet as the episode of chapter 6.4 above indicates, the analysis was nevertheless able to broadly follow the pattern laid down for each episode.

9.2.4 Scope and focus of undertaking

As Fred Niederman noted in an email to me the scope of the study has been non trivial, with Fred going so far as to say:

> I'd really emphasize that the extensions of AST are in fleshing out detail and looking at "microlevel" events. This is a most ambitious work. (FN 10/05/2008)

While I had a broad set of research goals, at an early stage I was wondering whether I had a clear enough focus to the work. As highlighted in 6.9.2 above I received feedback from the SIGCSE 2005 Doctoral consortium discussants on the issue of the scope and focus of the study. One discussant for instance asked pertinently:

> *"Not so much: what's your question as what's your focus. What exactly will you study? Will you focus on mediation? Tools, technology appropriation? Roles activities, group process? All these are too much for one PhD".*

Perhaps in hindsight I may have tried to cover too much ground in the thesis, but with the goal of understanding *technology-use mediation* it was these elements **in combination** which have enabled a broad and detailed picture to be drawn. Given my initial level of understanding of the phenomenon, and the exploratory and "explanatory" (Gregor, 2006, p.624) goals of the research I did not feel that I knew enough to be more tightly focused from the outset. Therefore while the findings are of necessity broad in scope, there are several areas of much deeper focus (e.g. appropriation, metastructure analysis, roles, technology features and use) which open avenues for further exploration by others, in much greater depth and with a narrower scope.

Thus it appeared to me that maybe I had simply needed to take this more 'broad brush approach' initially to understand where to focus attention next? In my draft notes for this chapter I had posed to myself the question, "is this inherent in an exploratory rather than confirmatory mode of research?" I had made similar points to Fred during the collaboration itself, when I shared the action research design for the collaboration with him attached to an email message. This design framework is incorporated in the thesis in appendix 9 below. As my email to Fred indicated:

> Re research design I guess it would be fair to say that the model is largely exploratory rather than confirmatory at this stage, and the goals of an exercise like this are multifaceted. (TC 29/07/2004)

I actually discussed this question with my supervisor, and we concluded that the broad and ambitious scope of the work was not necessarily an issue, and perhaps reflected my

own ambitions as an active researcher in the area over some time, as opposed to a younger candidate with a stronger need for a very tightly focused study. Furthermore we concluded that this was inherent in both the topic and the 'how and why' treatment of it, which necessitated a strategy encompassing both breadth and depth.

9.3 Evaluating the Quality of Action Research

As a study situated in the context of an action research programme, a methodologically relevant framework is required to support any quality evaluation. One concrete framework has been proposed by McKay & Marshall (2000) for evaluating the quality of action research in the Information Systems field. While the criteria in the framework are quite explicit, as outlined in table 9.1 below, they caution against its mechanistic use for "scoring" action research projects, since for some projects many of the criteria may not be applicable. They suggest that the greater the proportion of ratings to the right hand side of the Likert scales, the higher the quality of the work. They have recommended use of the framework in assessing research work:

> "examiners of masters and Doctoral theses may find this framework helpful in considering the quality of the submitted work. The obvious implication is that the framework could be used explicitly in the thesis by the student to demonstrate beyond doubt the quality of their work" (McKay & Marshall, 2000).

I have adopted those recommendations here to assess the quality of this study using their framework. This practice was applied previously in my M. Phil thesis (Clear, 2000), and as in that instance the "consumer" of this evaluation is also myself.

> "the evaluation is motivated by Melrose's recommendation that "Self-reflection on the student's learning and progress as an action researcher and/or practitioner is an important part of the thesis" (Melrose, [2001]). This self-assessment is effectively another AR stage of "specifying learning" (Susman & Evered, 1978). In this case learning about how well I have conducted the research, the extent to which my somewhat intuitive approach to action research bears scrutiny, the dimensions to cover and the omissions or inadequacies that need to be considered for future projects" (Clear, 2000, p.268).

Accordingly a set of reflections follows, tabulated in tables 9.1a - 9.1c below which present the results of this self-assessment.

CONDUCT OF RESEARCH		
Research Method	*Rating*	*Reference*
Is adequate and appropriate justification made for the use of action research as opposed to other research methods suitable for IS?	□ □ □ □ □ Limited Outstanding	Ch. 4.2 ff
Transparency of Process		
Are research aims / objectives clearly stated	□ □ □ □ □ Limited Outstanding	Ch. 1.2 - 1.3, App. 9
Are the history and context of the research described and explained in sufficient detail for consumers of the research	□ □ □ □ □ Limited Outstanding	Ch. 1.1, 6, App.9, App. 18
Are issues relating to the researcher (R) and practitioner (P) relationship made clear ? - Roles, responsibilities, expectations of P,R - Background of R - Scope of enquiry - Clear understanding by P of R's interest and intentions - Degree of involvement by P	□ □ □ □ □ Limited Outstanding	Ch. 1.1.2, 4, 6, App. 1, 2, 3, 9
Are approaches and techniques (and the rationale for their selection) for data collection and analysis stated clearly?	□ □ □ □ □ Limited Outstanding	Ch. 4, 5, App. 19
Credibility of the Research		
Is there evidence of an explicit theoretical framework, derived from a review of the relevant literature, guiding the action research intervention?	□ □ □ □ □ Limited Outstanding	Ch. 3, 3.5.7, 8.5.1, App.9
Have attempts been made to evaluate and explain the success or failure of actions taken to ameliorate the perceived problems in terms of the theoretical framework?	□ □ □ □ □ Limited Outstanding	Ch. 3, 8
Does it appear that there is a match between the constructions of P's and those reported by R?	□ □ □ □ □ Limited Outstanding	Ch 6, 7
Is there evidence of verification by P?	□ □ □ □ □ Limited Outstanding	Ch. 6, 7
Would it appear that R has presented a fair and faithful description of events?	□ □ □ □ □ Limited Outstanding	Ch. 6, 7, App. 9
Is there an explicit concern with the generation of theory which emerges from the theoretical framework tempered by the experiences of the intervention?	□ □ □ □ □ Limited Outstanding	Ch. 3, 4, 8, App. 9
Transferability of the Research		
Are descriptions of setting, process and outcomes sufficiently rich to aid the judgements and decisions of other researchers regarding the transferability of the research to other contexts?	□ □ □ □ □ Limited Outstanding	Ch. 3, 4, 5, 6, 7, 8, App. 9, 19
Could it reasonably be concluded that the research findings and outcomes could inform other organisational settings?	□ □ □ □ □ Limited Outstanding	Ch. 3, 4, 5, 6, 7, 8,
Are opportunities for various forms of triangulation exploited, thus providing greater confidence in the transferability of the outcomes?	□ □ □ □ □ Limited Outstanding	Ch. 4, 5, 6, 7, 8

Table 9.1a: A Framework to Enhance Quality and Rigour in Action Research - Part 1
(from McKay & Marshall, 2000)

CONDUCT OF RESEARCH (Cont'd)		
Dependability of the Research	*Rating*	*Reference*
Is the research process auditable?	□ □ ■ □ □ Limited Outstanding	Ch. 4, 5, 6, 7, App. 18, 19
Is the research process open to scrutiny?	□ □ □ ■ □ Limited Outstanding	Ch. 4, 5, 6, 7, App. 19
Are the bases for decision making and assertions/claims explicit?	□ □ □ ■ □ Limited Outstanding	Ch. 3, 4, 5, 6, 7, 8
Confirmability of the research		
Is there evidence of an orderly process of data collection and analysis?	□ □ □ ■ □ Limited Outstanding	Ch. 4, 5, 6, 7, App. 19
Are assertions / conclusions made about data logical and coherent?	□ □ □ ■ □ Limited Outstanding	Ch. 4, 5, 6, 7, 8
Are findings and conclusions grounded in the data?	□ □ □ ■ □ Limited Outstanding	Ch. 4, 5, 6, 7, 8
Are data analysis and research findings confirmable (or have they been confirmed) by an outside expert?	□ ■ □ □ □ Limited Outstanding	Ch. 6
Impact on participants		
Does a shared understanding amongst participants or other organisational benefits eventuate as a result of the action research intervention?	□ □ ■ □ □ Limited Outstanding	Ch. 1, 6
Research Skill		
Is there evidence of adequate skill to manage the action research intervention on the part of R, especially in terms of his/her ability to collect and explore data?	□ □ □ ■ □ Limited Outstanding	Ch. 3, 4, 5, 6, 7, App. 9, 18, 19

Table 9.1b: A Framework to Enhance Quality and Rigour in Action Research - Part 1 cont'd
(from McKay & Marshall, 2000)

CONCEPTUAL SIGNIFICANCE		
	Rating	*Reference*
Has the significance of the research topic to the IS profession been articulated and justified?	□ □ □ ■ □ Limited Outstanding	Ch. 1, 2, 3, 8
Has significant literature in the area of interest been accessed, supporting the selection of an appropriate theoretical framework to guide the research?	□ □ □ ■ □ Limited Outstanding	Ch. 2, 3, 4, 8
Is it obvious that new knowledge / theory has been developed or emerged as a result of the action research intervention?	□ □ □ ■ □ Limited Outstanding	Ch. 1, 3, 8
Does this action research study lead to questions or issues for future research?	□ □ □ □ ■ Limited Outstanding	Ch. 1, 8, 9, 10
PRACTICAL SIGNIFICANCE		
Would P's agree that some improvement in the problem situation had occurred as a result of the intervention?	□ □ □ ■ □ Limited Outstanding	Ch. 6, 7, 8
Could this research potentially make a helpful contribution to the work of practitioners in the field of IS?	□ □ □ ■ □ Limited Outstanding	Ch. 1, 3, 6, 7, 8
Does the research help alleviate problems that are evident in the IS discipline?	□ □ □ ■ □ Limited Outstanding	Ch. 1, 3, 6, 7, 8
PRESENTATION OF RESEARCH		
Is the action research presented in such a way that there is evidence of logical rigour throughout the study? Are the links evident between a problem in the IS field, the literature review, theoretical framework, research method and design, and results/outcomes?	□ □ □ ■ □ Limited Outstanding	Ch. 2,4,5,6,7,8
Has the consumer of the research been identified? Is the action research presented in an appropriate form and style to suit the consumer's objectives?	□ □ □ ■ □ Limited Outstanding	Ch. 1, 3, 6, 7, 8
Has publication of the action research (within confidentiality constraints) in an appropriate avenue been sought? Have adequate attempts been made to communicate findings to practitioners and other Rs?	□ □ ■ □ □ Limited Outstanding	Ch. 2, 6, 7, App. 18
Is the manuscript (thesis, research paper, report etc.) of a professional style and standard?	□ □ □ ■ □ Limited Outstanding	Ch. 1 - 10

Table 9.1c: A Framework to Enhance Quality and Rigour in Action Research - Part 2
(from McKay & Marshall, 2000)

The high proportion of the above ratings to the right hand side of the likert scales rates the conduct of this study as broadly consistent with McKay & Marshall's guidelines for quality and rigour in action research (AR) projects. Therefore the initial assessment of the work appears positive, assuming my self-assessment stands scrutiny. It should be noted that the McKay and Marshall (2000) framework above, better addresses research conducted within the "practical AR" and "technical AR" paradigms than within the

paradigm of "emancipatory AR" (Carr & Kemmis, 1983, cf. 4.2 above; Melrose, 2001). But given the largely "practical AR" focus of this study, the evaluation instrument remains appropriate.

The ratings for a few of the criteria above warrant some additional comment. Under "*credibility* of the research" the questions about practitioner and researcher's constructions and verification by practitioners, have been rated medium, since some of the research constructions developed in this study are relatively theoretical in nature and still have to be applied in the field. Similarly there has been some verification by the coordinators as 'practitioners' on selected points, as I have shared excerpts of the thesis as a work in progress [e.g. student culture with Diana (section A20-6.9.4); ethical review processes in Sweden with Arnold (section 8.6); and the more general feedback provided below (*in a letter of recommendation for my application for promotion*) from Fred].

> My experience in academia suggests that the management of a project of this type at one campus is stressful enough, but extended over three continents, it was certainly a major undertaking. …the project was a great success on several fronts. My students were presented with an opportunity to interact at a deeper than superficial level with fellow students in other lands; they were able to experience the problems and some of the solutions to those problems in the context of multi-national collaboration teams; and they were exposed to some technologies for collaboration they would not otherwise have encountered. Although student task performance was not always superior in quality, the learning opportunity was significant and unique. I would be eager to return to this sort of activity for my next teaching of this course in the fall. (FN 10/05/2008)

Such feedback has provided some level of triangulation on selected aspects of the work. The second level TUM actors have not been polled on the findings at this point, again due in part to the more theoretical nature of the findings and in part due to time pressures.

Concerning "*transparency*"of the research, the lesser degree of involvement of the TUM parties to the project outside the directly engaged coordinators is perhaps questionable in an action research context, yet they have certainly been actively (and indispensably) engaged in the project in their practitioner roles. However in the process of seeking consent for their contribution of email data to the project I have had 100% support, and they have been informed of the goals of the work. Their voices have spoken in this study through their email messages. I expect to circulate the full thesis to the wider set of participants once completed, and look forward to their more reflective feedback at that stage.

The level of "involvement" of the parties in the research (also criticized in chapter 4.2 above) can be more specifically categorized using the "daisy model" from Melrose & Reid (2000), which maps the core and peripheral participants within an action research study. As educational action researchers Melrose & Reid (2000) have advocated a

model of AR which required a level of involvement that made the "research inclusive and emancipatory".

> "Action research comprises a series of cycles of collegial research activity, with each cycle including planning, action, observation, reflection on and in action, and the generation of grounded theory about an area of common practice" (ibid., p.153).

As noted previously, the "practical action" research model used in this study did not impose such stringent demands, but practitioner involvement was nonetheless required. Figure 9.1 below demonstrates an "ideal daisy model" for an action research project which supports differing levels of involvement in the project. Melrose & Reid (2000) have advised that the model:

> "depicts a central core group of researchers, each of whom sets up and leads a petal or mini-project group, and uses the core group for feedback and critique of progress. Petal groups focus on closely related areas of educational practice. Petals can grow or wither at different times without the cessation of the entire project. An experienced action researcher acts as facilitator for the core group… any petal group may be used merely to enact a plan or collect more data between core group meetings. At any point in time the Daisy diagram may vary" (pp.151-153.

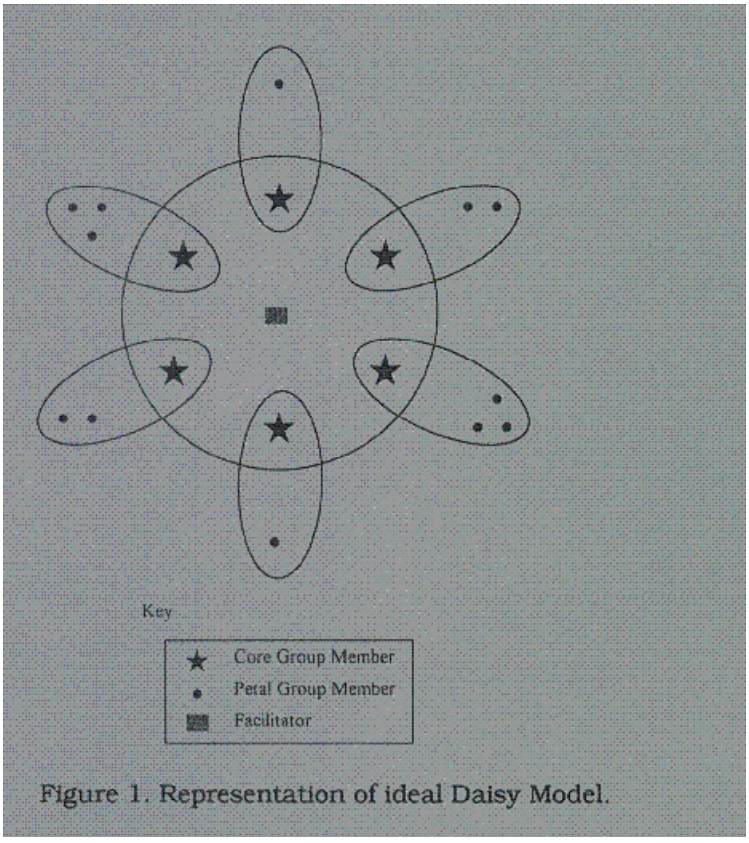


Figure 9.1: Representation of Ideal Daisy Model for Action Research
(from Melrose & Reid, 2000 p. 152)

I acted as the "facilitator" of this group jointly with Diana. Together with Kitty, Fred, Arnold and Mats, we formed what might be considered the "core group", each responsible for the petal at our own sites, while "petal group members" could be

conceived as supporting groups such as Flexible Learning Services, system administrators and other supporting roles at each site. The varying roles of the participants clouded this picture as core group and petal members performed combinations of researcher and practitioner roles (e.g. educator, developer, on-site coordinator, system administrator etc.). In some cases these roles were solely as 'practitioners' during the collaboration (e.g. system administrator. learning support), but later as 'participants in the research' through the sharing of email data after the collaboration. In summary, it appears that a viable model of involvement within a "practical action research" paradigm has been employed in the study.

As Diana Kassabova helpfully suggested (personal communication 13/06/2008) some external confirmation of "*research skill* - especially in terms of…ability to collect and explore data" - has been provided through the work of Art Hammon (2007), who based his Doctor of Management thesis on researcher supplied data from the earlier semester 2/2002 AUT – Uppsala collaboration. In that study Art has illustrated re-use of the data gathered within this action research programme and applied to a different study context and using a different (positivist) research paradigm. The data has withstood scrutiny in that context, suggesting that rigorous practices of data collection have been inbuilt into this work.

The *"confirmability"* of this research "by an outside expert" has been rated as relatively '*limited'*, in part due to the individual nature of Doctoral study. I have of course discussed the work with academic colleagues (both participants in the project and external to the research e.g. cf. section 8.5); with my partner Associate Professor Alison Young; at the SIGCSE doctoral symposium in 2005 (Clear, 2005); and with the late Professor John Hughes and Professor Stephen MacDonell my supervisors. I had also presented a seminar at the 2006 School of Computer & Information Sciences Postgraduate conference at AUT University and received input there from external academics (Clear, 2006). More recently the focus has simply been on analysis, synthesis and writing the thesis itself. Yet two highly positive sets of feedback on the analysis components of the research have been provided. The first in an associated email and the second in the same letter of recommendation cited above, by my colleague Professor Fred Niederman (also a recognised 'expert' in the area of GSS, virtual teams and global information management):

> I looked over a few selected chapters. I am flattered that you've referenced a couple of our works. Glad they are helpful. Everything I've seen looks fine. It looks like a good piece of research. I'd really emphasize that the extensions of AST are in fleshing out detail and looking at "microlevel" events. (email communication 10/05/2008)

> Having seen some of Tony's research work in the area, I am confident that he will be examining the multinational virtual classroom experience at a finer level of granularity than I know of anyone doing. I also believe he will successfully extend the Adaptive Structuration model of Poole and DeSanctis (based on Giddens' formulations) in a meaningful way with both theoretical and pragmatic implications. Eventually with polishing and response to reviewer feedback, I think this work can be well published and make a substantial contribution to the literature in this domain. (FN 10/05/2008)

The final point concerns "*impact on the participants*" where I have rated the work as moderate, since it should provide organisational benefits in terms of improved collaborative capabilities, but direct impact of the work on the participants has yet to be assessed. Generally improved capabilities in TUM and collaboration through experience of the exercise no doubt would have been gained, but that may have arisen as much from the practice element of this Action Research programme, as from the findings of this research. Future action cycles should provide the proving ground for the efficacy in the field of any of the frameworks developed here.

Even the above few exceptions which have been assigned "moderate" to "limited" ratings in this evaluation can be readily explained in the context of the study. Therefore the study generally receives a positive evaluation against the McKay & Marshall (2000) criteria for the rigorous conduct of high quality action research.

Extending this review to incorporate the more critical action research model of Melrose, the above *credibility* and *confirmability* criteria also reflect her requirements for rigour in action research:

> "it would be difficult to imagine an account of AR research written by one person who had not checked their interpretations, theories and tentative conclusions with others before, during and after the research process" (Melrose, 2001, p.170).

While, as noted above, the process of doctoral study may impose some constraints on this sharing of ideas, I have had some success in getting feedback from colleagues and intend to continue the process.

A further criterion for evaluating AR has been proposed by Melrose (2001, p.176) namely "pragmatic workability" where "theory is useful only if it guides praxis well". For instance:

> "Scandinavian action researchers in the field of organizational development..reject the preeminence of theory generation in research in favor of pragmatic outcomes as the main criterion for rigorous AR. It is more important for an AR project to trigger a process of change and improvement in the real world than to produce a singular theory, which fights for attention among existing theories in academia" Melrose (2001, p.176).

While I hope that the work reported here does not simply generate yet another theory to "fight for attention", the findings are of necessity (and unapologetically) theoretical. Yet theoretical developments within this study have simultaneously been coupled with

practical capability development in the broader AR programme. The action of the practitioners in this context has demonstrated improvements in the practical situation, for instance section 6.9.6 above has chronicled a significant improvement in the success of both the semester one and semester two/2005 collaborations. I do also see the diagnostic capabilities of the "collaborative technology fit (CTF)" theory being highly applicable to the improvement of global virtual collaborative practice. But I must acknowledge that this has yet to be demonstrated.

A further means of assessing the *practical significance* of the work, in the sense of triggering "a process of change and improvement in the real world" (Melrose, 2001), has been suggested by Bain (1999) in his "integrated evaluation framework" for innovations in higher education. That framework has addressed four phases of educational innovation ("analysis & design; development; implementation and institutionalization"). The latter phase can be argued as the true indicator of impact:

> "One article highlights the importance of evaluating the impact of an innovation beyond the immediate context of its implementation (McNaught *et al.).* Although early evaluations of the multimedia innovation in veterinary bacteriology indicated that complex reasoning and problem-solving capabilities were being achieved, inquiries made about the same cohort of students in later years of the course indicated that the benefits were short-lived and/or did not transfer. This finding offers a salutary caution to all educational innovators and underscores the need to view innovation within the institutional contexts in which it will thrive or die" (Bain, 1999, p.167).

The "Institutionalisation" phase of the framework is excerpted below in figure 9.2.

4. Institutionalisation	4.1 Impact evaluation	To determine the robustness of the learning and its transfer beyond the immediate context of the innovation.	Evidence of beneficial effects on: understanding and learning in related/subsequent areas of the curriculum; indirect indicators (e.g., progress and retention rates); development of generic capabilities; transfer to the workplace.
	4.2 Maintenance evaluation	To determine the sustainability of the innovation in the context of the whole course.	Peer and expert review of the educational benefits of the innovation considered in relation to its maintenance and opportunity costs, and in relation to the educational and funding policies of the institution.

Figure 9.2: Integrated Evaluation Framework for an Educational Innovation – Institutionalisation Phase (from Bain, 1999 p. 168)

This study has not conducted such an exhaustive evaluation of the educational innovation reviewed in this study, but as indicated in Clear & Kassabova (2008), this has been a collaboration of long-standing and has been solidly embedded in the curriculum of the participating Auckland, Swedish and (more recently) US courses. The indication above from Fred (within this section), of his willingness to continue the

collaboration this year provides positive evidence of a level of institutionalization at the St Louis site.

But running counter to this is the evidence from my discussions with Mats at this year's SIGCSE conference in Portland Oregon (13/03/2008). We were proposing to move the collaboration from its present position within the first year *Information Technology* course at Uppsala to the fourth year *IT in Society* Course involving a local collaboration between the Academic Hospital at Uppsala, and an international collaboration with Rose Hulman Institute of Technology in Terre Haute Indiana. Reasons for this related to a change in course coordinator for the *Information Technology* course who desired a tighter and more predictable student experience – as opposed to:

> "the leaky, incomplete, unpredictable, and at times chaotic processes that are characteristic of global virtual team interaction" (Jarvenpaa et al., 2004, p.262).

This experience echoes my own experiences at the Auckland site which I had earlier expressed in my M. Phil thesis:

> "An area of resistance that I found especially surprising, came from some of my teaching colleagues. In the Intelligent Business Systems course internal trial (4.6 above and Clear 1998a), I had disagreed with a colleague teaching the course, over the students' collaborative exercise. Our views did not align in several areas. 1) The extent to which groupware was a legitimate part of the curriculum for the course, and how much course time should be allocated to that topic. 2) The rough state of the collaborative database and its ability to support student learning rather than simply introduce confusion. 3) The level of risk associated with this course innovation, and the timing of the assigned exercise. I interpreted these concerns in terms of the opposing discourses of innovation vs. stability/consistency, where I was eager to introduce an innovation, and my colleague was concerned to reduce risk" (Clear, 2000 p. 267).

The rise of consumerism in education (Varnham 2001, Clear 2002b) and the need to manage student expectations and avoid the potential for complaints is a further force towards risk reduction, and away from innovation in the academy. As discussed in 6.4.4.3 above these forces reflect the inherent contradictions in a modern university context:

> the tensions between the university as an espoused locus of innovation in the research sphere, and as an experienced context for constraint as an educational service provider within a consumer society.

In a more cynical vein I am tempted to argue that the consumer model of pandering to students as 'expert' consumers, and therefore avoiding the risk of upsetting or challenging their consumerist sensibilities, driven by dubious models of regular course evaluations, undermines the whole notion of a university as a community of elders with wisdom to contribute and the responsibility to set an innovative agenda for learning.

At the Auckland end there is now instability too. I had discussed plans for this year's

collaboration briefly with Diana (12/05/2008) and several issues had arisen. Diana had concerns about radical change given the tightness of the present Intelligent Business Systems course, since our teaching semester has now been shortened from thirteen to twelve weeks. She also had concerns about student willingness to actively contribute (as the Business student workload expectations seem to be continually dropping) and their ability to cope with the complexities of a three-way collaboration. I also intend to be in Uppsala while on sabbatical this year during the collaboration, which will enable me to view things at first hand. This of course meant that I would not be on site to facilitate the collaboration from Auckland, and Diana would also have to pick up the postgraduate collaborative computing course, which we normally share.

As I wrote this section initially I had just sent an email to Mats, an excerpt from which is given below:

> Fred is keen to participate in another collaboration this year, but Diana has been a little unsure, given our present situation within the school, where about 12 people will be made redundant next month, and her status was unclear...Hopefully we can pin this down a bit more shortly. We could use another course with Fred separately if we can't make something work. (TC 14/06/2008)

While still sanguine about a positive continuation of the collaboration, as the observations above indicate, it will take some active TUM activity in the "broker" role (Roy et al., 2006) in order for us to achieve success. These points serve to illustrate the inherent fragility of global virtual collaborations, particularly the reliance on individual champions, and the challenges in sustaining them at the global level while enabling them to thrive within their local institutions. Since writing the first draft of this chapter our redundancy situation has now become clear and Diana has chosen to leave the University. This means a total rethink of plans, with the likelihood of cancellation for this year's collaboration. This "near death potential" graphically reinforces Bain's observations about educational innovation:

> "the need to view innovation within the institutional contexts in which it will thrive or die" (Bain, 1999, p.170).

9.4 Evaluating Interpretive Field Studies

As noted earlier in 9.3 above, the criteria of McKay & Marshall fail to address the more critical or "emancipatory" (Carr & Kemmis, 1983 p.136) modes of action research. While not the primary paradigm in this study, some elements of critical action research have nonetheless been employed (e.g. the review of ethical approval processes in section 8.6 above). In addition to the perspectives on action research provided by Melrose above, I have sought a more interpretive framework for evaluating field

research of this nature, to augment this evaluation of the action research elements of the study. The *seven principles for evaluating interpretive field studies* delineated by Klein and Myers (1999), provide further elements for consideration which address the critical dimension. These seven principles and how they have been realized in this work are tabulated below.

Evaluating Interpretive Field Studies		
Principle	**This Thesis**	**Reference**
1. The Fundamental Principle Of The Hermeneutic Circle	Integral to the multi level episodic analysis within the thesis. The four elements of structurational analysis oscillate between micro level data and macro level context. Analysis proceeds from appropriation moves to duality of technology. The multiple levels of culture explored in chapters 6 and 8 move consciously from the individual to the global level	Chapters 4.5.1, 6 & 8.5 - 8.6
2. The Principle Of Contextualization	The situated nature of the research, historicity of the research programme and key role of context acknowledged and explored. Each episode set in context through the structurational analysis, and temporal bracketing processes highlight key events and meetings	Chapters 1, 6, 7 Appendices 9, 18
3. The Principle Of Interaction Between The Researcher And The Subjects	Researcher role, and motivation for the research outlined. Processes for participation and research design explicit. Episodic analysis makes explicit researcher and "subjects" interactions through dialogues and reflections	Chapters 1, 6 & 7, Appendices 1 -3, 9, 18
4. The Principle Of Abstraction And Generalization	The thesis has applied a number of different frameworks and theories to support the analysis, draw conclusions and suggest areas for further work. The TUMAST (Technology-use mediated AST) and CTF (collaborative technology fit) frameworks directly result from this study	Chapters 3, 4, 6, 8
5. The Principle Of Dialogical Reasoning	Particular pre- and misconceptions conceptual and methodological have been explored with illustrations of how they have been instrumental in directing the work. The evolution from EAST to TUMAST downplaying broad analysis of activities, and to CTF with multilayered models of culture provide some relevant examples	Chapters 3, 4, 5, 6, 8
6. The Principle Of Multiple Interpretations	The thesis draws together diverse forms of data, and differing voices of the actors. The distinctions between these views are consciously addressed through multi dimensional forms of analysis which triangulate across perspectives	Chapters 6, 7
7. The Principle Of Suspicion	The principle of suspicion came periodically to the fore in the work. The review of constraints imposed by the context, institutional and global forces e.g. institutional security regimes and ethical approval processes frequently demanded a broader critique.	Chapters 6 (e.g. 6.4.4.4), 8.6

Table 9.2: Assessment of the study – Applying the seven principles for evaluating interpretive field studies from Klein & Myers, (1999, p.72)

9.5 Evaluating 'Case Study' Research

Alavi & Carlsson have proposed the definitions below for case study research:

> "4. Case Study:
> a. Single Case: examines a single organization, group, or system in detail; involves no variable manipulation, experimental design or controls; is exploratory in nature.
> b. Multiple Case Studies: as for single case studies, but carried out in a small number of organizations or contexts". (Alavi & Carlsson, 1992, p.61)

Gallupe & Tan (1999) have included action research within their "case study" category for Global Information Management research,

> "We have slightly modified this classification scheme by including action research and other qualitative research strategies in the "case study" category" (Gallupe & Tan, 1999, p.11).

The above classification appears to be more of a 'catch-all' categorization, than a rigorously defined distinction. I would draw a much stronger distinction between action research and case study research. Therefore the extent to which this research could be truly termed a "case study" is questionable.

For instance the definition of a "case" in this context is challenging. The action cycle of the 2004 collaboration could be considered to be a single case. But then the analyses conducted within the various episodes extended beyond that single cycle, suggesting multiple case studies. Were we to assign each "episode of interest" within this study to the category of a "case", then we would have eight cases. The further TUM activity modes (*establishment, adjustment/reinforcement* and *episodic change*) could be viewed as natural forms of cross-case grouping.

The study has examined an "organization, group or system in detail"; "involved no variable manipulation" – unless the variations between action cycles were considered as such; had a "quasi –experimental design"; but without "controls"; and was "exploratory in nature". It has involved "multiple" organizations; and could be said to have been "carried out in a small number of organizations or contexts". It could be maintained therefore that this research shared some elements of both these "single case" and "multiple case" definitions.

Notwithstanding some of the above reservations, were the research to be framed as a "case study", it could productively be reviewed against Eisenhardt's (1989, p.534) "process of building theory from case study research". The tabulation presented in table 9.3 below, compares this study against Eisenhardt's theory building process, as a further means of depicting the conduct of the research.

Process of building theory from case study research		
Step	**Activity**	**Realisation in This Study**
Getting Started	Definition of Research Question	Research Goals Chapter 1, Appendix 9
Selecting Cases	Theoretical not random sampling	Episodes & Process of selection Chapter 5.2, 5.4
Crafting Instruments and Protocols	Multiple data collection methods Qualitative and quantitative data combined	Chapter 4, Appendix 5 Chapters 6, 7
Entering the Field	Overlap data collection and analysis including field notes Flexible and opportunistic data collection methods	Chapters 6, 7, Appendix 5, 16 Chapters 6, 7, Appendix 5
Analysing Data	Within case analysis Cross-case pattern search using divergent techniques	Assuming 'episode' as a 'case' Chapter 6 Episodes grouped by 'TUM activity mode' - intra group and inter- group comparisons, Chapter 7
Shaping Hypotheses	Replication not sampling logic across cases Search evidence for why behind relationships	Hypothesis formulation not applicable Chapters 6, 7, 8
Enfolding Literature	Comparison with conflicting literature Comparison with similar literature	Chapters 2, 3, 6, 7, 8 Chapters 2, 3, 6, 7, 8
Reaching Closure	Theoretical saturation when possible	Chapters 3, 4, 5, 6, 7, 8

Table 9.3: Assessment of the study against the "process of building theory from case research" (Adapted from Eisenhardt, 1989 p. 533)

Table 9.3 provides further confirmation of the general quality of the research, when reviewing the conduct of the study. While not arguing here that the research has formally adopted the "case study" method, this comparison against a usefully broad framework suggests some general compatibility of methods. Thus it reinforces the earlier conclusions about rigour and quality of research, when compared with the "interpretive field study principles" of table 9.2 above. Chapters four and five above, have discussed the 'grounded theoretic' analysis, and provide further validation of a comprehensive approach to data analysis, and the notions of 'theoretical sampling' and

'theoretical saturation', while building theory from grounded data. In summary, Table 9.3 above indicates a degree of rigour consistent with good case study research has been applied in the overall process of building theory in this study.

9.6 AutoEthnographic Dimensions

To move from the case to the actors within it, my own role in this project has been significant. In this interpretive field study much of the data has originated from my own contributions, interactions, personally produced artefacts and reflections. The methodology chapter 4.5 above includes brief reflections upon the autoethnographic dimensions of the work. Given my level of involvement, it is challenging to assess the quality and rigour of my own contributions, however in the spirit of constructive self critique it is appropriate now to assess the quality of that element of the research.

Ruhleder (2000) has reflected upon the nature of ethnographic observation when engaged in analysis of virtual work and the definition of an "interaction" in a virtual forum. She noted among the challenges that:

> "virtual forums defied our understanding of observation as grounded in a natural setting in which an observer directly sees the unfolding of human interaction with people and artifacts…What would count as an interaction was really just a reflection of human action…reactions of participants were not available to us…on the other hand, these interactions including posts, text and audio, were available online at a level of detail that no field notes could duplicate" (p.10).

But other interactions were not so readily captured:

> "Representing distributed data required us at a minimum to account for what the people on each side of the [video conferencing] link said and heard, saw and did…a number of things were not visible to us at all, including private whispers and phone calls to the technical staff" (pp.8-10).

She therefore concluded:

> "Work in hybrid settings – worlds that cross and integrate both physical and virtual – pushes us to explore different ways of studying and representing technologically embedded activity" (p.13).

As appendix four below indicates, a large variety and richness of data is present in this study, as are the same inherent omissions and lacunae. The dominant use of email data in the study has nonetheless allowed a rich view to be gained of the "unfolding of human interaction with people and artifacts". It may even have supported a more continuous and tidier analysis than had more extensive use been made of video conferencing and voice conferencing technologies such as Skype™. Nevertheless, complementing the email data, several course and technology related artifacts including

postings from the shared databases have grounded these views in the context. The supplementary use of field notes from my diaries, and personal reactions as shared in the email conversations, have helped build the richness of this picture, but necessarily slanted by my own perspectives on events. Chapters four and five have discussed the challenges of analyzing this diverse corpus of data, (e.g. 4.3.1 has discussed my practice of "*diarying* to record field notes throughout the research process" (Richardson, 2000 p. 941). Chapters six and seven above have analysed these notes as raw data fed into the study.

As noted in chapter 4.6 above aspects of this study have included an 'autoethnographic' dimension, "where the author is both informant and investigator" (Cunningham & Jones, 2005, p.2). Unlike classic ethnography the autoethnographic researcher is not:

> "immersed over an extended period of time in a culture, with which he/she is unfamiliar" (Schultze, 2000, p.7).

Schultze (2000) in her account of ethnography, evaluated her research study by using a set of criteria which included a "confessional" account of the research, an account which:

> "Highlights the ethnographer's experience of doing fieldwork by giving a self-reflexive and self-revealing account of the research process. It presents the ethnographer's role as a research instrument and exposes the ethnographer rendering his/her actions, failings, motivations and assumptions open to public scrutiny and critique" (p.8).

This set of evaluation criteria for "a high quality ethnography and confessional writing", include: 1) "authenticity (demonstrate that the ethnographic researcher was indeed immersed in the field)"; 2) "plausibility (present the findings as relevant to the common concerns of the audience"; 3) "criticality (move readers to re-examine their own taken-for granted assumptions)"; "self-revealing writing"; and "interlacing 'actual' and confessional content" (Schultze, 2000, p. 30).

Many of these criteria seemed fully applicable to this study, and provided a relevant structuring mechanism for assessing the quality of this aspect of the work, from a more detached position removed from my direct involvement. Therefore in tables 9.4a – 9.4c below I have adopted Schultze's criteria to support such a 'confessional' assessment of the quality of my own 'autoethnographic' contributions to this research.

Requirement	Evidence in Text
Authenticity	
Descriptions of:	
everyday life as lived by members of the field;	Episodes in chapter 6 provide realistic depictions of aspects of the contributors' lives, my own diary notes augment this material
vernacular of the field;	Educational, research, and technical vernacular is ubiquitous (cf. glossary, chapter 6 etc.)
what members think about their lives in the field;	Episodes in chapter 6 provide frequent reflections upon the contributors' lives in the field. Socio-emotional codes are prevalent in chapters 6 & 7. My own diary notes augment this material with personal reflections
who the ethnographer talked to and observed;	Actors and their roles are made explicit in the analysis of chapters 6, & 7
the nature of the researcher's relationship with various categories of people in the field;	Explicitly defined in chapter 1 and developed during analysis chapters 6 & 7
the response of others on the scene to the researcher's presence;	As a participant observer, I was not seen as an 'outsider' as a classic ethnographer might. Chapter 6 details quite explicit responses to my presence and contributions
researcher's preunderstandings of the studied scene;	The prior research programme gave a considerable base of preunderstandings cf. Appendix 18. Chapters 1, 6 and 8.7.1 reflect on prior events and relationships leading to the study
researcher s interest in the scene;	Motivation for the study is explicitly outlined in chapter 1.2, and appendix 9
researcher's length of stay; start and end dates of the research;	The episodic analyses clearly identify the time windows of the analysis, as do appendices 9 and 18, which set the work in context
• the relationship between the fieldnotes and the written up ethnography;	The field notes constitute raw data to the study, and are featured in most chapters, either as support for argument based on reflections or as data for analysis as in chapters 6, 7 & 8
presenting "raw data" like fieldnotes, documents, and transcribed interviews;	Extensive excerpts from the fieldnotes are presented throughout the study, esp. chapter 6
conducting post-hoc respondent validation.	As noted in 9.3 above I have discussed sections of the analysis with colleagues and shared some draft chapters describing their work. Further feedback will be sought once the thesis is collated and published.

Table 9.4a: Comparison of This Research Against the Evaluation Criteria for a "High Quality Ethnography and Confessional Writing" (from Schultze, 2000 pp. 32-34)

Plausibility	
adhering to academic article genre;	this manuscript adheres to the doctoral thesis genre in that it follows a fairly standard thesis structure, and formatting conventions;
• justifying the research and differentiating its contribution through the identification of gaps in our understanding or the development of a novel theoretical approach;	Chapter 1 has presented the justification for the work, and summarised the contributions arising from the study. Chapters 3 and 8 have presented the novel theoretical contributions of Technology-Use Mediated AST (TUMAST) and Collaborative Technology Fit (CTF).
normalizing atypical research conditions and aligning the findings with common, everyday experiences.	The grounded micro-analysis for each episode in chapter 6, serves to normalise the research in the everyday context of the actors. Chapters 2 and 8 situate the work in the increasingly common contexts of distributed teams and global virtual collaboration.
Criticality	
challenging readers to pause and think about a specific situation;	Several critiques have challenged readers to reflect (e.g. consumerism in education 6.4.4.3; institutional security regimes 6.4.4.3; multi-layered models of culture 6.4.4.1, 8.5.1; cultural bias in IRB processes 8.6)
provoking them to answer questions;	Instigated by above critiques, and by chapter 1 presenting my role and motivating the work; by chapter 3 presenting the TUMAST framework; and by chapter 8 presenting the CTF theory
cultural juxtaposition.	by positioning myself as an academic and comparing and contrasting my practices with those of my colleagues at each site; with students; with differing global, national and institutional cultures; and with the professional cultures of supporting parties, "I challenge other academics [and professionals] to think about their assumptions and work practices through juxtaposition" (Schultze, 2000).

Table 9.4b: Comparison of This Research Against the Evaluation Criteria for a "High Quality Ethnography and Confessional Writing" (from Schultze, 2000 pp. 32-34)

Self-revealing account	
use of personal pronouns;	"the use of "i" is pervasive in the descriptions of my own informing practices as well as in the excerpts from the fieldnotes; this consistently highlights my role as [participant-]narrator;" (Schultze, 2000)
age, gender, and race, epistemological assumptions and theoretical point of view;	I have presented myself in chapter 1.1 and appendices 9 & 18, as an academic engaged in a longer term study into global virtual teams. While not explicit about race and age, I have presented myself as mature. I have also been explicit about the interpretive epistemological assumptions and the structurational theoretical point of view in chapters 3 & 4
disclosing details that present an unflattering picture of researcher, e.g., mistakes made;	The data for each episode comes unfiltered, so my mistakes and confusions have not been censored other than by the episode selection criteria. For instance 6.7.6.1.3 identified our confusions about AUTOnline uptime, 6.2.4.4 showed my struggle to keep up with the collaborative activity, 6.4.4.4 highlighted vain attempts to coordinate synchronous communication events. I have also aimed at honesty in my reflections, for instance upon email naming standards deficiencies 5.1.2.2; with a critique upon developments of the TUMAST model chapter 3.3.5.5 & 3.3.5.6; by identifying limitations in section 9.2 above
rendering canonical the problematic and less-than optimal research conditions.	Not an issue in this context as it was for Schultze, but the trials and tribulations have been reflected upon by student and academic participants in the St Louis Panel (cf. A20-6.9.4.2)
Interlacing "actual" and confessional content	
interlacing self-reflexive and autobiographical material with "actual" ethnographic material;	"I avoided the trap of constructing a purely methodological and self-absorbed account of my trials and tribulations as an ethnographer;" (Schultze, 2000) It is hoped that the triangulation from other data sources and the involvement of multiple other actors supports this contention (cf. 9.3 - 9.5 above).
limiting autobiographical material to information that has relevance to the subject of the research.	"did not elaborate on my race and cultural background as these did not appear relevant" (Schultze, 2000). Although broader 'cultural' dimensions have been canvassed in the study (e.g. 6.4.4.1.1 ff).

Table 9.4c: Comparison of This Research Against the Evaluation Criteria for a "High Quality Ethnography and Confessional Writing" (from Schultze, 2000 pp. 32-34)

From the evidence supplied in tables 9.4a – 9.4c above, the "autoethnographic" aspects of the research have compared credibly against the criteria proposed by Schultze.

9.7 Chapter Summary

In this chapter I have reviewed the research in an attempt to judge its quality and the rigour of its conduct. A set of evaluation frameworks have been selected and applied. These are believed to be consistent with the largely interpretive epistemology complemented by the empirically grounded and structurationist theoretical foundations of the work.

Some design and methodological flaws have been acknowledged, but hopefully none such as to invalidate the work. The structurationist perspective and grounded theoretic methodology underpinning the work are argued to compensate for some of these noted deficiencies.

From an *action research* perspective, the evaluation framework of McKay & Marshall (2000) has been applied to assess the quality and rigour of the essentially 'practical' (Carr & Kemmis, 1983) model of action research. This model has been complemented by additional criteria from Melrose (2001), Melrose & Reid (2000) which address a more 'critical' action research model, and from Bain (1999) for evaluating educational innovations.

From an *interpretive field study* perspective, the work has been compared against the Klein & Myers (1999) framework for evaluating interpretive field studies.

As a *case study* analogue, the process model of Eisenhardt (1989) for building theory from case studies has been reviewed in assessing this work.

From an *autoethnographic* perspective the more general (but nonetheless personal) criteria for evaluating "High Quality Ethnography and Confessional Writing" from Schultze, (2000) have been applied.

The conclusions from the several reviews suggest that the work is compatible with most of the tenets of each of these evaluation frameworks, and they are therefore appropriate instruments for evaluating the research. The study has been demonstrated to satisfy most of the criteria within each of these perspectives, thus offering a degree of triangulation for the overall research quality evaluation. For such a multifaceted study, (unless I have made some gross oversight) this is an encouraging result, suggesting that the work should bear scrutiny as a soundly and rigorously conducted piece of research.

Chapter 10 to follow will complement this assessment of the research conduct, by reviewing the outcomes contributed by the research.

Chapter 10: Conclusion

This chapter concludes the thesis with a brief recap from the introductory chapter, where the motivation for the research, and the contributions made by this study have been outlined. As asserted previously, I believe the work has contributed to our knowledge of *'technology-use mediation in global virtual teams'* in each of the substantive, conceptual and methodological domains (McGrath, 1985, p.16), and lays a platform for further work in the area. The chapter then moves from discussing the contributions of the work, to the contexts within which the work may be applicable, and proposes a series of recommendations for practice and for further research. A brief summary and a set of concluding remarks complete the chapter.

10.1 Motivation

This work began with a few questions which arose from mixed and puzzling experiences gained over seven years of global virtual collaborations, involving colleagues and students from Auckland University of Technology in New Zealand, Uppsala University in Sweden and latterly St Louis University, Missouri.

> *Why is global virtual collaboration difficult? What roles and activities are critical? How can we do it better?*

10.1.1 Research Goals

These questions were subsequently tightened in focus and refined to address each of the 'substantive', 'conceptual' and 'methodological' domains of *technology-use mediation* within *global virtual teams*. This refinement resulted in the following three specific research goals for this study:

> This thesis aims to investigate the role of "technology-use mediation' in supporting the work of global virtual teams.
>
> This study aims to develop and apply a framework for researching technology-use mediation in global virtual teams.
>
> The aim is to gain deeper insight, in order to develop frameworks for the guidance of researchers investigating global virtual teams.

Behind these research goals, the more specific motivations driving this work can be considered under the three headings of 'substantive', 'conceptual' and 'methodological' motivations.

10.1.2 Substantive Motivations

From a 'big picture' perspective, *global virtual collaborations* hold considerable potential. Some *substantive* 'practice' goals set for the primary action research cycle reviewed in this study (cf. Appendix 9) were:

- Developing global collaborative capabilities in students
- Developing cross cultural understandings
- Demonstrating the challenges and complexities of working within GVT's

Of course *technology-use mediation* is but one component in supporting the work of Global Virtual Teams, but two related 'research' goals in the *substantive* domain for the cycle (again cf. appendix 9) were:

- To explore the roles and actions of technology-use mediators when using collaborative technologies in GVT's
- To explore the moderator's role, and the facilitation process using collaborative technologies

10.1.3 Conceptual Motivations

The rationale just outlined for better understanding *technology-use mediation* (TUM) as a substantive phenomenon, led to an interest in developing a conceptualisation through this study that would provide a more abstract model of the process. A further rationale came from the literature, with this recent quote being germane:

> "Technology facilitation has been an important, yet neglected topic for many years [Niederman et al., 1996] about which we know little. Still, its importance seems to have increased as work has become increasingly computer mediated" (Thomas, Bostrom & Gouge, 2007, p.85).

Providing robust and enduring conceptual frameworks then, to model an understanding of TUM as a substantive phenomenon, has been a strong motivating force for this thesis.

10.1.4 Methodological Motivations

Beise et al., (2003) reviewing the many challenges in researching Distributed Group Support Systems have rued the "complexity of this type of research, largely due to the interaction of so many organizational, technology and individual participant variables". Therefore a further key motivation for this study has been that any conceptual frameworks derived from the work, should be readily applicable to investigating the complex and multi-faceted phenomena associated with TUM in Global Virtual Teams. The study itself has aimed to provide exemplars of the application of *conceptual* and *methodological* frameworks, tools and techniques, which others could adopt (or adapt) to suit their own purposes in similar studies.

10.2 Contribution of the work

This section largely reiterates the claims made in the introductory chapter 1.4, again framed within the three separate domains of McGrath (1985) (substantive, conceptual and methodological). The contribution of this study to our knowledge of *technology-use mediation in global virtual teams* traverses all three domains. Accordingly the following summary of contributions resulting from the study is grouped by domain.

10.2.1 Contributions in the Substantive Domain

1) This study has profiled a longitudinal field study of professionals in action within a *Global Virtual Team* (GVT) context, representing a 'real' (non student) GVT of global tertiary educators in collaboration.
2) It has presented the first known, in depth, longitudinal study of *technology-use mediation* (TUM) in a professional GVT setting.
3) It has studied GVTs in a tertiary education context, highlighting the roles of those supporting parties engaged in TUM activities outside the teams, but pivotal to the success of the venture.
4) It has added to the very few field studies in the area of "technology facilitation during team interaction" (Thomas et al., 2007, p.85).
5) It has added to the few studies of long term virtual teams (Saunders & Ahuja, 2006)
6) The study has addressed a gap in the literature highlighted by (Saunders & Ahuja, 2006) namely:
    a. To our knowledge, there have been no studies of the interaction of processes and structures in ongoing distributed teams (p.670).

10.2.2 Contributions in the Conceptual Domain

7) This study has developed a novel theorisation of TUM by extending the "Adaptive Structuration Theory" (AST) of DeSanctis & Poole (1994), through the "Extended AST" (EAST) of Clear (1999a), to the subsequently derived theoretical framework of "Technology-use Mediated AST" (TUMAST).
8) The study has developed a new theorisation of the notion of 'Collaborative Technology Fit' and outlines the implications for research and practice
9) The study has presented an illumination of "culture" as a many faceted and multi-layered concept (individual – international) in a GVT context

10) The study is based primarily upon the "ensemble" view of the IT artifact, in which the technology is "an evolving system embedded in a complex and dynamic social context" (Orlikowski & Jacono, 2001, p.126) or a "web of computing" (Kling & Scacchi, 1982). This 'ensemble' view is combined with the view of "technology as structure" (DeSanctis & Poole, 1994) in which structures have been embedded as rules and resources by designers of the technology, which are then appropriated in different ways during use.
11) The study has augmented the notion of "metastructuring" outlined by Orlikowski et al., (1995, p.438), by introducing an analytic mechanism through the new concept of a 'metastructure'.

10.2.3 Contributions in the Methodological Domain

12) This study contributes to our methodological knowledge through using TUMAST as an analytical framework by which to conduct a multi-level and micro level analysis of TUM as a phenomenon.
13) The study has demonstrated the application of TUMAST as a research framework in a field study context, thereby proving its viability for the study of TUM
14) The study has adapted the appropriation move types and sub-types of DeSanctis & Poole (1994) to accommodate 'TUM activity' in addition to actions of 'direct use'.
15) The thesis exemplifies the application of "Action Research" (McKay & Marshall, 2001), "Grounded Theoretic" (Glaser & Strauss, 1967) and "Structurational" methods (Poole & DeSanctis, 2004) to a field study of TUM in GVTs
16) It provides an example of the very few studies conducting analysis of a corpus of email data from multiple contributors (cf. Leuski 2004, & Kanawattanachai & Yoo, 2007).
17) The study has addressed some practical issues in research analysis techniques with a corpus of email data

The section above has chronicled an impressive set of seventeen separate contributions deriving from this work. Yet while the thesis has traversed a large amount of ground in the quest for a better understanding of "*technology use mediation in global virtual teams*", I feel as though it has hardly broken the surface. It has succeeded, I believe, in

developing a "theory for explaining" (Gregor, 2006, p.624), and has provided a set of tools and techniques to support enquiry into this dynamic and complex research domain. Yet there remain considerable gaps in our knowledge, and it is to be hoped that the techniques and theoretical frameworks pioneered in this thesis may be productively used or adapted by others wishing to investigate *global virtual teams* and *technology-use mediation*.

10.3 Domains of Applicability

The transferability of these conceptual and methodological findings to domains and field settings beyond that of tertiary education remains to be proven. Nonetheless I am optimistic that process will be relatively straightforward, given the professional dimensions and the realistic work setting that have been inherent in this study. My own observations from prior and continuing engagements in global software engineering projects, with students and fellow researchers, indicate that the methods, tools and findings of this study have wider applicability. Therefore I believe that there are several fields of endeavour in which this work may make a contribution, for both practitioners and researchers. The fields of research and practice considered applicable are proposed below, with pointers to some relevant actors and literature.

- ***Technology-use mediation* and *technology facilitation:***

  (Bansler & Havn, 2006; Barley, 1996; Davidson & Chiasson, 2005; Thomas, Bostrom & Gouge, 2007; Orlikowski et al., 1995; Pauleen & Yoong, 2001; Schultze, 2000; Niederman et al., 1996; Beise et al, 2003; Wheeler & Valacich, 1996).
- ***Global collaboration in tertiary education:***

  (Berglund, 2005; Bruegge et al., 2000; Cramton, 2001; Daniels, Petre et al, 1998; Jarvenpaa & Leidner, 1999; Last, 2003b; Montoya-Weiss et al., 2001; Qureshi & Vogel, 2001, Richardson et al., 2006; Swigger et al., 2006; vanGenuchten & Vogel, 2007).
- ***Global virtual teams in corporate settings:***

  (Lee-Kelley & Sankey, 2008; Herbsleb et al., 2000; Herbsleb & Paulish, 2005; Hertel, 2004; Dube & Pare, 2004; Powell et al, 2004, Leidner et al., 2006; Lurey & Raisanghani, 2001)
- ***Management of distributed development or outsourced activities and functions:***

  (Asprey et al, 2006; Carmel & Abbott, 2007, Davidson & Tay, 2002; Heeks et al., 2001; Lacity & Rottman, 2008; Sarker & Sahay, 2004; Schultze, 2000) may find aspects of the work useful

- ***Global virtual team research across multiple disciplines:***

  (Bell & Koslowski, 2002; Pauleen, 2004; Furst et al., 1999; Furst et al., 2004; Martins et al., 2004; Piccoli et al, 2004; Panteli & Duncan, 2004; Pinnsonneault & Caya, 2005; Schiller & Mandviwalla, 2007).

- ***e-Science in global research settings and grid computing:***

  e.g. teams of scientists engaged in grid computing research with large scale shared datasets or datastreams (Barua et al., 1995; OSI, 2006b; Sargent, 2006; Steves, 2002),

  or developers of e-science infrastructures concerned with collaborative information security models (Henricksen et al., 2007; OSI, 2006c; Lopez et al., 2006; Winton, 2005; Chen & Yang, 2006).

- ***Global Software Engineering teams:***

  (Cusick & Prasad, 2006; Lee et al., 2006; Treinen & Miller-Frost, 2006, Domino et al., 2002; Hanisch & Corbitt, 2004; Herbsleb & Paulish, 2005; Jalote & Jain, 2006; MacGregor et al., 2005; Nicholson & Sahay, 2001; Sarker & Sahay, 2004),

- ***Open source software development teams and communities:***

  (Raymond 1998a, 1998b; Scharff, 2002; Elliott & Scacchi, 2003).

- ***Small group, distributed group decision making and GSS research***

  (Arrow et al, 2004; Arrow et al, 2005; Ilgen et al., 2005; Saunders & Ahuja, 2006; Rutkowski, Vogel, Bemelmans et al., 2002; Khalifa, Davison & Kwok, 2002).

- ***e-Collaboration, Computer Supported Collaborative Work, Computer Supported Collaborative Learning***

  (Dustdar, 2004; Kock, 2005b; Bødker, 2000; Guzdial et al, 2000; Herder & Sjoer, 2003; Redmiles et al., 2005).

- ***Group facilitators working in virtual and distributed team contexts***

  (Niederman et al., 1996; Pauleen & Yoong, 2001; Rangarajan, N., & Rohrbaugh, 2003; Romano et al., 1999; Thorpe, 2007, 2008; Yoong, 1999).

- ***Computing Education Research, Education Technology, Distance Learning and e-Learning***

  (Coppola et al., 2004; Salmon, 2000; Goodyear et al., 2001; Ross et al., 2004; Hiltz et al., 2004; Jacobsen et al, 2000, Jones et al., 2002, Kim et al., 2002).

- ***E-commerce vendors and vendors developing software for collaborative environments and communities.***

  Who seek to capitalize on the strengths of collaborative communities and technologies enabled by such developments in technology as *Web 2.0* (Atkins, 2007; Churchill & Halversen, 2005; Franklin et al., 2007; Jones & Grandhi, 2005; Secker, 2007), *Collaborative Virtual Environments* (Benford et al., 2002; Hammon, 2007; Pekkola, 2002; Clear, 2004b; Hiltz et al., 2004; Lee et al, 2005; Schroeder et al., 2001) and *online games* (Hämäläinen et al,. 2006; van Eck, 2003; Damer, 1998)

- ***Researchers investigating collaborative models for e-commerce, collaborative technologies including collaborative virtual environments and support for online communities***

  (Balasubramanian, & Mahajan, 2001; Barab, 2003; Bird, 2001; Davison & DeVreede, 2001; DeSanctis et al., 2001; Kock, 2005a; Koh et al., 2007; DeLuca & Valacich, 2006; Hardin et al., 2006; Hettinga, 2002; Jiramahapoka, 2005; Pekkola, 2002).

Methodologically this study may offer insights for:

- ***Action researchers in Information Systems, computing education and other disciplines:***

  (Avison et al., 1999; Baskerville & Myers, 2004; Carter 2002; Clear, 2004a; Kock, 2005b; McKay & Marshall, 2001; Melrose, 2001);
- ***IS and other researchers seeking to apply structurationist methods empirically:***

  (Poole & DeSanctis, 2004; Pozzebon & Pinnsoneault, 2005)
- ***IS and other researchers with an interest in grounded theoretic approaches:***

  (Sarker et al., 2001; Orlikowski, 1993; Allan, 2003; Qureshi et al., 2005)
- ***Researchers with an interest in the pragmatics of researching in online environments and manipulating a large corpus of email data:***

  (Ruhleder, 2000; Panteli & Duncan, 2004; Cohen et al., 2004; Cramton, 2001; Leuski, 2004

The breadth and multidisciplinary scope of this study can be clearly seen from the above list. It certainly reflects the inherent complexities of studying collaborative systems and global virtual teams, as noted by DeSanctis & Poole, (1994) and Beise et al., (2003). Naturally the risk, in a broad study of this nature, is that rather than having something useful to say for everyone, it ends up with nothing much of worth to say to anyone. I hope this thesis, through its combination of breadth and depth, has avoided that trap. Accordingly the next sections of the conclusion propose some concrete recommendations for practitioners and researchers.

10.4 Recommendations for practice

These recommendations will again be organized as in sections 10.1 and 10.2 above, around the three separate domains of McGrath (1985), namely the 'substantive', 'conceptual' and 'methodological'.

10.4.1 Recommendations for Practice - Substantive

10.4.1.1 Missing Email Attachments

One pattern that emerged from the data was the frequency of missing email attachments, when the sender of a message had simply forgotten to attach a file. The impact of this in a global virtual setting was not merely annoyance, but frequently significant delays. In a note to myself (9/09/2007) I had come up with one suggestion. A relatively simple remedy for email software vendors to consider would be the inclusion of a small artificial intelligence routine in the email software which could scan an outgoing message and parse for variants on 'attach', 'attached', 'attachment' or other indicators of a file attachment. The software would then query the sender for confirmation if no file attachment had been added, before submission of the message. As with all such prompting features an option to activate or deactivate would be useful.

Note: subsequent to submission of the thesis I noted that Gmail Labs, an experimental incubator started at Google in June 2008, had developed a "forgotten email attachment feature" http://blogs.computerworld.com/behind_the_scenes_at_gmail_labs .

10.4.1.2 Group Level Security

A further pattern originating from the data was the challenge for global virtual collaboration posed by institutional security regimes. Issues with arranging access to systems and resources, managing usernames and passwords, establishing and managing groups, and readily accommodating additions and removals of participants were continuing themes. These appear to be common to global collaborative ventures, where Winton (2005) experimenting with virtual organization models in a grid computing context has reported:

> "Updating user and certification configuration during the construction of the HPC Challenge testbed was a time consuming and problematic task. Manual configuration inevitably led to errors which in some circumstances rendered resources temporarily unusable".

I have previously written about the unsuitability of many of our mechanisms for security, their single system focus and the primacy which they give to the individual as a user:

> "For instance group level security with shared authentication is often quite acceptable" (Clear, 2002d, p.13)

The rise of systems such as "Wikis" (Bergin, 2002, Rick & Guzdial, 2006) has been one response to shared access in the collaborative systems environment. I had made the following note to myself during the analysis, as a recommendation for collaborative system designers:

> To aid global collaborations, while retaining an acceptable level of security, designers of collaborative systems should investigate options for single password group permission accounts, with option for group level users to configure individual usernames and passwords within group once into system. Such a system might also support a workflow process including a verification option by administrator level user. (9/09/2007)

Acknowledging the challenges inherent in such mechanisms, this topic will be further addressed in 10.5.1 below under recommendations for research.

10.4.1.3 Formal versus Informal Meetings

The considerable challenges noted for both academics and students in arranging synchronous meeting events in this collaboration have occasioned considerable reflection. As the quote below indicates, this difficulty is inherent in a truly global multi-time zone setting.

> "Anyone who has tried to schedule a truly global meeting knows that it is impossible to find a time that is acceptable for all participants. If one divides the globe into only three geographical areas, as is commonly done, it is still quite difficult. If this is reduced to one more level of granularity and an attempt is made to accommodate each individual time zone in each of the three geographical areas, the problem becomes impossible" (Treinen & Miller-Frost, 2006, p.777).

Yet in this study we have observed difficulties in arranging synchronous chat sessions, even by students involved in local teams. More concretely and separately I have seen my own 'co-located' capstone project students struggling to hold team meetings with all members present and correct. So perhaps there is some phenomenon of 'student culture' (and more broadly perhaps a younger generational culture) relating to meetings in operation here. The excerpt below characterizing Japanese youth culture in the cell-phone era, provides a fascinating account of how the process of arranging meetings in time and space is changing:

> "Mobile phones have revolutionized the experience of arranging meetings in urban space. In the past, landmarks and pre-arranged times were the points that coordinated action and

> convergence in urban space. People would decide on a particular place and time to meet, and converge at that time and place. I recall hours spent at landmarks such as Hachiko Square in Shibuya or Roppongi crossing, making occasional forays to a payphone to check for messages at home or at a friend's home. Now teens and twenty-somethings generally do not set a fixed time and place for a meeting. Rather, they initially agree on a general time and place (Shibuya, Saturday late afternoon), and exchange approximately 5 to 15 messages that progressively narrow in on a precise time and place, two or more points eventually converging in a coordinated dance through the urban jungle. As the meeting time nears, contact via messaging and voice becomes more concentrated, eventually culminating in face-to-face contact.
>
> One of our subjects described how she sends a quick message as she waits for the bus. "I'll be about thirty minutes late." Her friend responds with a quick acknowledgement. Upon arrival, our research subject sends another message announcing her arrival, and they quickly converge at the train station. As is typical in cases like this, lateness is a matter to be announced but not apologized for. The one being "kept waiting" has been attending to other matters about town rather than waiting at an appointed spot. The older generation often describes these practices as "loose" in terms of commitments to time and place, a slackening of manners. But we can actually see a consistency in certain social norms and expectations attached to "gathering". As with meetings with appointed time and place, with these more flexibly arranged gatherings, the consistent rule is that you should not keep somebody waiting in a particular place. If their partner has already "shown up" in virtual space by announcing where they are, mobile phone users can go off to a book store or take care of an errand rather than wait at an arbitrary spot" (Ito, 2003, p.2).

This model of meetings is based upon a "kairotic" model of time, or the "right time" (Czarniawska, 2004) for the event in question:

> "Kairotic time is understood to be temporal autonomy, such that work gets done at the right time, rather than when mandated on a calendar or project plan" (Harmer & Pauleen, 2008, p.22).

This potentially 'self-centric' notion of time does not transfer well to the global virtual context, nor for that matter to the corporate context, where "temponomic" time (McGrath, 1986 p.61) dominates. For instance one of our capstone project teams is working in a community funded project with multiple stakeholders including commercial software developers and design consultants. Recently they rescheduled an online conference meeting at the last minute, and encountered a severely negative reaction from their clients, whose (paid) time had been wasted.

To consider the difference in these models of time from a meeting scheduling perspective we can see two distinct models of decision making in operation. In the formally scheduled meeting (at a predefined time and place) the "sequential" model as proposed by Langley et al., (1995) is dominant, with a classic "intelligence, design and choice" process, perhaps modified with an iteration or two. In the looser model of cell-phone aided meeting noted above, the "convergence" model of decision making "driven by iteration" is evident, in which the:

> "decision making follows a general trajectory of gradual convergence on the image of some

final action" (Langley et al., 1995, p.266)

We might term this an "informal" or an "approached" meeting. Now if this is a typical student understanding of a meeting process, for effective transfer to a global virtual setting there may need to be a very explicit redefinition of synchronous global virtual meetings as predefined "formal" meetings. Therefore explicit protocols for the organizing and conduct of these "formal" virtual meetings and for arranging follow-up virtual meetings may need to be defined for students (and maybe also for professionals), based upon the face to face meeting context but adapted to the global virtual.

10.4.1.4 Meeting Coordinator Role

As a logical corollary of defining virtual meetings as "formal" events, comes the need for some form of 'event' or 'meeting' coordinator role. Again in the student context, from observing the varying abilities of capstone software development students in coordinating formal quality reviews, the clear need for such a role has become apparent. In the software quality practice known as a "Fagan Inspection" (Fagan, 1976), specific roles have been made explicit:

> "The inspection team is best served when its members play their particular roles, assuming the particular vantage point of those roles. These roles are described below:
>
> 1. *Moderator* – the *key person* in a successful inspection…The moderator must manage the inspection team and offer leadership…His use of the strengths of team members should produce a synergistic effect large than their number; in other words, *he is the coach*. The duties of moderators also include scheduling suitable meeting places, reporting inspection results within one day, and follow up on rework. *For best results the moderator should be specially trained*" (Fagan, 1976).

Acknowledging that such defined roles are critical in coordinating software inspection processes in a face to face context, suggests that in a virtual context an even stronger role structure may be required. The brief excerpt above encapsulates many of the themes evident in this study (team leadership and team cohesion, and time and space). In a student context the 'leadership' role has already been noted as challenging, since student teams "suffer from no power structure within the group" (Powell et al., 2006, p.314). Yet the practical role of scheduling and coordinating events in 'time' and 'space' as indicated by Fagan above is crucial, and likely to prove more so in the virtual context. In support of that view the "DSDM-O" methodology (DSDM, 2005) has incorporated additional roles specific to working in an offshore environment. One specific role defined is that of "facilitator" with a combination of cultural, technical, coordinating and reflective skills. The responsibilities of that role are outlined below:

“DSDM Role Additional Responsibilities

Facilitator

- Have knowledge, or at least awareness, of cultural differences.
- Be skilled in facilitating the different cultures.
- Facilitate workshops using teleconferencing and videoconferencing facilities.
- Facilitate retrospective workshops (review at end of timebox).
- Capture lessons learned of what’s working, not working, in the area of collaboration and cooperation” (DSDM, 2005 p. 12).

As can be seen from the responsibility definitions, the ‘virtual meeting coordinator’ role is implicit in the statement “facilitate workshops using teleconferencing and videoconferencing facilities”. These practices suggest that professional contexts, which normally have some form of defined “power structure”, may well be easier to facilitate (whether face to face or virtually) than student teams, and virtual teams of either kind are likely to prove more challenging.

The logical conclusion therefore is that all global virtual teams (and especially student GVTs) should have a specific “meeting coordinator” role defined, supported by a set of concrete guidelines on how to schedule a formal “virtual meeting” as a synchronous event for the distributed team. These guidelines would include such practical elements as: the steps involved in scheduling a meeting; lead times to take into account when arranging a meeting; implications of working across time zones; working with sub teams; keeping everyone up to date with activities at each site; defining meeting goals and agenda setting; meeting conduct and chairing; meeting closure; dates for next meeting; and meeting record taking.

In providing such support for GVTs there may be scope for some level of automated assistance e.g. for arranging schedules and meetings, follow-up management and location based convergence (as being investigated through the “InContext” project discussed in 10.5.1.7 below)

10.4.1.5 Integrated Collaboration Platforms

As a complement to this specific role, a well integrated supporting technology platform would have much to contribute. For instance Swigger and colleagues have developed a platform for global software development with distributed student teams. A portal function helped students manage their individual groups and projects and enabled students to:

> Access their partner’s schedule and determine possible meeting times for their assigned projects. These features were added after the first semester because groups had

> difficulty identifying possible meeting times mostly because they had to adjust to the eight hour time difference between the two schools. Thus a special web-based scheduling tool was developed that helps groups determine possible meeting times" (Swigger et. al., 2006).

An integrated tool set to support both student course work and group communication as proposed by Swigger and colleagues, appears to be a productive direction for development, but integration of toolsets in these collaborative environments is challenging.

Google™ appears to be moving in the direction of providing an integrated collaborative platform through its "software as a service" model (Manford, 2008), under which the suite of applications known as "Google Apps" (Barlow & Lane, 2007) is being promoted. The latter authors' profile of Arizona State University as a large scale adopter of the "Google Apps" suite (e.g. Gmail, Google Personal Start Page, Google Docs, Google Spreadsheets, Google Maps) provides an example of a strategy for an integrated collaborative platform, which they see as contributing to:

> "the ongoing development of an interactive platform that supports student access and embodies the vision of 'one University in many places';
> the ongoing development of an integrated system to amass and disseminate digital knowledge assets" (Barlow & Lane, 2007, p.8)

Yet as a counterpoint to this positive view, one student evaluation from the most recent internal collaboration this semester made the following points about the separate features we are now using within the AUTonline platform, (itself provided by the single vendor Blackboard™):

> 19. What are the ***three*** main improvements you would suggest to improve the effectiveness of the Collaboration?
>
> First change:
>
> If there are one link that can go to Discussion board, Wiki and blog that will be better. Because I need to go around and around everytime to whether either three of them got something writen.If the function can combine that will be better. (anon, 4/06/2008

A variant on the synchronous meeting coordination guide and supporting technology platform may also need to further consider asynchronous 'meetings" and tracking more drawn-out activities. Yet for now, the primary need identified has been for effectively facilitating 'synchronous' events. Pauleen & Yoong (2001) have noted the importance of synchronous communication channels in 1) overcoming breakdowns (e.g. phone calls to follow up when email response was lacking) and in 2) helping to build trust relations through spontaneous informal communication (ICQ chat offered an adjunct

communication channel as an informal 'relationship building' mechanism, augmenting the more 'task oriented' channel of email) . For widely time-zone divergent collaborations, the ability to incorporate synchronous events may therefore contribute significantly to their success.

10.4.1.6 Support for Mobility

A logical progression from several of the above themes is to acknowledge the nature of the modern student (and perhaps to a lesser extent the modern professional), as a mobile and connected individual (Ito, 2003; Carroll et al., 2002; Hamilton & Berry, 2007, Petrova, 2007). Likewise mobility in space has been a strong theme for the professionals in this study, even if not quite to the point of their being "constantly already elsewhere" as mooted by Czarniawska (2004, p.786). Yet the mobility of professionals in this study has been apparent more often through their being 'disconnected' through periodic absences, than by their being 'connected'. At the time of the specific trial reviewed in this study, mobile phone usage was only beginning to develop the level of ubiquity among professionals or students in New Zealand that it has now reached (Mellow, 2005). The 'integrated collaboration platform' theme is also relevant to this now topical theme of 'support for mobility'. Two specific challenges for global virtual collaboration arising from this increasing mobility and connectedness can be illustrated from this semester's collaboration, and recent discussions with my colleague Diana Kassabova.

In the first instance I discussed with Diana (16/06/2008) the role of mobile phones and texting in AUT University student life. Diana was marking student assignments from this semester's internal collaboration and related the story of one team in which the team leader had become indisposed through an illness in the family and therefore was unable to complete his allocated task of posting the group quiz online by the due date. He realized that the team had not gone through the normal face to face team rituals of sharing cell phone numbers among their members, so in this crisis situation he could not contact his colleagues by phone. In the event one of his team mates helped out by posting the quiz on the team's behalf, with contact having been made (presumably by email or discussion thread).

This highlighted the problem of reduced ability to respond to crises when student team members didn't respond to their email. Diana observed that "students mostly just use cellphones to send text messages to one another". In a recent visit to a local tertiary institution for which I am the external degree monitor, the same issue had arisen, with

students not checking their email, and actually requesting a text message service, since cell-phones were their primary means of communication.

Two examples of final student evaluations from this semester have separately mentioned the use of mobile phones and text messaging:

> "19. What are the *three* main improvements you would suggest to improve the effectiveness of the Collaboration?
> First change: Video Chatting
> Second change: Voice Chatting System
> Third change: Mobile Phone or texting system would make life easier" (anon 4/06/2008).

> "20. What did you gain from the International Collaboration that was of most value ?
> I have learnt how to use different groupwares in different situations. Such as, it is efficient to use group discussion board and emails to organize the online meeting time, topic and any notice for each group member to check before the meeting, or we can use it is provide our suggestions and opinions on. Another example, It is better to use black chat tool to hold an online meeting, because everyone can join the meeting in different place but at the same time. So, we can fix some questions at once, there is no need to wait until someone reply your message in the next one or two days. Also, If someone lost the chance to join the online meeting, I used mobile text to tell he or she what he or she needs to do and also gave me suggestions to help her or him. In addition, I used file exchange to upload useful files for the other group members to read and check" (anon 4/06/2008)..

The latter message is particularly interesting as it demonstrates the interwoven manner by which the available technology features have been appropriated, both separately and in combination, by the student.

Had some form of text messaging facility direct to team members cell phones been integrated within the collaborative platform it may have better supported the situation within this semester's collaboration. But as Mellow (2005) has previously reported:

> "Mobile phone integration within an existing LMS was explored. There is a building block within Blackboard that offers a .push. SMS capability (clearTXT.com), however there are licensing costs ($10K US per year) as well as call charges (0.17 cents per message, per student). This service is more suited for sending out informative messages and advertisements than being used as a learning tool" (p.473).

This situation may have changed since then, but at the time of writing I have yet to clarify what we are intending to do through the University's standard online learning platform in the area of mobile phone service integration.

A second issue in this context and directly relevant to global virtual collaboration was whether the SMS facility extended to international cell-phone owners. Diana and I discussed the text facility available through the academic staff email system, and whether messages successfully accessed international cell-phones. We had both tried but unsuccessfully. A related question was whether students had access to a text messaging facility within their separate email systems, and whether that would link to

international cell phones. After some checking internally I found that our academic staff email to text service is supported by Vodafone who charge per message sent, and our IT department keeps track of messages sent per user to enable internal cost recovery. Subsequently (19/06/2008), I was also informed that the coverage of the "txtmail" service was New Zealand only. Therefore we would need to make specific arrangements in order to integrate the use of international cell-phones within our global virtual collaboration. This would involve a significant *establishment* phase of TUM activity in negotiating with internal and external service providers, sourcing funding to cover the associated costs, registering eligible parties to the service and providing instructions to participants. The offshore counterparts of this service would also need investigation, if we desired a two- or three-way service. The most likely option is that we would have to independently opt for an externally hosted service such as Skype™ perhaps, which would then not be integrated within the overall collaborative technology platform, again raising the issues noted in 10.4.1.5 above. At this point then we probably would have to proceed with no integration of the collaborative platform and an SMS facility, let alone an extension of the service to international cell-phones. This appears to be a fruitful area for improvement of the available services for mobile connectivity and their degree of integration within collaborative technologies, without incurring prohibitive costs.

10.4.1.7 New Job Roles Managing Collaborative Technologies

Some confirmation of the significance and topicality of this research, and especially in the tertiary educational context, came home to me at a recent luncheon hosted in Auckland by MIS and CIO Magazines to announce the MIS100 (1 May 2008). The event included a presentation by Dr. Scott Diener, Associate Director ITS, Academic who had recently taken over a new role created at the University of Auckland, where he had the title of "Associate Director Academic & Collaborative Technologies". I suppose in the fashion cycles of academe and technology this may be a short lived bloom, but it is reassuring to know that the work I have been engaged in with collaborative technologies for the last decade is now moving into the mainstream. But I would have to say most of the thorny issues raised in this study still remain to be addressed. For domains outside education this appears to be equally so, as noted in the systematic review of distributed software development by Prikladnicki, et al., (2008), with much being proposed but limited empirical research work being undertaken.

10.4.2 Recommendations for Practice - Conceptual

The primary concepts of direct relevance to practitioners arising from this work lie within the Theory of Collaborative Technology Fit (CTF). The theory now needs to be tested for its applicability and utility by practitioners in the field.

Of particular interest is whether the notion of a *metastructure* can be readily grasped by practitioners and applied within the *CTF* model to diagnose the level of *fit* within a collaborative situation. Can it be used effectively to map the degree of *Collaborative Technology Fit* within the given context? Can the scales be readily systematized to enable more reliable assessments to be conducted? Is CTF able to be applied before, during and after a collaboration, or only at completion and after the event? Are *metastructures* at differing levels of granularity more useful than others (e.g. are macrolevel *metastructures* preferable to microlevel?). Will a prior diagnosis of a lack of *fit* result in any ability to effect an improvement in outcomes? If so, which elements of the *CTF* model are most amenable to change in the field and with the best impact? Do salient *metastructures* appear in regular patterns? Are distinctive metastructure patterns visible across different domains in which collaborative technologies are employed? Or are these patterns highly genre and domain specific? Is the elusive and multilayered concept of *culture* able to be productively mapped within the model by practitioners?

10.4.3 Recommendations for Practice – Methodological

Practitioners, who explore aspects of the Theory of Collaborative Technology Fit (*CTF*) from a conceptual perspective, will need to develop an appropriate set of methods. In testing the theory for its applicability and utility by practitioners in the field, practical approaches to addressing the conceptual issues highlighted in the previous section will be required.

For instance strategies for identifying salient “metastructures” for GVTs before, during and after a collaboration event will need to be developed, as will systematic scales and methods for verifying their degree of *fit* or alignment. A ‘field guide’ for practitioners would provide useful methodological support.

Concrete strategies for mapping both ‘macro-’ and ‘micro-level’ *metastructures* against the *CTF* model will need to be operationalised in field settings. Then, methods for recording successful approaches will need to be developed. Such mechanisms as building libraries of ‘collaborative patterns’, and even ‘anti-patterns’, similar to the

"cultural patterns" noted by MacGregor et al., (2005) may be a productive strategy. Such libraries could be based upon the concept of "design patterns" as used in software engineering (Gamma et al., 1995), or in pedagogical contexts (Fincher, 2006). In the context of project work in computing education, Fincher, Petre & Clark (2001) have proposed the formulation of "practice bundles" (pp. 3-26), to encourage the transfer of patterns of use between educators and across institutions. While transfer of practice is far from straightforward in educational settings (cf. Fincher, 2000), such a recording process nevertheless may be more effective in other settings. For global software development or corporate global virtual teams such mechanisms may help to identify and codify both domain specific patterns, and more general patterns of 'collaborative technology fit'.

10.5 Recommendations for Research

10.5.1 Recommendations for Research - Substantive

This wide ranging study has opened several further avenues for substantive research into technology-use mediation and global virtual teams. It has proposed a framework for investigating TUM activity in a GVT context, and identified some characteristics of TUM activity, the actors and their roles within this context. However, much remains to be known, in this relatively little explored field.

Particular aspects on which our knowledge is either limited or would benefit from closer study include:

- The relationship between TUM activity and *appropriation* of technology in GVTs;
- TUM Activity performed by specific *roles* supporting the work of GVTs, and the characteristics demanded of actors performing those roles;
- The *structuring* and *metastructuring* dimensions of TUM activity in GVTs
    - the interplay of *time* and *space* with TUM activity;
    - the *duality of technology* as evident through TUM activity;
    - the role that *reflexivity of the actors* plays in TUM activity;
- The mix of *collaborative technologies and features* which are most compatible with effective TUM activity in GVTs
- The significance of the *socio-emotional* dimensions and particularly of *motivation* to the effectiveness of TUM activity in GVTs
- Developing suitable definitions for, and the role of, *culture* within GVTs
- The merits for researchers of the theories developed within this study, of

Technology-Use Mediated AST (TUMAST) and of *Collaborative Technology Fit (CTF)*

10.5.1.1 Paradigms of Management and Security – 'Command-and-Control' versus Collaborative Models

A clear tension evident within the study has been the clash between styles of management in the collaborative environment, between the hierarchical, corporate, 'command-and-control' model of management and the academic, with its more collegial, collaborative and lateral models of working. These tensions were most evident in issues to do with access to resources, permission to act in certain ways across institutional boundaries, and in an essential dilemma for actors in the study, between that of 'freedom' versus 'control'. It appears in a collaborative context, that finding workable models in between the two poles of this dilemma is challenging, and that all-or-nothing models predominate (e.g. individual user access models in VLE systems such as Blackboard™, versus wide open access to technology platforms such as Wikis). While admittedly some half-way houses are available (e.g. Wikis with limited access and modification rights to certain pages etc.), this study came up against limits imposed upon the collaboration by both policy and technology. Limits in providing workable and easily established group level models of security, (such as intra- and inter-group access), within trusted circles of participants, were encountered. Yet in our everyday lives we can and do readily distinguish between groups whom we do and do not trust - e.g. 'stranger-danger', family, friends – and to whom we give considerable latitude, unless they should breach our trust (personal communication Ewing Caldwell, 18/06/2008). It seems intuitive that our computer systems should be able to support with ease these very natural human needs. As I have noted previously:

> "group level security with shared authentication is often quite acceptable" (Clear, 2002d, p.13)

But, as this study has indicated, the technology component of security is but one element, and while, as Siponen & Oinas-Kukkonen (2007) have observed, research in the security area has "concentrated on technical problems", it has given limited attention to the broader issues of information security management:

> "While the role of deterrents have been studied extensively…the possibilities offered by non-deterrence strategies based on psychology (motivational theories)…are still largely unexplored areas. In particular, empirical works are needed, examining how to ensure that users are committed to security policy by means of motivational strategies, including the use of rewards" (Siponen & Oinas-Kukkonen, 2007, p.72).

In this study not only motivational strategies, but the lack of supportive institutional policies and suitably configured technologies, were all barriers to achieving a level of security tailored to the needs of the collaborative project. Resolving this tension between hierarchical control structures within silo institutions, and collaborative models for teams working globally is an area deserving of concentrated study. As the OSI (2006b) Report addressing Access, Authorisation, Accounting, Middleware and Digital Rights Management (AAA and DRM) in the e-Science context demonstrates, this is becoming a more pressing set of needs globally in many domains.

> "Developments to create an e-Infrastructure must take into account the institutional role and the need for e-Research to be aligned to institutional policy in terms of support, user rights and responsibilities, structures authorities and institutional service provision" (OSI, 2006b p. 18).

Therefore sets of institutional and technology solutions across domains at national and global levels will need to be put in place to address these needs. Technical mechanisms such as "secure federated authentication and authorization" (Vullings & Dalziel, 2007; Lopez et al., 2006; Morgan et al., 2004; OSI, 2006b; Chen & Yang, 2006; Winton, 2005), will only provide part of the answer. Yet in combination with more strategic models for inter-institutional and international collaboration as noted by Morgan et al., (2004); Sargent (2006) and OSI (2006a, 2006b), these movements are promising. Winton (2005) has noted the need to accommodate "groups and roles", and policies for "mapping users and groups within a VO [Virtual Organization] to shared accounts". Overcoming institutional and technical barriers for ready and flexible configuration of shared accounts, and accepting group level models of access and authorization, are important research areas for supporting effective TUM activity for global virtual teams.

10.5.1.2 Socio-Emotional Dimensions and the Role of Trust

The different approaches to security discussed above, demonstrate differing models of institutional trust in operation. The military 'command and control' model of trust views the individual as a locus of risk which needs to be secured, whereas the collaborative model for virtual organizations requires levels of trust that can be operative at the group level (Winton, 2005). In practice both levels of trust typically need to co-exist in some fashion (for instance the differing individual and group access and authority levels within AUTONLine in this study, as opposed to the open nature of the Lotus Notes collaborative database).

A more typical focus of the global virtual team literature is on trust within the GVT

itself (Powell et al., 2004), as opposed to that imposed by the institutional context. In table 10.1 below Powell and colleagues have identified the issues that have been the focus of early virtual team research. "Trust' as an issue has been located within the grouping of "socio-emotional processes". This set of issues has shown minimal focus on TUM activity, with "training" being the most closely linked issue.

Inputs	subject (students/ organization)	structure	culture	technology	training
Socio- emotional processes	cohesiveness	trust	relationship building		
Task processes	communication	coordination	task-technology fit		
Outputs	performance	satisfaction			

Table 10.1 Issues in Virtual Team Research (adapted from Powell et al., 2004, p.8)

The dominance of *socio-emotional* codes, and incidents associated with *trust* in this study, suggests several fruitful areas for further research. What is the role of TUM activity in building trust within GVTs? Is TUM activity critical to the building of "early trust" and sustaining "late cohesiveness" (Jarvenpaa et al., 2004, p.262) in GVTs? What is the role of TUM activity in developing GVT cohesiveness and in relationship building? Conversely how do socio-emotional dimensions support effective forms of TUM activity? How do different actors involved in TUM activity develop and sustain trust and group cohesion, even when the actors may rotate in and out of the scene on a regular basis, or be formed in constellations such as a "core" and "petal" groups (Melrose & Reid, 2000)? What is the role of socio-emotional behaviour in building relationships within teams (or such team constellations) engaged in TUM activity in support of GVTs?

10.5.1.3 The Impact of Subsequent Developments

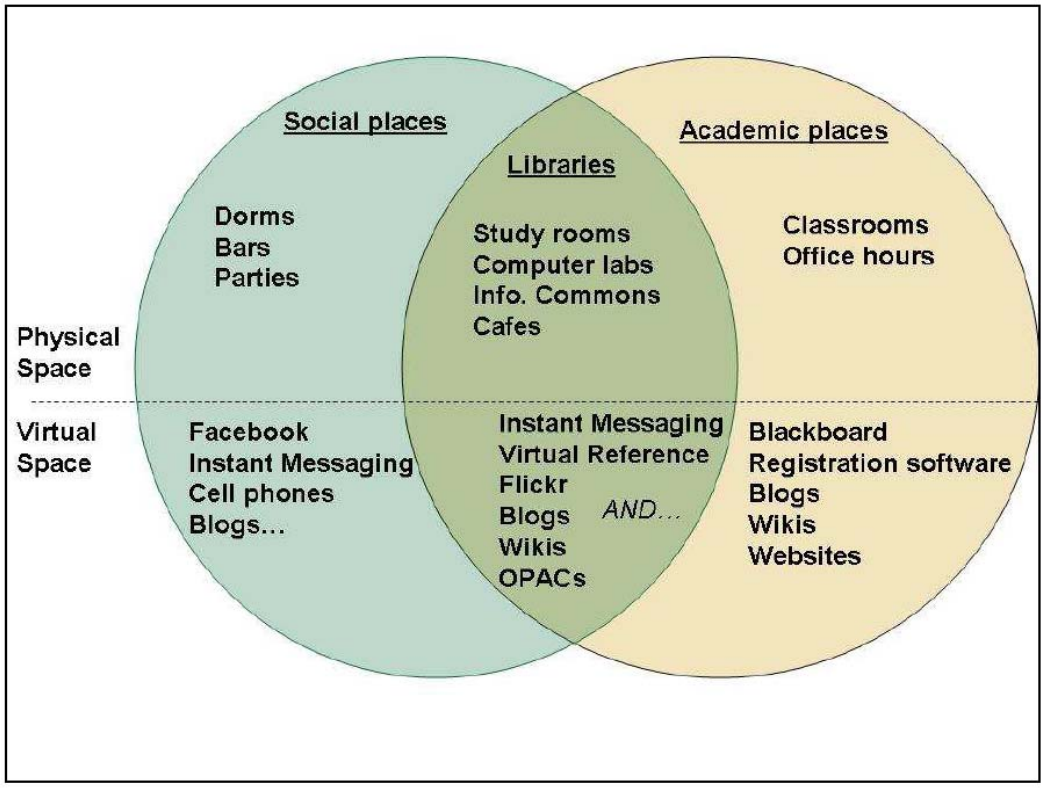
This study is based upon a global collaboration which took place in mid-late 2004. Significant developments in internet technology and global popular culture have occurred since that time. The rise of mobile technologies as previously discussed in 10.4.1.6 has been one notable development. There has been increasing penetration of voice conferencing technologies such as Skype™, with an estimated 250 million accounts worldwide (ELI, 2007). The rise of the forms of collaborative technology now known as "social software" (Secker, 2007), depicted in figure 10.1 below, mean that the current climate for global collaboration, and the models for collaboration have

advanced, especially within the global student community.

In support of this view from a recent Australian study, Kennedy et al., (2008) have reported the following:

> "It cannot be ignored that substantial proportions of incoming university students are using and reading blogs, are taking photos with their mobile phones, are regularly using social networking software such as MySpace, are communicating via web conferencing, and are sharing all sorts of digital files using both their mobile phones and the web" (Kennedy et al., 2008, p.119).

Secker (2007) depicts this changing landscape of student life in Figure 10.1 below:



From Michael Habib's Flickr site (Licensed under Creative Commons):
http://www.flickr.com/photo_zoom.gne?id=222296001&size=o

Figure 10.1: Social Software, Libraries and Distance learners – Spaces and Places (ex. Secker, 2007 p. 8)

In relation to this phenomenon, I had recorded a conversation with my colleague Dr. Ray Lister in which he had observed:

> "maybe the findings would be different with the Facebook and Myspace generation?? (diary note - 12/12/2007)

Accordingly, and as noted in 10.4.1.5 above, in response to this phenomenon we are now incorporating the use of 'Blogs' and 'Wikis' into our collaborations, with the first use of Wikis internationally in 2007 and the first use of Blogs this year internally. These technology features have now been incorporated as standard options within the

AUTOnline platform. To what extent this adds extra load and complexity to the global virtual context has yet to be determined, and the exact implications for TUM activity are being identified as we proceed. However these aspects of TUM activity will need to be given specific attention in further research.

Also of relevance will be the student reaction, and the implications for TUM activity within the student GVTs themselves. For instance will student GVTs be more effective if supported by such forms of 'social software', and will we see more use of complementary external services with which students are familiar, such as Skype, MySpace, Facebook etc.? If such patterns of use do emerge in GVTs, the research challenge will then lie in capturing this 'offline' activity occurring outside the boundaries of our technology platform. Then not only tracking the use of supplementary technologies, but also capturing the processes of TUM activity in which the students may engage will pose challenges for investigators. It may open the option for alternate designs using "Process Restricted AST" (Wheeler & Valacich, 1996; Salisbury & Stollak, 1999; Khalifa et al., 2002) in which some student GVTs may only use the authorised collaborative platform, while other GVTs are given the option to augment its features with any desired external technology platform.

The role of mobility through complementary use of cell-phones and SMS texting services (as discussed in section 10.4.1.6 above) is encompassed within this wider focus on "social software'. Mobility again raises a similar set of research questions. The issues related to use of a suite of collaborative technologies, how TUM activity supports such use and who are the main actors in TUM activity which occurs outside the official boundaries of the collaboration, should raise some interesting challenges

10.5.1.4 Invisible Work?

The multiplicity of roles involved in TUM activity and the criticality of such work to the effective functioning of GVTs, raises some interesting broader questions about the valuing of work. Schultze (2000) records how "system administrators" in her study called themselves "consultants", but their jobs were devalued by members of the organization and termed "commodity work". Barley (1996) has explored the ambivalence inherent in the work of "technicians" versus "professionals", and the challenges their knowledge posed "for vertical forms of organizing…because it decoupled the authority of position from the authority of expertise, a threat that was particularly strong in the case of brokers" (p.434). The "broker" role in contrast has been elsewhere identified not as a mere "technician's" activity, but as a key

"leadership" role (Roy et al., 2006). Star & Strauss (1999) have reflected on the nature of "invisible work", noting how:

> "With the introduction of large scale networked computing, and concomitant changes in how work is tracked and valued, a new ecology of visible and invisible work is being produced…these representations, often embedded in the neutral language of metrics are in fact quite political. Invisible work is at the heart of the politics: what will count as productive work, creative work, work which cannot be outsourced or replaced in today's new corporation" (p. 22).

The porosity between the boundaries of the "technician" and the "professional" roles undertaken by the academics in this study has been intriguing. Will we see over time tighter delineations between job roles for virtual educators as more Taylorist models of academic work are imposed, bringing with them a likely further set of tensions? Or will this very fluidity and ambiguity of roles remain hidden as an invisible extra load assumed by educators working in global virtual collaborations? Should such demands become more intensive and pressured, will we then see a rise in the forms of passive-aggressive behaviour against managerialism in the university cited by Anderson (2008). The importance of the roles identified in this study to the effective conduct of the collaboration is without dispute. The degree to which these forms of work are understood and their significance valued, however, remains questionable. The legendary corporate responses of IT technicians to being treated with disdain are enshrined in cartoon strips like *Dilbert*, and in the online narratives like the wonderful excerpt below from the "bastard operator from hell":

> "Another user rings.
> "I need more space" he says
> "Well, why not move to Texas?" I ask
> "No, on my account, stupid."
> Stupid? Uh-Oh..
> "I'm terribly sorry" I say, in a polite manner equal to that of Jimmy Stewart in a Weekend Family Matine Feature "I didn't quite catch that. What was it that you said?"
> I smell the fear coming down the line at me, but it's too late, he's a goner and he knows it.
> "Um, I said what I wanted was more space on my account, *please*"
> "Sure, hang on"
> I hear him gasp his relief even though he'd covered the mouthpeice.
> "There, you've got *plenty* of space now!"
> "How much have I got?" he simps
> Now this *REALLY* *PISSES* *ME* *OFF*! Not only do they want me to give them extra space, they want to check it, then correct me if I don't give them enough! They should be happy with what I give them *and that's it*!
> Back into Jimmy Stewart mode.
> "Well, let's see, you have 4 Meg available"
> "Wow! Eight Meg in total, thanks!" he says, pleased with his bargaining power
> "No" I interrupt, savouring this like a fine red at room temperature, with steak, extra rare, to follow; "4 Meg in total.."

> "Huh? I'd used 4 Meg already, How could I have 4 Meg Available?"
> I say nothing. It'll come to him.
> "aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaggggggghhhhhH!"
> I kill me; I really do!" (Travaglia, 1995)

Nonetheless these roles are pigeon-holed into the lowly "technician' category by managers and academics alike. In a recent review of the Peruvian Computing curriculum it was deemed that preparation for certain types of job roles in the IT industry was not the function of University level education, but rather the preserve of vocational institutions (Alvarez et al., 2008).

> "Finally for the immediate needs of the market it is possible to educate professionals at a technician level with specific capabilities in the use of computing tools. It is not the mission of the University system to produce this type of professionals, but of the institutions of short term technical education" (Alvarez et al., 2008, p.37).

This study has identified a crucial set of professional and para-professional job roles in an evolving arena. Academics in the study alternated in assuming a wide variety of TUM related roles. It is not clear that these are strictly academic roles, but alternative structures for performing TUM activity in this context did not exist, save for those participants able to acquire the support of teaching or research assistants. The extent to which we understand these roles, their interrelationships, their appropriate job definitions and levels of remuneration is highly arguable. This opens a hybrid area of study for computer personnel researchers, in understanding such roles, how they are defined and valued, the organizational units they reside within, and the seniority of job holders within their organizations. The more general question of work studies and appropriately valuing technicians in the workplace is a related area of inquiry.

10.5.1.5 Interdisciplinary Study and Cross Discipline Linkages

One of the primary challenges, of working in the area of global virtual teams and collaborative technologies, is the interdisciplinary nature of the work and the frequent lack of communication across discipline boundaries. The review of current virtual team literature conducted by Powell and colleagues (2004) incorporated a keyword search of the ABI/INFORM electronic database, supplemented by both selected articles from the ISWorld website and the review of experimental GSS research carried out by Fjermestad & Hiltz (1998-1999). In the latter comprehensive review of GSS experimental research, the authors have made specific mention of the interdisciplinary nature of the field of GSS, a field narrower than that encompassed by this study:

> "GSS is an interdisciplinary field spanning the boundaries of information systems, management, computer science, social psychology and communication. There are thirty

> seven different journals and seven conference proceedings represented in the list of publications" (Fjermestad & Hiltz (1998-1999, p.).

Surprisingly given the large number of studies of GVTs involving students (Powell et al., 2004), the active stream of research into GVTs conducted within the Computer Science Education and Software Engineering Education Communities (e.g. the ACM SIGCSE series of conferences and the IEEE Frontiers in Education conferences, and the Doctoral studies associated with the Runestone project of Berglund, 2005; Hause, 2004; & Last, 2003a) seems to have been largely ignored within IS Research. Does this absence reflect simply the firm delineation of discipline boundaries between CS and IS by IS researchers, ignorance of the work, lack of interest, or a deliberate shunning of educationally oriented research by IS researchers – as noted in the critical review of computing education research by Clear (2007b)?

A productive agenda for virtual team researchers then could be to imitate the initiative taken by Poole & Hollingshead (2005) with their book "*Theories of Small Groups - Interdisciplinary Perspectives"*, and apply a similar strategy of gathering together a group of writers from several disciplinary perspectives in the global virtual team research area to produce a shared volume. More generally it would seem productive for researchers in the area of GVTs to develop mechanisms for staying in touch with one another's work.

10.5.1.6 Global Collaboration in Course Delivery

As noted in this work, that by Swigger et al., (2006) and in Clear (2008) the challenges in delivery of courses across institutional, national and continental boundaries remain significant. While courses such as global software engineering provide a logical context for such global and collaborative modes of delivery, I have recently urged a degree of caution in wholesale adoption of such approaches:

> In conclusion while this work is fascinating for early adopters and those of us interested in research into global virtual teams, this is not yet a sustainable mode of education. For those of us who still like to sleep and work regular hours, I urge considered resistance against over enthusiastic administrators with a globalisation agenda based upon a "temponomic" [3] view of time (Clear, 2008, p.12).

Therefore continuing pioneering practice and programmes of research into global virtual teams and projects within education, such as the "Open Ended Group Projects" reported by Daniels, Faulkner & Newman, (2002) remain a necessary task. Without better understandings and stronger models, with TUM activity potentially a key element in such understandings, the 'nirvana' (envisaged by some) of globally connected students

working across institutions, across cultures and continental boundaries is unlikely to be approximated in any sustainable fashion.

10.5.1.7 Global Software Development: Integration of Collaborative Platforms and TUM Activity

Developments in the teaching of global software development are, nevertheless, seeing the rise of further collaborative projects with a combined teaching and research interest. Swigger and colleagues (2006) have reported on the development of a specialised software platform, to provide an "International Collaborative Environment". The software incorporated features to support standard student development tasks, communication between GVT members and such activities as global meeting scheduling.

The "InContext" Project (InContext, 2006, 2008; Schall et al., 2007) has a focus on supporting "knowledge workers" involved in the "dynamic forms of collaboration" cited below:

> "The development and application of knowledge in the modern world necessarily involves the employment of increasing numbers of Knowledge Workers. These key people increasingly operate in new kinds of organisational structures and work patterns that require a large amount of inter-organisational activity in terms of technology and communication. Their work interaction patterns require highly dynamic forms of effective team collaboration/communication, which we have classified as ranging from Nimble (short-lived) to Virtual and Mobile/Nomadic Teams" (InContext, 2006, 2008).

> "The inContext project is developing a platform and techniques that make use of service-oriented computing to integrate existing tools (such as email systems, calendars, project schedulers) into a coherent system that can be used on any device, anywhere in the world, to make collaborative work more productive.
>
> So far, the project has concentrated on the development of a Pervasive Collaboration Service Architecture (PCSA) that allows users to connect from a PC, a mobile phone or a PDA to the system and request services". (Leicester U.o., 2008,2008)

Research of this nature may go some way to addressing the issues, but it is my belief that technical solutions on their own will fail to address the issues raised in this study. While the InContext project does have a focus on the activities conducted by collaborative knowledge workers, it is my view that such work in combination with studies of the TUM activities involved is likely to prove more productive. In support of that viewpoint is the following observation made by Richardson and colleagues (2006). Reporting on the "Global Studio Project", an educational initiative in global software development conducted in partnership with Siemens, they noted the use of a suite of software applications, albeit reduced from that used commercially, but voiced the

caution below:

> "Bruegge et al., [5] found that even with a rich set of collaboration tools and some face-to-face meetings between certain team members, actual collaboration and information sharing between geographically remote teams was difficult and infrequent" (Richardson et al., 2006, p.680).

This statement echoes my own reservations in 10.5.1.6 above, and suggests that we still have much work to do to resolve the thorny issues around culture, practices and technology raised by global virtual collaboration. It is to be hoped that the contributions of this work, point to some productive new avenues for investigation.

10.5.2 Recommendations for Research - Conceptual

In addition to the substantive issues noted above, this study has opened several new conceptual avenues of inquiry.

10.5.2.1 Theories of TUMAST & CTF

The conceptual frameworks represented by the two new theorizations - 'Technology-use Mediated AST' (TUMAST) and 'Collaborative Technology Fit' (CTF) - require further work to validate their stability and contributions. Field studies applying these frameworks are needed to assess their merits, to enable more systematic application of assessments of 'fit' and to assess applicability of these frameworks in other domains. Other forms of research could be designed, such as applying TUMAST in Experimental settings where selected parameters could be varied to assess the impact of modifications on the degree of Collaborative Technology Fit. The application of the "Process Restricted AST" (PRAST) model of Wheeler & Valacich (1996), may enable manipulation of aspects of TUM activity to assess the impact of presence or absence of specific forms of TUM activity. Such experiments could use specific instruments suited to experimental studies, such as those developed by Salisbury, Chin et al., (2002) and Salisbury et al., (2006), as elaborated in 10.5.3 below.

10.5.2.2 The Question of Culture

Logically related to the theory of CTF is the question of 'culture' and its definition. As noted in 8.5.2 above, 'culture' is a multilayered and elusive concept. Defining levels of culture in specific contexts, and seeking to formalize culture as a 'construct' or set of constructs, with adequate analytical tools presents a significant challenge for researchers (Ford et al., 2003, Straub et al., 2002, Karahanna et al., 2002). The latter authors note challenges in defining cross cultural equivalence for cross cultural

comparative studies, and point to a number of potential sources of bias from a positivist perspective in analysing culture - construct bias (constructs and associated behaviours in each culture); method bias (administrative procedures); and item bias (operationalisations). While this study has not viewed culture from a positivist perspective, it has identified differing levels at which the diffuse concept of culture may operate, and the analysis is accordingly somewhat 'broad brush'. Therefore it is acknowledged that more research is needed to support a more robust definition and analysis of culture within the model of Collaborative Technology Fit. The "situating culture" framework of Weisinger & Trauth (2002, 2003) appears to be one promising avenue. That research is likely to have wider import within the area of cross-cultural Information systems research, which as Karahanna et al., (2002) have observed "remains relatively underdeveloped".

10.5.2.3 Metastructures and their Determination

The concept of a metastructure may need further development and refinement, from the definition given in section 6.2.4.1, whereby "a metastructure serves to link the six elements of institutional properties, [culture...], technology, individual actions, technology use and technology-use mediation". As noted in 10.4.2 above, it remains an open question whether practitioners will be able to readily identify key metastructures. Yet whether the concept, as a reification of the "metastructuring process" of Orlikowski et al., (1995), can readily be grasped by researchers also remains to be proven. Is the conceptualization significantly robust at this point, that it can be easily interpreted and built upon? Further work to identify and categorise metastructures within GVTs and particular domains will be needed, including confirmation that they can be readily applied within the *CTF* model to systematically and consistently diagnose the level of *fit* within a collaborative situation. The amount of information required to identify metastructures is unclear at this stage. Can they be defined before, during and after a collaboration, or only at completion, after the event? What is the role and utility of granularity in defining metastructures? Are 'macro-level' metastructures substantively different from 'micro-level' ones. Do salient *metastructures* of either form occur in regular patterns across all GVTs? Or are distinctive metastructure patterns visible, but restricted to the different domains in which collaborative technologies are employed? To what extent are any apparent patterns highly genre and domain specific? Then more generally and following on from section 10.5.2.2 above, how best may the relationship between culture and metastructures be elicited? The design of a research programme to

investigate these topics and their interrelationships will pose some significant challenges.

10.5.2.4 The Impact and Definition of Group Motivation

The significance of the *socio-emotional* dimensions and particularly of *motivation* to the effectiveness of TUM activity in GVTs, have been noted in 10.5.1 above as substantive areas for further research. In addition, from a conceptual perspective, a clear definition of the concept of "group motivation" within a GVT is demanded. This definition should distinguish the "group" from the "individual" forms of motivation, such as the traditional "intrinsic" or "extrinsic" motivations (Ryan and Deci, 2000). We have previously posed several related questions in the quote below:

> What motivates members to participate in a virtual group? What sustains that motivation as the group develops? What levels of motivation are necessary in order for a group to achieve its goals? (Clear & Kassabova, 2005).

The critical role of motivation has been evident in this study, but these questions, remain unanswered and present productive areas for future research. Related concepts for investigation are the role of TUM activity in building and sustaining motivation within a GVT, and the relationships between the social-emotional dimensions of GVT behaviour and TUM activity.

10.5.3 Recommendations for Research – Methodological

Several areas of research in the methodological domain arise from this work. The substantive and conceptual research areas identified in sections 10.5.1 and 10.5.2 above, also pose many methodological challenges, which will need to be surmounted in future investigations.

10.5.3.1 Applying the Theories of TUMAST & CTF

As previously discussed in section 10.5.2.1, further work to validate the theories proposed in this study is required. Whereas this study has adopted a structurationist perspective, many other research approaches could be adopted. The underlying basis of AST as an extension of experimental research frameworks for studying Groups, Electronic Meeting Support Systems and GSS (e.g. Dennis et al., 1988; Nunamaker et al., 1993 p. 127; Ilgen et al., 2005), suggests that TUMAST could also be applied in laboratory settings. Such studies (as previously discussed in 10.5.2.1) would require quite different research designs and more rigorously quantitative instruments.

"Breakdown analysis" as applied by Hettinga (2002) could prove to be a very effective research approach, as could the "critical incident technique" of Chell (1998) applied in the study by Thomas et al., (2007). Macro-level forms of "appropriation analysis" as conducted by Chudoba (1999) may also generate insights.

More critical studies applying such techniques as: "critical action research" (Clear, 2004a); "dilemma analysis" (Talanquer et al., 2007); "deconstruction" (Beath & Orlikowski, 1994); "dialectical hermeneutics" (Myers, 1995); etc. could also be undertaken.

As the above suggests, the frameworks developed in this study open the way to a broad range of further studies, applying many different research approaches.

10.5.3.2 Investigating the Phenomenon of Culture

New methods for analysing the phenomenon of culture, as noted in 10.5.2.2 above, are now required to complement the theory of 'collaborative technology fit' *(CTF)*. Adequate analytical tools to distinguish between 'subcultures' and levels, within the multilayered and elusive concept of *culture*, will be demanded. The present somewhat 'broad brush' approach to culture in the theory of *CTF* will need refinement, through new instruments and approaches to measuring culture at differing levels. These instruments will contrast with the present and rather limiting focus on the "national culture" constructs of Hofstede (1980). Instruments and approaches applied to the "organizational" level of culture (Leidner et al., 2006); to "occupational cultures" and "subcultures" (Guzman et al., 2008); "group culture" (Hogg et al., 2004, Thorpe, 2008 p. 560, Hunter, 2007 p. 42); and the "individual" level of culture (Swigger et al., 2004) may prove useful. New instruments to capture such context specific forms of culture as "student" culture, and broader concepts such as "global" culture (Leung et al., 2005) may need to be developed.

10.5.3.3 Strategies for Metastructure Identification and Analysis

While a metastructure may have been defined in section 6.2.4.1, as:

> "a mediating institutional, cultural, or technology structure, which serves to shape [collaborative] technology use",

specific strategies for identifying metastructures have yet to be developed, advancing the data driven but arguably somewhat intuitive strategies adopted in this study. As noted in section 10.5.2.3 above there are many conceptual questions related to identifying and defining metastructures, whether individually or grouped, and at

differing levels of granularity, which bring associated methodological challenges. The amount of information required to identify metastructures and the appropriate points at which they may be defined (e.g. before, during and after a collaboration) require suitable approaches and analytical methods to be developed. As noted in section 9.2.1 above, an in depth analysis of *metastructures* across a set of episodes, conducted by multiple raters may offer a useful strategy.

10.5.3.4 Analytical Methods for Email and Electronic Corpora

A further area in which analytical methods require to be developed is in the analysis of email corpora. As discussed in section 5.2 above, a myriad of separate issues arose while analysing the corpus of email data which contributed to this study. For instance decisions on "unit of analysis" and "segmentation procedures" (Naidu & Ja¨rvela, 2006), have significant implications, and depending upon the analytical strategy adopted (e.g. the *positivist* models of text analysis, as opposed to the *linguistic* or *interpretivist* models distinguished by Lacity & Janson, 1994) can serve to either underpin or undermine the quality of the research.

As I had noted earlier (section 5.2.2.1) these different approaches to text analysis suggest very different approaches to transcribing and analysing an email corpus. While Stubbe et al., (2003), have defined a set of transcription standards to be applied to such textual corpora as the "Wellington Corpus of Spoken New Zealand English", no equivalent standards exist for email analysis. While the difficulties for researchers in accessing large email datasets have been noted (Cohen et al., 2004), it seems likely that research studies analysing email data will become more common, reflecting the ubiquity and salience of email use within virtual teams (Lee-Kelley & Sankey, 2008), not to mention more generally in our daily lives. It may benefit future researchers to develop an email transcription standard, or perhaps differing sets of standards, to suit whichever of the above models of text analysis outlined by Lacity & Janson (1994) were chosen.

In addition to such consistent transcription standards for email data, a range of related data management strategies (including scrubbing and cleansing processes to remove duplicates etc. as applied in this study) require to be developed for analysis of the increasing range of data being captured within distributed electronic environments. As Ruhleder (2000) has noted:

> "these newly available forms of data require technical solutions to help in the capture, analysis, and management of large sets of data, as well as analytical strategies for managing multiple data streams" (p.14).

The management therefore of such interrelated interactions as those encompassed within chat session records, mobile 'txt' dialogue records, online discussion forums in threads and sequences of conversations, (frequently interwoven as in this study with email data, online forms and diary notes) requires concrete approaches, partly procedural and partly technical, to be developed.

Within this study for instance a further type of analysis which could be conducted would involve revisiting selected email sequences and analysing them in their logical groupings of "mosaic messages" (Lee, 1994). Whether the outcomes of that form of research would differ from the more disaggregated approach taken in this study, is at least an interesting question.

10.6 Chapter Summary

This final chapter of the thesis has reiterated the motivation for this study into *Technology-use Mediation in Global Virtual Teams* and its many substantive, conceptual and methodological contributions. The wide variety of research and practice domains in which the work is considered applicable has been outlined. A series of recommendations for practice have been given, including substantive recommendations relating to: email technology; security; formal meetings; coordination roles; integration of platforms; support for mobility; and new job roles managing collaborative technologies. Conceptual and methodological recommendations for practitioners, relating to the adoption of the 'Theory of Collaborative Technology Fit' within their own contexts, have been made.

For researchers likewise a set of recommendations for further research has been given. These recommendations have again addressed substantive, conceptual and methodological concerns. Substantively more research is recommended into the relationships between TUM activity the theorizations of TUMAST and CTF, and a broad range of topics canvassed in this study. At a more specific level, more research is recommended into paradigms of management control; socio-emotional dimensions and the role of trust; the impact of subsequent developments; the nature of invisible work; the interdisciplinary nature of global virtual team research; global collaboration in course delivery; global software development and platform integration. Conceptually, research gaps have been identified in the development and testing of the theories of TUMAST and CTF; the question of culture; metastructures and their determination; and the impact and definition of group motivation. From a

methodological perspective, the need for research into approaches to studying the identified conceptual issues has been identified, together with some recommendations relating to analyzing email corpora and electronic data within distributed settings.

This chapter and the thesis conclude with these final remarks about the nature of *Technology-Use Mediation within Global Virtual Teams.*

10.7 Concluding remarks

Panteli & Duncan (2004) have likened the performance of a virtual team to the enacting of a dramatic performance, progressing through the scripting, staging and performing phases of a virtual play. This dramaturgical interpretation of virtual life has its echoes in the familiar, far earlier and more concrete metaphor of human life presented to us by Shakespeare in *As You Like It (Act II, Scene VII)* through the soliloquy of melancholy Jacques:

> "All the world's a stage,
> And all the men and women merely players:
> They have their exits and their entrances;
> And one man in his time plays many parts" (Shakespeare, 1971 p. 218).

I have been both an actor and a member of the supporting cast, as we performed our "many parts" within the lesser drama recounted in this study. The staging metaphor seems appropriate here in many ways. In the performance of a dramatic play the actors on stage bask in the limelight, while the supporting cast dwells in the shadows. While toiling equally hard, the supporting cast can be seen as invisible actors, engaged in what Star & Strauss (1999) have termed "shadow work" in the "backstage". Perhaps naturally the attention in the theatre world is directed to the glamorous and visible actors on stage, and likewise much of the research into global virtual teams has concentrated on the 'actors' within their virtual plays. For instance Thomas and colleagues (2007) have remarked "we know of no prior field study examining this topic" of technology facilitation in virtual teams.

This selective attention is puzzling, have the researchers been unduly dazzled by the 'performers' on the virtual stage?

For just as in the real world, in the global virtual world the "backstage" is critical to the success of the play. It is crucial therefore that we better understand the supporting activities behind the scripting, staging and performing of these virtual plays. Thereby we may reduce the risk of future performances becoming commercial flops. In that quest, this study has chronicled the work of not only those who act "frontstage", but those who dwell "backstage", in the shadows of these global virtual 'plays'.

11. References:

Ackermann, F. (1996). Participants Perceptions on the Role of Facilitators Using Group Decision Support Systems. *Group Decision and Negotiation, 5*, 93-112.

Alavi, M., & Carlson, P. (1992). A Review of MIS Research and Disciplinary Development. *Journal of Management Information Systems, 8*(4), 45-62.

Alexander, I. (2005). A Taxonomy of Stakeholders: Human Roles in System Development. *International Journal of Technology and Human Interaction, 1*(1), 23-59.

Alexander, S., & McKenzie, J. (1998). *An Evaluation of Information Technology Projects for Education*. Canberra: Australian Government Publishing Service (AGPS). Executive Summary retrieved 14 June 2007 from http://www.iml.uts.edu.au/about/staff/alexander/cautexec.html.

Allan, G. (2003). A critique of using grounded theory as a research method. *Electronic Journal of Business Research Methods, 2*(1), 1-10.

Alter, S. (2007). Service system fundamentals: work system, value chain, and life cycle. *IBM Systems Journal, 47*(1), 71-85.

Alvarez, M., Baiocchi, J., & PowSang, J. (2008). Computing and Higher Education in Peru. *SIGCSE Bulletin, 40*(2), 35-39.

Ambler, S. (2002-2006, May 10, 2006). *Development Sandboxes: An Agile "Best" Practice*. Retrieved 2 May, 2007, from http://www.agiledata.org/essays/sandboxes.html

Anderson, G. (2008). Mapping Academic Resistance in the Managerial University. *Organization, 15*(2), 251-270.

Arrow, H., Henry, K., Poole, M. S., Wheelan, S., & Moreland, R. (2005). Traces, Trajectories and Timing - The Temporal Perspective On Groups. In M. S. Poole & A. Holllingshead (Eds.), *Theories of Small Groups - Interdisciplinary Perspectives* (pp. 313-367). Thousand Oaks: SAGE.

Arrow, H., Poole, M., Henry, K., Wheelan, S., & Moreland, R. (2004). Time Change and Development - The Temporal Perspective on Groups. *Small Group Research, 35*(1), 73-105.

Asprey, W., Mayadas, F., & Vardi, M. (2006). *Globalization and Offshoring of Software - A Report of the ACM Job Migration task Force*. New York: ACM.

Atkins, C. (2007). Here Be Dragons: Reflections on a Second Life Journey. *Bulletin of Applied Computing and Information Technology, 5*(1).

AUTEC. (2000). *Auckland University Of Technology Ethics Committee Guidelines - Version 3*. Auckland: Auckland University Of Technology.

Avison, D., Lau, F., Myers, M., & Nielsen, P. (1999). Action Research. *Communications of the ACM, 42*(1), 94-97.

Bain, J. (1999). Introduction (to the special Issue on Evaluation). *Higher*

Education Research & Development, 18(2), 165-172.

Balasubramanian, S., & Mahajan, V. (2001). The Economic Leverage of the Virtual Community. *International Journal of Electronic Commerce, 5*(3), 103-138.

Bansler, J., & Havn, E. (2003). Technology-Use Mediation: Making Sense of Electronic Communication in an Organizational Context. In *2003 International ACM SIGGROUP Conference on Supporting Group Work* (pp. 135-143). Sanibel Island, Florida: ACM.

Bansler, J., & Havn, E. (2006). Sensemaking in Technology-Use Mediation: Adapting Groupware Technology in Organizations. *Computer Supported Cooperative Work, 15*(1), 55-91.

Barley, S. (1986). Technology as an Occasion for Structuring: Evidence from Observation of CT Scanners and the Social Order of Radiology Departments. *Administrative Science Quarterly, 31*, 71-108.

Barley, S. (1996). Technicians in the Workplace: Ethnographic Evidence for Bringing Work into Organization Studies. *Administrative Science Quarterly, 41*, 404-441.

Barlow, K., & Lane, J. (2007, Oct 7–10). *Like Technology from an Advanced Alien Culture [1]: Google Apps for Education at ASU.* Paper presented at the 35th annual ACM SIGUCCS conference on User services (SIGUCCS'07), Orlando, Florida, USA.

Barab, S. (2003). An Introduction to the Special Issue: Designing for Virtual Communities in the Service of Learning. *The Information Society, 19*(3), 197-201.

Barua, A., Chellapa, R., & Whinston, A. (1995). Creating a Collaboratory in Cyberspace: Theoretical Foundation and an Implementation *Journal of Organizational Computing and Electronic Commerce, 5*(4), 417-442.

Baskerville, R. (1999). Investigating Information Systems With Action Research. *Communications of the AIS, 2*(Oct), 1-32.

Baskerville, R., & Myers, M. (2004). Special Issue on Action Research in Information Systems: Making IS Research Relevant to Practice. *MIS Quarterly, 28*(3), 329-335.

Baskerville, R., & Wood-Harper, A. (1998). Diversity in information systems action research methods. *European Journal of Information Systems, 7*(2), 90-107.

Beath, C., & Orlikowski, W. (1994). The Contradictory Structure of Systems Development Methodologies: Deconstructing the IS-User Relationship in Information Engineering. *Information Systems Research, 5*(4), 350-377.

Beise, C., Evaristo, R., & Niederman, F. (2003). *Virtual Meetings and Tasks: From GSS to DGSS to Project Management.* Paper presented at the 36th Hawaii International Conference on System Sciences, Maui, Hawaii.

Beise, C., Niederman, F., & Mattord, H. (2004). IT Project Managers' Perceptions and Use of Virtual Team Technologies. *Information Resources Management Journal, 17*(4), 73-88.

Bell, B., & Kozlowski, S. (2002). A Typology of Virtual Teams: Implications for Effective Leadership. *Group & Organization Management, 27*(1), 14-49.

Benford, S., Reynard, G., Koleva, B., & Drozd, A. (2002). *Staging and Evaluating Public Performances as an Approach to CVE Research.* Paper presented at the Collaborative Virtual Environments Conference (CVE) '02, Bonn, Germany.

Bergin, J. (2002). *Teaching on the Wiki Web.* Paper presented at the 7th Annual Conference on Innovation and Technology in Computer Science Education Aarhus, Denmark.

Berglund, A. (2005). *Learning computer systems in a distributed project course: The what, why, how and where*. Uppsala: Uppsala University.

Bernstein, P. (1996). Middleware: a model for distributed system services *Communications of the ACM, 39*(2), 86-98.

Bird, L. (2001, Dec 9-12). *Virtual Learning in the Workplace: The Power of Communities of Practice.* Paper presented at the 18th Annual Conference of the Australian Society for Computers in Learning in Tertiary Education, University of Melbourne.

Bødker, S. (2000). Coordinating Technical Support Platforms. *Communications of the ACM, 43*(11), 215-222.

Bødker, S., & Andersen, P. (2003). Complex Mediation. *Human-Computer Interaction, 20*, 353-402.

Bostrom, R., Anson, R., & Clawson, K. (1993). Group Facilitation and Group Support Systems. In L. Jessup & J. Valacich (Eds.), *Group Support Systems: New Perspectives*. New York: MacMillan.

Boud, D. (1985). Problem Based Learning in Perspective. In D. Boud (Ed.), *Problem Based Learning in Education for the Professions* (pp. 13-18). Sydney: Higher Education Research Society Of Australia.

Boyer, E. (1990). *Scholarship Reconsidered: Priorities of the Professoriate*. New Jersey: Carnegie Foundation Special Report. Princeton University Press.

Bridgeman, N., Tiffin, J., & Mosen, P. (1999). The Global Virtual University (GVU): an Institution Designed for the New Learning Environment. In S. Mann, J. Sinnott & L. Smith (Eds.), *Proceedings of the 12th Annual NACCQ Conference* (pp. 37-42). Dunedin: NACCQ.

Bruegge, B., Dutoit, A., Kobylinski, R., & Teubner, G. (2000, Dec). *Transatlantic Project Courses in a University Environment.* Paper presented at the 7th Asia-Pacific Software Engineering Conference (APSEC),, Singapore.

Bruegge, B., & Dutoit, A. (2004). *Object Oriented Software Engineering using UML, Patterns and Java* (2 ed.). Upper Saddle River, New Jersey: Prentice Hall.

Carmel, E., & Abbott, P. (2007). Why 'Nearshore' Means That Distance Matters. *Communications of the ACM, 50*(10), 40-46.

Carr, W., & Kemmis, S. (1983). *Becoming Critical: Knowing Through Action*

Research. Melbourne: Deakin University press.

Carroll, J., Howard, S., Vetere, F., Peck, J., & Murphy, J. (2002). *Just what do the youth of today want? Technology appropriation by young people.* Paper presented at the 35th Hawaii International Conference on System Sciences, Maui, Hawaii.

Carter, P. (2002). Building Purposeful Action: action methods and action research. *Educational Action Research, 10*(2), 207.

Casey, V., & Richardson, I. (2006, Oct 16-19). *Project Management Within Virtual Software Teams.* Paper presented at the First International Conference on Global Software Engineering (IGCSE'06), Costão do Santinho, Florianópolis, Brazil.

Chang, T., & Lim, J. (2002). Cross-Cultural Communication and Social Presence in Asynchronous Learning Processes. *e-Service Journal, 1*(3), 83-103.

Chell, E. (1998). Critical Incident Analysis. In G. Symon & C. Cassell (Eds.), *Qualitative Methods and Analysis in Organisational Research*. London: Sage.

Chen, J., & Yang, Y. (2006). Key Research Issues in Grid Workflow Verification and Validation. In R. Buyya & T. Ma (Eds.), *Proc. Fourth Australasian Symposium on Grid Computing and e-Research (AusGrid 2006), CRPIT* (Vol. 54, pp. 97-104). Tasmania, Australia: ACS. Retrieved 18/06/2008 from http://crpit.com/confpapers/CRPITV54Chen.pdf

Chin, W., Ghopal, A., & Salisbury, W. (1997). Advancing the Theory of Adaptive Structuration: The Development of a Scale to Measure Faithfulness of Appropriation. *Information Systems Research, 8*(4), 342-367.

Chudoba, K. (1999). Appropriations and Patterns in the Use of Group Support Systems. *The DATABASE for Advances in Information Systems, 30*(3&4), 131 - 148.

Churchill, E., & Halversen, C. (2005). Social Networks and Social Networking [Guest Editor's Introduction]. *Internet Computing, 9*(5), 14-19.

Clear, T. (1997). The Nature of Cognition and Action. *SIGCSE Bulletin, 29*(4), 25- 29.

Clear, T. (1999a, Jun 19-24). *International Collaborative Learning - The Facilitation Process.* Paper presented at the ED-MEDIA '99 - World Conference on Educational Multimedia, Hypermedia and Telecommunications, Seattle, Washington.

Clear, T. (1999b, Jun 27 - Jul 1). *A Collaborative Learning Trial between New Zealand and Sweden - Using Lotus Notes Domino in Teaching the Concepts of Human Computer Interaction.* Paper presented at the 4th Annual Conference On Innovation & Technology In Computer Science Education, Cracow, Poland.

Clear, T. (2000a). *Developing and Implementing a Groupware Application to Support International Collaborative Learning.* Unpublished M. Phil., Auckland University, Auckland.

Clear, T. (2002b). E-Learning: A Vehicle for Transformation or Trojan Horse for Enterprise? - Revisiting the role of Public Higher Education Institutions. *International Journal on E-Learning, 1*(4), 15 - 21.

Clear, T. (2002c, 8-11 December). *Genre Structuring In a Web-based Groupware Medium: The Evolution of a Project Progress Report.* Paper presented at the 19th Annual Conference of the Australasian Society for Computers in Learning in Tertiary Education (ASCILITE) 2002, Auckland.

Clear, T. (2002d). Design and Usability in Security Systems - Daily Life as a Context of Use? *SIGCSE Bulletin, 34*(4), 13-14.

Clear, T. (2003, 23 - 28 Jun). *Virtual groups, Collaborative Trials and Tribulations.* Paper presented at the ED-MEDIA 2003 World Conference On Educational Multimedia, Hypermedia & Telecommunications, Honolulu, Hawaii.

Clear, T. (2004a). Critical Enquiry in Computer Science Education. In S. Fincher & M. Petre (Eds.), *Computer Science Education Research: The Field and The Endeavour* (pp. 101- 125). London: Routledge Falmer, Taylor & Francis Group.

Clear, T. (2004b, 2 Nov). *Global Virtual Teams: Moderating Behaviour in 3D Collaborative Virtual Environments.* Paper presented at the E-Learn 2004 - World Conference on E-Learning in Corporate, Government, Healthcare and Higher Education, Washington, D.C.

Clear, T. (2005, 23 Feb). *The functioning of global virtual teams: the role of collaborative computing technologies and technology-use mediation in supporting their work.* Paper presented at the ACM Special Interest Group on Computer Science Education, Technical Symposium, Doctoral Consortium, SIGCSE2005, St Louis, Missouri. http://www.radford.edu/~kstevens2/DC05/

Clear, T. (2006, 15 Feb). *Supporting the Work of Global Virtual Teams - Thinking Outside the Group.* Paper presented at the School of Computer & Information Sciences Postgraduate Conference, AUT Technology Park, Auckland, New Zealand.

Clear, T. (2007a). To the Star John Hughes in the Constellation Pictor. *SIGCSE Bulletin, 39*(2), 102.

Clear, T. (2007b). Valuing Computer Science Education Research? In A. Berglund & M. Wiggberg (Eds.), *Proceedings of the 6th Baltic Sea Conference on Computing Education Research, Koli Calling* (pp. 8-18): Uppsala University, Uppsala, Sweden. Also available at http://cs.joensuu.fi/kolistelut/. http://www.it.uu.se/research/group/upcerg/Publications/proceedingsKoliCalling2006/

Clear, T. (2007c). Global Virtual Teams and 3D Collaborative Virtual Environments. In J. Hosking (Ed.), *Proceedings SIENZ'07 - Software Innovation and Engineering New Zealand Workshop 2007* Auckland, New Zealand: University of Auckland. https://www.se.auckland.ac.nz/sienz/SIENZ07/

Clear, T. (2007d). Computing Capstone Projects and the Role of Failure in

Education. *SIGCSE Bulletin, 39*(4), 13-15.

Clear, T. (2008). Global Collaboration in Course Delivery: Are We There Yet? *SIGCSE Bulletin, 40*(2), 11-12.

Clear, T., & Daniels, M. (2000, Oct 18-21). *Using Groupware For International Collaborative Learning.* Paper presented at the 30th American Society for Engineering Education/Institute of Electrical and Electronics Engineers Frontiers in Education Conference 2000. Retrieved 8 Nov 2003 from http://fie.engrng.pitt.edu/fie2000/authors/C.htm Kansas, Missouri. http://fie.engrng.pitt.edu/fie2000/authors/C.htm

Clear, T., & Daniels, M. (2001, June 25 - June 27). *A Cybericebreaker for an Effective Virtual Group?* Paper presented at the 6th Annual Conference On Innovation and Technology In Computer Science Education (ITiCSE), University of Canterbury, Kent.

Clear, T., & Daniels, M. (2003, 5-8 Nov, 2003). *2D & 3D Introductory Processes in Virtual Groups.* Paper presented at the 33rd ASEE/IEEE Frontiers in Education Conference. Retrieved November 6, 2003, from http://fie.engrng.pitt.edu/fie2003/, Boulder, Colorado.

Clear, T., & Foot, G. (2002). *Avatars in Cyberspace - A Java 3D Application to Support Performance of Virtual Groups.* Paper presented at the 7th Annual Conference On Innovation and Technology In Computer Science Education (ITiCSE), Aarhus, Denmark.

Clear, T., & Kassabova, D. (2005). Motivational Patterns in Virtual Team Collaboration. *Conferences in Research and Practice in Information Technology, 42*, 51-58.

Clear, T., & Kassabova, D. (2008). A Course in Collaborative Computing: Collaborative Learning and Research with a Global Perspective. In M. Guzdial & S. Fitzgerald (Eds.), *Proceedings of the 39th ACM Technical Symposium on Computer Science Education* (pp. 63-67). Portland, Oregon: ACM.

Clear, T., Whalley, J., Lister, R., Carbone, A., Hu, M., Sheard, J., et al. (2008). Reliably Classifying Novice Programmer Exam Results using the SOLO Taxonomy. In S. Mann & M. Lopez (Eds.), *21st Annual NACCQ Conference* (Vol. 1, pp. 23-30). Auckland, New Zealand: NACCQ.

Coakes, E., Coakes, J., & Rosenberg, D. (2008). Co-operative work practices and knowledge sharing issues: A comparison of viewpoints. *International Journal of Information Management, 28*, 12-25.

Cockburn, A. (2003). *People and Methodologies in Software Development* Unpublished Doctoral Dissertation, University of Oslo, Oslo. Retrieved 3/03/2008 from http://alistair.cockburn.us/images/Peopleandmethodologiesinsoftwaredevelopment.pdf

Cohen, W., Carvalho, V., & Mitchell, T. (2004, 25-26 Jul). *Learning to Classify Email into "Speech Acts".* Paper presented at the Empirical Methods in Natural Language Processing Conference, Barcelona, Spain.

Coler, M. (1974). Evolution of Art from Play. *Leonardo, 7*(4), 381-382.

Coppola, N., Hiltz, S., & Rotter, N. (2004). Building Trust in Virtual Teams.

IEEE Transactions on Professional Communication, 47(2), 95-104.

Cramton, C. (2001). The Mutual Knowledge Problem and its Consequences for Dispersed Collaboration. *Organization Science, 12*(3), 346-371.

Cunningham, S., & Jones, M. (2005, Jul 6-8). *Autoethnography: A tool for practice and education.* Paper presented at the 6th ACM SIGCHI New Zealand chapter's international conference on Computer-human interaction: making CHI natural (CHINZ'05), Auckland.

Cusick, J., & Prasad, A. (2006). A Practical Management and Engineering Approach to Offshore Collaboration. *IEEE Software, Sept/Oct*, 20-29.

Czarniawska, B. (2004). On Time, Space, and Action Nets. *Organization, 11*(6), 773-791.

Damer, B. (1998). *Avatars! Exploring and Building Virtual Worlds on the Internet*. Berkeley, CA: Peachpit Press.

Daniels, M., Berglund, A., & Petre, M. (1999). Reflections on International Projects in Undergraduate CS Education. *Computer Science Education, 9*(3), 256-267.

Daniels, M., Faulkner, C., & Newman, I. (2002, 25-27 Feb). *Open Ended Group Projects, Motivating students and Preparing them for the 'Real World'.* Paper presented at the 15th Conference on Software Engineering Education and Training (CSEET'02), Covington, Kentucky.

Daniels, M., Petre, M., Almstrum, V., Asplund, L., Bjorkmann, C., Erickson, C., et al. (1998). *RUNESTONE, an International Student Collaboration Project.* Paper presented at the IEEE Frontiers in Education Conference, Tempe, Arizona.

Davidson, E., & Chiasson, M. (2005). Contextual influences on technology use mediation: a comparative analysis of electronic medical record systems. *European Journal of Information Systems, 14*, 6-18.

Davidson, E., & Tay, A. (2002). *Studying Teamwork in Global IT Support.* Paper presented at the 36th Hawaii International Conference on System Sciences, Maui, Hawaii.

Davison, R., & DeVreede, G. (2001). The Global Application of Collaborative Technologies. *Communications of the ACM, 44*(12), 69-70.

Davison, R., Fuller, M., & Hardin, A. (2003). E-Consulting in Virtual Negotiations. *Group Decision and Negotiation, 12*, 517-535.

DeLuca, D., & Valacich, J. (2006). Virtual teams in and out of synchronicity. *Information Technology and People, 19*(4), 323-344.

Denning, P., & Yaholkovsky, P. (2008). Getting to "We". *Communications of the ACM, 51*(4), 19-24.

Dennis, A., & Garfield, M. (2003). The Adoption and Use of GSS in Project Teams: Toward More Participative Processes and Outcomes. *MIS Quarterly, 27*(2), 289-323.

Dennis, A., George, J., Jessup, L., & Nunamaker, J. (1988). Information Technology to Support Electronic Meetings. *MIS Quarterly, 12*(4), 591-624.

Dennis, A., Pootheri, S., & Natarajan, V. (1998). Lessons from the Early Adopters of Web Groupware. *Journal of Management Information Systems, 14*(4), 65-86.

Dennis, A., & Valacich, J. (1999, 05-08 Jan). *Rethinking media richness: Toward a theory of media synchronicity.* Paper presented at the Thirty-Second Annual Hawaii International Conference on System Sciences (HICSS), Maui, Hawaii.

Dennis, A., Wixom, B., & Vandenberg, R. (2001). Understanding Fit and Appropriation Effects in Group Support Systems via Meta-Analysis. *MIS Quarterly, 25*(2), 169-193.

Denton, L., & McKinney, D. (2004, Oct 20-23). *Affective Factors and Student Achievement: A Quantitative and Qualitative Study.* Paper presented at the 34th American Society for Engineering Education/Institute of Electrical and Electronics Engineers Frontiers in Education Conference 2004., Savannah, Georgia.

DeSanctis, G. (1993). Shifting Foundations in Group Support Systems Research. In L. Jessup & J. Valacich (Eds.), *Group Support Systems: New Perspectives*. New York: MacMillan.

DeSanctis, G., & Gallupe, B. (1987). A Foundation for the Study of Group Decision Support Systems. *Management Science, 33*(5), 589 - 609.

DeSanctis, G., & Monge, P. (1999). Introduction to the Special Issue: Communication Processes for Virtual Organizations. *Organization Science, 10*(6), 693-703.

DeSanctis, G., & Poole, M. (1994). Capturing the Complexity in Advanced Technology Use: Adaptive Structuration Theory. *Organization Science, 5*(2), 121 - 147.

DeSanctis, G., Wright, M., & Jiang, L. (2001). Building a Global Learning Community. *Communications of the ACM, 44*(12), 80-82.

Domino, M., Hevner, A., & Collins, R. W. (2002). *Applying Agile Software Development Processes to Global Virtual Teams: A Study of Communication Modalities.* Paper presented at the 2002 International ACM SIGCPR Conference, Kristiansand, Norway.

DSDM. (2005). *Guidelines for applying DSDM in an Offshore Environment*. London: DSDM Consortium. Retrieved 19/10/2005 from http://www.dsdm.org/kss/details.asp?fileid=533.

Dube, L., & Pare, G. (2004). The Multifaceted Nature of Virtual Teams. In D. Pauleen (Ed.), *Virtual Teams: Projects, Protocols and Processes* (pp. 1-39). Hershey PA: Idea Group.

DuGay, P., & Salaman, G. (1992). The Culture of the Customer. *Journal of Management Studies, 29*(5), 615-633.

Dustdar, S. (2004). Caramba-A Process-Aware Collaboration System Supporting Ad hoc and Collaborative Processes in Virtual Teams. *Distributed and Parallel Databases, 15*, 45-66.

Ehn, P., & Kyng, M. (1987). The Collective Resource Approach to Systems Design. In G. Bjerknes, P. Ehn & M. Kyng (Eds.), *Computers And*

Democracy (pp. 34-35). London: Avebury.

Eisenhardt, K. (1989). Building Theories from Case Study Research. *Academy of Management Review, 14*(4), 532-550.

ELI. (2007, December). 7 Things you Should know about Skype. *Educause Learning Initiative*. Retrieved 20/06/2008 from http://net.educause.edu/ir/library/pdf/ELI7032.pdf

Elliott, M., & Scacchi, W. (2003). *Free Software Developers as an Occupational Community: Resolving Conflicts and Fostering Collaboration.* Paper presented at the Group 2003 Conference, Sanibel Island, Florida.

Ellis, C., Gibbs, S., & Rein, G. (1991). Groupware Some Issues and Experiences. *Communications of the ACM, 34*(1), 39-58.

Engeström, Y., Miettinen, R., & Punamaki, R. (Eds.). (1999). *Perspectives on Activity Theory*. New York: Cambridge University Press.

Eriksson, S. (2007). *CODEX Rules and Guidelines for Research*. Retrieved 25 Oct, 2007, from http://www.codex.vr.se/codex_eng/codex/index.html

e-SI. (2008). *Theme08 - Trust and Security in Virtual Communities*. Retrieved 07 Jun, 2008, from http://www.nesc.ac.uk/esi/themes/theme_08/

Espinosa, J., Slaughter, S., Kraut, R., & Herbsleb, J. (2007). Team Knowledge and Coordination in Geographically Distributed Software Development. *Journal of Management Information Systems, 24*(1), 135-169.

Fagan, M. (1976). Design and code inspections to reduce errors in program development. *IBM Systems Journal, 3*, 182-211.

Fahraeus, E., Chamberlain, B., Bridgeman, N., Fuller, U., & Rugelj, J. (1999). Teaching with Electronic Collaborative Learning Groups. In *ITiCSE Working Group Reports* (pp. 121 - 128). New York: ACM.

Fan, Y. (2000). A Classification of Chinese Culture. *Cross Cultural management - An International Journal, 7*(2), 3-10.

Favela, J., & Pena-Mora, F. (2001). An Experience in Collaborative Software Engineering Education. *IEEE Software, Mar/April*, 47-53.

Fincher, S. (2000, Oct 18-21). *From transfer to transformation: towards a framework for successful dissemination of engineering education* Paper presented at the 30th American Society for Engineering Education/Institute of Electrical and Electronics Engineers Frontiers in Education Conference 2000., Kansas, Missouri.

Fincher, S. (2006). Editorial Comments - Special Issue on CSE Pedagogic Patterns. *Computer Science Education, 16*(2), 75.

Fincher, S., Petre, M., & Clark, M. (2001). *Computer Science Project Work Principles and Pragmatics*. London: Springer Verlag.

Fjermestad, J., & Hiltz, S. (1998-99). An Assessment of Group Support Systems Experimental Research: Methodology and Results. *Journal of Management Information Systems, 15*(3), 7-149.

Ford, P., Connelly, C., & Meister, D. (2003). Information Systems Research and Hofstede's Cultures Consequences: An Uneasy and Incomplete

Partnership. *IEEE Transactions on Engineering Management, 50*(1), 8-25.

Franklin, T., & van Harmelen, M. (2007). *Web 2.0 for Content Creation for Learning and Teaching in Higher Education* (Joint Information Systems Committee (JISC) Commissioned Report). Manchester: Franklin Consulting and University of Manchester. Retrieved 24/09/2007 from http://octette.cs.man.ac.uk/~mark/web2.0_for_comment.pdf.

Frey, L., & Sunwolf. (2005). The Symbolic-Interpretive Perspective of Group Life. In M. S. Poole & A. Holllingshead (Eds.), *Theories of Small Groups - Interdisciplinary Perspectives* (pp. 185-239). Thousand Oaks: SAGE.

Fulk, J., Schmitz, J., & Steinfield, C. (1990). A Social Influence Model of Technology Use. In J. Fulk & C. Steinfeld (Eds.), *Organizations and Communication Technology* (pp. 117-142). Beverley Hills, CA: SAGE.

Fuller, M., & Trower, J. (1994). Facilitation, Systems, and Users: the Complete Socio-Technical System. In *Twenty Seventh Annual Hawaii International Conference on System Sciences (HICSS)* (Vol. 1, pp. 82-91). Maui, Hawaii: IEEE.

Furst, S., Blackburn, R., & Rosen, B. (1999). Virtual team Effectiveness: A Proposed Research Agenda. *Information Systems Journal, 9*, 249 - 269.

Furst, S., Reeves, M., Rosen, B., & Blackburn, R. (2004). Managing the life cycle of virtual teams. *Academy of Management Executive, 18*(2), 6-20.

Gallivan, M. (2001). Striking a balance between trust and control in a virtual organization: a content analysis of open source case studies. *Information Systems Journal, 11*(4), 277-304.

Gallupe, R., & Tan, F. (1999). A Research Manifesto for Global Information Management. *Journal of Global Information Management, 7*(3), 5- 18.

Gamma, E., Helm, R., Johnson, R., & Vlissides, J. (1995). *Design Patterns*. Reading, Massachusetts: Addison-Wesley.

George, J., & Jessup, L. (1997). Groups Over Time: What are We Really Studying? *International Journal of Human-Computer Studies, 47*, 497 - 511.

Germonprez, M., Hovorka, D., & Collopy, F. (2007). A Theory of Tailorable Design. *Journal of the Association for Information Systems, 8*(6), 351-367.

Gersick, C. (1988). Time and transition in work teams: Toward a new model of group development. *Academy of Management Journal, 31*(1), 9-41.

Gersick, C. (1991). Revolutionary Change Theories: A Multilevel Exploration of the Punctuated Equilibrium Paradigm. *The Academy of Management Review, 16*(1), 10-36.

Giddens, A. (1984). *The Constitution of Society*. Cambridge: Polity Press.

Glaser, B. G. (1992). *Emergence vs. Forcing: Basics of Grounded Theory Analysis*. Mill Valley, CA: Sociology Press.

Glaser, B., & Strauss, A. (1967). *The Discovery of Grounded Theory*. Mill

Valley, CA: Sociology Press.

Goodyear, P., Salmon, G., Spector, M., Steeples, C., & Tickner, T. (2001). Competences for online teaching: A special report. *Educational Technology Research & Development, 49*(1), 65-72.

Gotterbarn, D., Clear, T., Gray, W., & Houliston, B. (2006). Developing Software in a Bicultural Context: The Role of a SoDIS® Inspection. *International Journal of Technology and Human Interaction, 2*(2), 1-21.

Greenwood, D., & Levin, M. (2000). Reconstructing the Relationships Between Universities and Society Through Action Research. In N. Denzin & Y. Lincoln (Eds.), *Handbook of Qualitative Research* (pp. 85-106). Thousand Oaks: SAGE.

Gregor, S. (2006). The Nature of Theory in Information Systems. *MIS Quarterly, 30*(3), 611-642.

Gruenfeld, D., & Hollingshead, A. (1993). Sociocognition in Work Groups: the Evolution of Group Integrative Complexity and its Relation to Task Performance. *Small Group Research, 24*(3), 383-405.

Guba, E., & Lincoln, Y. (1988). *Effective Evaluation* (6 ed.). San Francisco: Jossey Bass.

Gustafsson, B., Hermerén, G., & Petersson, B. (2006). *Good Research Practice What Is It? Views, guidelines and examples* (No. 1:2006). Stockholm: Swedish Research Council.

Guzdial, M., Ludovice, P., Realff, M., Morley, T., & Carroll, K. (2002, 23- 26 Oct). *When Collaboration Doesn't Work* Paper presented at the International Conference of the Learning Sciences, Seattle, Washington. Retrieved 02/08/2007 from http://home.cc.gatech.edu/csl/uploads/6/CMCI-ICLS-final.pdf.

Guzdial, M., Rick, J., & Kerimbaev, B. (2000). Recognizing and Supporting Roles in CSCW. In *ACM 2000 Conference on Computer Supported Cooperative Work*. Philadelphia, PA.: ACM. Retrieved 07/10/2004 from http://coweb.cc.gatech.edu/csl/24

Guzman, I., Stam, K., & Stanton, J. (2008). The Occupational Culture of IS/IT Personnel within Organizations. *The DATABASE for Advances in Information Systems, 39*(1), 33-50.

Habermas, J. (1984). *The theory of communicative action (Vol 1) reason and the rationalisation of society* (T. McCarthy, Trans. Vol. 1). Boston: Beacon Press.

Hackman, & Morris, M. (1975). Group tasks, group interaction process, and group performance effectiveness: A Review and proposed integration. In L. Berkowitz (Ed.), *Advances in Experimental Social Pscychology* (pp. 45-99). New York Academic Press.

Hafner, W., & Ellis, T. (2004). *Project-Based, Asynchronous Collaborative Learning.* Paper presented at the 37th Hawaii International Conference on System Sciences, Maui, Hawaii.

Hämäläinen, R., Manninen, T., Järvelä, S., & Häkkinen, P. (2006). Learning to collaborate: Designing collaboration in a 3-D game environment. *The*

Internet and Higher Education, 9, 47-61.

Hamilton, M., & Berry, M. (2007). Mobile computing, programming, games and online communities: changes to the communicative ecology of design students through mobile computing: part 2. In S. Mann & Simon (Eds.), *Conferences in Research and Practice in Information Technology* (Vol. 66, pp. 55-61). Ballarat, Victoria, Australia: ACS.

Hammon, A. (2007). *Participation And Communication In Virtual Teams Using Representational Avatars* Unpublished Doctor of Management In Organizational Leadership Dissertation University of Phoenix, Phoenix, Arizona, USA.

Hanisch, J., & Corbitt, B. (2004). *Requirements Engineering During Global Software Development: Some Impediments to the Requirements Engineering Process: A case study.* Paper presented at the Twelfth European Conference on Information Systems, Turku, Finland.

Hardin, A., Fuller, M., & Valacich, J. (2006). Measuring Group Efficacy in Virtual Teams - New Questions in an Old Debate. *Small Group Research, 37*(1), 65-85.

Harmer, B., & Pauleen, D. (2008). Time and Tide. *University of Auckland Business Review, 10*(1), 21-28.

Harrison, S., & Dourish, P. (1996). *Re-Place-ing Space: The Role of Place and Space in Collaborative Systems.* Paper presented at the Computer Supported Cooperative Work Conference, Cambridge, MA.

Hauer, A., & Daniels, M. (2008). A learning theory perspective on running open ended group projects (OEGPs). In Simon & M. Hamilton (Eds.), *Conferences in Research and Practice in Information Technology* (Vol. 78, pp. 85-92). Wollongong, NSW, Australia: ACS.

Hause, M. (2004). *Software development performance in remote student teams in international computer science collaboration.* Unpublished PhD Thesis, Open University, Milton Keynes, UK.

Hause, M., Petre, M., & Woodroffe, M. (2003, 5-8 Nov, 2003). *Performance in International Computer Science Collaboration Between Distributed Student Teams.* Paper presented at the 33rd ASEE/IEEE Frontiers in Education Conference, Boulder, Colorado. Retrieved 8 November 2003 from http://fie.engrng.pitt.edu/fie2003/

Heeks, R., Krishna, S., Nicholson, B., & Sahay, S. (2001). Synching or Sinking: Global Software Outsourcing Relationships. *IEEE Software, 18*(2), 54-60.

Henricksen, M., Caelli, W., & Croll, P. (2007). Securing Grid Data Using Mandatory Access Controls. In P. Coddington & A. Wendelborn (Eds.), *Proc. Fifth Australasian Symposium on Grid Computing and e-Research (AusGrid 2007), CRPIT* (Vol. 68, pp. 25-32). Ballarat, Australia: ACS. Retrieved 18/06/2008 from http://crpit.com/confpapers/CRPITV68Henricksen.pdf

Herbsleb, J., Mockus, A., Finholt, T., & Grinter, R. (2000). Distance, Dependencies, and Delay in a Global Collaboration. In *ACM 2000 Conference on Computer Supported Cooperative Work (CSCW 2000)*

(pp. 319-328). Philadelphia, PA: ACM Press.

Herbsleb, J., & Paulish, D. (2005). *Global Software Development at Siemens: Experience from Nine Projects.* Paper presented at the 27th International Conference on Software Engineering, St Louis Missouri.

Herder, P., & Sjoer, E. (2003, 5-8 Nov, 2003). *Group-Based Learning in Internationally Distributed Teams: An Evaluation of a Cross Atlantic Experiment.* Paper presented at the 33rd ASEE/IEEE Frontiers in Education Conference, Boulder, Colorado.

Hertel, T. (2004). Effective Virtual Teams. In D. Pauleen (Ed.), *Virtual Teams: Projects, Protocols and Processes* (pp. 209-230). Hershey PA: Idea Group.

Heshusius, L. (1994). Freeing Ourselves from Objectivity: Managing Subjectivity or Turning Towards a Participatory Mode of Consciousness. *Educational Researcher*(Apr), 15-22.

Hettinga, M. (2002). *Understanding evolutionary use of groupware.* Unpublished Doctoral Dissertation, Delft University of Technology, Enschede.

Highsmith, J. (2002). *Agile Software Development Ecosystems*. Boston: Addison-Wesley.

Hill, S., Yates, R., Jones, C., & Kogan, S. (2006). Beyond predictable workflows: Enhancing productivity in artful business processes. *IBM Systems Journal, 45*(4), 663-682.

Hiltz, S., Alavi, M., & Dufner, D. (2004, Apr 24 - 29). *Asynchronous Learning Networks: Priorities for Software Development.* Paper presented at the Conference on Human Factors in Computing Systems, Vienna, Austria.

Hiltz, S., & Wellman, B. (1997). Asynchronous Learning Networks as a Virtual Classroom. *Communications of the ACM, 40*(9), 44 -49.

Hirschon, J., Krugman, S., Witting, M., Furuno, J., Limcangco, M., Perisse, A., et al. (2002). Variability in Institutional Review Board Assessment of Minimal Risk Research. *Academic Emergency Medicine, 9*(12), 1417-1420.

Hofstede, G. (1980). *Culture's Consequences: International Differences in Work-Related Values*. Beverley Hills, California: SAGE.

Hogg, M., Abrams, D., Otten, S., & Hinkle, S. (2004). The Social Identity Perspective Intergroup Relations, Self-Conception, and Small Groups. *Small Group Research, 35*(3), 246-276.

Hollingshead, A., Wittenbaum, G., Paulus, P., Hirokawa, R., Ancona, D., Peterson, R., et al. (2005). A Look at Groups from the Functional Perspective. In M. S. Poole & A. Holllingshead (Eds.), *Theories of Small Groups - Interdisciplinary Perspectives* (pp. 21-62). Thousand Oaks: SAGE.

HPCwire. (2007). eScience: It's Really About People *HPCwire, Oct 26*. http://www.hpcwire.com/features/17903754.html

HRC. (2005). *Health Research Council Guidelines on Ethics in Health Research*. Wellington: Health Research Council of New Zealand.

Retrieved 24/10/2007 from http://www.hrc.govt.nz/assets/pdfs/publications/Ethics%20Guidelines%20July%202006.pdf.

Huang, W., Wei, K., & Lim, J. (2003). Using a GSS to Support Virtual Team Building: A Theoretical Framework. *Journal of Global Information Management, 11*(1), 72-89.

Hunter, D. (2007). *The Art of Facilitation*. Auckland: Random House.

Hyde, P. (2000). Science Friction: Cervical Cancer and the Contesting of Medical Beliefs. *Sociology of Health and Illness, 22*(2), 217-234.

IBM. (2006, Mar 2006). *Agreement for IBM Academic Initiative*. Retrieved 18 Dec, 2007, from http://www-304.ibm.com/jct09002c/university/scholars/members/pdf/scholars-agreement-newzealand.pdf

Ilgen, D., Hollenbeck, J., Johnson, M., & Jundt, D. (2005). Teams in Organizations: From Input-Process-Output Models to IMOI Models. *Annual Review of Psychology, 56*, 517-543.

InContext. (2006, 2008). *InContext: Unleash team Power*. Retrieved 21 June, 2008, from http://www.in-context.eu/homep.asp?PageRef=1

Ito, M. (2003, August). Mobiles and the appropriation of place. *Receiver, 8,* 1-3. Retrieved 20 May 2008 from http://www.vodafone.com/flash/receiver/08/articles/index07.html

Jacobsen, M., Kremer, R., & Shaw, M. (2000). Experiments with Distance Learning in Software Engineering Graduate Courses. *SIGCSE Bulletin, 32*(2), 56 - 59.

Jalote, P., & Jain, G. (2006). Assigning tasks in a 24-h software development model. *The Journal of Systems and Software, 79*, 904-911.

Järvenoja, H., & Järvela, S. (2005). How students describe the sources of their emotional and motivational experiences during the learning process: A qualitative approach. *Learning and Instruction, 15*(5), 465-480.

Jarvenpaa, S., Knoll, K., & Leidner, D. (1998). Is Anybody Out There? Antecedents of Trust in Global Virtual Teams. *Journal of Management Information Systems, 14*(4), 29-64.

Jarvenpaa, S., & Leidner, D. (1998). Communication and Trust in Global Virtual Teams. *Journal of Computer Mediated Communication, 3*(4).

Jarvenpaa, S., & Leidner, D. (1999). Communication and Trust in Global Virtual Teams. *Organization Science, 10*(6), 791-815.

Jarvenpaa, S., Shaw, T., & Staples, D. (2004). Toward Contextualised Theories of Trust: The Role of Trust in Global Virtual Teams. *Information Systems Research, 15*(3), 250-267.

Jick, T. (1979). Mixing Qualitative and Quantitative Methods: Triangulation in Action. *Administrative Science Quarterly, 24*(4), 602-611.

Jiramahapoka, N. (2005, May). The Impacts of Flexible Facilitation in Collaborative Learning. *Bulletin of Applied Computing, 3. Retrieved 14 May 2005 from*

http://www.naccq.ac.nz/bacit/0301/2005Jiramahapoka_CLearn.htm.

Jones, Q., & Grandhi, A. (2005). P3 Systems: Putting the Place Back into Social Networks. *Internet Computing, 9*(5), 38-46.

Jones, R., Oberst, B., Siller, T., & Johnson, G. (2002). *International exposure for Engineering Students Using Distance Learning Techniques.* Paper presented at the 2002 ECI Conference on e-Technologies in Engineering Education: Learning Outcomes Providing Future Possibilities, Davos, Switzerland.

Kanawattanachai, P., & Yoo, Y. (2007). The Impact of Knowledge Coordination on Virtual Team Performance Over Time. *MIS Quarterly, 31*(4), 783-808.

Karahanna, E., Evaristo, R., & Srite, M. (2002). Methodological Issues in MIS Cross-Cultural Research. *Journal of Global Information Management, 10*(1), 48-55.

Karsten, H. (1999). Collaboration and Collaborative Information Technologies: A Review of the Evidence. *The DATABASE for Advances in Information Systems, 30*(2), 44 - 65.

Kayworth, T., & Leidner, D. (2002). Leadership Effectiveness in Global Virtual Teams. *Journal of Management Information Systems, 18*(3), 7-40.

Kennedy, G., Judd, T., Churchward, A., Gray, K., & Krause, K.-L. (2008). First year students' experiences with technology: Are they really digital natives? *Australasian Journal of Educational Technology, 24*(1), 108-122.

Khalifa, M., Davison, R., & Kwok, R. (2002). The effects of Process and Content Facilitation Restrictiveness on GSS-Mediated Collaborative Learning. *Group Decision and Negotiation, 11*, 345-361.

Kim, Y., Hiltz, S., & Turoff, M. (2002). Coordination Structures and System Restrictiveness in Distributed Group Support Systems. *Group Decision and Negotiation, 11*, 379-404.

Kimball, R., Reeves, L., Ross, M., & Thornthwaite, W. (1998). *The Data Warehouse Lifecycle Toolkit : Expert Methods for Designing, Developing, and Deploying Data Warehouses*. New York: John Wiley.

Klein, B., Daniels, M., Hagan, D., Berglund, A., Goold, A., Last, M., et al. (2000, July 11-13). *Teaching Inter-institutional Courses: Sharing Challenges and Resources.* Paper presented at the 5th Annual Conference on Innovation and Technology in Computer Science Education (ITiCSE), Helsinki, Finland.

Klein, H., & Myers, M. (1999). A Set of Principles for Conducting and Evaluating Interpretive Field Studies in Information Systems. *MIS Quarterly, 23*(1), 67 - 93.

Kling, R., Rosenbaum, H., & Sawyer, S. (2005). *Understanding and Communicating Social Informatics: A Framework for Studying and Teaching the Human Contexts of information and Communication Technologies*. Medford, New Jersey: Information Today Inc.

Kling, R., & Scacchi, W. (1982). The Web of Computing: Computer Technology as Social Organization. In *Advances in Computers* (pp. 21).

New York: Academic Press.

Kock, N. (2005a). Editorial Essay - What is E-Collaboration? *International Journal of E-Collaboration, 1*(1), i-vii.

Kock, N. (2005b). Using Action Research to Study E-Collaboration. *International Journal of E-Collaboration, 1*(4), i-vii.

Kock, N., & Nosek, J. (2005). Expanding the Boundaries of E-Collaboration - (Introduction to the Special issue). *IEEE Transactions on Professional Communication, 48*(1), 1-9.

Koh, J., Y Kim, Butler, B., & Bock, G. (2007). Encouraging Participation in Virtual Communities. *Communications of the ACM, 50*(2), 69-73.

Korpela, M., Mursu, A., & Soriyan, H. (2002). Information Systems Development as an Activity. *Computer Supported Cooperative Work, 11*, 111 - 128.

Kraut, R., Fussell, S., Brennan, S., & Siegel, J. (2002). Effects of Proximity on Collaboration. In P. Hinds, S. Kiesler & J. Valacich (Eds.), *Distributed Work* (pp. 137-162). Cambridge: The MIT Press.

Lacity, M., & Janson, M. (1994). Understanding Qualitative Data: A Framework of Text Analysis Methods. *Journal of Management Information Systems, 11*(2), 137-155.

Lacity, M., & Rottman, J. (2008). The Impact of Outsourcing on Client Project Managers. *IEEE Computer, 41*(1), 100-102.

Lamb, R., & Kling, R. (2003). Reconceptualizing Users as Social Actors in Information Systems Research. *MIS Quarterly, 27*(2), 197-235.

Langley, A., Mintzberg, H., Pitcher, P., Posada, E., & Saint-Macary, J. (1995). Opening up Decision Making: The View from the Black Stool. *Organization Science, 6*(3), 260-277.

Last, M., Almstrum, V., Daniels, M., Erickson, C., & Klein, B. (2000). *An International Student/Faculty Collaboration: The Runestone Project.* Paper presented at the Innovation and Technology in Computer Science Education, Helsinki, Finland.

Last, M., Daniels, M., Hause, M., & Woodroffe, M. (2002). *Learning from students: continuous improvement in international collaboration.* Paper presented at the Innovation and Technology in Computer Science Education, Aarhus, Denmark.

Last, M. (2003a). *Investigating the group development process in virtual student software project teams.* Unpublished PhD Thesis, Kingston, University, London, UK.

Last, M. (2003b). *Preparing Students for Distributed Teamwork.* Paper presented at the Innovation and Technology in Computer Science Education Conference, Thessaloniki, Greece.

Leicester, U. o. (2008, 2008). New tool aims to revolutionise scheduling meetings. *eBulletin, 11 April*. Retrieved 17/04/2008 from http://www2.le.ac.uk/ebulletin/news/press-releases/2000-2009/2008/04/nparticle.2008-04-10.1864770817

Leidner, D., Alavi, M., & Kayworth, T. (2006). The Role of Culture in

Knowledge Management: A Case Study of Two Global Firms. *International Journal of E-Collaboration, 2*(1), 17-40.

Leidner, D., & Jarvenpaa, S. (1995). The Use of Information Technology to Enhance Management School Education: A Theoretical View. *MIS Quarterly*(September), 265-291.

Leidner, D., & Kayworth, T. (2006). Review: A Review Of Culture In Information Systems Research: Toward A Theory Of Information Technology Culture Conflict. *MIS Quarterly, 30*(2), 357-399.

Lee, A. (1994). Electronic Mail as a Medium for Rich Communication: An Empirical Investigation using Hermeneutic Interpretation. *MIS Quarterly, 18*(2), 143-158.

Lee, G., Delone, W., & Espinosa, J. (2006). Ambidextrous Coping Strategies in Globally Distributed Software Development Projects. *Communications of the ACM, 49*(10), 35-40.

Lee, Y., Kozar, K., & Larsen, K. (2005). Does Avatar Email Improve Communication. *Communications of the ACM, 48*(12), 91-95.

Lee-Kelley, L., & Sankey, T. (2008). Global virtual teams for value creation and project success: A case study. *International Journal of Project Management, 26*, 51-62.

Leung, K., Bhagat, R., Buchan, N., Erez, M., & Gibson, C. (2005). Culture and international business: recent advances and their implications for future research. *Journal of International Business Studies, 36*, 357-378.

Leuski, A. (2004, Jul 25-29). *Email is a Stage: Discovering People Roles from Email Archives.* Paper presented at the 27th Annual International ACM SIGIR Conference Sheffield, South Yorkshire.

Levine, J., & Moreland, R. (1994). Group Socialization: Theory and Research. *European Review of Social Psychology, 5*(1), 305-336.

Levine, J., & Moreland, R. (2004). Collaboration: The Social Context of Theory Development. *Personality and Social Psychology Review, 8*(2), 164-172.

Li, H., & Singhal, M. (2007). Trust Management in Distributed Systems. *IEEE Computer, 40*(2), 45-53.

Limayem, M. (2006). Human Versus Automated Facilitation in the GSS Context. *The DATABASE for Advances in Information Systems, 37*(2&3), 156-166.

Lin, T., & Davidson, E. (2007). *Mediating Organizational Innovation: A Study of Implementation of Digital Technologies in TV News.* Paper presented at the 40th Hawaii International Conference on System Sciences, Waikoloa, Hawaii.

Litchfield, A. (2005). *Modelling Tribal Genealogies for Information Systems Design and Development.* Unpublished Master of Business (Information Technology), Auckland University of Technology, Auckland.

Lopez, M., Mann, S., Peppiatt, J., Sewell, A., & Stott, C. (2006). A Standards based approach to Federated Identity. In S. Mann & N. Bridgeman (Eds.), *Proceedings of the 19th annual NACCQ Conference* (pp. 157-163). Wellington: NACCQ.

Low, N., Egger, M., Sterne, J., Harbord, R., Ibrahim, F., Lindblom, B., et al. (2006). Incidence of severe reproductive tract complications associated with diagnosed genital chlamydial infection: the Uppsala women's cohort study. *Sexually Transmitted Infections, 82*, 212-218.

Lurey, J., & Raisinghani, M. (2001). An empirical study of best practices in virtual teams. *Information & Management, 38*, 523-544.

Lyytenin, K., & Ngwengyama, O. (1992). What Does Computer Support for Cooperative Work Mean? A Structurational Analysis of Computer Supported Cooperative Work. *Accounting, Management and Information Technologies, 2*(1), 19 -37.

MacGregor, E., Hsieh, Y., & Kruchten, P. (2005, May 16). *Cultural Patterns in Software Process Mishaps: Incidents in Global Projects.* Paper presented at the Human and Social Factors of Software Engineering Conference (HSSE), St Louis, Mo.

Majchrzak, A., Rice, R., Malhotra, A., King, N., & Ba, S. (2000). Technology Adaptation: The Case of a Computer-Supported Inter-Organizational Virtual Team. *MIS Quarterly, 24*(4), 569-600.

Manford, C. (2008). The impact of the SaaS model of software delivery. In S. Mann & M. Lopez (Eds.), *Proceedings of the 21st Annual NACCQ Conference* (Vol. 1, pp. 283-286). Auckland, New Zealand: NACCQ.

Mann, S., & Smith, L. (2007). Computing and Sustainability. In S. Mann & N. Bridgeman (Eds.), *Proceedings of the 20th annual NACCQ Conference* (pp. 157-162). Nelson: NACCQ. Retrieved 21 May 2007 from http://hyperdisc.unitec.ac.nz/naccq07/proceedings/papers/157.pdf

Mansfield, K. (1987). At the Bay. In *The Garden Party - Katherine Mansfield's New Zealand Stories* (Illustrated ed., pp. 85-116): Century Hutchinson.

Marks, M., Mathieu, J., & Zaccaro, S. (2001). A Temporally Based Framework and Taxonomy of Team Processes. *Academy of Management Review, 26*(3), 356-376.

Markus, M. (2005). Technology-Shaping Effects of E-Collaboration Technologies: Bugs and Features. *International Journal of E-Collaboration, 1*(1), 1-23.

Markus, L., & Robey, D. (1988). Information Technology and Organizational Change. *Management Science, 34*(5), 583-598.

Martins, L., Gibson, L., & Maynard, M. (2004). Virtual teams: What Do We Know and Where Do We Go from Here? *Journal of Management, 30*(6), 805-835.

Massey, A., Montoya-Weiss, M., & Hung, Y. (2003). Because Time Matters: Temporal Coordination in Global Virtual Project Teams. *Journal of Management Information Systems, 19*(4), 129-155.

Massey, A., & Montoya-Weiss, M. (2006). Unravelling the Temporal Fabric of Knowledge Conversion: A Model of Media Selection and Use. *MIS Quarterly, 30*(1), 99 -114.

Maznevski, M., & Chudoba, K. (2000). Bridging Space Over Time: Global Virtual Team Dynamics and Effectiveness. *Organization Science, 11*(5), 473-492.

McGrath, J. (1984). *Groups, interaction and performance*. Englewood Cliffs, New Jersey: Prentice Hall.

McGrath, J. (1985). *Validity and the Research Process*. Beverly Hills, California: SAGE.

McGrath, J. (1991). Time Interaction and Performance (TIP): a theory of groups. *Small Group Research, 22*(1), 147-174.

McGrath, J., & Hollingshead, A. (1994). *Groups Interacting with Technology*. Thousand Oaks: SAGE.

McGrath, J., & Kelly, J. (1986). *Time and Human Interaction: Toward a Social Psychology of Time* New York: The Guilford Press.

McGrath, J., Arrow, H., & Berdahl, J. (2000). The Study of Groups: Past, Present, and Future. *Personality and Social Psychology Review, 4*(1), 95-105.

McKay, H., & Gillespie, G. (1992). Extending the Social Shaping of Technology Approach: Ideology and Appropriation. *Social Studies of Science, 22*, 685-716.

McKay, J., & Marshall, P. (1999). *2x6=12, or Does it Equal Action Research?* Paper presented at the Australasian Conference on Information Systems, Wellington.

McKay, J., & Marshall, P. (2000). *Quality and Rigour of Action Research in Information Systems.* Paper presented at the European Conference on Information Systems, Vienna. Retrieved 28/04/2007 from csrc.lse.ac.uk/asp/aspecis/20000011.pdf .

McKay, J., & Marshall, P. (2001). The dual Imperatives of action research. *Information Technology and People, 14*(1), 46-59.

McKernan, J. (1991). *Curriculum Action Research*. London: Kogan Page.

Mehra, R. (2006, Jul). Impact of User Participation on Consensus in Group Collaboration: An Adaptive Structuration Perspective. *Bulletin of Applied Computing, 4. Retrieved August 13, 2007 from http://www.naccq.co.nz/bacit/0401/2006Mehra_User_Participation.htm*

Mellow, P. (2005, 4-7 Dec.). *The media generation: Maximise learning by getting mobile.* Paper presented at the 22nd ASCILITE Conference, Brisbane, Queensland. Retrieved 19 Jun 2008, from http://www.ascilite.org.au/images/papers/conferences/brisbane05/blogs/proceedings/The%20media%20generation:%20Maximise%20learning%20by%20getting%20mobile.pdf.

Melrose, M. (2001). Maximising the Rigour of Action Research? Why Would You Want To? How Could You? *Field Methods, 13*(2), 160-180.

Melrose, M., & Reid, M. (2000). The Daisy Model for Collaborative Action Research: application to educational practice. *Educational Action Research, 8*(1), 151-165.

Mennecke, B., & Hoffer, J. (1992). The Implications of Group Development and History for Group Support System Theory and Practice. *Small Group Research, 23*(4), 524-572.

Mingers, J. (2001). Combining IS Research Methods: Towards a Pluralist

Methodology. *Information Systems Research, 12*(3), 240 - 259.

Montoya-Weiss, M., Massey, A., Hung, C., & Ramesh, V. (2001). Getting It Together: Temporal Coordination And Conflict Management In Global Virtual Teams. *Academy of Management Journal, 44*(6), 1251-1262.

Moran, T. (2005). Unified Activity Management: Explicitly Representing Activity in Work Support Systems. In *European Conference on Computer Supported Cooperative Work (ESCW) Workshop on Activity: From a Theoretical to a Computational Construct* (pp. 1-10). Paris. Retrieved 26 Feb 2008 from http://www.daimi.au.dk/~bardram/ecscw2005/papers/moran.pdf

Morgan, R., Cantor, S., Carmody, S., Hoehn, W., & Klingenstein, K. (2004). Federated Security: The Shibboleth Approach. *EDUCAUSE Quarterly, 27*(4), 12-17.

Myers, M. (1995). Dialectical hermeneutics: a theoretical framework for the implementation of information systems. *Information Systems Journal, 5*(1), 51-70.

Myers, M., & Tan, F. (2002). Beyond Models of National Culture in Information Systems Research. *Journal of Global Information Management, 10*(1), 24-32.

Myers, M., & Young, L. (1997). Hidden Agendas, Power and Managerial Assumptions in Information Systems Development. *Information Technology and People, 10*(3), 224 - 240.

Naidu, S., & Ja¨rvela, S. (2006). Analyzing CMC Content for What? *Computers & Education, 46*(1), 96-103.

Nandhakumar, J. (2002). Managing Time in a Software Factory: Temporal and Spatial Organization of IS Development Activities. *The Information Society, 18*, 252-262.

Nandhakumar, J., & Baskerville, R. (2006). Durability of online teamworking: patterns of trust. *Information Technology and People, 19*(4), 371-389.

Neale, D., Carroll, J., & Rosson, M. (2004). Evaluating Computer-Supported Collaborative Work: Models and Frameworks. In *ACM 2004 Conference on Computer Supported Cooperative Work* (pp. 112-121). Chicago, Illinois: ACM.

Neece, O. (2004). Factors Contributing to Knowledge Sharing and Communication in a Large Virtual Work Group. In D. Pauleen (Ed.), *Virtual Teams: Projects, Protocols and Processes* (pp. 280-316). Hershey PA: Idea Group.

Newgard, C., & Lewis, R. (2002). The Paradox of Human Subjects Protection in Research: Some Thoughts on and Experiences with the Federalwide Assurance Program. *Academic Emergency Medicine, 9*(12), 1426-1429.

Newman, M., & Robey, D. (1992). A Social Process Model of User-Analyst Relationships. *MIS Quarterly, 16*(2), 249-266.

Ngwenyama, O. (1998). Groupware, social action and organizational emergence: on the process dynamics of computer mediated distributed work. *Accounting, Management and Information Technologies, 8*, 127-

146.

NHMRC. (2007). *National Statement on Ethical Conduct in Human Research* (NHMRC Policy Guidelines). Canberra, Australia: Jointly developed by Australian Government - National Health and Medical Research Council, Australian Research Council, Australian Vice Chancellors' Committee.

Nicholson, B., & Sahay, S. (2001). Some political and cultural issues in the globalisation of software development: case experience from Britain and India. *Information & Organization, 11*, 25-43.

Niederman, F., Beise, C., & Beranek, P. (1996). Issues and Concerns about Computer-Supported Meetings: The Facilitator's Perspective. *MIS Quarterly, 20*(1), 1-22.

Nikas, A., & Poulymenakou, A. (2008). Technology Adaptation: Capturing the Appropriation Dynamics of Web-Based Collaboration Support in a Project Team. *International Journal of E-Collaboration, 4*(2), 1-28.

Northover, M. (2004, 5-8 Dec.). *International communication: Putting your money where your mouth is.* Paper presented at the 21st ASCILITE Conference, Perth, WA. Retrieved 19 Dec 2004, from http://www.ascilite.org.au/conferences/perth04/procs/northover.html.

Nunamaker, J., Dennis, A., Valacich, J., Vogel, D., & George, J. (1991). Electronic Meetings to Support Group Work. *Communications of the ACM, 34*(7), 40-61.

Nunamaker, J., Dennis, A., Valacich, J., Vogel, D., & George, J. (1993). Group Support Systems Research: Experience from the Lab and Field. In L. Jessup & J. Valacich (Eds.), *Group Support Systems: New Perspectives* (pp. 125 - 145). New York: MacMillan.

Nyerges, T., & Jankowski, P. (1997). Enhanced Adaptive Structuration Theory: A Theory of GIS-Supported Collaborative Decision Making. *Geographical Systems, 4*(3), 225-259.

NZUSA. (2006). *A living allowance for all tertiary students; not borrowing to live*. Retrieved 17 Feb, 2008, from http://www.students.org.nz/index.php?page=livingallowances

Okamura, K., Orlikowski, W., Fujimoto, M., & Yates, J. (1994). Helping CSCW Applications Succeed: The Role of Mediators in the Context of Use. In *ACM 1994 Conference on Computer Supported Cooperative Work (CSCW'94)* (pp. 55-65). Chapel Hill, NC: ACM.

Olesen, K., & Myers, M. (1999). Trying to Improve Communication and Collaboration With Information Technology. An Action Research Project which Failed. *Information Technology and People, 12*(4), 317 - 332.

Olson, G., & Olson, J. (2000). Distance Matters. *Human-Computer Interaction, 15*, 139-178.

Oriogun, P., Khatri, A., Choudhry, Z., & Borkhataria, M. (2003, 7-10 Dec.). *Using the Enhanced Problem Based Learning Grid to Guide the Documentation of the Win-Win Spiral Model.* Paper presented at the 20th ASCILITE Conference, Adelaide, Australia.

Orlikowski, W. (1992). The Duality of Technology: Rethinking the Concept of

Technology in Organisations. *Organization Science, 3*(3), 398 - 427.

Orlikowski, W. (1993). CASE Tools as Organizational Change: Investigating Incremental and Radical Changes in Systems Development. *MIS Quarterly, 17*(3), 309-340.

Orlikowski, W. (1996). Improvising Organisational Transformation Over Time: A Situated Change Perspective. *Information Systems Research, 7*(1), 63-92.

Orlikowski, W. (2000). Using Technology and Constituting Structures: A Practice Lens for Studying Technology in Organizations. *Organization Science, 11*(4), 404 - 428.

Orlikowski, W., & Baroudi, J. (1991). Studying Information Technology in Organizations: Research Approaches and Assumptions. *Information Systems Research, 2*(1), 1 - 28.

Orlikowski, W., & Gash, D. (1994). Technological Frames: Making Sense of information Technology in Organizations. *ACM Transactions on Information Systems, 12*(2), 174-207.

Orlikowski, W., & Hofman, J. (1997). An Improvisational Model for Change Management: The Case of Groupware Technologies. *Sloan Management Review, Winter*, 11-21.

Orlikowski, W., & Iacono, C. (2001). Research Commentary: Desperately seeking the "IT" in IT Research - a Call to Theorizing the IT Artifact. *Information Systems Research, 12*(2), 121-134.

Orlikowski, W., & Robey, D. (1991). Information Technology and the Structuring of Organizations. *Information Systems Research, 2*(2), 143-169.

Orlikowski, W., & Yates, J. (1994). Genre repertoire: The structuring of communicative practices in organizations. *Administrative Science Quarterly, 39*, 541-574.

Orlikowski, W., & Yates, J. (2002). It's About Time: Temporal Structuring in Organizations. *Organization Science, 13*(6), 684-700.

Orlikowski, W., Yates, J., Okamura, K., & Fujimoto, M. (1995). Shaping Electronic Communication: The Metastructuring of Technology in the Context of Use. *Organization Science, 6*(4), 423 - 444.

Oshri, I., Kotlarsky, J., & Willcocks, L. (2008). Missing Links: Building Critical Social Ties for Global Collaborative Teamwork. *Communications of the ACM, 51*(4), 76-81.

OSI. (2006a). *Report of the OSI e-Infrastructure Working Group*. London: Department of Trade & Industry, Office of Science and Innovation e-Infrastructure Steering Group.

OSI. (2006b). *Report of the Working Group on Virtual Research Communities*. London: Department of Trade & Industry, Office of Science and Innovation e-Infrastructure Steering Group.

OSI. (2006c). *Report of the Working Group on Middleware, AAA (authentication, authorization, accounting) and DRM (digital rights management)*. London: Department of Trade & Industry, Office of

Science and Innovation e-Infrastructure Steering Group.

Overdijk, M., & vanDiggelen, W. (2006). Technology Appropriation in Face-to-Face Collaborative Learning. In E. Tomadaki & P. Scott (Eds.), *Innovative Approaches for Learning and Knowledge Sharing, EC-TEL 2006 Workshops Proceedings* (pp. 89-96). Crete, Greece.

Panteli, N., & Duncan, E. (2004). Trust and temporary virtual teams: alternative explanations and dramaturgical relationships. *Information Technology and People, 17*(4), 423-441.

Pauleen, D. (2003). Leadership in a global virtual team: an action learning approach. *Leadership & Organization Development Journal, 24*(3), 153-162.

Pauleen, D. (2003-4). An Inductively Derived Model of Leader-Initiated Relationship Building with Virtual Team Members. *Journal of Management Information Systems, 20*(3), 227-256.

Pauleen, D. (2004). *Virtual Teams: Projects, Protocols and Processes*. Hershey PA: Idea Group.

Pauleen, D., & Yoong, P. (2001). Facilitating virtual team relationships via Internet and conventional communication channels. *Internet Research: Electronic Networking Applications and Policy, 11*(3), 190-202.

Pekkola, S. (2002, 19-23 Oct). *Critical Approach to 3D Virtual Realities for Group Work.* Paper presented at the NordiCHI Conference, Aarhus, Denmark.

Pekrun, R. (2005). Progress and open problems in educational emotion research. *Learning and Instruction, 15*, 497-506.

Petrova, K. (2007). Mobile learning as a mobile business application. *International Journal of Innovation and Learning, 4*(1), 1-13.

Piccoli, G., Powell, A., & Ives, B. (2004). Virtual teams: team control structure, work processes, and team effectiveness. *Information Technology and People, 17*(4), 359-379.

Pindur, W., Rogers, S., & Kim, P. S. (1995). The history of management: a global perspective. *Journal of Management History, 1*(1), 59-77.

Pinsonneault, A., & Caya, O. (2005). Virtual Teams: What We Know, What We Don't Know. *International Journal of E-Collaboration, 1*(3), 1-16.

Poole, M. (1981). Decision Development in Small Groups I: A Comparison of Two Models. *Communication Monographs, 48*(1), 1-24.

Poole, M. (1983). Decision Development in Small Groups II: A Study of Multiple Sequences in Decision Making. *Communication Monographs, 50*(3), 206-232.

Poole, M., & DeSanctis, G. (1992). Microlevel Structuration in Computer-Supported Group Decision Making. *Human Communication Research, 19*(1), 5-49.

Poole, M., & DeSanctis, G. (2004). Structuration Theory in Information Systems Research: Methods and Controversies. In M. Whitman & A. Woszcynski (Eds.), *The Handbook of Information Systems Research* (pp. 206-249).

Hershey PA: Idea Group Publishing.

Poole, M. S., & Hollingshead, A. (Eds.). (2005). *Theories of Small Groups - Interdisciplinary Perspectives*. Thousand Oaks: SAGE.

Powell, A., Galvin, J., & Piccoli, G. (2006). Antecedents to team member commitment from near and far. *Information Technology and People, 19*(4), 299-322.

Powell, A., Piccoli, G., & Ives, B. (2004). Virtual Teams: A Review of Current Literature and Directions for Future Research. *The DATABASE for Advances in Information Systems, 35*(1), 6-36.

Pozzebon, M., & Pinsonneault, A. (2005). Challenges in Conducting Empirical Work Using Structuration Theory: Learning from IT Research. *Organization Studies, 26*(9), 1353–1376.

Prikladnicki, R., Damian, D., & Audy, J. (2008, 31 Mar - 4 April). *Patterns of Evolution in the Practice of Distributed Software Development: Quantitative Results from a Systematic Review.* Paper presented at the 5th IEEE Workshop on Engineering of Autonomic and Autonomous Systems (EASe 2008), Belfast, Northern Ireland.

Purvis, M., Purvis, M., & Cranefield, S. (2004). *Educational Experiences from a Global Software Engineering (GSE) Project.* Paper presented at the 6th Australasian Computing Education Conference (ACE 2004), Dunedin.

Pylkkänen, E., & Smith, N. (2004). *Career Interruptions due to Parental Leave − A Comparative Study of Denmark and Sweden* (Working Paper No. 04-1). Aarhus, Denmark: Aarhus School of Business.

QSR. (2007). *QSR International Website*. Retrieved 22 May, 2008, from http://www.qsrinternational.com/default.aspx

Qureshi, S., Liu, M., & Vogel, D. (2005, 03-06 Jan). *A Grounded Theory Analysis of E-Collaboration Effects for Distributed Project Management.* Paper presented at the Thirty-Eighth Annual Hawaii International Conference on System Sciences (HICSS), Maui, Hawaii.

Qureshi, S., & Vogel, D. (2001). Adaptiveness in Virtual teams: Organisational Challenges and Research directions. *Group Decision and Negotiation, 10*(1), 27-46.

Rangarajan, N., & Rohrbaugh, J. (2003). Multiple Roles of Online Facilitation: An Example in Any-Time, Any-Place Meetings. *Group Facilitation, 5*(Spring), 26-36.

Raymond, E. (1998a). The Cathedral and the Bazaar. *First Monday, 3*(3), Retrieved 16 Apr 2006 from http://www.firstmonday.org/issues/issue2003_2003/raymond/.

Raymond, E. (1998b). Homesteading the Noosphere. *First Monday, 3*(10), Retrieved 19 Nov 2007 from http://www.firstmonday.org/issues/issue2003_2010/raymond/index.html.

Redmiles, D., Wilensky, H., Kosaka, K., & dePaula, R. (2005, Nov 6-9). *What Ideal Users Teach Us About Collaborative Software.* Paper presented at the 2005 International ACM SIGGROUP Conference on Supporting Group Work (Group'05), Sanibel Island, Florida.

Reich, B., & Nelson, K. (2003). In Their Own Words: CIO Visions About the Future of In-House IT Organizations. *The DATABASE for Advances in Information Systems, 34*(4), 28 - 44.

Richardson, L. (2000). Writing; A Method Of Inquiry. In N. Denzin & Y. Lincoln (Eds.), *Handbook of Qualitative Research* (pp. 923-948). Thousand Oaks: SAGE.

Richardson, I., Milewski, A., Keil, P., & Mullick, N. (2006, May 20-28). *Distributed Development - An Education Perspective on the Global Studio Project.* Paper presented at the 28th International Conference on Software Engineering (ICSE'06), Shanghai, China.

Rick, J., & Guzdial, M. (2006). Situating Coweb: A Scholarship of Application. *International Journal of Computer-Supported Collaborative Learning, 1*(1), 89-115.

Romano, N., Nunamaker, J., Briggs, R., & Mittelman, D. (1999, 05-08 Jan). *Distributed GSS Facilitation and Participation: Field Action Research.* Paper presented at the Thirty-Second Annual Hawaii International Conference on System Sciences (HICSS), Maui, Hawaii.

Rosenthal, R., & DiMatteo, M. (2001). META-Analysis: Recent Developments in Quantitative Methods for Literature Reviews. *Annual Review of Psychology, 52*, 59-82.

Ross, S., Kukulska-Hulme, A., Chappel, H., & Joyce, B. (2004). Taking E-Moderating Skills to the Next Level: Reflecting on the Design of Conferencing Environments. *Journal of Asynchronous Learning Networks, 8*(2), 115-138.

Roy, V., Bernier, C., & Leveille, L. (2006). The High Wire Balancing Act of the IS Project Director. *The DATABASE for Advances in Information Systems, 37*(1), 8-39.

Ruhleder, K. (2000). The Virtual Ethnographer: Fieldwork in Distributed Electronic Environments. *Field Methods, 12*(1), 3-17.

Rutkowski, A., Vogel, D., Bemelmans, T., & Genuchten, M. V. (2002). Group Support Systems and Virtual Collaboration: The HKNET Project. *Group Decision and Negotiation, 11*, 101-125.

Rutkowski, A., Vogel, D., vanGenuchten, M. V., Bemelmans, T., & Favier, M. (2002). E-Collaboration: The Reality of Virtuality. *IEEE Transactions on Professional Communication, 45*(4), 219-230.

Rutkowski, A., Vogel, D., vanGenuchten, M., & Bemelmans, T. (2004). *The HKNET Project: E-Collaboration and Virtual team Identity.* Paper presented at the Twelfth European Conference on Information Systems, Turku, Finland.

Ryan, R., & Deci, E. (2000). Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions. *Contemporary Educational Psychology, 25*, 54-67.

Sadasivan, P. (2005, July). Impact of Appropriation and Participation on Decision Outcomes. *Bulletin of Applied Computing, 3. Retrieved 21 Jun 2005 from http://www.naccq.ac.nz/bacit/0302/2005Sadasivan_Appropriation.html.*

Salisbury, W., Carte, T., & Chidambaram, L. (2006). Cohesion in Virtual Teams: Validating the Perceived Cohesion Scale in a Distributed Setting. *The DATABASE for Advances in Information Systems, 37*(2&3), 147-155.

Salisbury, W., Chin, W., Ghopal, A., & Newsted, P. (2002). Research Report: Better Theory Through Measurement-Developing a Scale to Capture Consensus on Appropriation. *Information Systems Research, 13*(1), 91-103.

Salisbury, W., & Stollak, M. (1999). *Process restricted AST: an assessment of group support systems appropriation and meeting outcomes using participant perceptions.* Paper presented at the 20th International Conference on Information Systems, Charlotte, North Carolina.

Salmon, G. (2000). *E-moderating: The Key to Teaching and Learning Online*. London: Kogan Page.

Sargent, M. (2006). *Final Report of the e-Research Coordinating Committee: An Australian e-Research Strategy and Implementation Framework*. Canberra: Department of Education, Science and Training and the Department of Communications, Information Technology and the Arts e-Research Coordinating Committee.

Sarker, S., Lau, F., & Sahay, S. (2001). Using an Adapted Grounded Theory Approach for Inductive Theory Building About Virtual Team Development. *The DATABASE for Advances in Information Systems, 32*(1), 38-56.

Sarker, S., & Sahay, S. (2003). Understanding Virtual Team Development: An Interpretive Study. *Journal of the Association for Information Systems, 4*, 1-38.

Sarker, S., & Sahay, S. (2004). Implications of space and time for distributed work: an interpretive study of US-Norwegian systems development teams. *European Journal of Information Systems, 13*, 3-20.

Saunders, C., & Ahuja, M. (2006). Are All Distributed Teams the Same? Differentiating Between Temporary and Ongoing Distributed Teams. *Small Group Research, 37*(6), 662-700.

Saunders, C., Van_Slyke, C., & Vogel, D. (2004). My time or yours? Managing time visions in global virtual teams. *Academy of Management Executive, 18*(1), 19-31.

Shachaf, P. (2008). Cultural diversity and infomation and communication technology impacts on global virtual teams: An exploratory study. *Information & Management, 45*, 131-142.

Schall, D., Gombotz, R., Dorn, C., & Dustdar, S. (2007, July 9-13). *Human Interactions in Dynamic Environments through Mobile Web Services.* Paper presented at the IEEE International Conference on Web Services (ICWS 2007), Salt Lake City, Utah, USA.

Scharff, E. (2002). *Open Source Software: A Conceptual Framework for Collaborative Artifact and Knowledge Construction.* Unpublished PhD Thesis, University of Colorado, Boulder.

Schiller, S. Z., & Mandviwalla, M. (2007). Virtual Team Research An Analysis

of Theory Use and a Framework for Theory Appropriation. *Small Group Research, 38*(1), 12-59.

Schroeder, R., Huxor, A., & Smith, A. (2001). Activeworlds: geography and social interaction in virtual reality. *Futures, 33*, 569-587.

Schuff, D., Turetken, O., D'Arcy, J., & Croson, D. (2007). Managing E-Mail Overload: Solutions and Future Challenges. *IEEE Computer, 40*(2), 31-36.

Schultze, U. (2000). A Confessional Account of an Ethnography about Knowledge Work. *MIS Quarterly, 24*(1), 3-41.

Schultze, U., & Boland, R. (2000). Place, space and knowledge work: a study of outsourced computer systems administrators. *Accounting, Management and Information Technologies, 10*, 187-219.

Secker, J. (2007). *Social Software, Libraries and distance learners: Literature review* (Commissioned Report). London: University of London Centre for Distance Education and Research Awards.

Shakespeare, W. (1971). As You Like it. In R. Clay (Ed.), *The Complete Works of William Shakespeare* (14th ed., pp. 209-233). London: Chaucer Press.

Sim, S., & Holt, R. (1998, 19-25 Apr). *The Ramp-up Problem in Software Projects: A Case Study of How Software Immigrants Naturalize.* Paper presented at the Proceedings of the 1998 (20th) International Conference on Software Engineering, Kyoto, Japan.

Siponen, M., & Oinas-Kukkonen, H. (2007). A Review of Information Security Issues and Respective Research Contributions. *The DATABASE for Advances in Information Systems, 38*(1), 60-80.

Smith, R., Hixon, R., & Horan, B. (1998). Supporting Flexible Roles in a Shared Space. In *ACM 1998 Conference on Computer Supported Cooperative Work* (pp. 197-206). Seattle, Washington: ACM.

Star, S. L., & Strauss, A. (1999). Layers of Silence, Arenas of Voice: The Ecology of Visible and Invisible Work. *Computer Supported Cooperative Work, 8*, 9-30.

Steinfeld, C., Huysman, M., David, K., Yang, C., Poot, J., Veld, M., et al. (2001). *New Methods for Studying Global Virtual Teams: Towards a Multi-Faceted Approach.* Paper presented at the 34th Hawaii International Conference on System Sciences, Maui, Hawaii.

Steves, M. (2002, Mar 2002). *NIST Manufacturing Collaboratory*. Retrieved july 6, 2002, from http://www.mel.nist.gov/msid/collaboratory/

Straub, D., Loch, K., Evaristo, R., Karahanna, E., & Srite, M. (2002). Toward a Theory-based Measurement of Culture. *Journal of Global Information Management, 10*(1), 13-23.

Strauss, A., & Corbin, J. (1990). *Basics of Qualitative Research*. Newbury Park, California: Sage Publications.

Stubbe, M., Lane, C., Hilder, J., Vine, E., Vine, B., Marra, M., et al. (2003). Multiple Discourse Analyses of a Workplace Interaction. *Discourse Studies, 5*(3), 351-389.

Susman, G., & Evered, R. (1978). An Assessment of the Merits of Scientific

Action Research. *Administrative Science Quarterly, 23*(December), 583 - 603.

Swigger, K., Alpaslan, F., Brazile, R., & Monticino, M. (2004). Effects of culture on computer supported international collaborations. *International Journal of Human-Computer Studies, 60*, 365-380.

Swigger, K., Brazile, R., Harrington, B., Peng, X., & Apaslan, F. (2006, 17-20 Nov). *Teaching Students How to Work in Global Software Development Environments.* Paper presented at the International Conference on Collaborative Computing: Networking, Applications and Worksharing, 2006 (CollaborateCom 2006), Atlanta, Georgia, USA.

Talanquer, V., Tomanek, D., & Novodvorsky, I. (2007). Revealing Student Teachers' Thinking through Dilemma Analysis. *Journal of Science Teacher Education, 18*(3), 399-421.

Thomas, D., Bostrom, R., & Gouge, M. (2007). Making Knowledge Work In Virtual Teams. *Communications of the ACM, 50*(11), 85-90.

Thorpe, S. (2007). Facilitation Online. In D. Hunter (Ed.), *The Art of Facilitation* (pp. 175-182). Auckland: Random House.

Thorpe, S. (2008). The use of story in building online group relationships. In S. Kelsey & K. S. Amant (Eds.), *Handbook of Research on Computer Mediated Communication* (Vol. 1, pp. 551-569). Hershey, Pennsylvania: Information Science Reference.

Tolmie, A., & Boyle, J. (2000). Factors Influencing the success of computer mediated communication (CMC) environments in university teaching: a review and case study. *Computers & Education, 34*, 119 - 140.

Travaglia, S. (1995). The Bastard Operator from Hell #1. *The Bastard Operator from Hell Official Archive, 1*. Retrieved 21 June 2008 from http://bofh.ntk.net/Bastard1.html

Treinen, J., & Miller-Frost, S. (2006). Following the sun: Case studies in global software development. *IBM Systems Journal, 45*(4), 773-783.

Trigg, R., & Bodker, S. (1994). From Implementation to Design: Tailoring and the Emergence of Systematization in CSCW. In *Computer Supported Cooperative Work Conference*. Chapel Hill, NC: ACM.

Van de Ven, A., & Poole, M. (1990). Methods For Studying Innovation Development In The Minnesota Innovation Research Program. *Organization Science, 1*(3), 313-335.

Van Eck, R. (2006). Digital Game Based Learning - It's Not Just The Natives Who Are Restless. *EDUCAUSE Review, 41*(2), 16-30.

Van Genuchten, M., & Vogel, D. (2007). Getting Real in the Classroom. *IEEE Computer, 40*(10), 106-108.

Varnham, S. (2001). Straight talking, straight teaching: are New Zealand tertiary institutes potentially liable to their students under consumer protection legislation? *Education and the Law, 13*(4), 303-317.

Venkatraman, N. (1989). The Concept of Fit in Strategy Research: Toward Verbal and Statistical Correspondence. *Academy of Management Review, 14*(3), 423-444.

Venkatraman, N. (1991). IT-Induced Business Reconfiguration. In M. S. Morton (Ed.), *The Corporation of the 1990s - Information Technology and Organizational Transformation* (pp. 122-158). New York: Oxford University Press.

Vogel, D., & Wetherbe, J. (1984). MIS research: a profile of leading journals and universities *ACM SIGMIS Database, 16*(1), 3-14.

Vullings, E., Dalziel, J., & Buchhorn, M. (2007). Secure Federated Authentication and Authorisation to GRID Portal Applications using SAML and XACML. *Journal of Research and Practice in Information Technology, 39*(2), 101-114.

Weisinger, J., & Salipante, P. (2000). Cultural Knowing as Practicing - Extending our Conceptions of Culture. *Journal of Management Inquiry, 9*(4), 376-390.

Weisinger, J., & Trauth, E. (2002). Situating Culture in the Global Information Sector. *Information Technology and People, 15*(4), 306-320.

Weisinger, J., & Trauth, E. (2003). The Importance of Situating Culture in Cross-cultural IT Management. *IEEE Transactions on Engineering Management, 50*(1), 26-30.

Wheeler, B., Denis, A., & Press, I. (1999). Groupware Comes to the Internet: Charting a New World. *The DATABASE for Advances in Information Systems, 30*(3 & 4), 8 - 21.

Wheeler, B., & Valacich, J. (1996). Facilitation, GSS and Training as Sources of Process Restrictiveness and Guidance for Structured Group Decision Making: An Empirical Assessment. *Information Systems Research, 7*(4), 429 - 450.

Whittington, R. (1992). Putting Giddens into Action: Social Systems and Managerial Agency. *Journal of Management Studies, 29*(6), 693-712.

Whitworth, B. (1997). *Generating Group Agreement in Cooperative Computer Mediated Groups: Towards an Integrative Model of Group Interaction.* Unpublished PHD, Waikato, Hamilton.

Williams, L., Kessler, R., Cunningham, W., & Jeffries, R. (2000). Strengthening the Case for Pair Programming. *IEEE Software*(Jul), 19-25.

Winograd, T., & Flores, F. (1986). *Understanding Computers And Cognition: A New Foundation For Design*. Norwood, N.J.: Ablex Publishing Corp.

Winograd, T., & Flores, F. (1997). *Understanding Computers And Cognition: A New Foundation For Design* (Reprint - originally published by Ablex Corporation, Norwood NJ 1986 ed.). Reading, Massachusetts: Addison Wesley.

Winton, L. (2005). A Simple Virtual Organisation Model and Practical Implementation. In P. Coddington & A. Wendelborn (Eds.), *Proc. Australasian Workshop on Grid Computing and e-Research (AusGrid 2005), CRPIT* (Vol. 44, pp. 57-65). Newcastle, Australia: ACS. Retrieved 18/06/2008 from http://crpit.com/confpapers/CRPITV44Winton.pdf

Wood, D., & Gray, B. (1991). Toward a Comprehensive Theory of

Collaboration. *Journal of Applied Behavioral Science, 27*(2), 139-162.

Woodward, B. (1999). Challenges to Human Subject Protections in Medical Research. *Journal of the American Medical Association, 282*, 1947-1952.

Wool, A. (2004). A Quantitative Study of Firewall Configuration Errors. *IEEE Computer, 37*(6), 62-67.

Wosnitza, M., & Volet, S. (2005). Origin, direction and impact of emotions in social online learning. *Learning and Instruction, 15*(5), 449-464.

Yang, X., Li, Y., Tan, C., & Teo, H. (2007). Students' participation intention in an online discussion forum: Why is computer mediated interaction attractive? *Information & Management, 44*, 454-466.

Yates, J., Orlikowski, W., & Okamura, K. (1999). Explicit and Implicit Structuring of Genres in Electronic Communication: Reinforcement and Change of Social Interaction. *Organization Science, 10*(1), 83 - 103.

Yin, R. (1994). *Case Study Research* (2nd ed.). Thousand Oaks: SAGE.

Yoong, P. (1999). Making Sense of Group Support Systems Facilitation: A Reflective Practice Perspective. *Information Technology and People, 12*(1), 86 - 112.

Zaheer, S., Albert, S., & Zaheer, A. (1999). Time scales and organizational theory. *Academy of Management Review, 24*(4), 725-741.

Zeni, J. (1998). A Guide to Ethical Issues and Action Research. *Educational Action Research, 6*(1), 9-19.

Zigurs, I., & Buckland, B. (1998). A Theory of Task-Technology Fit Theory and Group Support Systems Effectiveness. *MIS Quarterly, 22*(3), 313-334.

Zigurs, I., & Kozar, K. (1994). An exploratory study of roles in computer supported groups. *MIS Quarterly, 18*(3), 277-297.

Appendix 1 - Participant Information Sheet

Participant Information Sheet

Date Information Sheet Produced:

05 March 2006

Project Title

Collaborative Database & Collaborative Learning Project –

Supporting the work of Global Virtual Teams: the role of technology-use mediation in educational settings

Invitation

This information sheet describes the above project and invites your participation in an ongoing research programme into the nature of global virtual teams, international collaborative learning, and the use of groupware.

- Participants may withdraw from the research at any time without giving reasons and without being disadvantaged.
- Participants may withdraw information they may have provided at any time, except where data is held anonymously and cannot be traced to be withdrawn.

What is the purpose of this research?

This research arises from an ongoing action research programme in which global virtual student teams from Auckland University of Technology and Uppsala University in Sweden have collaborated annually since 1998 as an element of their studies. The research has aimed to broaden the scope of student studies and provide a practical experience of global virtual collaboration within teams of people who have never physically met. This specific phase of the study is investigating the ways in which "mediators" [those parties who, while not direct users of the technology themselves, undertake activities which support or shape the use of the technology by team members] may or may not assist the work of such teams. The roles and activities that are involved in the work of such mediators is one focus of study. This specific study into technology use mediation has been extracted as an element which contributes towards the achievement of the researcher's doctoral thesis, while the broader programme of research is ongoing. It is expected that the findings of the doctoral study will both contribute to the overall research programme and provide a baseline upon which further research may build.

How are people chosen to be asked to be part of this research?

Those who have been involved in the selected collaborative trials in a "mediating" role, as opposed to those direct subjects participating in the research, will be invited to contribute.

What happens in this research?

The participants will be asked to give permission for their email correspondence or online database postings relating to the collaboration process to be analysed. The researcher has a large body of saved email and the Lotus Notes databases relating to each trial, augmented by research diary notes, and it is proposed to sift through these in some depth to identify the roles and activities conducted by those who act in "technology-use mediating" roles [roles performed by indirect users of technology to support the work of direct users]. The research data relating to the semester 2/2004 collaborative trial will be the primary focus of this study. The research will aim to build categorisations of these roles and activities,

which can be used to provide insight into the significance of these activities in supporting global virtual teamwork. It is intended to use the categorisations developed, in this and future research applying a research framework developed by the researcher. Given our limited knowledge in the area of technology-use mediation, it is expected that the data will be retained for ongoing research purposes, revisited and further analysed, in additional combinations or time segmentations, and in support of emerging research questions in the course of the continuing research project. The data will reside on AUT servers, and also in the N-Vivo data files, (a copy of which will be kept in an archive CD on AUT premises).

What are the discomforts and risks?

While much of the research should result in generic models of particular roles tasks and activities, it may be that specific identifiable aspects of an individual's work may be highlighted. To the extent that any issues identified may reflect upon the individual's views of their role and those around them, or reflect upon their own performance in the role, there is some potential (believed minor) risk of embarrassment or upset.

How will these discomforts and risks be alleviated?

Where the research diverges from the more generic level in descriptions of roles and activities, to highlight specific incidents, cite specific passages or the activities of particular persons, where they may be readily identifiable, relevant passages of the thesis will be reviewed with the participant concerned to confirm their accuracy and acceptability for publication. If either requested by the participant or felt necessary or appropriate, participant details may be anonymised to alleviate any potential concerns. Should concerns still remain, the relevant section may be removed by agreement or generalised to remove the particular concern. In any event participants will have the opportunity from the outset to give their consent to being named in the report from the research. In addition should any personal discomfort arise from the research the AUT online counselling service [http://www.aut.ac.nz/student_services/counselling/online_welcome.shtml] is an available option, should a research participant feel such a need.

What are the benefits?

For today's IT practitioners, Reich & Nelson (2003) have argued that the "most important skills that were needed were the ability to work effectively in diverse, global teams". This study addresses their challenge, and aims to develop and apply a framework for researching technology-use mediation in global virtual teams. This work is one strand of an ongoing action research project initiated by the researcher in 1997, within which regular educational collaborations have taken place involving Global Virtual Teams of AUT and Uppsala University students from Sweden. The technology-use mediation evaluation framework will be piloted then applied more extensively to data arising from recent collaborative trials. Subsequently it is intended to compare these findings from an educational setting, with the results from commercial software projects which utilize Global Virtual Teams. It is hoped that a general purpose framework can be developed, to enable researchers to effectively explore this complex area, and from which insights can be drawn to guide practitioners, and researchers working with Global Virtual Teams.

Of particular benefit to the researcher is the intended contribution of this work to the achievement of a doctoral qualification.

How will my privacy be protected?

In addition to the safeguards in the section on discomforts and risks above, it is proposed that participants will be identified by role rather than by name, unless naming the individual is considered important for the investigation. In any case the permission of the individual will be sought in such cases where clear identification is both necessary (or at least preferable) and unavoidable.

What are the costs of participating in this research?

Time involved should be minimal as the research is primarily using already stored textual data. You may be questioned for clarification, but this is expected to be in exceptional cases only.

What opportunity do I have to consider this invitation?

If you agree to participate, it would be appreciated if you could sign the associated consent form within no more than one week from receipt of this information sheet.

How do I agree to participate in this research?

You will be provided with a consent form to sign, or (for offshore participants) to at least verify your acceptance of such consent via email.

Will I receive feedback on the results of this research?

Some feedback will be provided through the above mechanisms for managing privacy and risks. Otherwise the research findings will be disseminated via the standard academic channels, published PhD thesis, related seminars, conference and journal papers.

What do I do if I have concerns about this research?

Any concerns regarding the nature of this project should be notified in the first instance to the Project Supervisor, *Professor Stephen MacDonell, stephen.macdonell@aut.ac.nz, 021 422 099.*

Concerns regarding the conduct of the research should be notified to the Executive Secretary, AUTEC, Madeline Banda, *madeline.banda@aut.ac.nz* , 921 9999 ext 8044.

Who do I contact for further information about this research?

Researcher Contact Details:

Tony Clear, Associate Head of School (Industry & Development), School of Computer & Information Sciences, Auckland University of Technology, tony.clear@aut.ac.nz, 921-9999 xtn. 5329.

Project Supervisor Contact Details:

Professor Stephen MacDonell, Professor of Software Engineering, School of Computer & Information Sciences, Auckland University of Technology, stephen.macdonell@aut.ac.nz, 021 422 099..

Approved by the Auckland University of Technology Ethics Committee on *10 May 2006*, AUTEC Reference number *06/11*.

Appendix 2 - Consent Form

CONSENT TO PARTICIPATION IN RESEARCH

Title of Project: **Collaborative Database & Collaborative Learning Project - Supporting the work of Global Virtual Teams: the role of technology-use mediation in educational settings**

Project Supervisor: **Professor Stephen Macdonell**

Researcher: **Tony Clear, Mats Daniels, Diana Kassabova, Kitty Ko, Philip Carter, Arnold Pears, Mattias Wikberg, Fred Niederman, Art Hammon**

- I have read and understood the information provided about this research project (Information Sheet dated 05 March 2006
- I have had an opportunity to ask questions and to have them answered.
- I understand that the contributions I have made, or may make through email messages and postings to the collaborative databases (including non incorporated but related critiques made during course and related work) augmented by research diary notes taken by the researcher, may be analysed in order to better understand the collaborative process and ascertain the uses to which the database has been and may be put. They may be presented or made accessible in other ways for interested research colleagues, collaborative participants and collaborative researchers, both current and future, to view, in order to better understand the nature of the international collaborative process and the functions and purpose of these databases.
- I understand that I may withdraw myself or any information that I have provided for this project, at any time, and that all relevant input data, or parts thereof, will be destroyed. I consent to the use of any information in the nature of email communications or postings that I have entered into the databases or developed in the course of critiques of the database in the manner, and for the purposes described above.
- I understand that I may withdraw myself or any information that I have provided for this project at any time, without being disadvantaged in any way. I agree to take part in this research.
- I consent to being named in the report from the research: tick one: Yes O No O
- I wish to receive a copy of the report from the research: tick one: Yes O No O

Participant signature: .....……..

Participant name: …….

Participant Contact Details (if appropriate):

……..

……..

……..

……..

Date:

Approved by the Auckland University of Technology Ethics Committee on 10 May 2006 **AUTEC Reference number** 06/11

Note: The Participant should retain a copy of this form.

Appendix 3 - Draft Interview Schedule

Draft Interview Schedule

Date Interview Schedule Produced:

05 March 2006

Project Title

Collaborative Database & Collaborative Learning Project –

Supporting the work of Global Virtual Teams: the role of technology-use mediation in educational settings

Introduction

This proposed interview schedule is indicative only, of the types of follow-up questions that may be posed in order to clarify ambiguities or address incomplete information arising from the data analysis, which is yet to be conducted in the above project. The questions will be of the nature indicated in sections E8 and E9 of the AUTEC ethics application, namely to clarify particular points of interest, or to confirm roles and activities.

Indicative Questions

Preamble

From analysing the corpus of data related to the Sem2/2004 collaborative trial I notice from:

- the email dated dd/mm/yyyy between you and x person;
- or the sequence of emails between you and x, y, z persons dated from dd/mm/yyyy to dd/mm/yyyy;
- or from the discussion thread or sequence of threads, (or other form of online posting) dated dd/mm/yyyy or from dd/mm/yyyy to dd/mm/yyyy
- or from my diary notes of dd/mm/yyyy

that I am unclear as to the: a) role b) activities, or c) tasks which you were performing in that situation.

Q.1 *Could you please attempt to recreate the sequence of events relating to the incident which I have highlighted (cf. attached documents or online artefacts), so that I can better understand and categorise the role(s), activities or tasks which you were performing during this sequence of events.*

From the research to date I have identified some generic roles; or activities; or tasks, which are depicted in the attached list.

Q.2 *Please select from the list whichever of these generic roles; or activities; or tasks, that you consider best matches those which you were performing at that time. If this matching is best conducted sequentially (for instance, if you were performing multiple roles over that time) then please attempt to break these into separate groups over time.*

Q.3 *I notice that you have selected the indicated a) role b) activities, or c) tasks, in preference to (a, b or c) indicated alternatives. Could you please indicate your reasoning in doing so.*

Q.4 Optional questions (for puzzling or problematic incidents):

4.1. What actions do you consider worked particularly well in this situation? (consider up to 3 actions in order of significance)

4.2. If you were in this situation again what different actions would you take, in order to improve the outcomes? (consider up to 3 actions in order of significance)

Q.5 *Finally do you have any further observations which you consider relevant?*

Thank you for your invaluable help in clarifying this incident for me, and for supporting this research.

Appendix 4 - Research Data Sources for Analysis

Supporting the work of Global Virtual Teams: the role of technology-use mediation

Data Sources for analysis

No.	Type	Description	Quantity	Time Window		
1	Email messages raw	TUM related raw email message sequences	**175**	overall	16/06/2004	01/03/2005
2	Email messages unpacked	TUM related email message segments (multipart plus attached files)	**1086**	overall	16/06/2004	01/03/2005
2.1	Email messages w/o duplicates	TUM related email msg segments scrubbed w/o duplicates (multipart)	**366**	overall	16/06/2004	01/03/2005
3.1	email msgs raw attached files	word files	**25**		16/06/2004	'02/02/2005
3.2	email msgs raw attached files	powerpoint files	**1**		20/08/2004	
3.3	email msgs raw attached files	excel files	**1**		30/08/2004	
3.4	email msgs raw attached files	text files	**2**		18/08/2004	'17/09/2004
3.5	email msgs raw attached files	.xml files	**1**		30/08/2004	
3.6	email msgs raw attached files	html files	**2**		29/06/2004	'18/08/2004
4	Literature excerpts	Tum role related literature excerpts	**31**		1994	2007
5	AUTonline announcement	announcements, reminders and links	**5**		17/09/2004	28/10/2004
6	AUTonline information links	links to instructions & information sites (note one broken - SFU GIM cou	**5**	N/S		
7	AUTonline staff information	Brief staff details & links	**4**	N/S		
8	AUTonline discussion Board	Forum - virtual café [note: no postings]	**1**	N/S		
9	AUTonline external links	external website links [Collab Db & time zones]	**2**	N/S		
10	AUTonline group pages	group forum spaces [9 GVT's + tutor space]	**10**	N/S		
10.1	AUTonline group discussion Boards	Forums [3 per GVT, get to know one another	**27**	N/S		
10.2	AUTonline group discussion Boards	[3 for tutors, before collab, all students added, phase 2]	**3**	N/S		
10.3	AUTonline group file exchange	GVT5 (4), GVT8 (1)	**5**		20/10/2004	22/10/2004
10.4	AUTonline group chat session recordings	GVT5 (12) - some well developed sessions	**12**		20/10/2004	30/10/2004
	(collaboration feature)	GVT2 (4) - look like tests only	**4**		9/09/2004	9/09/2004
		GVT4 (2) - one dialogue with Diana about co-op, one test	**2**		9/09/2004	9/09/2004
10.1.1	AUTonline group forum threads "Get to know each other"	GVT1	**17**		12/09/2004	1/11/2004
	AUTonline group forum threads "Get to know each other"	GVT2	**15**		9/09/2004	15/10/2004
	AUTonline group forum threads "Get to know each other"	GVT3	**16**		9/09/2004	5/10/2004
	AUTonline group forum threads "Get to know each other"	GVT4 [single forum used for all 3]	**30**		9/09/2004	27/10/2004
	AUTonline group forum threads "Get to know each other"	GVT5	**10**		7/09/2004	6/10/2004
	AUTonline group forum threads "Get to know each other"	GVT6	**9**		7/09/2004	12/10/2004
	AUTonline group forum threads "Get to know each other"	GVT7	**8**		7/09/2004	12/10/2004
	AUTonline group forum threads "Get to know each other"	GVT8	**49**		7/09/2004	28/10/2004
	AUTonline group forum threads "Get to know each other"	GVT9	**18**		7/09/2004	7/10/2004
	AUTonline group forum threads "GVT Leadership"	GVT1	**0**			
	AUTonline group forum threads "GVT Leadership"	GVT2 [explanatory posting by Diana]	**1**		13/10/2004	13/10/2004
	AUTonline group forum threads "GVT Leadership"	GVT3	**8**		9/09/2004	9/10/2004
	AUTonline group forum threads "GVT Leadership"	GVT4	**0**			
	AUTonline group forum threads "GVT Leadership"	GVT5	**8**		7/09/2004	14/10/2004
	AUTonline group forum threads "GVT Leadership"	GVT6	**3**		4/10/2004	12/10/2004
	AUTonline group forum threads "GVT Leadership"	GVT7	**2**		9/10/2004	27/10/2004
	AUTonline group forum threads "GVT Leadership"	GVT8	**10**		2/10/2004	10/10/2004
	AUTonline group forum threads "GVT Leadership"	GVT9	**17**		7/10/2004	12/10/2004
	AUTonline group forum threads "Phase 2 Group decision making"	GVT1	**9**		11/10/2004	14/10/2004
	AUTonline group forum threads "Phase 2 Group decision making"	GVT2	**8**		12/10/2004	27/10/2004
	AUTonline group forum threads "Phase 2 Group decision making"	GVT3	**13**		9/10/2004	4/11/2005
	AUTonline group forum threads "Phase 2 Group decision making"	GVT4	**0**			
	AUTonline group forum threads "Phase 2 Group decision making"	GVT5	**12**		19/10/2004	2/11/2004

No.	Type	Description	Quantity	Time Window		
	AUTonline group forum threads "Phase 2 Group decision making"	GVT6	**4**		13/10/2004	28/10/2004
	AUTonline group forum threads "Phase 2 Group decision making"	GVT7	**3**		12/10/2004	29/10/2004
	AUTonline group forum threads "Phase 2 Group decision making"	GVT8	**17**		9/10/2004	16/10/2004
	AUTonline group forum threads "Phase 2 Group decision making"	GVT9	**15**		7/10/2004	27/10/2004
10.2.1	AUTonline group forum threads "Before the collaboration has started"	"First tutors thread" [archived] Tutors space	**14**		6/09/2004	15/09/2004
	AUTonline group forum threads "Before the collaboration has started"	"All students are added now at last" Tutors space	**3**		17/09/2004	29/09/2004
	AUTonline group forum threads "Before the collaboration has started"	"Phase 2 " Tutors space	**2**		28/09/2004	29/09/2004
11	AUTonline home pages	From online archive - (GVT1-GVT9) 5 + 2 + 4 + 3 + 5 + 3 + 4 + 3 + 3	**32**		?	?
12	Organization statistics	available for 2004 time window from archive, but dates not triggering	**1**		28/09/2006	29/09/2006
13	PhD notebook	Tony's field notes & observations	**144**		25/09/2004	8/02/2007
13.1	PhD notebook	Book 2 PhD notes etc.	**50**		14/02/2007	current
14.1	Notes Collaborative database forms	GVT leadership decision	**31**		5/10/2004	29/10/2004
14.2	Notes Collaborative database forms	Uploaded Website forms	**41**		4/10/2004	29/10/2004
14.3	Notes Collaborative database forms	website ranking forms	**37**		16/10/2004	2/11/2004
14.4	Notes Collaborative database forms	icebreaker review forms	**41**		5/10/2004	2/11/2004
14.5	Notes Collaborative database forms	final trial review forms	**42**		27/10/2004	9/11/2004
15.1	Notes Collaborative database view pages	View GVT leadership decision	**2**		5/10/2004	29/10/2004
15.2	Notes Collaborative database view pages	View uploaded websites	**2**		4/10/2004	29/10/2004
15.3	Notes Collaborative database view pages	View uploaded websites by date	**4**		4/10/2004	29/10/2004
15.4	Notes Collaborative database view pages	View WebsiteEvaluations_by_GVT	**6**		16/10/2004	2/11/2004
15.5	Notes Collaborative database view pages	View WebsiteEvaluations_by_LT	**6**		16/10/2004	2/11/2004
15.6	Notes Collaborative database view pages	View website rankings	**2**		16/10/2004	2/11/2004
15.7	Notes Collaborative database view pages	View cyberquestionnaires	**2**		5/10/2004	2/11/2004
15.8	Notes Collaborative database view pages	View final questionnaires	**2**		27/10/2004	9/11/2004
16	Misc Institutional Policy Documents	Tbd (ethics guidelines, email policies etc.)	**0**			
17	IBS student reflective reports	assessment reports for AUT students	**8**		31/10/2004	3/11/2004
18	Action Research Design Document		**1**		26/07/2004	26/07/2004
19	IBS S2/2004 Handbook	Module handbook	**1**		15/07/2004	15/07/2004
	Note: colour depicts Missouri groups excluded due to ethics approval constraints					
		total source items	**2546**			
	'14/01/2008	total coded for episodes	**244**			
		Percentage	**9.58**			

Appendix 5 – Nvivo7™ Coded Analysis Sources

Supporting the work of Global Virtual Teams: the role of technology-use mediation

Data Sources for analysis

Coded episode data in Nvivo

No.	Type	Description	Quantity	Nvivo Object	Time Window	from	to
No.	**Type**	**Description**	**Quantity**				
2.1a	Email messages w/o duplicates	TUM related email msg segments initial scrub w/o duplicates (multipart)	**366**	Folder	overall	16/06/2004	01/03/2005
		TUM related email msg segments second scrub w/o duplicates (multipart)	**332**	Folder	overall	9/04/2003	01/03/2005
4a	Literature excerpts	Tum role related literature excerpts	**31**	Folder	n/a	1994	2007
13a	Non email datasources	diary notes & announcement	**20**	Folder	multiple	7/11/2003	27/05/2005
17a	Email messages largely w/o duplicates	Establishment window - full [includes 39 near duplicates - 3rd scrub]	**214**	set	preparatory	9/04/2003	17/09/2004
17b	diary notes + 1 announcement	adj-rein episode window 1	**9**	set	snapshot	30/09/2004	30/09/2004
17c	email + attachment (syllabus)	adj-rein episode window 2	**4**	set	snapshot	20/10/2004	20/10/2004
17d	diary notes	adj-rein episode window 3	**2**	set	snapshot	6/10/2004	7/10/2004
17e	diary notes + emails	adj-rein episode window 4	**5**	set	snapshot	18/10/2004	20/10/2004
17f	word doc (mtg summary)	episodic window 1	**1**	set	snapshot	17/11/2003	17/11/2003
17g	diary note	episodic window 2	**1**	set	snapshot	13/10/2004	13/10/2004
17h	diary notes	episodic window 2	**7**	set	snapshot	21/02/2005	27/05/2005
18	Research design document	establishment window	1	set	snapshot	26/07/2004	26/07/2004
		total source items	**993**				
		total coded for episodes	**244**				
	03/08/2007	Percentage	**24.57**				

Appendix 6 – Summary of Extended Types and Subtypes of Appropriation Moves

Appropriation Moves	Types	Subtypes	Definition
Direct Use (Structure is preserved)	1. Direct appropriation	a. explicit	Openly use and refer to the structure
	1. Direct appropriation	b. implicit	use w/o referring to the structure (e.g. typing)
	1. Direct appropriation	c. bid	suggest use of the structure
Relate to other structures (structure may be blended with another structure)	2. Substitution	a. part	use part of the structure instead of the whole
	2. Substitution	b. related	use a similar structure instead of the structure at hand
	2. Substitution	*c. unrelated	use an opposing structure in place of the structure at hand
	2. Substitution	d. bid	propose use similar structure instead of the structure at hand and seek confirmation
	2. Substitution	e. proposal bid	request proposal(s) to use a similar structure instead of the structure proposed
	3. Combination	a. composition	combine two structures in a way consistent with the spirit of both
	3. Combination	*b. paradox	combine contrary structures with no acknowledgement that they are contrary
	3. Combination	c. Corrective	Use one structure as a corrective for a perceived deficiency in the other
	3. Combination	d. element request	request one structural element required in order to create a composite structure
	3. Combination	e. Bid corrective	propose use one structure as a corrective for a perceived deficiency in the other
	4. Enlargement	a. positive	note the similarity between the structure and another structure via a positive allusion or metaphor
	4. Enlargement	b. negative	note the similarity between the structure and another structure via a negative allusion or metaphor
	5. Contrast	a. contrary	express the structure by noting what it isn't, that is, in terms of a contrasting structure
	5. Contrast	b. favored	structures are compared, with one favored over the others
	5. Contrast	c. none favored	structures are compared, with none favored over the others
	5. Contrast	d. criticism	Criticizing the structure but without an explicit contrast
Constrain the structure (structure is interpreted or reinterpreted)	6. Constraint	a. definition	Explaining the meaning of the structure or how it should be used
	6. Constraint	b. command	Giving directions or ordering others to use the structure
	6. Constraint	c. diagnosis	commenting on how the structure is working, either positive or negative
	6. Constraint	d. ordering	specifying the order in which structures should be used
	6. Constraint	e. queries	asking questions about the structure's meaning or how to use it
	6. Constraint	f. closure	Show how use of a structure has been completed
	6. Constraint	g. status report	state what has been or is being done with the structure
	6. Constraint	h. status request	question what has been or is being done with the structure
	6. Constraint	i. query response	answering questions about the structure's meaning or how to use it
	6. Constraint	j. proposal	suggesting how the structure should be used
	6. Constraint	k. future status	state what is being proposed to be done with (or to establish) the structure
	6. Constraint	l. set-up request	request to establish or modify the structure
	6. Constraint	m. diagnosis request	request comment on how the structure is working, either positive or negative

Appropriation Moves	Types	Subtypes	Definition
Express judgments about the structure	7. Affirmation	a. agreement	agree with appropriation of the structure
	7. Affirmation	b. bid agree	ask others to agree with appropriation of the structure
	7. Affirmation	c. agree reject	others agree to reject appropriation of the structure
	7. Affirmation	d. compliment	note an advantage of the structure
	7. Affirmation	e. bid improve	request suggestions to improve the structure
	8. Negation (structure is rejected or ignored)	a. reject	disagree or otherwise directly reject appropriation of the structure
	8. Negation	b. indirect	Reject appropriation of the structure by ignoring it, such as ignoring another's bid to use it
	8. Negation	c. bid reject	suggest or ask others to reject use of the structure
	9. Neutrality	a. explicit	expressing uncertainty or neutrality towards use of the structure
	9. Neutrality	b. refer to authority	acknowledge uncertainty towards use of the structure and need to consult an authority
	9. Neutrality	c. offer help	query uncertainty towards use of the structure and offer assistance

Note * denotes unfaithful appropriation

Adapted 'Appropriation Types and Subtypes' 12/04/2007 Tony Clear [yellow highlighted].

Based on data in corpus, and gaps in prior coding scheme, aiming to remain consistent with rhetorical tropes DeSanctis & Poole (1994) [table 5 p.135] & Poole & DeSanctis (1992) p.7 & pp. 18-20, plus such augmentation is also consistent with comment on limitations of scheme on pp. 23 – 25.

Interpretation of "Renaissance and Elizabethan rhetorical tropes"

Renaissance and Elizabethan rhetorical tropes	Appropriation moves	Appropriation types
a. Metaphor – similarity – comparison/contrast	Relate to other structures	4. - enlargement
b. Metonymy – contiguity (e.g. crown for royalty)	Relate to other structures	2. - Substitution
c. Synecdoche – part for the whole	Relate to other structures	5. - Contrast
d. Irony - contradiction	Relate to other structures	3. - Combination
?	Direct Use (structure is preserved)	1. - Direct appropriation
?	Express judgments about the structure	7. - Affirmation
?	Express judgments about the structure	8. - Negation
?	Express judgments about the structure	9. - Neutrality/uncertainty
?	Constrain the structure	6. - Constraint

DeSanctis, G., & Poole, M. (1994). Capturing the Complexity in Advanced Technology Use: Adaptive Structuration Theory. *Organization Science, 5*(2), 121 - 147.

Appropriation Moves Types & Subtypes – adapted from Table 5.

Appendix 7 - Establishment Episode Full - Extended Content Summary

No.	Messages	Contents
1	Email Message: Aterea Brown 16/09/2004	note that users are now in AUTonline
1	File: Aterea Brown 16/09/2004	attached username & Password file - hieroglyphics “Adding ahlstrom,john,ext000050,QV9EO4Ux7...success”
22	Email Messages: Arnold Pears 23/06/2004 – 17/09/2004	introductory email welcoming all, advising alternate email in case aggressive spam flitering cuts anyone out, prev exp with runestone 4-5 years, looking fwd; uppsala VC room set up but not sure of status, access to 16 webcams for teams with usb, runestone exp suggests Vc not that good, picture not useful, poor voice quality an issue for multicultural teams, IRC chat rooms best, plenty of clients and logging facilities, runestone since 2000; thinking about SE course goals and assessment, link to hospital in SE course another level of coord, advised phone no and at home, confirmed course timings for start, advised Arnold running project, s'one else doing lectures, third person labs, about 45 students, need more input form Mts on hospital and impact for timings etc.; preference to do both (VC and async?) and give exposure to diff comms and working in global s/w teams as a context?; suggestions for learning goals - software design/prototype, experience with and recommendations on how collaboration is best managed, then evaluate diff comm tools - some more ideas?; comment re ethics over to Fred to manage, protocol at uppsala simply a and they can refuse to participate or allow data to be used, data to be anonymised b4 release and no student id in publications, 1st mtg on 9/9 and will introduce collab and plans; I'll have an enrolment list sent out to me and will work on allocating groups; have req final names and 1st lecture tomorrow so shld have confirmed list soon; I guess I shld also do as Fred has done and allocate to groups - but what about handling drop outs?, project intro on 9th btw; stuff up form enrolment office list sent on paper, electronis one requested, but not until tomorrow; 08/09 interactive email with diana responding on several points re student list and AUTonline set up, group numbers and allocations, and use of cenral respository rather than complexity of this email discussion; email of list students personal numbers (private) email addresses [not all provided - students do not have to give out, so will chase for AUTonline] and names in defined formats, assuem shld allocate into 9 groups - 5 per group - quite a lot?; intro tomorrow, like to have class evaluate different comms tools than supported in trial (VOIP, collab whiteboards, explanograms), any interesting resou diana suggesting use of BB, maybe missed an email re login to blackboard? tried arnold and arnoldp and same pwd but no luck; forwarding bouncing msg (for NZ) from fred; advice that student list has a problem of 10 people not taking course on it, will work out how to eliminate b4 assigning teams; didn't get login info, but have asked students to reflect on usability of BB tools, want to evaluate comms tools for collab and s/w dev't so if suitable web sites then ok with suggested topics; 17/09 AUTonline not letting users set own passwords a security risk? No accts existed for Fred or my students Wed and starting to get a bit frustrated esp since phase 1 due to complete on weekend; thanks, unfortunately at a course all day so sorry about delay
3	Email Messages: Bridgit Bretherton Jones 24/08/2004 – 16/09/2004	advice re setup of me and kitty as leaders, acct to be set up for brendan, email address for oseas colleagues and once set up witll email them access details, reset pwd on diana's student acct; note list delay and request for student details in specified order by Mon, with pwd if supplied otherwise name as pwd and will try to have up by Tues, but reliant on ITG so if not will notify by email; here is the list with usernames and pwd
5	Email Messages: Brendan Dobbs 30/06/2004 – 23/08/2004	forwarded Bruce Collofs details re VC; home contact phone details in case of server error; arranging mtg re RA support role; confimed mtg at 10:30,

80	Email Messages: Diana Kassabova 23/06/2004 – 17/09/2004	15/06 to me - comm project looks good for IBS studs too, tho type of Gware and assessment weight will need considering; 23/06 to me - Kitty way for a week but finished marking and could meet to discuss tomorrow??, including stud report feedback; cu tomorrow at 3:00; to fred & Arnold - happy to discuss changes for 3 stud groups and go, 5-7 week duration, need time window - pref 30 Aug on - what are your dates? We usu have three streams abotu 50 studs, pse advise pref dates & how many on your side; 01/07 to me - fine, ok for a mtg on Mon?; kitty declined 2 jul mtg 11:00 ok for 3 of us tomorrow 3:00; 5/07 thanks to Mark for mtg, double check email address issue for offshore studs 1) use AUTonline within AUTonline 2) own email address by forwarding but need to set up themselves, also chat settings affected by email ?? pse advise; 5/07 to Fred & arnold - report semester finished and update re collab ex and answer to qu's, propose 30 aug start for 3 weeks, 2 weeks break then begin again 4 oct and finish on 15th, usu intro class session, discuss groupware readings, demo system, handout instructions and timeline, deliverables - refelctive report + evidence (hope answers freds qus'), share exp re weighting Fred's 10% ours was 15% now 20% recognising stud effort, note ex tony's email workign on VC session - hoping end aug early sep, report able to use BB for external studs plus Notes db linked to store evaluation data, prev studs grouped in VTs SE and AUT now will include US, ex Mats & Tony disc. icebreaking choose group leader free form and supported by VC, group task - rank websites on groupware - suits all 3 courses - studs can use any features of BB create webpages, disc forums, email o chat, note that AUT studs very culturally and ethnically diverse with variable comms and lang skills, think we will have about 35 studs but not settled until week 1 or 2 of semester, pse get back to us with comments/suggestions, meanhwile will check out what is required for enrolling extnl studs in AUtonline, look fwd to working together; to Mark - tks for resp would email address affect studs particp'n in chat?;
	Diana Kassabova	06/07 to Fred advice re email addresses 1) internal to AUtonline, cna only use AUTOline email, 2) to receive via own email - AUTonline mail fwded to own email, but need to setup, another logistics item; 7/07 to arnold - noticed yr email address diff from last one msgs sent to so enclosing below, acknowledge yr point about pros and cons of VC but shld try, Net meeting a problem from campus - firewalls etc., suggest group photos of each team in gware to help build spirit; 09/07 to me - how is conference going? leaving for o'seas tomorrow and back thurs next wk sugg we meet fri? let me know time, will check email while o'seas, Fred up to speed with collab and makign good suggs, have to discuss further on fri b4 responding - he is on holiday for 2 weeks now; 12/07 Hi Tony 9:30 is good cu then; 12/08 Tony I only have URL's for instructors navigator 2003/ s1 and S2 and can't fgure out URLs for 2002 and earlier, can u hlp; 17/08 Paul Miller query don't have permissions to create a new forum, tho once set up will be able to create threads, scrnshot shows what I see - diff from tutor view; 17/08 Hi Paul have now created forum assgt 1 hope you will be able t 18/08 to tony - attached is GVT diagram in 3 colours, pse advise any suggs; 19/08 to praveen - tks for advice re experiment, shldn't be any server probs, will have task to you at 9pm tonight by email; 19/08 to mark, reminder re int'l collab in 2 wks time and request to set up AUTonline instance plus qu how to get extnl studs & lecturers into system, just a list of names?; 19/08 to Fred understand re ethics issue and proposed changes re group formation, since 9 grps already formed for another assessment in course wld like to maintain them, sugg 1st 3 teams with US studs not eligible for research unless later approval gained, other teams SE and NZ LT's only shld not impact exercise, note grp indices in diagram needed for UI & instructions, our ethics approval allows studs to w/drwa at any tiem, but hopefully not too many will, pse confirm happy with grouping arrangements so we can move on to next stage of exercise; 20/08 to Julia Hallas reminder of trial and query re lack of response from mark yesterday and wondering is he away and if so how to proceed, help;

Diana Kassabova	22/08 to me - from arnold's email he will start with studs 9/9 not sure if on exercise or just mtg them 1st time, as we are plg wk7 here could be a problem unless we shift fwd by a wk, will talk on Tues let's hope we've heard from mark o Julia by then; 23/08 from Mark about to set up this org of yrs, can u remind me of name or code to keep it meaningful; 23/08 to Mark tks for email, wondering about what to do if on holiday in fiji or similr, paper name and no ibs 407106, c we have a couple of generic stud accts to ensure settings for ex as we wish them, let us know what you need to upload studs to site and make it accessible, also some extn'l tutors; 24/08 hi mark & bridgit tks for creating org for us, renamed as int'l collab, from now on assume comm with Brdigit as Mark is away, pse make avail tony, kitty brendan a instructors, also need same rights for fred and arnold, pse advise their login detials or wld u prfr their email addr and advise them direct, coudln't login with stud acct creatd 4 me, don't have pwd pse advise; 24/08 to fred and arnold advice re contact from bridgit re AUtonline access, 4 time being not much structure on site group forums etc, will set u 24/08 to tony - 1st draft of icebreaking phase completed with Kitty pse review b4 we send to fred & arnold, only 1st 2 pages changed, rest from last sem to be u/d; 25/08 to tony re GVt instructions tks for that I'll email Fred & arnold now, cld see this a.m. that you are all loaded as instructors in the org named Internat Collab; 25/08 to arnold & fred - movin fwd now u have login details and can access site, u cn also use generic stud acct dianakstudent, pwd diana, after rdg all prior emails tony, kitty & I concluded best window 6 sept end by 22 oct, by 6th sept will have follwg - confirmed lists of studs frm arnold & fred pref by end aug to enable uploading, studs frm ea uni assigned to LTs, grp pages and grp forums setup for GVTs, have compiled a draft of part 1 of instructions attached, pse confirm schedule and instr ok, will compile phase 2 instrs once icebreaking underway, idea all LTs upload URL for 2 sites related to gpware/GDSS, after that all GVTs evaluate sites uploaded by LTs and thru a negotiation process aim to achieve a consensus on ranking the sites, look fwd to replies; 25/08 sorry forgot to provide attachment to email; 27/08 to fred, glad happy with draft, sorry about missing URL, will be in revised instructions, studs will get indiv pwds from tech support, as far as I know can't be changed by studs [our studs pwds synch with LAN for accessing n/wk], for icebreaking we need to set up groups for each GVT only accessible by studs in team and instructors, video clips shld be available to all - what do u think? homepages will be accessible to all by default, don't believe there is a way to restrict them, instructors have access to everything except chat sessions studs forget to record and emails, planning for phase 2 to use tony's collab DB prototype to give structure to task and embed in AUTonline, plg to work on that thi week and then write up instructions for 2nd task, wld be great if you provide us with list of yr groups and full list of studs names and email addresses as our tech support need for uploading into AUtonline, for our assgt spec here we are plg s'thing v. similar to your assgt so pse send yr paper when you have completed, (note paper here = course/subject v. confusing for non NZ'ers;
Diana Kassabova	27/08 (US date/time??] from Fred, recd' draft, instr'ns clear, need URL, does each stud recv an indiv pwd or one for a group? do instructors have a diff access to browse stud activities? I have a stud list in three teams of 4 shall fwd at en of day, do u wnt pref pwd with each name? I like the split of project into 2 parts, studs to keep journal & comment on isuses with final short paper on lessons learnt, will refine and send to u, but will fwd as I develop in case u want s'thing similar; 30/08 to tony attached s/sheet with some stats from 3 prior trials, will extract int'l comments from reports too, Kitty and I will be working on setup and instructions 2 morw morning; 30/08 forgot the file here it is; 30/08 to tony - attached a file with all refs to int'l collab in evaluations from last 3 semesters; 30/08 to tony - attached an excel version of the stats xml file [embed from tony - unable to read xml version with excel 2000, attached latest version of paper - maybe rename patterns of motivation in virtual teams? thnk over and catch up 2morw?; 30/08 to fred and Arnold - aware that we are ahead but pse fwd details of yr studs so we can prepare, with admin complexities always possible for things to go wrong at lst minute, we need a few days of prep b4 handing out to studs next wk, fyi draft of AUT assgt attached, note 2 versions to meet ethics approval stipulations; 31/08 attached here; 31/08 to fred tks for immediate response and finalised list of names as tech support did not want to be drip fed; 31/08 Hi Arnold tks for that sounds great; 01/09 to Arnold - we need the list of studs more urgently as our tech support staff need to load them into AUTonline, once done we will create groups & assign studs to them on the site, so if there are studs who drop out we can easily remove them from the groups regardless of the fact they are loaded to the system, hope this answers your qu?;

		02/09 Arnold sorry about probs from yr admin staff, let's hope you get yr electronic list soon, I fwd below email rec'd few min ago from suppt staff indicating what they want in the lst can u pse include this info,BTW kitty & I created group pages for the 9 GVts and two forums for each get to know each other and GVt leadership, only shells for groups as studs loaded we will each have to assign them to GVTs as in earlier diagram, instructions for doing so via BB, also created group page tutors space so we can use collab tools, u can add info abt yrslef in staff info tony has done so - instructions, pse comment and add own elements to site, it will develop as we go, looking fwd to getting stud info and starting next week; 03/09 to Bridgit - delays over studnet lists hoping to rec've sat (fri their time), but wnat to start Tues any probs & can u load on Monday?; 03/09 tks bridgit, I feel a lot better now, I'll fwd info as soon as I get it, let's hope we can start Tues; 06/09 Bridgit - unfortunately no lists from SWe yet, Kitty and my classes start 2morrw so will go with IBS studs who are enrolled, no probs for you?;
	Diana Kassabova	06/09 re a couple of qu's tks a lot Bridgit; 08/09 to Fred - as far as I understand emails needed so studs can get login info by email, no probs with nos I have some groups with 3 or even 2 and we have put them in the GVTs with 3 LTs, we started yesterday, explaining and signing consent forms etc, soem studs have introduced themsleves and studs are looking fwd to getting in contact with studs from US and SWe, lookign fwd to info from u; 09/09 to arnold - this am fwded list to support not sure how they will cope with missing email addrs, will advise when I hear, happy to comm via tutors forum if everyone else is and will copy this email there, tony & I dscussed issues with team size and no of studs, but dropouts etc part of whole game, but NZ and US LTs smaller than yrs so shld manage traffic, re sugg to add in more tools to use interesting and shld discuss in forum, but instrcutions given to studs so unlikley but maybe cld evaluate via websites?; 09/09 to Tony not sure why not accessible to you, you are a user to all GVTs check via control panel - maybe need to check with Bridgit; 09/09 re I'm ok now(tony), good that's one less thing to worry about;
		10/09 to arnold & Fred - ystrdy studs introducing selves via GVt forums and encouraged to use lightweight chat, if they follow instructions they dont get buttons for archiving, but if they follow these steps they do, pse explain to studs, lecturers get buttons regardless; 10/09 to arnold, pse fwd missing email addresses so studs can be loaded into system; 12/09 to Arnold shld not be a prob as long as LTs only made up of people going to participate in the trial, have fweded yr updated list and Fred's to supprt staff and pushing to have them loaded ASAP, pse let me know days of yr class - ours tues -and when to expect contributions to forum, our studs go on a 2 week break from next week; 12/09 (to Arnold) tks for this, I did get one of Fred's msgs ystrday - no idea why bouncing back; 13/09 to Brdigit, attached file of SE studs with updated email addrs, not all present but go ahead, can't wait - happy to assign nonexistnt email addrs, they will just not have email, pse upload US studs from ystrdy too, we need this for trial to proceed;
	Diana Kassabova	13/09 to Fred - will try to explain details, I thought you had them, using BB at URL with yr name & pwd 'fred', our support staff were to have sent you thsi info, yr studs will get login info from supprt staff, not yet loaded but shld happen over nxt few hrs, as discussed yr teams will be LTs part of GVT1,2,3 and will use Autonline for icebreaking phase, for phase 2 will use integrated DB URL link, but still finishing off design - 2 wks away, not sure if u have used BB b4, here is a brief intro - login - international collaboration - announcements - group pages & grp discussion brd - more info in instructions see course info, all grp spaces open to tutors, presently only NZ students in system, US & SE details fwded to support staff and hope to have in today, will load yr studs into 1st 3 grps and will email u, arnold is going to load grps himself, tutors can access control panle to get access to most settings, studs don't have thsi access, hope have answered qu's just ask if anythng left out; 14/10 - to Toni Welsh (stud) - not sure what email addr u are using for this email to SE studs, if using AUTonline they do not get them, need to use extnl addresses, if u want th

		16/09 Hi Fred here is the file; 16/09 hi Arnold here is the file of SE studs login details note pwds randomly generated and studs cant change so ask them to remember, they ned to know do not have aut email addresses so cant use email within Autonline but can receive email to own address from anyone who cna email form within AUTonline (NZ studs), pse add studs to groups I can help if u wish, and add names to instructions under info in AUtonline, hope we can start collab now; 16/09 ditto email to Fred, but will add studs to first 3 GVTs; 17/09 to fred & arnold - have loaded file with phots of 4 LTs to BB virtual cafe - linked from announcements, also uploaded team photo to each forum GVT page, will keep reminding studs to contribute over break but obviously can guarantee, look fwd to 1st contributions frm yr studs; 17/09 to Naveed attached assessment sheet - unclear whether field notes indiv or group; 17/09 to me - FYI file with login details for int'l studs; 17/09 Hi Arnold I notice u have added a couple of studs to first 2 GVTs and one has introduced himself, any probs with process, happy to help just let me know;
10	Files: Diana Kassabova 18/08/2004 – 17/09/2004	18/08 GVT diagram; 20/08 GVT Diagram v2; 24/08 draft instructions phase 1; 30/08 3 sem prior collab stats xml file; 30/08 stud evaluation excerpts int'l dimension of trials; 30/08 3 sem prior collab topic completion stats excel file; 31/08 IBS assgt 2 groupware assessment; 13/09 Sweden list_v2 (SE stud names, emails, pwds - some missing emails); 16/09 SE studs login details, incl AUTonline uname (ext0000nnn) & pwd; 17/09 marking schedule Naveed cc assgt 1;
1	Email Message: A. Pseudonym 01/07/2004	vpn password
38	Email Messages: Fred Niederman 10/06/2004 – 14/09/2004	request to Felix for UG or PG student support in developing a Global IT course with his TA, eventual aim to include int'l student collaborators; planned course at UG level IB or IT students, TA to help develop course & runthrough of global collab, aiming to design activity for global contribution, ICIS mtg plan; To me update re approval for course, Fall semester dates non contiguous & proposed model - VC at beginning and end, intro and brainstorm then debrief, BB & email to post whitepapers on topics, graded on quality of study and 3-5 pg paper on process, IB students mostly work in dist pairs or fours, reserv re level of detail to propose vague vs. inflexible, issues re VC schdeuling & sync w tiemzones, BBoards at St Louis password protected & contractually not open to unenrolled students so need to do s'thing at AUT end, qu is this like SE trial, can we do with yr course & 3 way? home email address since over summer only come into campus 2 -3 times /wk and don't want to hold up, eager to move fwd; to me - enjoyed reading unzipped materials and some ideas how to proceed, pse send unzipped copy of thesis to work not home email (hours downloa
		query re emails from home not received and req to send one to confirm; wonderful, limited to a few addresses or maybe ISP cleaned it up? likes the assgt and would like to meet at AMCIS NY in Aug where Fred is on a panel; to Diana, draft syllabus & timeline for assgt, clarification re timings and our 2 wk break, any prior work? how to introduce students - lab class briefing or written instructions, debriefing session at end? Want a VC session to start - realise logistical issues etc. but may be interesting for studs, about 10 studs, but nos. notorious for going up and down, maybe 20 max, haven;t had time to check out websites yet, but exercise looks fine, thanks for eforts; forgot to attach syllabus sorry; GIM syllabus with course schedule; to me 0- tks for getting ball rolling, VC session not proposed for in class [midnight NZ], hoping to schedule special 6-7 pm session 8 am NZ still to check time, rationale try out technology and get techs to explain it to class, and sync intro session for teams as alt to f-t-f, if not then could do with other US teams; update b4 heading off for 2 wks - runestone site URL problem, will check out whether they have webc
		Inclination to make voluntary but need to track for research purposes who does and who doesn't VC, thanks for Dianas comprehensive email & congrats on finishing semester, away for 2 wks but then back into it, timing sounds good, 7 wks will check agst syllabus, reminder ours IB studs aim to interest in tech use, yours in tech design/construction, will start off with groupware - any suggested readings? would like to test system - via outlook in classroom? Confirming deliverables, and research brief - AUT Info sheets for human subjects ethics - will pass out ours, do they need updating? team composition NZ/SW/US all same size? Assgt weighting 20% and alt assgt for non participants - exclude their data?? End Aug/early sept good for VC & will pencil in subject to conf, can you set up a BE acct, happy for studs to do same as SW studs, Vc hopefully to contribute to team leader selection, web site ranking task on groupware Fred's studs to focus on functionality, ease of use & cost benefits - but intertwined with tech aspects, re choice of tools if hypothesis proving research then may not have adequate samples - research model quar

	Fred Niederman	Amazed at cultural diversity - will we control for language in group selection?? Hope useful suggestions, considering collecting up all emails and writing education oriented paper, looking fwd to exercise; Diana do you need email addresses for all studs? down to 9 - 3 in each team; copy to self of 29072004 email with 13 qu responses from me; GIM course starts next tues, copy of most recent syllabus attached, 1) re website is there a test version for Fred to pla with? now 12 students being allocated to groups, we have new s/w on campus to which we could add students - will tr out this week, 2) for IRB no plan to use data as research (std teaching activity) but as archival data for which later approval may be gained - to check with IRB admin whether ok, stud assgts and topics and instructions being written up and to be circulated, will be talking with VC techs over session - planned 7 sept & 8 - purpose to create contact with studs - if too difficult or expensive then video - not interactive but may be useful, anything let out, looking fwd to working with you; update re mtg with VC techs - tech specs and 30 sec videotape segments for downloading, pref stud virus warning syllabus attachment removed, phone no at home and at work, strategy for website AUTonline & embeded notes DB, but LMS people need details of students to register and can't cope with fits & starts, stable list usu avail of unames & pwds by 31 Aug, still to tailor notes dbs with Diana - no security reqmt, maybe St Louis s/w an option, but too many env'ts an issue for studs, forgot need pwd & logon but St Louis vendor contract won't allow extn'l studs - sorry, Tony est. of nos of students (35=60=12) and grouping implications- triadic with pairs form each country? to meet with diana, IRB at AUT v linear, IRB at St Louis v. strict but ok on teaching w/o pub expect. option to include US studs in only some groups with that data altho carefully kept, not available for research, unless later petitioned , unfortunately don't recognise other IRB approvals so use of AUT's not an option; flexible on topics and happy to have studs work on same task; re VC real problems with AUT studs commitment, non residential unlike at St Louis, tech support nightmare after CC ex. & no TA, re video taping will consider - maybe a phone call to sort out.
	Fred Niederman	virus removal message, mail helpdesk for copy; interleaved msg - it looks like a live VC is a dead issue, possibility of exch of videotapes?; Syllabus last upd 16/08; apology & revised proposal re groups 7 only NZ and SE, 3 US also and only avail. for teaching not research purposes to keep IRB happy; attached group schematic; confirmation to diana tha her v.2 alignment of teams is ok by Fred, 1st mtg nxt tues 23/8 and looking fwd to est teams; thank you to Tony re IRB understanding, unless pinned down to nth degree will keep bouncing, so will use for teaching with focus on student benefit and if desired will request post-hoc approval and student consent to use data later; to Tony looking fwd to reading chapter, and discussion re next years St Louis visit and arranging a research presentation; rec'd draft of instructions, seem pretty clear, need URL, any instructor mode to view student work? do you want preferred passwords with each name? Have 12 students who will be assigned to 3 teams by end of day and will send details, like split of tasks into 2 phases, will ask students to keep a journal and write a reflective report - may refine but will sen to Diana have selected out teams, just want to check with studs in class that they are stable to avod having to resend; attached names of students incl. some who haven't showed up but assigned to teams to ensure that at least two remain per team, given each team a name to bulid cohesion, also attach an investigation - 3rd assgt in course, your instructions re group project are excellent; investigation; team assignment; msg to arnold to forward email msg to NZ, as Fred's get bounced, email containing embedded student name and email details, since our system rejects his attachments; advice to diana hadn't heard from support staff, will run thru instructions tomorrow b4 class begins, days and time of classes advised and in Central time zone, happy with whatever as icebreaker; urgent request to Diana, about to start tomorrow wants URL to db (only has 2003 one), is there a diff one for instructors? Names for teams and how do students get to their team spaces? o'wise happy to go;
6	Files: Fred Niederman 29/06/2004 – 01/09/2004	29/06 draft GIM syllabus; 18/08 virus warning mailscanner text file; 18/08 updated syllabus; 20/08 revised team formation approach; 01/09 investigation 1; 01/09 GIM team assignment;
2	Email Messages: Felix Tan 04/09/2003 – 25/09/2003	request re Fred's course - UG or PG in order to forward to coord, advice to Fred re me & UG SE course collab, copied and over to me to take it further
1	Email Message: Fredrik 03/10/2004	chasing up team colleagues - no communication yet and phase 1 about to complete
3	Email Messages: Gordon Grimsey 01/09/2004 – 06/09/2004	IBM scholars pgm renewal - advice req re use of Notes; and thanks for submission
2	Email Messages: Kitty Ko 01/07/2004 – 01/07/2004	req to meet on Mon after PCIS exam finalised; suggestion re mtg time, noting my impending absence

2	Email Messages: Mats Daniels 16/06/2004 – 17/09/2004	notification that arnold is teacher this year, end of week message observation re IT in Society course and grook for the week
1	Files: Mats Daniels 16/06/2004	attached copy of Fred's syllabus
6	Email Messages: Mark Northover 05/07/2004 – 23/08/2004	query resp to diana - stud accts given AUTonline accts with AUT address which Bb uses, but students can (since 2 days) set up alternate diversion addresses from offcampus via webmail; resp no problems using chat as chat server only dependent on login acct; about to set up org & req for code of course to enable org name to be meaningful - can rename if desired; created org diana as leader & student acct as std, req for anything else, away for six weeks & bridgit to handle addition of oseas students;
2	Email Messages: Naveed Iqbal 16/09/2004 – 16/09/2004	email attachment forgotten reminder and resubmission
28	Email Messages: Tony Clear 10/06/2004 – 17/09/2004	copy of MPhil thesis to Fred; ; confirming receiving Fred's email Ok; forwarded email thread with details of Fred's course; confirming mtg with Brendan; msg to Fred commiserating re email glitches, sharing module handbook, status re collab planning, copy of FIE notes, copy of last AUT assgt, URL for evaluations from past collabs, apologies for AMCIS, encourgament re GVT; suggested mtg time for diana; welcome msg to arnold encouragement re spam, comment on runestone, suggest copy details to fred;msg to bruce Colloff re AUT vc options & costs, & speaknsee tech support for firewalls etc. plus request for prefs from fred and arnold given trade-off flexibility vs. tech reqmts; proposed mtg time diana; advice that diana and I would meet shortly to plan collab, noted own absence and others on leave, will respond on o/s qu's after mtg, CC course now up to speed so may involve PG studs; 29/07 email to fred re 13 points on the collab; msg to fred, noting need to get RA support and will advise; msg to Fred re email filters and javascript, voicemail from arnold suggesting comms as a focus, things beginning to get underway; advice re tentaive plan Diana and I, model for GVT's attached, hping to get RA support, Fred and Arnold to consider; msg to Brendan re interest in RA work as rec by Felix, pse contact; thanks to Fred and note as advised to arnold need to work flexibly to accommodate all, but will get there; resp to Fred re IRB process and need to be sensitive from personal experience, scandinavians cope better; msg to brendan re mtg time; tweaks to 1st 2 pages of instructions, note need to be more specific about indiv vs group structures in AUTOnline once worked out; msg to gordon re use of notes in various courses and contexts incl collabs; addendum re CC course & prototype; msg to diana about accessing discussion threads from announcements - links not active; follow up msg - found them had not come in via org link; msg to Mats advising how to log in to trial - as arnold (uname & pwd advised) or can set up acct, URL for AUTonlien and naviagation instructions plus invitation to join in discussion group for tutors, now u/way 2 weeks late.
1	File: Tony Clear 25/07/2004	Action Research (McKay & Marshall) Plan for the trial

As at 09/09/2007

Appendix 8 - Establishment Episode Full - Activity Breakdown by Week

Trial Week Planned	Trial Week Actual	Date	Day (NZ)	Name	No of Messages	
-52	-53	4/09/2003	Thurs	FT	1	
-52	-53	5/09/2003	Fri	FN	1	
-52	-53	6/09/2003	Sat	FN	1	
-49	-50	25/09/2003	Thurs	FT	1	
Trial Week Planned	**Trial Week Actual**	**Date**	**Day (NZ)**	**Name**	**No of Messages**	**Messages/wk**
-13	-14	10/06/2004	Thurs	FN	2	
-13	-14	10/06/2004	Thurs	TC	1	3
-12	-13	15/06/2004	Tues	DK	2	
-12	-13	15/06/2004	Tues	FN	1	
-12	-13	15/06/2004	Tues	TC	1	
-12	-13	16/06/2004	Wed	MD	2	
-12	-13	16/06/2004	Wed	TC	1	7
-11	-12	21/06/2004	Mon	TC	1	
-11	-12	22/06/2004	Tues	FN	2	
-11	-12	23/06/2004	Wed	AP	2	
-11	-12	23/06/2004	Wed	DK	2	
-11	-12	23/06/2004	Wed	FN	2	
-11	-12	23/06/2004	Wed	TC	3	
-11	-12	24/06/2004	Thurs	DK	1	
-11	-12	24/06/2004	Thurs	TC	1	
-11	-12	25/06/2004	Fri	DK	1	15
-10	-11	29/06/2004	Tues	FN	4	
-10	-11	30/06/2004	Wed	BD	1	
-10	-11	30/06/2004	Wed	TC	1	
-10	-11	1/07/2004	Thurs	DK	2	
-10	-11	1/07/2004	Thurs	DS	1	
-10	-11	1/07/2004	Thurs	KK	2	
-10	-11	1/07/2004	Thurs	TC	2	
-10	-11	2/07/2004	Fri	FN	1	14
-9	-10	5/07/2004	Mon	DK	3	
-9	-10	5/07/2004	Mon	MN	2	
-9	-10	6/07/2004	Tues	DK	1	
-9	-10	6/07/2004	Tue	MN	1	
-9	-10	7/07/2004	Wed	AP	1	
-9	-10	7/07/2004	Wed	DK	1	
-9	-10	9/07/2004	Fri	DK	1	
-9	-10	9/07/2004	Fri	FN	1	11
-8	-9	12/07/2004	Mon	DK	1	
-8	-9	12/07/2004	Mon	TC	1	
-8	-9	14/07/2004	Wed	TC	1	3
-6	-7	26/07/2004	Mon	TC	1	
-6	-7	29/07/2004	Thurs	DK	1	
-6	-7	29/07/2004	Thurs	TC	1	3
-4	-5	9/08/2004	Mon	FN	1	
-4	-5	12/08/2004	Thurs	DK	1	
-4	-5	14/08/2004	Sat	FN	1	3
-3	-4	16/08/2004	Mon	FN	1	
-3	-4	17/08/2004	Tues	AP	2	
-3	-4	17/08/2004	Tues	DK	2	
-3	-4	17/08/2004	Tues	FN	3	
-3	-4	17/08/2004	Tues	TC	2	
-3	-4	18/08/2004	Wed	AP	1	
-3	-4	18/08/2004	Wed	DK	2	
-3	-4	18/08/2004	Wed	FN	8	
-3	-4	18/08/2004	Wed	TC	1	
-3	-4	19/08/2004	Thurs	BD	1	
-3	-4	19/08/2004	Thurs	DK	3	
-3	-4	20/08/2004	Fri	AP	1	
-3	-4	20/08/2004	Fri	DK	4	
-3	-4	20/08/2004	Fri	FN	3	
-3	-4	20/08/2004	Fri	TC	1	
-3	-4	21/08/2004	Sat	FN	1	
-3	-4	21/08/2004	Sat	TC	3	
-3	-4	22/08/2004	Sun	DK	1	
-3	-4	22/08/2004	Sun	FN	1	41
-2	-3	23/08/2004	Mon	BD	3	
-2	-3	23/08/2004	Mon	DK	2	
-2	-3	23/08/2004	Mon	MN	3	
-2	-3	23/08/2004	Mon	TC	1	
-2	-3	24/08/2004	Tues	AP	2	
-2	-3	24/08/2004	Tues	BB	1	
-2	-3	24/08/2004	Tues	DK	7	
-2	-3	24/08/2004	Tues	FN	1	
-2	-3	25/08/2004	Tues	DK	3	
-2	-3	25/08/2004	Wed	TC	1	
-2	-3	27/08/2004	Fri	DK	2	
-2	-3	27/08/2004	Fri	FN	1	
v	-3	30/08/2004	Mon	DK	8	
-2	-3	31/08/2004	Tue	DK	6	41
-1	-2	1/09/2004	Wed	AP	2	
-1	-2	1/09/2004	Wed	DK	2	
-1	-2	1/09/2004	Wed	FN	4	
-1	-2	1/09/2004	Wed	GG	1	
-1	-2	2/09/2004	Thurs	DK	1	
-1	-2	3/09/2004	Fri	AP	1	
-1	-2	3/09/2004	Fri	BB	1	
-1	-2	3/09/2004	Fri	DK	4	16
1	-1	6/09/2004	Mon	DK	2	
1	-1	6/09/2004	Mon	GG	2	
1	-1	6/09/2004	Mon	TC	2	
1	-1	8/09/2004	Wed	AP	1	
1	-1	8/09/2004	Wed	DK	2	
1	-1	9/09/2004	Thurs	AP	3	
1	-1	9/09/2004	Thurs	DK	3	
1	-1	9/09/2004	Thurs	TC	2	
1	-1	10/09/2004	Fri	AP	1	
1	-1	10/09/2004	Fri	DK	2	
1	-1	10/09/2004	Fri	FN	1	21
1	-1	12/09/2004	Sun	DK	2	
2	1	13/09/2004	Mon	AP	2	
2	1	13/09/2004	Mon	DK	4	
2	1	14/09/2004	Tues	AP	1	
2	1	14/09/2004	Tues	DK	1	
2	1	14/09/2004	Tues	FN	3	
2	1	16/09/2004	Thurs	AB	2	
2	1	16/09/2004	Thurs	BB	1	
2	1	16/09/2004	Thurs	DK	4	
2	1	16/09/2004	Thurs	NI	2	
2	1	17/09/2004	Fri	AP	2	
2	1	17/09/2004	Fri	DK	5	
2	1	17/09/2004	Fri	MD	1	
2	1	17/09/2004	Fri	TC	1	31
3	4	3/10/2004	Sun	FX	1	1
4	5	14/10/2004	Thurs	DK	1	1

as at 09/09/2007

Appendix 9 - Action Research Framework – International Collaborative Trial - sem2/2004

Element	Description
F (Framework)	• Collaborative, IT enabled pedagogy (Leidner & Jarvenpaa, 1995) • Problem Based learning (Boud, 1985) • Adaptive Structuration Theory (Desanctis, 1994) & Extended AST (Clear, 1999, 2000) • Integrative model of Group Interaction (Whitworth, 1997) • Technology-Use Mediation (Orlikowski et al., 1995) • Web Based Groupware (Wheeler et al., 1999) • Critical enquiry in CS education (Clear, 2004)
$\mathbf{M_R}$ (Research Method)	• Practical Action Research, combining elements of Emancipatory Action Research, • Dual cycle action research (McKay & Marshall, 2001) • Multi methodological analysis (Mingers, 2001)
$\mathbf{M_{PS}}$ (Problem solving method)	Practical Action Research, Prototyping, collaborative pedagogical designs, Use of global virtual teams (GVT's)
A - (problem situation of interest to the researcher)	• To explore the practicalities and issues associated with establishing international collaborations with GVT's • To explore the distinctions between dyadic and triadic configurations with global virtual teams (GVT's) • To explore the processes for building trust in international collaborations with GVT's • To explore the development of groups in international collaborations with GVT's • To explore the ways in which groups appropriate collaborative technologies within GVT's • To explore ranking and group decision processes using collaborative technologies • To explore the moderator's role, and the facilitation process using collaborative technologies • To explore the roles and actions of technology-use mediators when using collaborative technologies in GVT's • To test methods for improving functionality and usability in the prototype collaborative database • To explore methods for encouraging student communities, engaged in peer learning processes within GVT's • To explore methods of linking research and teaching

P - a problem situation in which we are intervening	• Improving teaching & learning • Developing student capabilities in teamwork, communication and use of IT • Providing an interesting & meaningful learning experience • Using collaborative technologies to teach and practically demonstrate key concepts of groupware and group decision support • Developing global collaborative capabilities in students • Demonstrating the challenges and complexities of working within GVT's • Developing cross cultural understandings

Table [A9]1: elements of the action research intervention – international collaborative trial - sem2/2004

References:

Boud, D. (1985). Problem Based Learning in Perspective. In D. Boud (Ed.), *Problem Based Learnign in Education for the Professions* (pp. 13-18). Sydney: Higher Education Research Society Of Australia.

Clear, T. (1999, Jun 19-24). *International Collaborative Learning - The Facilitation Process.* Paper presented at the ED-MEDIA '99 - World Conference on Educational Multimedia, Hypermedia and Telecommunications, Seattle, Washington.

Clear, T. (2004). Critical Enquiry in Computer Science Education. In S. Fincher & M. Petre (Eds.), *Computer Science Education Research: The Field and The Endeavour* (pp. 101- 125). London: Routledge Falmer, Taylor & Francis Group.

Clear, T., & Daniels, M. (2000, Oct 18-21). *Using Groupware For International Collaborative Learning.* Paper presented at the The 30th American Society for Engineering Education/Institute of Electrical and Electronics Engineers Frontiers in Education Conference 2000, Kansas, Missouri.

DeSanctis, G., & Poole, M. (1994). Capturing the Complexity in Advanced Technology Use: Adaptive Structuration Theory. *Organization Science, 5*(2), 121 - 147.

Leidner, D., & Jarvenpaa, S. (1995). The Use of Information Technology to Enhance Management School Education: A Theoretical View. *MIS Quarterly*(September).

McKay, J., & Marshall, P. (2001). The dual Imperatives of action research. *Information Technology and People, 14*(1), 46-59.

Mingers, J. (2001). Combining IS Research Methods: Towards a Pluralist Methodology. *Information Systems Research, 12*(3), 240 - 259.

Orlikowski, W., Yates, J., Okamura, K., & Fujimoto, M. (1995). Shaping Electronic Communication: The Metastructuring of Technology in the Context of Use. *Organization Science, 6*(4), 423 - 444.

Wheeler, B., Denis, A., & Press, I. (1999). Groupware Comes to the Internet: Charting a New World. *The DATABASE for Advances in Information Systems, 30*(3 & 4), 8 - 21.

Whitworth, B. (1997). *Generating Group Agreement in Cooperative Computer Mediated Groups: Towards an Integrative Model of Group Interaction.* Unpublished PHD, Waikato, Hamilton.

Appendix 10 – [Paper] Ed-Media 1999 Invited Presentation

Clear, T. (1999, Jun 19-24). *International Collaborative Learning - The Facilitation Process.* Paper presented at the ED-MEDIA '99 - World Conference on Educational Multimedia, Hypermedia and Telecommunications, Seattle, Washington. http://www.aace.org/conf/edmedia/default.htm

Copy of paper available at AACE Digital Library http://www.editlib.org/

International Collaborative Learning – The Facilitation Process

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Abstract: International collaborative learning is becoming more viable through a variety of Internet enabled software products. Group Support Systems appear to offer promise. But how to facilitate the teaching and learning process in electronic environments is not well understood. If education is to involve an interactive process of collaborative inquiry and dialogue between remote groups of learners, then how to design meaningful learning experiences presents challenges in logistics, technology support, software design, and pedagogy. To better model the facilitation process in such environments, a theoretical framework based upon an extension of Adaptive Structuration Theory is suggested. This framework is then related to experiences with custom application software development using Lotus Notes Domino™, internal trials and a limited scale collaborative learning exercise between students at Auckland Institute of Technology and Uppsala University. The paper concludes with some recommendations for redesign of the application, suggests revisions to the collaborative process based upon the framework above and discusses further extensions to the trials

Introduction

Numerous teaching and learning initiatives, frequently cited in conferences such as this, now include an Internet dimension. Different products such as the common "chat", "email", and "newsgroups", are being used to support collaborative learning (Siviter, Petre & Klein, 1997). In the business environment, organisations seeking to link disparate global teams are increasingly using groupware products such as Lotus Notes™ (Lloyd & Whitehead 1996), and this form of product appears to have much to offer to support collaborative learning processes (Galpin & Birchall 1996). In this paper when talking of *collaborative learning*, the term is being used in the sense suggested by Siviter, Petre & Klein, 1997. They place it in the context of "groupwork", broken down into three interrelated components of "communication, collaboration and coordination". These activities in turn may be supported by *groupware* – a term "adopted to describe systems that support groupwork" (Siviter, Petre & Klein, 1997). "Groupware technologies provide electronic networks that support communication, collaboration and coordination through facilities such as information exchange, shared repositories, discussion forums and messaging. Such technologies are typically designed with an open architecture that is adaptable by end users allowing them to customize existing features and create new applications". (Orlikowski & Hofman, 1997) The Lotus Notes Domino™ application discussed in this paper can be categorised as an example of an open ended customizable groupware product, and of different time, different place groupware.

Group Support Systems (GSS) is an alternative term for groupware. Previously termed Group Decision Support Systems (GDSS), which covered particularly that class of systems known as electronic meeting systems, the GDSS research generated the ***Adaptive Structuration Theory*** model (DeSanctis & Poole, 1994) discussed in this paper. Group Support Systems has been suggested as a generic term for the field (Nunamaker et al., 1989), and defined by Whitworth (1997) as:

"GSS: any system which supports a group interaction by becoming an integral part of that interaction"

In this paper the terms GSS and groupware will be used somewhat interchangeably.

Facilitation and Group Support Systems

The Group Support Systems (GSS) field has turned its focus from more technocentric aspects, to broader study of how effective the technology is in use. Dennis and Gallupe (1993) have identified five stages of GSS research, which evidence this trend. Stage four covered field studies of the organisational impact of GSS, and stage five an in depth focus on specific aspects - one of which is *the role of the facilitator*. A further stage seems to be evolving, which focuses on organizational issues associated with the ***mutual influence*** *of technology and social processes*. This stage represents an extension from stage four's focus on the more deterministic organizational impact of GDSS. A research approach based upon the study of these *interaction effects* seems particularly suited to investigating the role of the facilitator in conjunction with GSS.

It is apparent for instance, that the complexities of GSS use in the Electronic Meeting Support context, cannot sensibly be understood without inquiry into the interaction effects between dimensions of the group and the group process, the skills of the facilitator and the technology. Likewise in asynchronous groupware contexts an analysis of interaction effects may prove a productive approach to understanding the complexities of groupwork in these distributed electronic environments. It has been suggested that "organizations need the experience of using groupware technologies in particular ways and in particular contexts to better understand how they may be most useful in practice". (Orlikowski & Hofman, 1997)

This paper discusses a general framework for analysing technology facilitation roles. It is shown how this model might be applied to the facilitator role and provide a basis for an "interactionist" model for GSS's, which may be extended to improve our understanding of the processes involved in electronic collaborative learning.

Structuring Processes and Information Technology

Orlikowski and several colleagues have been following an interactionist line of research into Information Technology for some time. Their model of technology is structurationist in approach, based upon the work of Giddens (1984) and the concept of technology as an "occasion for structuring"(Barley, 1986). Initial work identified the reflexive nature of Information Technology (IT) in which IT both *shapes* and *is shaped by* the actions of users and the organisational context (Orlikowski, 1992). Subsequently the concepts of *metastructuring* and *technology –use mediation* (Orlikowski et al., 1995) are introduced as further sources of structure. These two key terms of the Orlikowski model are defined as:

1) ***Metastructuring*** While "The research on technology structuring...tends to focus primarily on the activities of users who shape their technology as they use it in particular contexts", [there are] "another set of activities that, although carried out by users, are not activities of use. Rather they involve the shaping of other users activities of use, a process we designate as ***Metastructuring***…The notion of metastructuring allows us to see that interventions in users' use of technology occur frequently over time, in a variety of ways, and are often very influential".(Orlikowski et al., 1995)
2) ***Technology-use mediation*** Orlikowski et al. refer to "a particular type of metastructuring***, technology-use mediation***, and find that it structures users' use of technology by influencing their interpretations and interactions, by changing the institutional context of use and by modifying the technology itself. Because *technology-use mediation* is a sanctioned, explicit, deliberate and ongoing set of activities, we argue that it is a particularly powerful mechanism in the context of dynamic organisations, enabling rapid and customised adaptations of the technology and its use to changes in circumstances, organizational form and work practices".(Orlikowski et al., 1995)

In their study of the use of a computer conferencing system in a Japanese R&D project group (Orlikowski et al., 1995), identified four different types of mediating activities that the network administration group members performed. These were: 1) *establishment*: established role, determined and built consensus around use of the communication technology, established guidelines etc. for its use; 2) *reinforcement*: training, monitoring, and follow-up with members and the group to reinforce the established guidelines; 3) *adjustment*: on the basis of feedback obtained from members, adjusted the definitions and usage rules for specific newsgroups and occasionally added new newsgroups on request; 4) *episodic change*: twice during the project, NAGA initiated major changes to the news system as a whole.

Structuring and Facilitation Processes

"***Facilitation is a dynamic process that involves managing relationships between people, tasks and technology, as well as structuring tasks and contributing to the effective accomplishment of the meeting's outcome***"(Bostrom et al. 1993). It is argued here that both *metastructuring* and *technology-use mediation* are closely allied to the concept of facilitation in GSS environments, whether in synchronous or asynchronous modes.

The Structure of a "Meeting"

Bostrom et al. (1993) define a meeting as "a goal- or outcome-directed interaction between two or more people (teams, groups) that can take place in any of four environments (same time/same place, same time/different place, different time/same place, different time / different place)...Most GSS facilitation research has focused on face-to-face environments (same time/same place)". In this paper by contrast, the collaborative learning trials have been designed to operate as an *extended meeting*, in the different time, different place environment.

Bostrom et al. (1993) further note that "meetings rarely die, they just keep rolling along in a cycle of premeeting, meeting and postmeeting activities...The actual meeting is but one phase of a three-phase cycle of activities that constitute a meeting". This fits with the shift from the earlier decisionist view of GDSS towards more of a concept of Group Support Systems, where the group decision-making processes are more ones of managing "issue streams"(Langley, Mintzberg et al., 1995), a model better suited to asynchronous than synchronous GSS. Elaborating upon Bostrom's structure, Ackermann (1996) defines the concept of a "meeting" as broken into several stages:

- the pre-meeting stage;
- the meeting itself with three substages
    - introductory,
    - exploration and development,
    - closure
- the post-meeting stage.

Electronic Collaborative learning trial

A collaborative electronic learning trial is now briefly described to enable a concrete exercise to be related to the concepts being developed in this paper. Some pilot trials had been conducted intra-institution at Auckland Institute of Technology with an experimental *generic collaborative database* developed using Lotus Notes Domino™ (Clear, 1998). Subsequently a cross institution collaborative trial had been arranged. This trial involved a Computer Science class at Uppsala University, collaborating with a class of Business students at Auckland Institute of Technology. The Uppsala group consisted of approximately 80 students and the New Zealand group approximately 20. Both groups were to collaborate on a common task involving a role play. The Auckland group were to be business analysts consulting to a local client, while the Uppsala group were a group of software game developers, with whom the Auckland consultants had to liaise. The purpose of the exercise was to jointly develop a feasibility study for a computer game to support the client's need for a software product. The software product was to help young pharmacy assistants become more informed about the client's nailcare product range. By better diagnosis of customers' problems, greater sales of products and reduced instances of misdiagnosis and nail damage were expected to result. The project scenario thus represented an opportunity for problem based learning, (Boud, 1985) based upon a live business case.
The trial took place over a 3-week period between September 22nd and October 22nd 1998. By the end of the exercise many of the students had made some progress in mastering the system, which had significant usability problems. The variety of different approaches and features used indicated a degree of ingenuity. Each combined group had come up with at least one design concept for a game, showing they had thought about the problem, variously using the database or e-mail alone to express it with.

In the definition of Bostrom et al (1993) above, this trial could be deemed a *meeting*.

Facilitation frameworks

Bostrom et al. (1993) propose a framework for understanding and investigating facilitation in GSS environments. " A given source of facilitation (external facilitator, leader, member, GSS) provides ***structures*** (e.g. agenda, procedures, GSS tools) and/or support (e.g. the facilitator administers a procedure, or deals with a disruptive participant) to a group in order to positively influence how the group accomplishes its outcomes. Structures provide an overall frame or context to activate individuals or groups to behave in a particular way. On the other hand support activities are used primarily to maintain and promote these structures, encourage effective task and relational behaviors, and deal with disruptive influences in the meeting. A facilitator, by his or her actions, attempts to influence three general targets: meeting ***process***, ***relationships***, and ***task*** outcomes. This facilitation framework may support several different levels of analysis - the individual, subgroup or entire group.

Adaptive Structuration Theory (AST) has been suggested, as a theoretical perspective which "provides a general framework for investigations" of the facilitation process. "From an AST perspective, the role of facilitation is to select and present beneficial structures to groups in a manner that encourages their faithful appropriation. A key construct within AST is appropriation. Appropriation is the process by which participants invoke or enact available structures (e.g. GSS, agenda, etc.) and thereby give meaning to them...AST posits that the success of an appropriation is determined by three dimensions, the *faithfulness* (in respect to the structure's design principles) of the appropriation, the group's *attitudes* towards the structures, and the group's *level of consensus* (i.e. agreement on how structures should be used). As we discussed earlier, a facilitator affects all three of these modes through support activities: faithfulness through promotion and maintenance of structure; attitudes through activities that develop positive affect; and consensus through monitoring the group's reactions and making appropriate adjustments." (Bostrom et al., 1993)

The AST model (DeSanctis & Poole, 1994) developed largely from a view of technology "as an occasion for structuring"(Barley, 1986), which reflects the interactions between the technology, the institutional features of the organization and the actions of individuals. The extensions to this brought through the concepts of *metastructuring* and the notion of *technology-use mediation* offer the opportunity to augment the AST model in a manner which should more directly and discretely support investigation of the facilitation process.

Before developing the AST model to accommodate these dimensions, some threads from this paper will be tied together. The facilitator role is clearly difficult to model in any simple manner, and the different frameworks contrasted so far, help to further confuse the picture. Which dimensions relate to one another, and how should they be depicted? The classic GSS design constructs of "*process support*", "*process structure*", "*task support*, and "*task structure"* (Nunamaker et al., 1993), who define them as follows, provide a useful starting point:

- ***"Process Support*** - refers to the communication infrastructure (media, channels, and devices, electronic or otherwise) that facilitates communication among members…such as an electronic communication channel or blackboard.
- ***Process Structure*** - refers to process techniques or rules that direct the pattern, timing or content of this communication…such as an agenda or process methodology such as nominal Group Technique.
- ***Task Support*** - refers to the information and computation infrastructure for task-related activities…such as external databases and pop-up calculators.
- ***Task Structure*** - refers to techniques, rules, or models for analyzing task related information to gain new insight…such as those within computer models or Decision Support Systems (DSS)." (Nunamaker et al., 1993)

Domains and Mechanisms for GSS Facilitation

The table below attempts to link some aspects of the structuring and facilitation processes earlier described, to assess the role of the facilitator in the context of the Uppsala – Auckland collaborative trial (Clear, 1999).

Domain	Design Contingency	Facilitation Means	Facilitation Avenue
Technology	Process Support	GSS	parallel communication group memory group and individual contributions identifiable (as opposed to the usual anonymity in GSS)
		Scanner, Photoshop™, Word™ Excel™, text editors & GSS	media effects (photos, diagrams files etc. as well as text)
		email	Individual or mail group messages, combined with external/ internal facilitation and GSS use
		External/ internal electronic facilitation	Registration database, database forms and views, fax (as a last resort)
Institutional and Technology	Process Structure	External/ internal facilitator, telephone, fax, email and GSS (in part)	Global process structuring e.g. establish collaboration, determine client, task & groups and advise, agree collaboration window setting, remote trial coordinators, project/group leaders
		GSS	Internal process structuring e.g. project, task, document, section, discussion threads, file attachments, on-line help, questionnaires, communication & use of naming standards
Institutional and Technology	Task Structure	External/ internal facilitator and GSS in Combination	use of GSS features such as project, document, and discussion thread hierarchies, views, hyperlinks and file attach/detach features plus remote trial coordinators, & project/group

				leaders
Technology and institutional	Task Support	GSS		Access to repository of std templates, group data, links with other applications e.g. Word or Excel. Specialised views and Database hierarchies. Database or email advice to groups and individuals
			External facilitator & email	

Table 1 Domains and Mechanisms for GSS facilitation

While the table shows some meaningful information, it does not provide a clear framework for understanding the facilitator role. For instance, the domain of *individual's actions*, while implicit in each of the rows, is omitted, as is the area of *relationships* and specific *support activities*.

Temporal Analysis of Mediating Activities and Relationships with GSS Facilitation

In this next analysis a time dimension is included, and the four mediation activities of Orlikowski et al. (1995) are used to structure the comparison. Illustrative examples are again drawn from the collaborative trial. (Clear, 1999)

Mediating Activity	Meeting Phase	Design Contingency	Facilitator Actions	Example
Establishment	Pre-Meeting	Process Support	Set up physical parameters and features of the technology	Confirm resources (system capacity, technical support etc.) Organise creation of collaboration database and registration database for participants
	Pre-Meeting & Meeting - introductory	Process Structure (global)	Modify institutional properties of the organization to facilitate technology assimilation	Establish collaboration parameters (scope, purpose, content, participants & timing with partnering institution's facilitator) Confirm suitability of task Determine assessment regime Communicate intentions and obtain participants' consent Ensure a match is made between the problem task, and the participants & facilitator's skill levels Determine and communicate group numbers and membership
	Pre-Meeting & Meeting - introductory		Articulate the cognitive and behavioral routines through which the technology may be appropriated by users	Provide a clearly defined task or set of objectives and corresponding agenda Create and communicate an overview of the issue/problem (via facilitator at each site and posting instructions in database Advise process to register users Clarify roles and expectations Advise of help or other tutoring features available, such as guides, sample templates, naming standards etc.
Reinforcement	Meeting - exploration and development Meeting - closure	Process Support	maintain the operational fidelity of the technology	Check registration process, monitor entries, resolve access problems (forgotten passwords etc.). Check for activity level of participants, and resolve bugs, problems
		Process Structure	help users adopt and use appropriate cognitive and behavioral routines to use the technology	The GSS itself as facilitator (shaping of other user's activities of use) - enabling participants to contribute freely Providing the participants with some form of control Facilitator promotes use of the GSS system Facilitator communicates and educates re. use of GSS
Adjustment	Meeting - exploration and development Meeting - closure Post meeting	Process Support	Adjust technical features of the technology to promote use	If facilitator is a developer, may fine tune views, forms etc. to enhance usability Facilitator may advise technical support staff of problems needing attention (e.g. "out of file space" errors etc.)
	Meeting - exploration and development Meeting - closure Post meeting	Process Structure (internal) Task Support Task Structure	Alter usage rules and procedures to facilitate the use of the technology	Facilitator may decide to deviate from plan of action and use different facilities of the GSS to support the meeting activity (e.g. attached files vs. document section entries) May advise new naming or other standards to enhance use May create new features e.g. on-line questionnaire for evaluations
Episodic Change	Post meeting	Process Support	Redesign the technical functions and features of the technology	Facilitator as researcher may decide to recommend changes to clumsy or ineffective aspects of technology (e.g. upgrade views, redesign hierarchies that are too deep, improve navigation etc. Facilitator may recommend extensions or enhancements to GSS e.g. automatic links between registration and collaboration Databases to share email addresses within and between groups, or use of agents to link mail features more tightly with the GSS
	Post meeting	Process Structure	Modify institutional properties of the organization to facilitate change in technology use	Determine a general ethical approval process for collaborations Set policy regarding summative vs. formative assessment in trials Streamline the process of establishing further collaborations, or extending the model to other courses
	Post meeting	Process Structure	Redefine cognitive and behavioral routines to facilitate change in users appropriation of the technology	Facilitator may decide to use different features of the technology for next collaboration (e.g. a ranking feature may be used to judge the merits of the design proposals submitted)

Table 2 Temporal Analysis of Mediating Activities and Relationships with GSS Facilitation

From table 2 it can be seen that ***technology-use mediation*** does add to our understanding of the facilitation process, and can be incorporated into existing perspectives on the field of GSS and group facilitation.

The Extended AST Model - Including GSS Facilitation

Returning to the AST model, the above frameworks have suggested the value of *technology-use mediation*, but are relatively static as a base for further analysis. Given the inherently dynamic nature of the facilitation process, a model capable of reflecting that is required. The base AST constructs have been built upon to incorporate the *technology-use mediation* dimension. This now gives us an **Extended AST Model,** which includes *technology-use mediation* as a further source and form of structure within the model. At this stage the concept is generic, and could include other mediation roles such as systems administrators or designers, but the term *technology-use mediator* should be read to mean *facilitator* for the purposes of this paper.

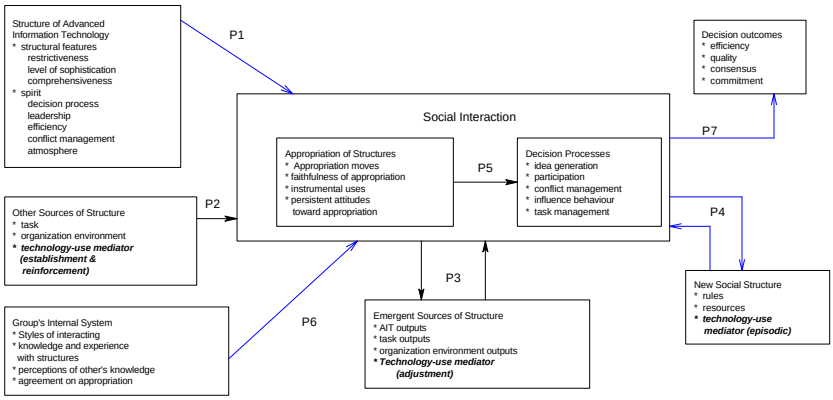

Figure 1 Summary of Major Constructs and Propositions of Extended AST Model [based upon figure 1 ex (DeSanctis & Poole, 1994)]

The modified constructs are highlighted in the redrawn model (bold italics). Basically the three constructs dealing with sources and forms of structure have been augmented;

- **Other Sources of Structure**
  - has had the *technology-use mediator* (facilitator) added, with the assumption that much of this intervention would occur during either the *establishment* or *reinforcement* modes of activity as shown in table 2 above
- **Emergent Sources of Structure**
  - has had the *technology-use mediator* (facilitator) added, with the assumption that much of this intervention would occur during the *adjustment* mode of activity from table 2
- **New Social Structure**
  - has had the *technology-use mediator* (facilitator) added, with the assumption that much of this intervention would occur during the *episodic* mode of activity from table 2

Conclusions

The complexities of developing new forms of collaborative electronic pedagogy defy simple analysis. The above model is an extension of a model developed to support research in the GSS field. It may be criticised for assuming that meetings result in decision outcomes. Nonetheless it allows for "meetings" to be broadly defined, and some aspects of the "outcomes" construct do apply to educational activities of this nature. Its strength lies in its ability to encompass the several dimensions at play in such learning environments.

For instance in the Auckland-Uppsala trial several issues required attention. The collaborative *task* needed reconsideration, its scope was too ambitious in the time available and the degree of group interactivity demanded was too low. The process of *establishing* and assigning groups needs greater structure, probably through extra workflow features of the GSS. The organising elements and views of the database need simplification, and structures for reinforcing naming standards need to be more inbuilt than open to group selection. If anything the degree of genericity needs to be reduced and the application designed to more specifically suit the educational group collaborative context. The question of *appropriation* is an interesting one, given that half the groups were not faithful to the *spirit* of the groupware application, by choosing to use the more individualistic technology option of email. The extended AST model enables such issues to be discretely analysed in depth, but within a framework which does not omit the complex interaction effects.

Initial uses of groupware for collaborative learning tend to occur at the intra-institution level (Siviter, Petre, Klein, 1997; Schrum 1997), but as inter-institutional collaborations grow, it becomes important that we find ways to increase their chances of success, and develop means to research the effectiveness of such learning practices. The author intends to continue a programme of international collaborative learning trials. This extended AST model may be one means of better designing such trials, while considering all the relevant dimensions. It may also prove a useful means to analyse the complex interactions of actors, institutional factors and technology in groupware supported collaborative learning contexts.

Acknowledgements

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References:

Ackermann F. (1996), Participants Perceptions on the Role of Facilitators using Group Decision Support Systems, *Group Decision and Negotiation* 5; pp. 93 - 112

Barley S., (1986), "Technology as an Occasion for Structuring: Evidence from Observation of CT Scanners and the Social Order of Radiology Departments", *Administrative Science Quarterly*, 31, pp. 71 - 108

Bostrom R., Anson R., Clawson K., (1993) Group Facilitation and Group Support Systems, In Jessup L. & Valacich J. (Eds) *Group Support Systems: New Perspectives*, New York, MacMillan

Boud D., (1985) Problem Based Learning In Perspective. In D. Boud (Ed). *Problem Based Learning In Education For The Professions* (Pp 13 –18) Higher Education Research Society Of Australia.

Clear A., (1998) A *Generic Collaborative Database* - Part of a strategy to internationalise the curriculum and develop teamwork and communication capabilities, *Proceedings Of The ITICSE'98 Conference*, p. 274, ACM Press

Clear A., (1999) A Collaborative Learning Trial between New Zealand and Sweden – Using Lotus Notes Domino™ in Teaching the Concepts of Human Computer Interaction, *in Proceedings of the ITiCSE'99 Conference Cracow Poland*, ACM, in press

Dennis A., Gallupe R.B., (1993), "A History of GSS Empirical Research: Lessons Learned and Future Directions." in Jessup L, Valacich J,. (1993) *Group Support Systems: New perspectives*, New York MacMillan

DeSanctis G., (1993), "Shifting Foundations In Group Support System Research." in Jessup L, Valacich J,. *Group Support Systems: New perspectives*, New York MacMillan

DeSanctis G., MS. Poole (1994), "Capturing The Complexity In Advanced Technology Use: Adaptive Structuration Theory", *Organization Science* 5;2 pp.121 - 147

Galpin F., & Birchall D., (1996), Henley College Of Management: Developing A Global Business School, in Lloyd P., Whitehead R., (Eds) *Transforming Organisations Through Groupware: Lotus Notes In Action*, pp. 101 – 108 Springer Verlag, London

Giddens A., (1984), *The Constitution of Society*, Polity Press Cambridge

Langley A., Mintzberg H., Pitcher P., Posada E. & J Saint-Macary, (1995) Opening Up Decision Making : The View From The Black Stool, *Organization Science* 6;3 May-Jun 1995 pp. 260 -279

Lloyd P., Whitehead R., (1996) (Eds) *Transforming Organisations Through Groupware: Lotus Notes In Action*, Springer Verlag, London

Nunamaker J., Dennis A., Konsynski B. (1989), Interaction Of Task and Technology to Support Large Groups, *Decision Support Systems*, 5, 139-152, cited in Whitworth B., (1997) below

Nunamaker J., Dennis A., Valacich J., Vogel D., George J., (1993), "Group Support Systems Research: Experience from the Lab and Field" in Jessup L, Valacich J,. *Group Support Systems: New perspectives Chapter 7*, New York MacMillan

Orlikowski W., (1992), The Duality Of Technology: Rethinking The Concept Of Technology In Organizations, *Organization Science*, 3;3 pp. 398 - 427

Orlikowski W., Hofman J., (1997) An Improvisational Model For Change Management: The Case Of Groupware Technologies, *Sloan Management Review*, Winter, pp. 11 - 21

Orlikowski W., Yates J., Okamura K., Fujimoto M., (1995) Shaping Electronic Communication: The Metastructuring of Technology in the Context of Use, *Organization Science*, 6;4 pp. 423 - 444

Schrum L., (1997), Creating Collaborative Learning Environments: The Challenge For Distant Learners, *Proceedings of ED-MEDIA 97 & ED-TELECOM 97*, pp. 51 –57, AACE, Virginia

Siviter D., Petre M., Klein B., (1997), Harnessing technology for effective inter- and intra-institutional collaboration, Report Of The ITICSE'97 Working Group On Supporting Inter- And Intra-Institutional Collaboration, *ITICSE'97 Working Group Reports and Supplemental Proceedings*, pp. 70 –93 ACM Press

Whitworth B., (1997), Generating Group Agreement In Cooperative Computer Mediated Groups: Towards An Integrative Model Of Group Interaction, *PHD Thesis, University of Waikato*

Appendix 11 – Instructions for the International Collaborative Trial

Instructions
for the International Collaborative Trial
September 2004

Introduction

The aim of this collaborative trial is to introduce the participating students to some of the principles and issues related to working in an International virtual team on an assigned task. The collaborative group work will be supported by *AUTonline* which is the name of Blackboard™ the Learning Management System adopted by AUT, Auckland. The web site is available at http://autonline.aut.ac.nz/.

The International collaboration exercise involves students from universities from three different countries: Auckland University of Technology (New Zealand), Uppsala University (Sweden) and St Louis University (USA). Local Teams (LT) make up nine Global Virtual Teams (GVT) - GVT1 to GVT9. Each GVT consists of two or three LTs from different universities (for example GVT1 consists of LT_{NZ1}, LT_{SE1} and LT_{US1}). The exact makeup of each GVT is shown in **Figure 1**. The names of students in each LT can be seen in **Figure 2**.

The collaboration consists of two phases: **Icebreaking** and **Group decision-making**.
The Icebreaking phase involves GVTs members getting to know each other and establishing their group dynamics.

The second phase of the collaboration involves group decision making related to a common task. GVTs are expected to identify and evaluate a few Web sites related to chosen collaborative technologies by participating in group discussions, and to reach group consensus on the final ranking of the sites.

The second phase is supported by a prototype Collaborative Database developed in Lotus Notes at the School of Computing and Information Sciences, AUT. The database is integrated in AUTonline.

Phase 1. Icebreaker

Time frame: between the 6th and the 19th of September.

Task: Participants in each GVT become acquainted with one another and subsequently select a leader for their virtual team, or decide if their team will be self-managed. The means for communication are to be agreed on by the students themselves. Any combination of the following communication channels supported by AUTonline can be considered: Group Forum, Lightweight Chat, Email and Individual Home pages.

Group forum is available by clicking on Communication>Group Pages and select your own GVT.

Light Chat is available by clicking on Communication>Collaboration>Join Lightweight chat.
Please note that if you want to record your session in Lightweight Chat you will need to manually record it by doing the following:
Click on 'Begins archive recording' button at the start of the session and at the end do not forget to click on 'Stops archive recording'. Both buttons are at the upper right corner on the Chat window.

You can email other GVT members by accessing Communication> Send email

You can create your own Homepage by accessing Tools>Edit your web page.

You can view all Homepages by accessing Communications>Roster>List All

In the second week of the exercise LTs will be also uploading their video clips where they introduce themselves to other participants. Instructions and equipment for this activity will be provided by the tutors.

Please note that students from New Zealand have a two week break between the 20th of September and the 3rd of October. Members of GVTs are encouraged to carry on with the icebreaking process using any of the above communication channels.

Phase 2. Group decision making

Time frame: Between Monday, the 4th of October and Monday, the 1st of November
Aim: GVTs are expected to upload and evaluate a few Web sites related to chosen collaborative technologies by participating in group discussions, and to reach group consensus on the final ranking of the sites.

Orientation

The second phase of the international collaborative exercise makes use of a collaborative database prototype that is accessible from within AUTonline. You can access it by following the link *External Links>Collaborative database* from the navigation panel on the left. [1]

You will need to take about **15 min to familiarise yourself with the database, its navigation and layout.** As you can see there is a **Main Navigator** with a number of links grouped in 4 main groups:

- Team Management
- Website Evaluation
- Scoring and Ranking
- Student Reviews

[1] You can also access the Collaborative database without logging on to AUTonline. The URL is http://online.aut.ac.nz/tony/2004/s2_2004.nsf/

The database provides you with a few **forms** and **views** that are accessible through the **Main Navigator.**
Please note that some forms appear in **two different modes** – **`edit`** (when you need to enter information there) and **`view`** (when you are using the form to view information already entered there by someone else).

You need to make sure that when filling out forms you **select correctly your GVT and LT** and enter your **first and last name** where prompted to do so.

When finished with a form in `edit` mode **you need to click on `'Save and close'`** at the top of the form.

Required tasks

This phase involves collaboration among the Local Teams (LT) within each of the Global Virtual Teams (GVT). The phase consists of the following steps:

1. **Each GVT** needs to enter their group decision on group leadership (from Phase 1). Either the **Leader** of the group (for Leader-driven GVT) or a **nominated person** (for self-managed GVT) should make this entry.

You will use the following steps:

- `Team Management => Confirm GVT Leadership Decision`
- Select your GVT and LT and enter your name.
- Select the radio button that indicates your GVT leadership decision.
- `'Save and close' the form.`

You can view your and other GVTs leadership decisions by clicking on the link `'View GVT Leadership Decision'`

2. **Each LT** uploads **two web sites** that are related to groupware. For uploading **each Web** site you need to use the following steps:

- `Website Evaluation => Upload Website => fill out the form`
- `'Save and Close'`

You can **view** the uploaded sites by using the following step:

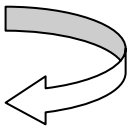
- `Website Evaluation => View Websites/Create Evaluation`

3. **Each student** enters their own evaluation of the **Icebreaking phase** using the following steps:

- `Student Reviews =>Icebreaker Review => fill out the form`
- `'Save and Close'`

Please note that the Review forms are submitted **anonymously**, and once submitted they **cannot be viewed**.

Complete the above by Sunday, the 10th of October and move on to the next step



4. **Each LT** needs to view and evaluate the Web sites that were **uploaded by your GVT.**

Use the following steps:

- `Website Evaluation => View Websites/Create Evaluation`
- Identify the Web sites **uploaded by your GVT**.
- Click on the name of the **Author** (contributor of the site) and a form will open for you in `Edit` mode so you can see information about the site that was entered by the contributor.
- Click on the `'Create Website Evaluation'` at the top of the form and enter your evaluation for the site.
- Make sure **you enter values between 0 and 10** (the form doesn't provide field validation).
- `'Save and Close'`

Please note that you need to evaluate **each site** in a **separate form**.

Complete the above by end of Sunday, 17th of October and move on to the next step.

5. Members of **each GVT** view their evaluations and the total scores for each site (scores are worked out automatically by the database)

Use the following step:

- `Scoring&Ranking => View Website Evaluations by GVT`

6. Members of each GVT need to go through a **group decision-making process and reach a consensus for ranking the web sites** that they have uploaded and evaluated. The process will be carried out online in the Group pages for each GVT. Any combination of the following communication channels supported by AUTonline can be utilised: Group Forum, Lightweight Chat and Email. LTs can also make use of `Ranking forms` in `'Draft'` status to support their discussion. Use the following steps:

- `Scoring and Ranking => Enter Website Rankings`
- `Select 'Draft'` ranking status on the form

7. As a result of your discussions within the GVT the decision making process should reach a consensus. At this point someone (the **leader** or a **nominated member**) needs to submit a `confirmed Ranking form` with the final ranking (use status `'Confirmed'` in the form). One `Ranking form` is needed for each GVT.

Use the following steps:

- `Scoring and Ranking => Enter Website Rankings`
- `Select "Confirmed" Ranking Status on the form`

Students can view the forms submitted by all GVTs by using the following step:

- Scoring and Ranking => View Website Rankings

Complete the above by Thursday, the 28th of October and move on to the next step.

8. Perform an **individual** `Final Review` of the Collaborative trial as a whole

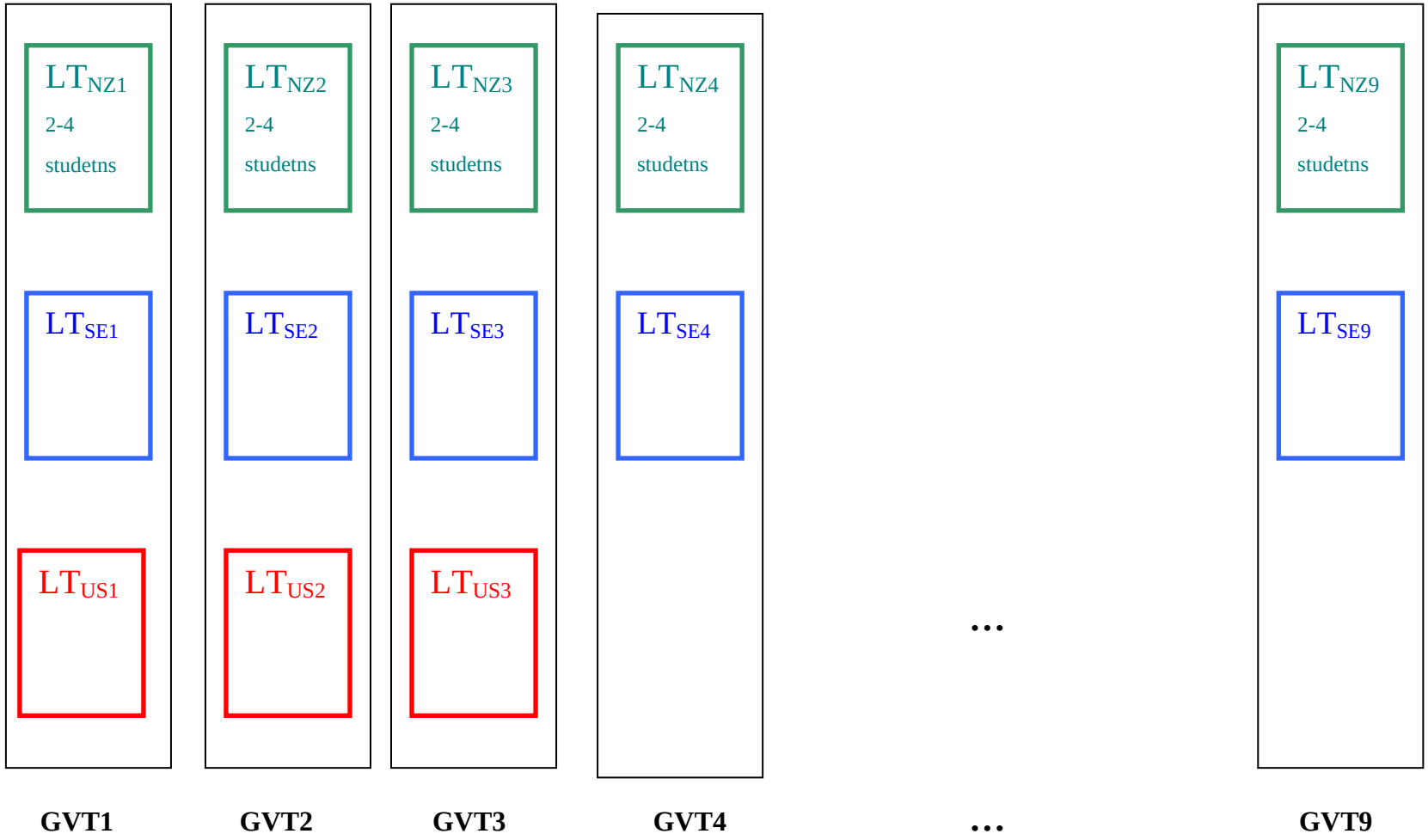
Use the following steps:

- `Student Review =>Final Trial Review => fill out the form`
- `'Save and Close'`

Please note that the Review forms are submitted **anonymously**, and once submitted they **cannot be viewed**.

Complete the above by end of Monday, the 1st of November.

GVT – Global Virtual Teams **LT – Local Teams**



Nine Global Virtual Teams. The first three (GVT1 to GVT3) have 3 Local Teams (LTs) each. The remaining 6 GVT (GVT4 to GVT9) have two Local Teams each – one from NZ and one from Sweden.

Figure 1

GTV and LT members

	GTV1	GTV2	GTV3	GTV4	GTV5	GTV6	GTV7	GTV8	GTV9
NZ	**LT_{NZ1}** Ravneet Ram Tim Clark	**LT_{NZ2}** Xin Zhou Nigel Wilmshurst Shampika Bandarage	**LT_{NZ3}** Chris Myhre Klaudia Tafra Kelly Ackerman	**LT_{NZ4}** Sunghee Lee Deepa Meghji David Tobias	**LT_{NZ5}** Samuel Osorio Michael Lee Eva Ramos Lei Zou	**LT_{NZ6}** Nicholas Langdon Kieran Mahony France Martinet Sean Wang	**LT_{NZ7}** Tammie Fung Danny Mi Sharon Rodrigues Anju Shrestha	**LT_{NZ8}** Yue Liu Choon Sarn Ng Tanida Poffley Susan Tan Toni Welsh	**LT_{NZ9}** Nini Guo Marco Ma Sheree Ou Josephine Tan
Se	**LT_{SE1}** John Ahlstrom Bjorn Magnusson Murat Sabotic	**LT_{SE2}** Niklas Edlund Frederic Stein Hjalmar Wennerstrom	**LT_{SE3}** Jonas Linden Robin Malmros Samuel Oest	**LT_{SE4}** Hakan Johansson Mikael Nordstrom	**LT_{SE5}** Tobias Knutsson Andreas Naslund Kalle Nilsson	**LT_{SE6}** Christopher Overall Jakob Schutte Martin Wrangenby	**LT_{SE7}** Ida Lindgren Christian Petersson	**LT_{SE8}** Tobias Jonasson Mattias Lundin Niklas Moritz	**LT_{SE9}** Carl Borg Fredrik Hildorsson Cristobal Wetzig
US	**LT_{US1}** Adam Dewoskin Laura Hoseholder Kristine Lanspa	**LT_{US2}** Juan Jose Becerra Vilaplana Jose Espuelas Azofra Rodrigo Gomez Medina	**LT_{US3}** Shelly Hall James Redd Lance Reed						

Figure 2

Appendix 12 – AUT University Semester 2 2004 Timetable – Postgraduate Studies in Information Technology

Postgraduate Studies in Information Technology Timetable

Note: This timetable is provisional and may change according to student enrolments

Semester 2, 2004									
	MON AM	TUE AM	WED AM	THU AM	FRI AM	SAT AM		SAT PM	
WEEK	8-10	8-10	8-10	8-10	8-10	9:30 – 12:30		1:00 – 4:00	
1	19-Jul	20-Jul	21-Jul	22-Jul	23-Jul	24-Jul			
		Int IT	IT S&P	CI	RM	CI	DM& KE	CI	IS
2	26-Jul	27-Jul	28-Jul	29-Jul	30-Jul	31 July			
		Col	DM&KE	IS	RM	IT S&P		Col	
3	2-Aug	3-Aug	4-Aug	5-Aug	6-Aug	7-Aug			
		Int IT	IT S&P	CI		RM		RM	
4	9-Aug	10-Aug	11-Aug	12-Aug	13-Aug	14-Aug			
		Col	DM&KE	IS	RM	CI		CI	Int IT
5	16-Aug	17-Aug	18-Aug	19-Aug	20-Aug	21-Aug			
		Int IT	IT S&P	CI		DM&KE		IS	
6	23-Aug	24-Aug	25-Aug	26-Aug	27-Aug	28-Aug			
		Col	DM&KE	IS	RM	IT S&P		Col	
7	30-Aug	31-Aug	1-Sep	2-Sep	3-Sep	4-Sep			
		Int IT	IT S&P	CI				Int IT	
8	6-Sep	7-Sep	8-Sep	9-Sep	10-Sep	11-Sep			
		Col	DM&KE	IS	RM	CI		CI	
9	13-Sep	14-Sep	15-Sep	16-Sep	17-Sep	18-Sep			
		Int IT	IT S&P	CI		RM	DM& KE	RM	IS
Mid- Semester Break 20 Sept - 3 Oct									
10	4-Oct	5-Oct	6-Oct	7-Oct	8-Oct	9-Oct			
		Col	DM&KE	IS	RM	CI	IT S&P	CI	Col
11	11-Oct	12-Oct	13-Oct	14-Oct	15-Oct	16-Oct			
		Int IT	IT S&P	CI				Int It	
12	18-Oct	19-Oct	20-Oct	21-Oct	22-Oct	23-Oct			
		Col	DM&KE	IS	RM	***Labour Weekend***			
13	25-Oct	26-Oct	27-Oct	28-Oct	29-Oct	30-Oct			
	Labour Day			CI		RM		RM	
14	1-Nov	2-Nov	3-Nov	4-Nov	5-Nov	6-Nov			
	Assessments				RM	CI 8-5.00pm			
15	8-Nov	9-Nov	10-Nov	11-Nov	12-Nov	13-Nov			
	Assessments				RM 5-9.00pm	RM			
16	15-Nov	16-Nov	17-Nov	18-Nov	19-Nov	20-Nov			
	Assessments								

Rooms	WW205	WW206	WW306

Module Codes

408201 Contemporary Issues (CI)

408206 Collaborative Computing (Col)

408208 IT Stategy & Policy (IT S&P)

408210 Integrating IT & Enterprise (Int IT)

408215 Bioinformatics (BI)

408216 Data Mining & Knowledge Engineering (DM&KE)

408217 IT Security (IS)

478002 Research Methods (RM)

408005 E Business, the Internet & Society (EBIS) Wednesday evenings 5 –7.00pm Room WW104

Appendix 13 – 407106: Intelligent Business Systems Assignment 2, Part 1; Group ware Assessment

407106: Intelligent Business Systems
Assignment 2, Part 1: Groupware Assessment

Due Date: 5pm, Monday, the 1st of November 2004 (Week 14)
Where to hand it in: Your tutor's assignment box on Level 2, WW Building
Value: 20% of course mark
Expected hours of independent work: 11
Scheduled class hours: 5

You may choose either option 1 or 2 from the two options below. For either option, ***evidence of research and correct citation are expected*** for your report.

You need to submit hard copies of your Reflective report and the Originality Report from http://www.tunitin.com. For Option 1 you also need to submit your evidence as appendices to your report.

Your report will not be marked if an Originality report is not attached.

Option 1.

Take part in the International collaborative trial and write up an individual reflective report of 800 words.

Required:

- Consistent and meaningful participation in the trial according to the requirements in the ***Instructions for the trial.***
- Identify **five key issues** that you have experienced during the trial and collect **at least five pieces of evidence** related to these issues.
- Reflective report in which you **reflect** upon the **process of collaboration** and the **five issues** that you identified during the collaborative trial. Reference to relevant readings is required.

The reflective report should be 800 words (12 points, Times New Roman, 1.5 spacing) and the word count should be shown in the cover sheet. References are not included in the word count and must be in APA style.

Option 2.

This is an alternative assessment option for those students who choose not to participate in the International collaborative trial and do not sign the consent form.

It is also available to students who have signed the consent form and have started participating in the trial, but subsequently decide to withdraw. In this case though the student will have to let the other GVT members know about their decision by personally emailing them and also notify the tutor providing the copies of their emails to the GVT members.

Required:

A research report that provides your research findings on groupware used in business context. You will need to explain and justify your findings by referencing to relevant sources. The report should also cover critical assessment of the suitability of **a groupware of your choice** which you base on **your own business scenario**. This means you need to evaluate the key benefits and key drawbacks of your chosen groupware, the collaborative process, or another dimension of the collaborative technology relating to the overall theme of "business intelligence".

Report should be 2500 words (12 points, Times New Roman, 1.5 spacing) and the word count should be shown in the cover sheet. References are not included in the word count and must be in APA style.

Appendix 14 – St Louis Panel on Collaborative Pedagogy with Global Virtual Teams

Saint Louis University

Event Co-sponsors:

Boeing Institute of International Business
http://biib.slu.edu/

Cook School of Business Decision Sciences and MIS Departments
http://business.slu.edu/dsmis/

Reinert Center for Teaching Excellence
http://cte.slu.edu

Feb. 21, 2005
3:00-4:30 p.m.
Cook Hall 240

Directions to SLU and campus map:
www.slu.edu/visitors.html
If you are non-SLU attendee, please park in Visitor Parking

Registration:
Please register online at http://cte.slu.edu/gvt
Refreshments will be served.
Registration is free.

Announcing

Collaborative Pedagogy with Global Virtual Teams

A Panel Discussion

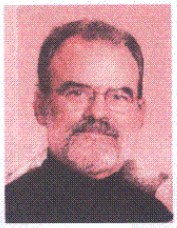
Saint Louis University John Cook School of Business
February 21, 2005, 3:00-4:30, Cook Hall 240

Information Technology (IT) is being applied to increasingly broad domains for delivering or supplementing educational content. The ability to use IT to link new learning partners across continents and build global connections is an exciting concept. It promises new modes of collaborative learning, where students gain authentic experience of globalization through working in global virtual teams. In practice however the logistics of global collaboration can prove quite daunting. This session explores some of the challenges facing educators, and the accompanying challenges for researchers in this multi-faceted domain.

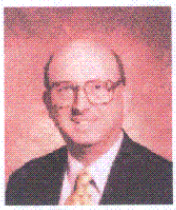
Panel members will include Professor Tony Clear, Auckland Institute of Technology, John Zhao, Saint Louis University, and Michael Burks, Saint Louis University. Fred Niederman, Saint Louis University will serve as moderator. Panelists will discuss using information technology to facilitate global student interaction, the challenges with group interaction, and explore new ideas for collaboration.

Tony Clear is Associate Head of School (Industry & Development) for the School of Computer and Information Sciences at Auckland University of Technology. Tony's early career was spent in industry as a practicing software developer and manager. His research has included a long term action research project into collaborative learning using groupware technologies and global virtual teams, which is the topic of his current doctoral thesis. Tony chairs the *Research and Support* working group for the New Zealand National Advisory Committee on Computing Qualifications, and is a Column Editor for the ACM *SIGCSE Bulletin*. A list of his publications can be viewed at http://www.aut.ac.nz/cis/our_staff/tony_clear.shtml.

Hongxin (John) Zhao, Associate Professor, International Business Dr. John Zhao is an associate professor of international business at Boeing Institute of International Business. He taught previously at National University of Singapore. He published in journals such as Journal of International Business Studies, Journal of Global Information Management, Journal of International Marketing, Management International Review, International Marketing Review, Thunderbird International Business Review, Journal of Consumber Behavior, Asia Pacific Journal of Management, ect. His research interests include foreign direct investment, e-commerce and Asian business.



Michael Burks serves as Administrator for Teaching, Learning, Research and Clinical IT Support. He taught at colleges and universities in communication and fine arts for over 20 years and has woked in industry, developing interactive media for commerce, marketing and training. Dr. Burks initiates and supervises development of projects that employ technologies in various learning environments, from "conventional" distance learning through hybrid courses that combine conventional classroom techniques and digital materials and activities. His particular interest concerns how pedagogy changes to involve technology in learning activities to accomplish specific educational goals. His most current work involves the use of Internet 2, including video conferencing over high speed networks.



Dr. Fred Niederman serves as Shaughnessy Associate Professor of MIS at Saint Louis University. He has edited special issues of Communications of the ACM and the Journal of Global Information Management on the topic of the global IT workforce. He has published in MIS Quarterly, Decision Sciences, Decision Support Systems, the Journal of Strategic Information Systems, and DATA BASE among others. Other MIS areas of research and teaching include systems analysis and design, group decision support systems, and the diffusion of information technology.

Appendix 15 – Semester 2 2005 AUT Uppsala International Collaboration: Summary of Discussion Forums - GVT Leadership and Phase 2 Create a Quiz

Semester 2 2005 AUT Uppsala International Collaboration: Summary of Discussion Forums - GVT Leadership and Phase 2 Create a Quiz

GVT1

GVT Leadership

Jeff chosen as leader – commercial ldrshp exp

Hey
We haven't chosen a team leader yet. We need to choose one. I will nominate one myself. I nominate Jeff, I reckon he has been in the market for a while doing stock management and other leadership skills so I think he is suitable for that. Any other suggestions?
regards
Ali (12/10/2005)

Phase 2: Create a quiz

Discussion contributing qu's – 6 x AUT members

Is there anyone who wants to make the quiz ? i assume that one of us makes it and then it gets posted online, so any volunteers? Jeff (30/10)

Combined word doc with qu's & A's - Mike

Request to download s/w and populate – Jeff

questions.doc (21 Kb)
Here is the quizz questions/answers
Can someone please go to the articulate.com website, download the quizz software, and create the quizz.
This was due yesterday (31/10/2005)
qm201trial.exe (15.153 Mb)
Here is the quiz software (31/10/2005

1 related forum GVT Leadership 1 thread 9 posts 5 participants
1 related forum Phase 2: Create a quiz 7 threads 30 posts 7 participants

GVT2

GVT Leadership

All in favour of Jonas for group leader reply with a yessir.

And all in favour of Haakon as the NZ leader reply with a didelidoo.

yessir.
didelidoo. (16/09/2005)
yessir.
didelidoo.
It sounds good to me. I don't know what to do really, but ok!
It's very good that Odd Haakon understand Swedish, to guarantee no misunderstandings between me and him, since we are the great leaders of this GVT! (19/09/2005)

Ldr chosen

Phase 2: Create a quiz

Well, anyone who feels like getting this started? Time is running out.
And.. I can't find my papers, so I have to rely on you guys!
I've never really figured out what this "quiz-thing" is all about.. anyone who can
give me some kind of help here? I'm supposed to be your almighty leader, but hey!? ;) (20/10)
You can find the paper under Information link.
And I agree in your confusion after hearing from another group how pretentiously they've attacked the quiz.. To me it seemed clear that we were supposed to ask 10 horribly strained questions with some stupid options as answers about this kind of system and then return to the quizzer his/her

score after completion. Judging from their questions they've understood the quiz to be a basis for deep discussions about blabla without distinguishable answers.
I vote for a junior quiz with optional answers. (20/10/2005)

Discussion on topic and reading assignment

Well, I suggest we all post one question each in this thread, and then decide who will complete the quiz making the "program", or "interactive quiz".
But first we have to choose a subject for the quiz.
I suggest, as Rachel did, the subject "Technology Supporting Groupwork".
So, questions anyone? (24/10/2005)

Discussions (multiple student created threads 9 – including 'please read" under create a quiz forum contributing qu's – 6 x SE 2 x AUT members

Odd Haakon, I give you the assignment to hand in the completed quiz.
Ok?
Sweet! (24/10/2005)

Great!
Somebody who can create and upload the quiz when it's finished?
I'm coming up with a question soon.. (out of ideas) (28/10/2005)

I have uploaded the quiz now. It is just in a word document since I didn't know what else to use. I can still edit it, anyone know of a tool that I can use??? (31/10/2005) [Haakon]
Quiz uploaded to site html 3/11 & .rar files 30/10 plus another quiz posting (Elvis?) 28/10

1 related forum GVT Leadership 3 threads 17 posts 7 participants
1 related forum Phase 2: Create a quiz 9 threads 28 posts 7 participants

GVT3

GVT Leadership

This collaboration with students from Sweden is quite different to anything I've done before, I'm quite looking forward to it!
I've just been reading through the assignment sheet to see what we need to do, and it looks as though we need to create homepages for eachother, but the person we create one for can't be the one who creates one for us! And they all have to be created by/for someone in a different "Local Team". So I think I worked out who should create for who.. like this:
Kevin creates Olof
Yi creates Markus Elving
Jenni creates Marcus EkstrRm
Olof creates Jonas
Joel creates Fredrik
Marcus EkstrRm creates Staffan
Jonas creates Kevin
Fredrik creates Jenni
Markus Elving creates Joel
Staffan creates Yi
That sound about right to you guys? Can get quite confusing! Once we all starting communication we can get enough info to make a homepage.
What do you think? Have a good day for those in Sweden.. :)
Jen (13/9)
Subject: I suggest Jenni as group leader.
Motivation: She took the first initiative with the homepage list. (anon 25/09/2005)
i second that. it was a really good initiative.

/ Markus E (27/09)
Subject: And the first nominee is...
Jenni, unless of course she has has disappeared off the face of the earth since we begun working with this project? (22/09/2005)

Haha, why me! Thank you. I haven't disappeared..
I nominate Marcus Ekstrom. (24/09/2005)
:)

Ldr chosen

Phase 2: Create a quiz

Discussion on topic proposal and mutual agreement x4 members

Hi everyone
I can't see in the assignment sheet about whether we need to use special software to create the quiz.. maybe I'm going blind?
Our problem is that we only have 7 questions, some of which are very similar as well. A number of you have done a good job by posting more than one question and some haven't posted at all!
Fredrik could you point me in the direction of this software? Unless you care to create our quiz for us - the questions people have posted are in the attached file. This needs to be done today, and if I recall correctly.. Sunday is over here before Sunday is over in Sweden. (30/10/2005)

virtual_teams_quiz.doc (29.5 Kb)
Sorry, here's the file.. (30/10/2005)
Hi Jenni!

Here's the link that I followed
http://www.tac-soft.com/
good luck! (30/10/2005)
Thanks.
It's a bit late, but I've posted up our quiz now.
It's been fun working with you all! (31/10)

1 related forum GVT Leadership 3 threads 8 posts 7 participants
1 related forum Phase 2: Create a quiz 8 threads 25 posts 7 participants

GVT4

GVT Leadership

Vote for the person you wish to have as our Group Leader!
http://www.poll.cybertools.se/poll.asp?id=15487
After the IceBreaker phase i will paste the name of the Leader :D (23/10)
The vote is over, and we have elected our leader as you all probably know.
Congratulations Per Hamrin, may the force be with you! (20/10)

Ldr chosen

Phase 2: Create a quiz

Discussion about choice of quiz s/w tested & to be assessed x actors proposal & consensus

Proposal for workflow – ea post 3 x qus to thread set up for purpose

4 x contributors (3 x SE 1 xNZ) + 1x ldr SE

1 posted quiz

I have now composed a quizz from the questions i have recieved so far together with some of my own. I'll add the zip file here. just unzip and run the quizmaker.html to check it out.
It feels nice not to have this hanging over our shoulders. Hope you who hasn't sent all your questions feel cheated or anything cause I dindn't wait but I wanted to get this overwith.
GoodJob
GL HF :)
//Per (26/10/2005)
nzswequiz.zip (331.195 Kb)
heres the zip (26/10/2005)
Okey, nice work Per! Sorry that i didnt handed in any questions in time. Hope thats okey with everybody. (26/10) SE
Sorry Per, I got my dates mixed up but thats no excuse for not handing in the questions, but good work on the quiz. (26/10) NZ

2 x apologies for lateness

1 related forum GVT Leadership 1 thread 8 posts 5 participants
1 related forum Phase 2: Create a quiz 5 threads 17 posts 6 participants

GVT 5

GVT Leadership

Hi, all, I think it would be good for someone to volunteer him/herself to do the leader role for our group. (Certainly not myself, I do not have the ability) (Rebecca 15/09)
Hi all,
As no one has stepped up to become the leader and we need to do this by tomorrow, I'll nominte myself to take the role. Can someon just second that. If someone else wants to go for it then that's cool just let us know by end tomorrow. (Hitesh 25/9)
Ldr chosen

Phase 2: Create a quiz

Topic discussion x 2 NZ participants tentative agreement
Continued topic discussion 1 x prior NZ participant not available (wisdom tooth), 3 x nz + 3 x se agreed topic
hi hitesh has been absent lately so if its ok with everyone how about we do the quiz on: technology supporting group work eg email, blackboard, discusion boards, instant messaging etc each person could simply formulate one quiz question with multi choice answers and then we can assemble it, and be done
How does this sound?(25/10)
Discussion about quiz s/w (2 x nz – no concusion)
1 NZ contributor 10 qus, 1 NZ contributor scoring rubric, SE contributors agree

Hi, group, I made some quiz questions that relate to the Technology Supporting Group Work. Please give me feedback. Thanks! (25/10)
well done Rebecca,
this is enough to complete the quiz!
However perhaps to ensure collaboration we should wait for input from other group members as well.
The other thing to think about is the scoring methods for the quiz: (i'm not sure this is necessary) for instance:
0-3 answers correct : hopeless
4-6 answers correct: average
7-9 answers correct: good effort
10-11 answers correct : very well done
12 answers correct: you must have cheated!
what do u all think?
we have a few days before the final quiz is to be submitted so I think we should wait for other group members input. What do u reckon?
cheers
mace (26/10)
OMG Rebbeca!
Looks like you haven't done anythink else but quizes in your life.. hehe
GJ!
/ cheers (28/10/2005)
Hi, group, the deadline of upload quiz is 30/Oct. Haven't got other quiz up to now, so I am wondering whether I should upload the 11 quiz that I posted before. Any idea? Cheers, Rebecca (29/10)
Since time is running short and your questions are good anyway, you go ahead and upload the quiz. Really good work comming up with thoose questions.hi, yeah good on u for uploading the quiz,(30/10)
my link to aut from home is not giving me access to autonline so I couldnt do it yesterday
thanks again
mace (31/10)
So you have had this problem as well?
The only place I can usually access it from is work. Maybe because I have dial up at home???? (31/10)
Quiz uploaded 30/10

4 x agreed 2 NZ, 2 SE- 1 posted quiz
1 related forum GVT Leadership 1 threads 16 posts 9 participants
1 related forum Phase 2: Create a quiz 7 threads 29 posts 10 participants

GVT6

GVT Leadership

As you know, we are supposed to write home pages for (and about) each other. I guess the first problem we are facing is to select who will write about whom.

Our lecturer didn't want us to organise it in pairs, so I suggest that we instead build a "chain". By simply walking the list of group members, taking one in turn from each LT, I get:

Stanislas -> Erik -> Assar -> Rati -> Fredrik -> Björn -> Yue -> Henrik -> Johan -> Soini -> Stanislas

That's all of us, isn't it? So, what that means is that Stanislas would write about me, I would write about Assar, who would write about Rati, and so on.

Does that sound okay? Any other suggestions?(13/9 – Erik)

Ldr chosen by voting process – 6 votes Erik (volunteered self as default)

Yes, I think you did a great job on organising the home page planning. We will be appreciate if you take the place of leadership (25/9)

Phase 2: Create a quiz

Welcome back

I think each LT can take responsibility for each topic, I think it will be easier to manage things than picking a topic individually (17/10)

Discussion about topic agreed work in pairs or LTs on diff topics (3x se & 1 x Nz)

Hey team, where are you? :) So far only me and Rati have posted here in the phase 2 discussion board.

Our quiz questions should be ready by the 26th of October, which is less than a week away. It would probably be a good idea to post them before Monday, here on the discussion board where we all can see them. Then we have a chance to choose among them or make modifications if required.

The current suggestion regarding the topics of our questions is to use the three GDSS-related themes mentioned earlier, and split them up among our local teams. Going through the list, these are the topics that the local teams would work with:
LTNZ6: Internationalisation and globalisation of Group Decision Support Systems (GDSS)
LTSE11: Technology supporting group work
LTSE12: Global virtual teams

Each LT should probably write around 5 or 6 quiz questions on their topic, don't you think?

If you have any comments on this, please post them ASAP. Otherwise, start organizing the members in your own LT.

Cheers,

Erik (20/10)
I'm sorry to hear that you were in an accident. I hope you're okay?

I haven't heard from either Assar, Björn, Henrik or Mattias. I think we can assume that most of them aren't going to help with the quiz, but I think we'll have enough questions anyway.(27/10)
onlinequiz.doc (28.5 Kb)
I have post some quiz that i can think of as attachment. Hope that would be useful. (26/10)
Fredrik will take all the multi-choise questions posted here on Saturday and create a quiz using Articulate Quizmaker (unless anyone else would like to do that?). He'll post the quiz here, so that we can all take a look at it. I'll upload it in VTEAM on Sunday. Sounds good?
/Erik(27/10)

If you find the questions to your satisfaction.
I will assemble them and make the quiz. So please tell us what you think, give me the green light :D (28/10)
Have a nice day! /Fredrik

The questions look good.. you have the green light from me :) (29/10)

the_quiz.rar (5.317 Mb)
Ok, here it is...
added some pics to :D
Tell me what you think and if I should change something before uploading it.
/Cheers! (29/10)

It looks very nice. I tried to upload it to VTEAM, but I can't get it to work. I've tried both Safari and Firefox. I don't get any error message, the file just doesn't get saved. Who else will try?

Erik (31/10)
quiz_gvt6.zip (590.824 Kb)
I tried making a smaller file (the one attached to this post), but that didn't seem to help.(31/10)
Hey Erik,
The file has been uploaded when u posted it. It works fine(1/11)
Well actually, it never worked when I tried to upload it to the VTEAM navigator. But it did work for Fredrik when he tried a few hours later.

It might have been a temporary problem, or maybe the VTEAM thing just didn't like my web browser.

Erik(1/11)
2 x posted quiz (1 GVT)– no topics

1 related forum GVT Leadership 2 threads 11 posts 7 participants
1 related forum Phase 2: Create a quiz 6 threads 32 posts 7 participants

GVT7

GVT Leadership

Hi everybody! The post regarding a potential leader have been in the forum for about one week.
We now need to take the final decision.
I am so far the only one who can imagine to be the leader it seems...
But to make sure no one is forgotten, I'm leaving it till Monday 3:d of october to notify the people in charge.
SO if you want to vote for anyone else or for yourself make a post in this thread before end of monday 3:d of october.
The situation at this point:
Candidate_____Votes
Martin_____4
Talk to you later! (30/9)

Ldr chosen

Phase 2: Create a quiz

We need to construct a quiz consisting of 10 - 12 questions on one of the following subjects:

- Internationalisation and globalisation of GDSS
- Technology supporting group work
- Global virtual teams
- Any other topic related to GDSS

The software to make the quiz is available and working so all we need to do is decide upon a subject and compose the questions.

I suggest we pick the subject of Techology supporting group work.

Now, I suggest that everyone starts researching on this and hopefully by the middle of this week we will have some good questions.

As the group leader I will take responsibility to upload our finished quiz so all you guys need to do is gather some really good questions along with the answers.

The quiz needs to be posted by the end of sunday 30:th of october.
That leaves us with one week from now.

My main concern is that so few of you have posted in the forum over the past week or two. Please remind your friends to sign in and contribute... only the ones who have posted questions will get credit for this teamwork!(23/10)
Found this on wikipedia

http://en.wikipedia.org/wiki/Decision_support_system

could be a good starting point for researching.(27/10)
Questions posted 8 contributors cross sites
Remember that the quiz is based upon multiple choice questions - you will need to post the correct answer along with two false ones.
Martin(27/10)
I've just uploaded the quiz. 10 questions and I compiled it using a flash application. Thanks guys! (30/10)
sorry mates, i havent made any questions, bad of me.... aaahhh! (31/10)
1 posted quiz Networking and cooperation

1 related forum GVT Leadership 2 thread 5 posts 4 participants
1 related forum Phase 2: Create a quiz 10 threads 26 posts 9 participants

GVT8

GVT Leadership

Subject: Scope for the Team Leader
As far as I understand, the leader is only responsible for ensuring that the Quiz is delivered. Except for that, it's pretty much up to us to define the scope, so I think we might take a stab at that before agreeing on whom it should be.
Any suggestions? :-)
Best regards,
Patrik (13/9)

Subject: Re: Scope for the Team Leader
It's difficult to give any exact requirements at this early stage but I'll have a go at it from a more general point of view.
I feel that a leader should more or less be responsible for the project as a whole. The leader should be someone with great knowledge and skills in whatever we are going to do (We'll just have to guess in this case), someone who realizes other peoples capabilities and limitations. Delegating tasks efficiently while still being able to do your own part adequately, at least, is what makes an excellent leader.

That being said, I think the leader in this very case should split up the work and delegate tasks while working as much as he can himself. Judging from the instructions we've received so far, there are clearly different tasks involved in this project, suited for different people. Having people do whatever they happen to like the most would result in total chaos, obviously. So a leader who is responsible of the completion of the project is definitely required and we all should do our best to stick to his plans.

Simply put, he should tell others what to do while working his ass off himself :) (14/9)
Subject: Erik, you should be our leader ;)
I reckon as Erik understands so thoroughly what a true leader is, he should be the one. :)))

What do you think? (20/9)
I'd also like to nominate Maria, since she already does a good job organising the board and other activities.
Does any of you want the position? Either alternative
is fine with me!(20/9)
(Maria volunteered as a default, Erik declined as too busy)
Congratualtions Maria. You should go ahead and confirm the leadership.(26/9)

Phase 2: Create a quiz

Choosing topic

Proposed and agreed due to no counter offer

Hi guys,

As nobody else voted for any other topics, ⁄Technology supporting group work⁄ is chosen as a topic for our quiz.

As for not taking seriously this project, Anton, I know that you can⁄t be responsible for others,

it⁄s their choice, but can you just let me know my opinion on this.

It might not seem to be a really serious project, but in fact, it develops some very important skills for real life. Team work is very important, because you will never ever in real life manage to do anything just by yourself. Not taking the project seriously is one thing, but letting down your group members is a completely different thing.
I am also quite busy, I have two other really huge assignments (for two different papers) due in a week and half and I also work full-time.(21/10)
This project is indeed integrated with a course, but the project itself is quite abstract regarding the "connection " to the course. Hence, a lot of participants i Sweden do not take this seriously and are not very active in this project.
Yes, I will remind our swedish GVT members, but I doubt all of them will participate in a live chat session.(20/10)
Another (late) question:

What problems CANNOT occur when working in a group over the Internet (like this project)?

A. Missunderstandings
B. Time-based problems
C. Loss of important information
D. None of the above

(Correct answer, D. I hope you can figure out why.)(27/10)
Hello guys,
the quiz is due tomorrow, that's why we with Jules decided to give everybody a chance to contribute.
I am going to upload it online tomorrow morning or by midday (our time).(29/10)

Multiple contributors cross sites. Final list of questions posted

1 posted quiz Technology Supporting Group Work
1 related forum GVT Leadership 1 thread 21 posts 5 participants
1 related forum Phase 2: Create a quiz 10 threads 42 posts 7 participants

GVT9

GVT Leadership

Hi everyone.
I just tried to create a homepage. It seems to me that the only homepage autonline let me create is my own. Does anyone know how we are supposed to create each other's?
Right now i've used my own homepage-area here at autonline to make Martin Tägtström's. So if you want to see it, click my name in the group list.
Is this the way they meant for us to do it or have i missed something?(Alexander 20/9)
Today is monday, not many hours left to deside.
Since the only real task the leader has to do, as far as i've understood, is to hand in the final report, i guess i could shoulder that responsibility if noone else want to.
/alex(27/9)

Phase 2: Create a quiz

Discussion on process and topic

Hey Alex,
We're actually on vacation now, already had 1 week and have 1 more to go. But I can check the group pages on here anytime, I'm online a lot. Our classes start again on the 10th October.
In our assignment handouts it says we have to fill out the ice breaker review before we begin the quiz part.
That can be found in this link.
http://online.aut.ac.nz/tony/2005/s2_2005.nsf
Th next section says the quiz wil be 10-12 questions long and to be based on the following topics:
* Internationalisation and globalisation of GDSs
* Technology supporting group work
* Global virtual teams
* Any other topic related to GDSS

I guess we will need to discuss the topics on here and then come up with some ideas on what our quiz will involve. We can also use the chat rooms for collaboration on here, but I'm not sure we're all online at the same time. I guess I could always collaborate with Aaron and everyone else comes up with something in their own local team, and then we all post on here. That's all I know for now.
Yvonne :) (30/09)
Hi Alex, the [icebreaker evaluation] link is the same as the one which you used to confirm your leadership awhile back.
Aaron and I had an idea that we could each discuss a topic or two in our LVT and come up with some ideas or questions, so that different groups do not repeat the same things, etc.
In response to the quiz, I guess we could use questions in it that we think are the most relevant to each topic and will be useful for others.
I will see Aaron in class tomorrow, I think we have already decided on going the topics global virtual teams and the technology supporting group work.
We should probably come up with at least 3 questions within each LVT that we can discuss here as a global team and decide what best to do.
I will post again once we have done more.
Yvonne :) (17/10)
I agree on most of what you said, Yvonne.
One thing though. Since we need to do 10-12 questions in total, and we are 3 LVTs, we need to do 4 questions each, not 3. (or rather, at least one LVT need to do 4 questions). Since the New Zealand LVT ony has two members, i think its fair that you only need to do 3 questions while the other two LVT's make 4 each. That gives us 11 questions in total.
Beside that, i agree. We need to get these questions done as soon as possible as time is running out.
This is how i think we should do this.
Each LVT has until tuesday to finish their questions. (we swedes have an exam on monday so we will have very little time to finish the questions by then)
The questions are posted here when done.
Unless anyone has anything to object to on any of the questions, i will compile them into a simple textdokument (answers on a separate file), zip them together and send them in by Wednesday.
I'm aware that this leaves no room for delays so make sure you get the questions done in time!
The earlier they are posted here, the more time we have to review them before i send them in.
Ok, i think thats all.
Oh, one more thing. For those of you who've yet to fill in the ice breaker review, do it now!
The link Yvonne provided works. There is a link on that page to "Main Navigator".
Click it and you should get to a menu with the option "Ice Breaker Review".
The reviews are anonymous but you do provide your GVT and LVT so it's vital that everyone does this for the group as a whole to pass.
Thats all for now.
Good luck with the questions, everybody! (21/10)
Sharing questions x 6
LVT SE18 + LVT SE17 + LVTNZ9

Uploaded quiz

Hey Guys,
Have had a look at the uploaded quiz and we may need to use the suggested software to create the quiz and not just using text files. I will try to create one by tonight and post up a new quiz.

Yvonne :) (27/10)
Hey guys!
Please go to this link and try out the quiz I created with Articulate software.
http://online.aut.ac.nz/tony/2005/s2_2005.nsf/Navibsup?OpenNavigator
Alex, hope you don't mind me removing the one you uploaded.
Let me know what you guys think!
Yvonne :) (27/10)
Nice!
Looks alot better than the textfiles, i agree. :)
Of course i dont mind.
I'm just sorry i missed that information in the first place. (4/11)

1 related forum GVT Leadership 2 threads 13 posts 7 participants
1 related forum Phase 2: Create a quiz 4 threads 20 posts 6 participants

Appendix 16 – Methodology Development

PhD Methodology Development 16/05/2008

Action Research Categorisation

Baskerville, R., & Myers, M. (2004). Special Issue on Action Research in Information Systems: Making IS Research Relevant to Practice. MIS Quarterly, 28(3), 329-335.
Baskerville, R., & Wood-Harper, A. (1998). Diversity in information systems action research methods. European Journal of Information Systems, 7(2), 90-107.
Carr, W., & Kemmis, S. (1983). Becoming Critical: Knowing Through Action Research. Melbourne: Deakin University press.
Clear, T. (2000). Developing and Implementing a Groupware Application to Support International Collaborative Learning. Unpublished M. Phil., Auckland University, Auckland.
Clear, T. (2004). Critical Enquiry in Computer Science Education. In S. Fincher & M. Petre (Eds.), Computer Science Education Research: The Field and The Endeavour (pp. 101- 125). London: Routledge Falmer, Taylor & Francis Group.
McKay, J., & Marshall, P. (2001). The dual Imperatives of action research. Information Technology and People, 14(1), 46-59.

Multi-Methodology

Beise, C., Evaristo, R., & Niederman, F. (2003). *Virtual Meetings and Tasks: From GSS to DGSS to Project Management.* Paper presented at the 36th Hawaii International Conference on System Sciences, Maui, Hawaii.
Mingers, J. (2001). Combining IS Research Methods: Towards a Pluralist Methodology. Information Systems Research, 12(3), 240 - 259.
Greenwood, D., & Levin, M. (2000). Reconstructing the Relationships Between Universities and Society Through Action Research. In N. Denzin & Y. Lincoln (Eds.), Handbook of Qualitative Research (pp. 85-106). Thousand Oaks: SAGE.
Poole, M., & DeSanctis, G. (2004). Structuration Theory in Information Systems Research: Methods and Controversies. In M. Whitman & A. Woszcynski (Eds.), *The Handbook of Information Systems Research* (pp. 206-249). Hershey PA: Idea Group Publishing.
Qureshi, S., & Vogel, D. (2001). Adaptiveness in Virtual teams: Organisational Challenges and Research directions. *Group Decision and Negotiation, 10*(1), 27-46.

Philosophy

Fred Niederman email communication 11/05/2008 - I can understand the 'dental' analogy. I like to do qualitative research -- I don't have much faith in precise measures of highly equivocal entities. I have understood that period of having a lot of ideas but not knowing yet how they cohere.

My email 10/05/2008 - The thesis has certainly been a > challenge, with the drill down to the data I have felt > like a dentist undertaking a root canal at times :-).

Analytical Tools

Weitzman, E. (2000). Software and Qualitative Research. In N. Denzin & Y. Lincoln (Eds.), Handbook of Qualitative Research (pp. 803-820). Thousand Oaks: SAGE.

Gwyn Claxton personal conversation (re use of QSR N6. less powerful than N-Vivo and difficulties in comparing across hierarchical trees) Nov 2004 & 2/06/2005 – demo of limitations in displaying matrices with child levels below parent nodes

Analytical and Coding Strategies

Sarker, S., Lau, F., & Sahay, S. (2001). Using an Adapted Grounded Theory Approach for Inductive Theory Building About Virtual Team Development. The DATABASE for Advances in Information Systems, 32(1), 38-56.
Allan, G. (2003). A critique of using grounded theory as a research method. Electronic Journal of Business Research Methods, 2(1), 1-10.
Clear, T. (1999, Jun 19-24). International Collaborative Learning - The Facilitation Process. Paper presented at the ED-MEDIA '99 - World Conference on Educational Multimedia, Hypermedia and Telecommunications, Seattle, Washington.
Clear, T. (2000). Developing and Implementing a Groupware Application to Support International Collaborative Learning. Unpublished M. Phil., Auckland University, Auckland.
DeSanctis, G., & Poole, M. (1994). Capturing the Complexity in Advanced Technology Use: Adaptive Structuration Theory. Organization Science, 5(2), 121 - 147.
Glaser, B., & Strauss, A. (1967). The Discovery of Grounded Theory. Mill Valley, CA: Sociology Press.
Glaser, B. G. (1992). Emergence vs. Forcing: Basics of Grounded Theory Analysis. Mill Valley, CA: Sociology Press.
Guba, E., & Lincoln, Y. (1988). Effective Evaluation (6 ed.). San Francisco: Jossey Bass.
Hettinga, M. (2002). Understanding evolutionary use of groupware. Unpublished Doctoral Dissertation, Delft University of Technology, Enschede.
Orlikowski, W., Yates, J., Okamura, K., & Fujimoto, M. (1995). Shaping Electronic Communication: The Metastructuring of Technology in the Context of Use. Organization Science, 6(4), 423 - 444.
Ryan, G., & Bernard, H. (2000). Data Management and Analysis Methods. In N. Denzin & Y. Lincoln (Eds.), Handbook of Qualitative Research (pp. 769-802). Thousand Oaks: SAGE.

Espinosa, J., Slaughter, S., Kraut, R., & Herbsleb, J. (2007). Team Knowledge and Coordination in Geographically Distrubuted Software Development. *Journal of Management Information Systems, 24*(1), 135-169.
"Grounded theory is a widely used qualitative method in information systems research [10, 60, 76] and global teams [62], particularly when the study is exploratory and the theoretical development of the topic is in its early stages [60]".

Field methods (diarying etc.)

Richardson, L. (2000). Writing; A Method Of Inquiry. In N. Denzin & Y. Lincoln (Eds.), Handbook of Qualitative Research (pp. 923-948). Thousand Oaks: SAGE. [p. 941]

Autoethnography

Cunningham, S., & Jones, M. (2005, Jul 6-8). Autoethnography: A tool for practice and education. Paper presented at the 6th ACM SIGCHI New Zealand chapter's international conference on Computer-human interaction: making CHI natural (CHINZ'05), Auckland.

Limitations

Rosenthal, R., & DiMatteo, M. (2001). META-Analysis: Recent Developments in Quantitative Methods for Literature Reviews. Annual Review of Psychology, 52, 59-82.

Reliability of single rater – Spearman Brown 'downed"

Activity Analysis

Alter, S. (2007). Service system fundamentals: work system, value chain, and life cycle. *IBM Systems Journal*, *47*(1), 71-85.
Hill, S., Yates, R., Jones, C., & Kogan, S. (2006). Beyond predictable workflows: Enhancing productivity in artful business processes. *IBM Systems Journal*, *45*(4), 663-682.

Insights TUM activity modes useful (only 4 discrete groupings – therefore manageable)
UML composite pattern activity and task not usable – too complex and volatile, to produce any consistent analysis
Metastructure an "activity pattern"? A possible analytical response albeit a reification?

16/05/2008

Appendix 17 – Cross Episode Analysis – Comparative Tables

Appendix 17: Cross Episode Analysis by TUM Activity Mode - Preparatory Tables and Commentary

A17.1 Introduction

This appendix contains the full set of supporting tables and associated episode level commentaries for the cross episode analysis conducted in chapter seven.

A17.2 Grouped episodes of interest – TUM establishment mode

This grouping includes a single large episode. For ease of cross episode comparison, a set of quantitative summaries tabulating the key elements present within the episode is first developed. These summaries are then augmented by a condensed profile of the key aspects identified in the episode which are less readily amenable to quantification.

A17.2.1 Appropriation Analysis - TUM establishment mode

Tables A17.1, A17.2 and A17.3 below summarise the set of appropriation moves coded in the episode, by category. As the number of data sources between episodes varies considerably, a normalised frequency measure *(F)* is used to aid within and between episode comparisons. This measure has been derived via the formula below, converting the code counts *(c)* (as the number of unique data sources *(S)* in which the code has been cited) into a simple percentage of the overall number of data sources for the episode:

$$F = ((c \div \sum_{i=1}^{n} S_i) * 100)$$

Tabulation of the *categories* of appropriation move, *concepts* and *codes* identified within each table is based upon this normalized frequency measure, representing their relative occurrences on a percentage basis for comparative purposes. These summaries for the *establishment* episode are then augmented by a condensed profile of the key aspects identified in the episode which are less readily amenable to quantification.

App Move Category	Normalised Frequency*
Constraint	%
6. Constraint - a. definition	8.3
6. Constraint - b. command	6.5
6. Constraint - c. diagnosis	18.1
6. Constraint - d. ordering	14.8
6. Constraint - e. queries	14.4
6. Constraint - f. closure	0.9
6. Constraint - g. status report	27.8
6. Constraint - h. status request	5.1
6. Constraint - i. query response	4.6
6. Constraint - j. proposal	5.1
6. Constraint - k. future status	15.7
6. Constraint - l. set-up request	2.3
6. Constraint - m. diagnosis request	0.5
** % of sources in which category coded*	
No of source items	216
TUM specific added moves	

Table A17.1: TUM Establishment Mode - Normalised Frequencies for 'Constraint' Appropriation Moves

App Move Category	Normalised Frequency*
Judgement	%
7. Affirmation - a. agreement	5. 6
7. Affirmation - b. bid agree	5.1
7. Affirmation - c. agree reject	0.9
7. Affirmation - d. compliment	4.6
7. Affirmation - e. bid improve	4.2
8. Negation - a. reject	1.4
8. Negation - b. indirect	
8. Negation - c. bid reject	0.9
9. Neutrality - a. explicit	5.6
9. Neutrality - b. refer to authority	5.1
9. Neutrality - c. offer help	1.9
** % of sources in which category coded*	
No of source items	216
TUM specific added moves	

Table A17.2: TUM Establishment Mode - Normalised Frequencies for 'Judgement' Appropriation Moves

App Move Category	Normalised Frequency*
Relate	%
2. Substitution - a. part	
2. Substitution - b. related	1.9
2. Substitution - c. unrelated	
2. Substitution - d. bid	5.6
2. Substitution - e. proposal bid	4.6
3. Combination - a. composition	0.9
3. Combination - b. paradox	0.5
3. Combination - c. Corrective	1.4
3. Combination-d. element request	3.7
3. Combination-e. bid corrective	4.6
4. Enlargement - a. positive	1.9
4. Enlargement - b. negative	1.9
5. Contrast - a. contrary	3.7
5. Contrast - b. favored	4.2
5. Contrast - c. none favored	0.5
5. Contrast - d. criticism	4.6
** % of sources in which category coded*	
No of source items	216
TUM specific added moves	

Table A17.3: TUM Establishment Mode - Normalised Frequencies for 'Relate' Appropriation Moves

It should be noted that no '*direct use*' appropriation moves were coded against the episode.

A17.2.2 Other Grounded Data - TUM establishment mode

Grounded data coded for the episode is profiled below, based upon the tables from the original establishment episode. The totals within these adapted tables have again been 'normalized' for ease of comparison. The normalised frequency tables A17.4a and A17.4b below are adaptations of the original tables 6.7a and 6.7b, applying the same formula as in A17.2.1 above.

Concepts	Codes	Normalised Frequency Counts %	Normalised Frequency Subtotals %
Activity	planning-meeting scheduling	9.3	
Activity	scripting	9.3	
Activity	trial planning	1.4	19.9
TUM Activity	Episodic change	0.9	
TUM Activity	Reinforcement	1.9	2.8
AIT	AIT	38.9	
AIT	Attachment transmission	8.3	47.2
Breakdown	breakdown	20.8	
Breakdown	recovery plan	14.4	
Breakdown	technical issues	0.5	35.6
Collaboration	collaboration	0.5	0.5
communication	communication	0.5	0.5
Control	authentication	11.1	
Control	usernames	0.5	
Control	authorization	0.5	
Control	control	0.5	
Control	freedom	0.5	
Control	Online registration	18.5	
Control	security	0.9	32.4
Culture	Asian	0.5	
Culture	European	0.5	
Culture	Pacific Island	0.5	
Culture	Maori	0.5	
Culture	Pakeha	0.5	
Culture	cultural issues	0.9	
Culture	Student culture	6.9	10.2
Economic	economic issues	1.4	1.4
Env output	Formally scripted interactions	7.8	7.8
GVT	GVT	17.6	
GVT	GVT Formation	16.7	34.3
Informating up	Informating up	0.9	0.9
LT	LT	7.9	7.9
Measures	Measures	0.6	0.5

Table A17.4a: Establishment Episode Full – Normalised Frequencies for Concepts and Codes

Concepts	Codes	Normalised Frequency Counts %	Normalised Frequency Subtotals %
Metastructure	Genre	0.5	
Metastructure	Metastructure	70.8	
Metastructure	format	6.9	
Metastructure	Metastructure Spirit	0.5	
Metastructure	Pedagogic patterns	0.5	
Metastructure	syllabus sample	0.5	79.6
Organizational unit	ISP	0.5	
Organizational unit	Inst för Informationsteknologi	0.5	
Organizational unit	audiovisual unit - SLU	0.9	
Organizational unit	IT Services	0.9	
Organizational unit	Organizational unit	1.4	
Organizational unit	IRB	1.9	
Organizational unit	School of Computer & Information Sciences	2. 8	
Organizational unit	Technology Services	3.7	
Organizational unit	Academic Hospital [Uppsala]	0.5	
Organizational unit	Flexible Learning Services	9.3	22.2
Research	research design	3.7	
Research	paper	0.9	
Research	data	2.3	
Research	research	2.8	
Research	research subject	1.4	11.1
Facility	Facility	0.9	0.9
socio-emotional	other directed emotions	12.0	
socio-emotional	us-them emotion	0.5	
socio-emotional	I-them emotion	0.5	
socio-emotional	I-s-he emotion	0.9	
socio-emotional	self-directed emotions	2.31	
socio-emotional	task directed emotions	8.3	
socio-emotional	context & technology-directed emotions	11.1	
socio-emotional	performance-driven emotions	8.8	
socio-emotional	motivation	0.5	44.9
Task	Task	2.3	
Task	Learning task	15.3	
Task	Assessment	5.6	23.2
task outputs	task outputs	0.9	1.4
Trust	trust	0.5	
Trust	recommender trust	1.9	2.3

Table A17.4b: Establishment Episode Full – Normalised Frequencies for Concepts and Codes

A17.2.2.1 Other Grounded Data 'Roles' - TUM establishment mode

Table A17.5 below augments the concepts of table A17.4a and A17.4b, with the further concept of 'roles', drawn from the original table 6.14. As observed in the original episode, the dominance and diversity of 'role' as a concept warranted its independent tabulation.

Grounded Data – Concepts	**Normalised Frequency***
Roles	%
audiovisual unit - SLU	0.9
Broker	2.8
Configurer	0.5
Content facilitator	0.5
Coordinator	27.8
curriculum developer	6.0
Developer	3.7
Explainer	0.5
external participant	0.9
Formal (teaching -research assistants)	2.8
Graduate Student	0.5
help desk staff	0.9
Innovator	0.5
IRB	1.9
IRB administrator	0.5
ISP	0.5
Motivator (energizer, encourager)	31.9
Officially sanctioned local developer	0.9
Offshore Technical Coordinator	19.0
paper coordinator	1.4
Programmer	0.9
Purpose agents - teacher	20.4
Research Subject	1.4
Researcher	10.7
SCIS Resource Coordinator	2.3
socio-emotional group-bldg and mtce roles	1.9
Standard user	0.5
Supplier	0.5
Support and Maintenance Team representatives	5.6
System Support Consultant	0.9
Team leaders or session owners	0.5
Technical Coordinator	0.9
Technologist	0.5
Testers.	2.3
trainers	0.9
Undergraduate Student	28.7
videoconference technicians	0.5
** % of sources in which category coded*	
No of source items	216

Table A17.5: TUM Establishment Mode – Normalised Frequencies for Coded 'Roles'

A17.2.2.2 Other Grounded Data 'Time & Space' - TUM establishment mode

Table 7.6 below, provides normalized frequencies for the ever present concepts of 'space and time', based on the original table 6.18. The significance of these concepts has warranted their independent tabulation in most episodes, which suggests promise for cross-episode comparison.

Concepts	Codes	Normalised Frequency Count %	Normalised Frequency Subtotals %
Space	Location	28.7	
Space	face to face	3.7	
Space	Uppsala	0.5	
Space	US	0.5	
Space	Sweden	0.9	
Space	absence	4.6	38.9
Time Pressure	busyness	0.5	
Time	daylight-saving	0.5	
Time	Runestone	0.9	
Time	schedule	1.4	
Time	experience	1.9	
Time	stages of scripting the project	4.6	
Time	time zone	3.2	
Time	holiday	4.6	
Time	Synchronize	34.3	
Time	Time	6.5	
Time	class schedule	8.8	
Time	delay	9.7	
Time	time separation	11.6	88.4

Table A17.6: TUM Establishment Mode – Normalised Frequencies for Coded 'Time & Space'

A17.2.2.3 Other Grounded Data ‘Metastructures’ - TUM establishment mode

Table 7.7 below lists the ‘metastructures’ given particular attention in the original episode, whether in the discussion relating ‘metastructures’ to ‘culture’ at varying levels, or in the visual maps displaying the dynamics of the selected ‘metastructures’ across sites. .

Establishment Episode Full - Metastructures
Metastructures (in body of chapter)
Metastructures and National Culture
Metastructures and National/Institutional Cultures
Metastructures and Student Culture
Metastructures and Professional Culture
Metastructures and International Culture
Metastructures in Visual Maps
Institutional Ethics Process
Cultural dimensions of the Institutional Ethics Process
GVT Formation Process
Videoconference session

Table A17.7: TUM Establishment Mode – Featured ‘Metastructures’

A17.2.3 Evolution of Practices - TUM establishment mode

Table A17.8 below portrays the evolution of practices within the extended temporal bracket augmenting the analysis for the episode. The 'TUM activity in focus' for this bracket related to mediating 'an international collaboration with an additional partner', plus 'student email accounts' as an incidental *metastructure* captured within the bracket. As this bracket inherently extended beyond the '*establishment*' 'TUM mode' of the episode, this portrayal is presented mainly for the sake of completing the picture of the episode rather than to enable direct comparison, between TUM activity modes.

Start Bracket	**End Bracket**	**Desired Practice**	**Realised Practice**	**Dominant AIT**
Sept 2003	Oct 2004	Triadic Global Collaboration including St Louis University, AUT & Uppsala	Triadic Global Collaboration including St Louis University, AUT & Uppsala (with a new coordinator at each offshore site)	Email
June 2004	Oct 2004	Students registered for 6th Sept scheduled start to collaboration	Students registered by 17th Sept for late start to collaboration	AUTonline student account Registration
June 2004	Oct 2004	Students email accounts set up by 6th Sept scheduled start to collaboration	External students email accounts not functional for collaboration	AUTonline student email accounts

Table A17.8: TUM Establishment Mode – Evolution of Practices

A17.3 Grouped episodes of interest – TUM adjustment/reinforcement mode episode one

This grouping includes four episodes. Again a set of quantitative summaries tabulating the key elements present within each of the episodes is first developed. These summaries are then augmented within each episode by a condensed profile of the key aspects identified in each episode which are less readily amenable to quantification.

A17.3.1 Appropriation Analysis - TUM adjustment/reinforcement mode episode one

The tabulation in tables A17.9, A17.10 and A17.11 below summarises the set of appropriation moves coded in 'adjustment/reinforcement episode one', by category.

App Move Category	Normalised Frequency*	Normalised Frequency*
Constraint	Adjustment %	Reinforcement %
6. Constraint - a. definition		
6. Constraint - b. command		
6. Constraint - c. diagnosis		
6. Constraint - d. ordering	11.1	
6. Constraint - e. queries	11.1	11.1
6. Constraint - f. closure		
6. Constraint - g. status report	11.1	11.1
6. Constraint - h. status request	11.1	
6. Constraint - i. query response		
6. Constraint - j. proposal	22.2	22.2
6. Constraint - k. future status	66.7	11.1
6. Constraint - l. set-up request	33.3	22.2
6. Constraint - m. diagnosis request	22.2	11.1
** % of sources in which category coded*		
No of source items	9	
TUM specific added moves		

Table A17.9: TUM Adjustment/reinforcement Mode Episode One - Normalised Frequencies for 'Constraint' Appropriation Moves

App Move Category	Normalised Frequency*	Normalised Frequency*
Judgement	Adjustment %	Reinforcement%
7. Affirmation - a. agreement		
7. Affirmation - b. bid agree		
7. Affirmation - c. agree reject		
7. Affirmation - d. compliment	22.2	33.3
7. Affirmation - e. bid improve		
8. Negation - a. reject	11.1	
8. Negation - b. indirect		
8. Negation - c. bid reject		
9. Neutrality - a. explicit		
9. Neutrality - b. refer to authority		
9. Neutrality - c. offer help		
** % of sources in which category coded*		
No of source items	9	
TUM specific added moves		

Table A17.10: TUM Adjustment/reinforcement Mode Episode One - Normalised Frequencies for 'Judgement' Appropriation Moves

App Move Category	Normalised Frequency*	Normalised Frequency*
Relate	Adjustment %	Reinforcement%
2. Substitution - a. part		
2. Substitution - b. related		
2. Substitution - c. unrelated		
2. Substitution - d. bid		
2. Substitution - e. proposal bid		
3. Combination - a. composition	11.1	11.1
3. Combination - b. paradox		
3. Combination - c. Corrective	22.2	
3. Combination-d. element request		
3. Combination-e. bid corrective		
4. Enlargement - a. positive		
4. Enlargement - b. negative		
5. Contrast - a. contrary		
5. Contrast - b. favored	11.1	
5. Contrast - c. none favored	11.1	11.1
5. Contrast - d. criticism	11.1	11.1
** % of sources in which category coded*		
No of source items		9
TUM specific added moves		

Table A17.11: TUM adjustment/reinforcement Mode Episode One - Normalised Frequencies for 'Relate' Appropriation Moves

It should be noted again that no '*direct use*' appropriation moves were coded against the episode.

A17.3.2 Other Grounded Data – TUM adjustment/reinforcement mode episode one

Grounded data coded for 'adjustment reinforcement episode one' is profiled below, based upon the tables from the original episode. The totals within these adapted tables have again been 'normalized' for ease of comparison. The normalised frequency table A17.12 below is an adaptation of the original table 6.26.

		Normalised Frequency	*Normalised Frequency*
Concepts	Codes	Counts %	Subtotals %
Activity	planning-meeting scheduling	22.2	
Activity	scripting	22.2	44.4
AIT	AIT	100.0	
AIT	AIT Spirit	11.1	
AIT	attachment transmission	22.2	133.3
Breakdown	Breakdown	22.2	
Breakdown	Recovery Plan	11.1	33.3
Control	authentication	11.1	
Control	authorization	33.3	
Control	Control	11.1	
Control	security	11.1	66.7
Data Source	diary note	33.3	33.3
Env Output	Formally scripted interactions	11.1	11.1
GVT	Global Team Formation	11.1	
GVT	GVT	55.5	66.7
LT	LT	11.1	11.1
Metastructure	Metastructure	88.9	88.9
Research	data	11.1	11.1
Socio-emotional	context & technology-directed emotions	22.2	
Socio-emotional	performance-driven emotions	22.2	44.4
Task	Learning task	11.1	11.1
TUM Activity	Adjustment	100.0	
TUM Activity	Establishment	55.6	
TUM Activity	Reinforcement	44.4	200.0

Table A17.12: TUM Adjustment/reinforcement Mode Episode One - Normalised Frequencies for Concepts and Codes

With the small number of data sources (namely nine) which constituted this episode, some of the concept frequency percentages have exceeded 100%. Nonetheless these values do serve to indicate the relative frequency of occurrence of the concepts and codes. While the episode has been primarily categorized as representing 'TUM adjustment/reinforcement activity', it should be noted that just over half of the data sources also contained activity in the 'TUM

establishment mode'. This 'establishment' activity was effectively delayed from the project initiation phase and addressed activities relating to setting up phase two of the project. There may be a resulting rationale for comparing this episode with the 'establishment' episode, to assess whether its characteristics match its allocated 'adjustment/reinforcement' episode grouping as opposed to an 'establishment' episode grouping.

A17.3.2.1 Other Grounded Data 'Roles' - TUM adjustment/reinforcement mode episode one

Table A17.13 below augments the concepts of table A17.12 with the further concept of 'roles', drawn from the original table 6.28. As observed in the original episode, the prevalence of 'role' as a concept warranted its independent tabulation.

		Normalised Frequency	*Normalised Frequency*
Concepts	Codes	Counts %	Subtotals %
Role	Central users - self selected, emergent (like a Coweb webmaster)	22.2	
Role	Coordinator	66.7	
Role	Developer	22.2	
Role	Formal (teaching - research assistants)	11.1	
Role	IRB	11.1	
Role	Motivator (energizer, encourager)	22.2	
Role	Officially sanctioned local developer	11.1	
Role	Offshore Technical Coordinator	44.4	
Role	Purpose agents - teacher	44.4	
Role	Technologist	11.1	
Role	Testers.	55.6	
Role	Undergraduate Student	33.3	355.6

Table A17.13: TUM Adjustment/reinforcement Mode Episode One - – Normalised Frequencies for Coded 'Roles'

A17.3.2.2 Other Grounded Data 'Time & Space' – TUM adjustment/reinforcement mode episode one

Table A17.14 below, provides normalized frequencies for the ever present concepts of 'space and time', based on the independently tabulated data of table 6.29 from the original episode.

		Normalised Frequency	*Normalised Frequency*
Concepts	Codes	Counts %	Subtotals %
Space	Location	55.6	55.6
Time	Class Schedule	11.1	
Time	day	44.4	
Time	daylight saving	11.1	
Time	holiday	11.1	
Time	stages of scripting the project	55.6	
Time	Synchronize	55.6	
Time	Time	33.3	
Time	Time separation	33.3	
Time	time zone	11.1	266.7

Table A17.14: TUM Adjustment/reinforcement Mode Episode One - – Normalised Frequencies for Coded 'Time & Space'

A17.3.2.3 Other Grounded Data 'Metastructures' – TUM adjustment/reinforcement mode episode one

Table A17.15 below, lists the 'metastructures' which were given particular attention in the original episode. The review covering the diversity of AITs and their features revealed several implicit 'metastructures', and the visual map section displayed the dynamics of the 'metastructure' of the 'phase 2 trial instructions' across sites.

Establishment Episode Full - Metastructures
Metastructures (in body of chapter)
Certain Metastructures Implicit in AITs and their Features profiled in table 6.27a and 6.27b
Metastructures in Visual Maps
Draft Phase 2 instructions for the trial

Table A17.15: TUM Adjustment/reinforcement Mode Episode One – Featured 'Metastructures'

A17.3.3Evolution of Practices – TUM adjustment/reinforcement mode episode one

Table A17.16 below portrays the evolution of practices within the extended temporal bracket augmenting the analysis for the episode. The 'TUM activity in focus' for this bracket related to mediating 'synchronous technologies and AUTOnline email technology use'. As this bracket inherently extended beyond the '*adjustment/reinforcement*' 'TUM mode' of the episode, this portrayal is presented mainly for the sake of completing the picture of the episode rather than to enable direct comparison, between TUM activity modes.

Start Bracket	**End Bracket**	**Desired Practice**	**Realised Practice**	**Dominant AIT**
23/08/2004	14/10/2004	Students free to choose communication software from AUTOnline features including AUTOnline email for external students	AUTOnline email communication not available for external students Have to use own Swedish email addresses	AUTOnline Email accounts
31/08/2004	3/11/2004	AUT students to identify 5 key issues during trial, collect at least 5 pieces of evidence, could include chat session recording	Issues identified by students, discussion thread postings and Notes forms attached as appendices No chat recordings	AUTOnline Discussion threads, Notes Database forms, AUTOnline lightweight chat feature
28/09/2004	3/11/2004	Arnold proposed a joint chat session between members of each GVT	No chat sessions eventuated	AUTOnline Discussion thread AUTOnline Announcement AUTOnline lightweight chat feature

Table A17.16: TUM Adjustment/reinforcement mode episode one – Evolution of Practices

A17.4 Grouped episodes of interest – TUM adjustment/reinforcement mode episode two

A17.4.1 Appropriation Analysis - TUM adjustment/reinforcement mode episode two

The tabulation in tables A17.17, A17.18 and A17.19 below summarises the set of appropriation moves coded in 'adjustment/reinforcement episode two', by category.

It should be noted again that no '*direct use*' appropriation moves were coded against this episode.

App Move Category	Normalised Frequency*	Normalised Frequency*
Constraint	Adjustment %	Reinforcement %
6. Constraint - a. definition		
6. Constraint - b. command		50.0
6. Constraint - c. diagnosis		25.0
6. Constraint - d. ordering		25.0
6. Constraint - e. queries		
6. Constraint - f. closure		
6. Constraint - g. status report		25.0
6. Constraint - h. status request		
6. Constraint - i. query response		50.0
6. Constraint - j. proposal		
6. Constraint - k. future status		
6. Constraint - l. set-up request		
6. Constraint - m. diagnosis request		
** % of sources in which category coded*		
No of source items	4	
TUM specific added moves		

Table A17.17: TUM Adjustment/reinforcement Mode Episode Two - Normalised Frequencies for 'Constraint' Appropriation Moves

App Move Category	Normalised Frequency*	Normalised Frequency*
Judgement	Adjustment %	Reinforcement%
7. Affirmation - a. agreement		25.0
7. Affirmation - b. bid agree		
7. Affirmation - c. agree reject		
7. Affirmation - d. compliment		50.0
7. Affirmation - e. bid improve		25.0
8. Negation - a. reject		
8. Negation - b. indirect		
8. Negation - c. bid reject		
9. Neutrality - a. explicit		
9. Neutrality - b. refer to authority		
9. Neutrality - c. offer help		
** % of sources in which category coded*		
No of source items		4
TUM specific added moves		

Table A17.18: TUM Adjustment/reinforcement Mode Episode Two - Normalised Frequencies for 'Judgement' Appropriation Moves

App Move Category	Normalised Frequency*	Normalised Frequency*
Relate	Adjustment %	Reinforcement%
2. Substitution - a. part		
2. Substitution - b. related		
2. Substitution - c. unrelated		
2. Substitution - d. bid	25.0	
2. Substitution - e. proposal bid		
3. Combination - a. composition		
3. Combination - b. paradox		
3. Combination - c. Corrective		
3. Combination-d. element request		
3. Combination-e. bid corrective		
4. Enlargement - a. positive		
4. Enlargement - b. negative		
5. Contrast - a. contrary		
5. Contrast - b. favored	25.0	
5. Contrast - c. none favored		
5. Contrast - d. criticism		
** % of sources in which category coded*		
No of source items		4
TUM specific added moves		

Table A17.19: TUM adjustment/reinforcement Mode Episode Two - Normalised Frequencies for 'Relate' Appropriation Moves

A17.4.2 Other Grounded Data – TUM adjustment/reinforcement mode episode two

Grounded data coded for 'adjustment reinforcement episode two' is profiled below, based upon the tables from the original episode. The totals within these adapted tables have again been 'normalized' for ease of comparison. The normalised frequency table A17.20 below is an adaptation of the original table 6.38.

		Normalised Frequency	*Normalised Frequency*
Concepts	Codes	Counts %	Subtotals %
Activity	trial planning	25.0	25.0
AIT	AIT	100.0	
AIT	AIT Spirit	25.0	
AIT	attachment transmission	25.0	150.0
Breakdown	Breakdown	25.0	25.0
collaboration	collaboration	25.0	25.0
competition	competition	25.0	25.0
Control	Online Registration	25.0	
Control	security	50.0	75.0
Culture	cultural issues	25.0	
Culture	Student culture	75.0	100.0
GVT	Global Team Formation	25.0	
GVT	GVT	75.0	100.0
LT	LT	100.0	100.0
Metastructure	Instructions	25.0	
Metastructure	Metastructure	100.0	125.0
Organization	Organization	25.0	25.0
Research	research design	50.0	50.0
Socio-emotional	context & technology-directed emotions	50.0	
socio-emotional	motivation	50.0	
Socio-emotional	other-directed emotions	50.0	
Socio-emotional	performance-driven emotions	50.0	
Socio-emotional	Self-directed emotions	25.0	225.0
Task	Assessment	25.0	
Task	Learning task	75.0	
Task	Each GVTs participants become acquainted	25.0	
Task	select a leader or self-managed option for GVT	25.0	150.0
TUM Activity	Adjustment	50.0	
TUM Activity	Reinforcement	100.0	150.0

Table A17.20: TUM Adjustment/reinforcement Mode Episode Two - Normalised Frequencies for Concepts and Codes

With the small number of data sources (namely four) which constituted this episode, some of the concept frequency percentages have again exceeded 100%. Nonetheless these values do

serve to indicate the relative frequency of occurrence of the concepts and codes.

A17.4.2.1 Other Grounded Data 'Roles' - TUM adjustment/reinforcement mode episode two

Table A17.21 below augments the concepts of table 7.20 with the further concept of 'roles', drawn from the original table 6.38. While not separately tabulated in the original episode, for ease of comparison here 'role' as a concept is independently tabulated below.

		Normalised Frequency	*Normalised Frequency*
Concepts	Codes	Counts %	Subtotals %
Role	Central users - self selected, emergent (like a Coweb webmaster)	25.0	
Role	Coordinator	75.0	
Role	Facilitator	25.0	
Role	Officially sanctioned local developer	25.0	
Role	Offshore Technical Coordinator	75.0	
Role	Purpose agents - teacher	50.0	
Role	trainers	25.0	
Role	Undergraduate Student	75.0	375.0

Table A17.21: TUM Adjustment/reinforcement Mode Episode Two - – Normalised Frequencies for Coded 'Roles'

A17.4.2.2 Other Grounded Data 'Time & Space' – TUM adjustment/reinforcement mode episode two

Table A17.22 below, provides normalized frequencies for the again pervasive concepts of 'space and time', based on the independently tabulated data of table 6.39 from the original episode.

		Normalised Frequency	*Normalised Frequency*
Concepts	Codes	Counts %	Subtotals %
Space	Location	100.00	
Space	Absence	25.00	125.00
Time	Class Schedule	75.00	
Time	Delay	25.00	
Time	experience	25.00	
Time	holiday	75.00	
Time	Schedule	25.00	
Time	stages of scripting the project	25.00	
Time	Synchronize	25.00	
Time	Time	25.00	
Time	time zone	25.00	325.00

Table A17.22: TUM Adjustment/reinforcement Mode Episode Two - – Normalised Frequencies for Coded 'Time & Space'

A17.4.2.3 Other Grounded Data 'Metastructures' – TUM adjustment/reinforcement mode episode two

Table A17.23 below lists the 'metastructures', which were tabulated in tables 6.39a - 6.39c within the body of the original episode. The visual map section (table A17.23 below) portrayed the dynamics of the 'metastructure' of each local team ('LT') across sites.

Metastructures (Table 6.39a)	**Metastructures (Table 6.39b)**	**Metastructures (Table 6.39c)**
NZ/SW/USA Collaboration exercise	Phases Exercise Instructions Collaborative database Site	Research Websites Assignment Groups (GVTs) Ranking Prize Paper Discussion Competition Game Required task Optional task
structure of the exercises	international collaboration	Instructions Email Attachment
deliverables that the entire team must work towards.	Introduction Email	AUTOnline
online synchronous chat meetings.	Online registration Lab Projector Classroom Project Class LT	
LT	GVT Websites Ranking discussions Paper Set of questions Email Experience	
GVT		
Collaborative data base		
Instructions		
Message exercise		

Table A17.23: TUM Adjustment/reinforcement Mode Episode Two – Featured 'Metastructures'

Metastructures in Visual Maps
LT at each site

Table A17.24: TUM Adjustment/reinforcement Mode Episode Two – Featured 'Metastructures' in Visual Maps

A17.4.2.4 Evolution of Practices – TUM adjustment/reinforcement mode episode two

Table A17.25 below portrays the evolution of practices within the extended temporal bracket augmenting the analysis for the episode. The 'TUM activities in focus' for this bracket related to 1) establishing AUTONline as the Technology Platform; 2) registering external students to the AUTOnline platform; 3) Connectivity difficulties of a more intermittent nature. As the components within this bracket inherently extended beyond the '*adjustment/reinforcement*' 'TUM mode' of the episode, this portrayal is presented again for the sake of completing the picture of the episode rather than to enable direct comparison, between TUM activity modes.

Start Bracket	**End Bracket**	**Desired Practice**	**Realised Practice**	**Dominant AIT**
11/11/2003	20/10/2004	Groups free to choose own software implicitly both asynchronous and synchronous	AUTOnline features and Lotus Notes DBs confirmed as technology platform AUT students make some attempts Uppsala students have accounts finally but no active partners US students don't work outside class	AUTOnline features Lotus Notes Collab DB
16/09/2004	22/09/2004	External students registered and freely able to use AUTOnline	St Louis students now set up for access and still to log on - 2 weeks after original start date	AUTOnline, AUTOnline student accounts
22/09/2004	24/02/2005	External students, coordinators and local counterparts able to freely access and use AUTOnline and Lotus Notes DB	AUTOnline down frequently, Swedish collaborators and St Louis collaborators unable to access site during peak daylight hours. Able to advise Arnold due to scheduled overnight downtime for backups at AUT not advised to us	AUTOnline Lotus Notes DB

Table A17.25: TUM Adjustment/reinforcement mode episode two – Evolution of Practices

A17.5 Grouped episodes of interest – TUM adjustment/reinforcement mode episode three

A17.5.1 Appropriation Analysis - TUM adjustment/reinforcement mode episode three

The tabulation in tables A17.26, A17.27, A17.28 and A17.29 below, summarises the set of appropriation moves coded in 'adjustment/reinforcement episode three', by category.

App Move Category	Normalised Frequency*	Normalised Frequency*
Constraint	Adjustment %	Reinforcement %
6. Constraint - a. definition		
6. Constraint - b. command		
6. Constraint - c. diagnosis		50.0
6. Constraint - d. ordering		
6. Constraint - e. queries		
6. Constraint - f. closure		
6. Constraint - g. status report		50.0
6. Constraint - h. status request		
6. Constraint - i. query response		50.0
6. Constraint - j. proposal	50.0	
6. Constraint - k. future status		50.0
6. Constraint - l. set-up request		
6. Constraint - m. diagnosis request		
** % of sources in which category coded*		
No of source items	2	
TUM specific added moves		

Table A17.26: TUM Adjustment/reinforcement Mode Episode Three - Normalised Frequencies for 'Constraint' Appropriation Moves

Unlike prior episodes this episode did contain an example of a 'direct use' appropriation move, as tabulated below in table 6.25.

App Move Category	Normalised Frequency*	Normalised Frequency*
Direct Use	Adjustment %	Reinforcement %
1. Direct appropriation - a. explicit		
1. Direct appropriation - b. implicit	50.0	50.0
1. Direct appropriation - c. bid		

Table A17.27: TUM Adjustment/reinforcement Mode Episode Three - Normalised Frequencies for 'Direct use' Appropriation Moves

App Move Category	Normalised Frequency*	Normalised Frequency*
Judgement	Adjustment %	Reinforcement%
7. Affirmation - a. agreement		
7. Affirmation - b. bid agree		
7. Affirmation - c. agree reject		
7. Affirmation - d. compliment		50.0
7. Affirmation - e. bid improve		
8. Negation - a. reject	50.0	
8. Negation - b. indirect		
8. Negation - c. bid reject		
9. Neutrality - a. explicit		50.0
9. Neutrality - b. refer to authority		50.0
9. Neutrality - c. offer help		
** % of sources in which category coded*		
No of source items	2	
TUM specific added moves		

Table A17.28: TUM Adjustment/reinforcement Mode Episode Three - Normalised Frequencies for 'Judgement' Appropriation Moves

App Move Category	Normalised Frequency*	Normalised Frequency*
Relate	Adjustment %	Reinforcement%
2. Substitution - a. part		
2. Substitution - b. related		
2. Substitution - c. unrelated		
2. Substitution - d. bid		50.0
2. Substitution - e. proposal bid	50.0	
3. Combination - a. composition		
3. Combination - b. paradox		
3. Combination - c. Corrective		
3. Combination-d. element request		
3. Combination-e. bid corrective		
4. Enlargement - a. positive		
4. Enlargement - b. negative		
5. Contrast - a. contrary		
5. Contrast - b. favored		
5. Contrast - c. none favored		
5. Contrast - d. criticism		
** % of sources in which category coded*		
No of source items		2
TUM specific added moves		

Table A17.29: TUM adjustment/reinforcement Mode Episode Three - Normalised Frequencies for 'Relate' Appropriation Moves

A17.5.2 Other Grounded Data – TUM adjustment/reinforcement mode episode three

Grounded data coded for 'adjustment reinforcement episode three' is profiled below, based upon the tables from the original episode. The totals within these adapted tables have again been 'normalized' for ease of comparison. The normalised frequency table A17.30 below is an adaptation of the original table 6.2.

		Normalised Frequency	*Normalised Frequency*
concepts	codes	*Counts %*	*Subtotals %*
AIT	AIT	100.0	
AIT	AIT Spirit	50.0	150.0
Breakdown	Breakdown	50.0	
Breakdown	Recovery Plan	50.0	100.0
control	security	50.0	
control	authorization	100.0	150.0
culture	Student culture	50.0	
culture	cultural issues	100.0	150.0
data source	diary note	100.0	100.0
GVT	GVT	100.0	100.0
LT	LT	100.0	100.0
Metastructure	Metastructure	100.0	
Metastructure	Metastructure Spirit	50.0	150.0
socio-emotional	other-directed emotions	100.0	
socio-emotional	Self-directed emotions	50.0	
socio-emotional	context & technology-directed emotions	50.0	
socio-emotional	performance-driven emotions	100.0	
socio-emotional	motivation	50.0	350.0
TUM activity	Reinforcement	100.0	100.0
Tum activity	Adjustment	100.0	100.0

Table A17.30: TUM Adjustment/reinforcement Mode Episode Three - Normalised Frequencies for Concepts and Codes

With the very low number of data sources (namely two) which constituted this episode, some of the concept frequency percentages have again exceeded 100%. Nonetheless these values do serve to indicate the relative frequency of occurrence of the concepts and codes.

A17.5.2.1 Other Grounded Data 'Roles' - TUM adjustment/reinforcement mode episode three

Table A17.31 below augments the concepts of table A17.30 with the further concept of 'roles', again drawn from the original table 6.2. While not separately tabulated in the original episode, for ease of comparison here 'role' as a concept is independently tabulated below.

		Normalised Frequency	Normalised Frequency
concepts	codes	Counts %	Subtotals %
Role	Central users - self selected, emergent (like a Coweb webmaster)	50.0	
Role	Coordinator	100.0	
Role	Offshore Technical Coordinator	100.0	
Role	Process Facilitator	50.0	
Role	Purpose agents - teacher	100.0	
Role	Undergraduate Student	100.0	500.0

Table A17.31: TUM Adjustment/reinforcement Mode Episode Three - – Normalised Frequencies for Coded 'Roles'

A17.5.2.2 Other Grounded Data 'Time & Space' – TUM adjustment/reinforcement mode episode three

Table A17.32 below, provides normalized frequencies for the pervasive concepts of 'space and time', again based on the data from table 6.2 of the original episode.

		Normalised Frequency	Normalised Frequency
concepts	codes	Counts %	Subtotals %
Space	Location	100.0	100.0
Time Pressure	busyness	50.0	
Time Pressure	concurrent tasks	50.0	100.0
Time	Synchronize	100.0	
Time	Time separation	50.0	
Time	Time	100.0	
Time	time zone	50.0	
Time	Runestone	50.0	
Time	day	100.0	
Time	experience	50.0	500.0

Table A17.32: TUM Adjustment/reinforcement Mode Episode Three - – Normalised Frequencies for Coded 'Time & Space'

A17.5.2.3 Other Grounded Data 'Metastructures' – TUM adjustment/reinforcement mode episode three

Table A17.33 below lists the 'metastructures', which were given particular attention in the original episode. The discussion within the chapter introducing the notion of a 'metastructure' named several illustrative examples, and the two dimensional 'visual map' section displayed the dynamics of the 'metastructure' constituted by 'synchronous chat sessions and technologies'.

Adjustment/reinforcement mode episode three - Metastructures
Metastructures (in body of chapter)
Global email list GVT LT AUTOnline Group Page Firewalls Student web pages Announcements Online questionnaires Video conference Global Virtual Classroom Collaborative teaching team (GVT)
Metastructures in Visual Map
Synchronous chat sessions and technologies

Table A17.33: TUM Adjustment/reinforcement Mode Episode Three – Featured 'Metastructures'

A17.5.2.4 Evolution of Practices – TUM adjustment/reinforcement mode episode three

Table A17.34 below portrays the evolution of practices within the extended temporal bracket augmenting the analysis for the episode. The 'TUM activities in focus' for this bracket related to the use of synchronous technologies. As the components within this bracket inherently extended beyond the '*adjustment/reinforcement*' 'TUM mode' of the episode, this portrayal is presented again for the sake of completing the picture of the episode rather than to enable direct comparison, between TUM activity modes.

Start Bracket	**End Bracket**	**Desired Practice**	**Realised Practice**	**Dominant AIT**
11/11/2003	30/10/2004	Groups free to choose own software implicitly both asynchronous and synchronous	AUTOnline lightweight synchronous chat features used only by LTs of AUT students (based upon few recorded sessions) Logistics of coordinating global chat sessions across time zones prove too daunting	AUTOnline lightweight chat & recording features
3/10/2004	4/10/2004	Global email list for communication with all participants	No overall email list set up on AUTOnline, logistics of setting up forwarding option (to be done individually by each external student) would take too long to build global list	AUTOnline email account (forwarding option for external students), external students home email accounts
29/09/2004	30/10/2004	1) Proposed introductory global synchronous chat session for all GVTs be arranged 2) 3 way phone call of trial coordinators tba 3) Proposed trial coordinators to convene synchronous chat sessions with three GVTs each	1) rejected as "too hard' 2) decided to defer, timezones & limited time 3) proposed students initiate sessions for each GVT and invite coordinators to join – did not eventuate	AUTOnline lightweight chat feature telephone

Table A17.34: TUM Adjustment/reinforcement mode episode three – Evolution of Practices

A17.6 Grouped episodes of interest – TUM adjustment/reinforcement mode episode four

A17.6.1 Appropriation Analysis - TUM adjustment/reinforcement mode episode four

The tabulation in tables A17.35, 7.36 and 7.37 below summarises the set of appropriation moves coded in 'adjustment/reinforcement episode four', by category.

App Move Category	**Normalised Frequency***	**Normalised Frequency***
Constraint	Adjustment %	Reinforcement %
6. Constraint - a. definition		
6. Constraint - b. command		
6. Constraint - c. diagnosis		
6. Constraint - d. ordering		
6. Constraint - e. queries		
6. Constraint - f. closure		
6. Constraint - g. status report	40.0	20.0
6. Constraint - h. status request	20.0	
6. Constraint - i. query response		40.0
6. Constraint - j. proposal		
6. Constraint - k. future status		
6. Constraint - l. set-up request		
6. Constraint - m. diagnosis request		
** % of sources in which category coded*		
No of source items	5	
TUM specific added moves		

Table A17.35: TUM Adjustment/reinforcement Mode Episode Four - Normalised Frequencies for 'Constraint' Appropriation Moves

This episode unlike its predecessor, exhibited no examples of a 'direct use' appropriation move.

App Move Category	Normalised Frequency*	Normalised Frequency*
Judgement	Adjustment %	Reinforcement%
7. Affirmation - a. agreement		
7. Affirmation - b. bid agree		
7. Affirmation - c. agree reject		
7. Affirmation - d. compliment		
7. Affirmation - e. bid improve		
8. Negation - a. reject		
8. Negation - b. indirect		
8. Negation - c. bid reject		
9. Neutrality - a. explicit	20.0	
9. Neutrality - b. refer to authority	20.0	
9. Neutrality - c. offer help		20.0
** % of sources in which category coded*		
No of source items	5	
TUM specific added moves		

Table A17.36: TUM Adjustment/reinforcement Mode Episode Four - Normalised Frequencies for 'Judgement' Appropriation Moves

App Move Category	Normalised Frequency*	Normalised Frequency*
Relate	Adjustment %	Reinforcement%
2. Substitution - a. part		
2. Substitution - b. related		
2. Substitution - c. unrelated		
2. Substitution - d. bid		
2. Substitution - e. proposal bid		
3. Combination - a. composition		
3. Combination - b. paradox		
3. Combination - c. Corrective		20.0
3. Combination-d. element request		
3. Combination-e. bid corrective		
4. Enlargement - a. positive		
4. Enlargement - b. negative		
5. Contrast - a. contrary		
5. Contrast - b. favored		
5. Contrast - c. none favored		
5. Contrast - d. criticism		
** % of sources in which category coded*		
No of source items		5
TUM specific added moves		

Table A17.37: TUM adjustment/reinforcement Mode Episode Four - Normalised Frequencies for 'Relate' Appropriation Moves

A17.6.2 Other Grounded Data – TUM adjustment/reinforcement mode episode four

Grounded data coded for 'adjustment reinforcement episode four' is profiled below, based upon the tables from the original episode. The totals within these adapted tables have again been 'normalized' for ease of comparison. The normalised frequency table A17.38 below is an adaptation of the original table 6.43.

		Normalised Frequency	Normalised Frequency
Concepts	Codes	Counts %	Subtotals %
Activity	planning-meeting scheduling	40.0	40.0
AIT	AIT	100.0	100.0
Breakdown	Breakdown	20.0	20.0
Culture	Student culture	20.0	20.0
GVT	GVT	20.0	20.0
LT	LT	20.0	20.0
Metastructure	Metastructure	100.0	100.0
Research	research	20.0	
Research	paper	40.0	
Research	diary note	40.0	100.0
Socio-emotional	other-directed emotions	20.0	
Socio-emotional	context & technology-directed emotions	20.0	
Socio-emotional	motivation	20.0	60.0
TUM activity	Reinforcement	80.0	
TUM activity	Adjustment	80.0	
TUM activity	episodic change	40.0	200.0

Table A17.38: TUM Adjustment/reinforcement Mode Episode Four - Normalised Frequencies for Concepts and Codes

With the small number of data sources (namely five) which constituted this episode, some of the concept frequency percentages have again exceeded 100%. Nonetheless these values do serve to indicate the relative frequency of occurrence of the concepts and codes.

A17.6.2.1 Other Grounded Data 'Roles' - TUM adjustment/reinforcement mode episode four

Table A17.39 below augments the concepts of table 7.38 with the further concept of 'roles', again drawn from the original table 6.43. While not separately tabulated in the original episode, for ease of comparison here 'role' as a concept is independently tabulated below.

		Normalised Frequency	Normalised Frequency
Concepts	Codes	Counts %	Subtotals %
Role	socio-emotional group-bldg and mtce roles	20.0	
Role	Motivator (energizer, encourager)	40.0	
Role	Coordinator	100.0	
Role	Developer	20.0	
Role	External consultants (infrastructural)	20.0	
Role	Offshore Technical Coordinator	40.0	
Role	Purpose agents - teacher	20.0	
Role	Researcher	40.0	
Role	Undergraduate Student	20.0	
Role	Support and Maintenance Team representatives	20.0	
Role	Testers.	40.0	
Role	Lotus Notes administrator	20.0	380.0

Table A17.39: TUM Adjustment/reinforcement Mode Episode Four - – Normalised Frequencies for Coded 'Roles'

A17.6.2.2 Other Grounded Data 'Time & Space' – TUM adjustment/reinforcement mode episode four

Table A17.40 below, provides normalized frequencies for the pervasive concepts of 'space and time', again based on the data from table 6.43 of the original episode.

		Normalised Frequency	Normalised Frequency
Concepts	Codes	Counts %	Subtotals %
Space	Location	60.0	
Space	face to face	40.0	100.0
Time	Delay	40.0	
Time	Synchronize	100.0	
Time	holiday	20.0	
Time	Time	60.0	
Time	time zone	20.0	
Time	day	60.0	300.0
Time Pressure	busyness	20.0	
Time Pressure	concurrent tasks	20.0	40.0

Table A17.40: TUM Adjustment/reinforcement Mode Episode Four - – Normalised Frequencies for Coded 'Time & Space'

A17.6.2.3 Other Grounded Data 'Metastructures' – TUM adjustment/reinforcement mode episode four

Table A17.41 below lists the 'metastructures', which were given particular attention in the original episode. The chapter reviewed the 'metastructure' codes, and cited several relevant examples, at differing levels of granularity. The 'visual map' section displayed the dynamics of the 'metastructures' constituted by the 'server upgrade and the 'St Louis panel session'.

Adjustment/reinforcement mode episode four - Metastructures
Metastructures (in body of chapter)
Servers Server upgrade Testing and backup plans Notes collaborative Database AUTonline GVT LT Fred's phone number Websites Meetings Minibreak Midterms Answerphone message Session here on campus Visit Panel discussion Seminar Collaborative computing topic
Metastructures in Visual Maps
Server upgrade St Louis Panel session

Table A17.41: TUM Adjustment/reinforcement Mode Episode Four – Featured 'Metastructures'

A17.6.2.4 Evolution of Practices – TUM adjustment/reinforcement mode episode four

Table A17.42 below portrays the evolution of practices within the extended temporal bracket augmenting the analysis for the episode. The 'TUM activities in focus' for this bracket related to the 'Notes Server upgrade'. While the components within this bracket may have inherently extended beyond the '*adjustment/reinforcement*' 'TUM mode' of the episode, it appeared that the event represented a full sequence of adjustment activities. However, this portrayal is presented again for the sake of completing the picture of the episode rather than to enable direct comparison, between TUM activity modes.

Start Bracket	**End Bracket**	**Desired Practice**	**Realised Practice**	**Dominant AIT**
28/09/2004	19/10/2004	Notes server software to be upgraded to version 6.5 for AUT Centre for Educational and Professional Development We recommended ideal time after our global collaboration	University wide priorities took precedence Negotiated a testing and recovery plan with IT service providers External support consultant called in to conduct upgrade Tests conducted satisfactorily and no disruption to collaboration	Lotus Notes Domino Server Lotus Notes Designer Lotus Notes Clients Email

Table A17.42: TUM Adjustment/reinforcement mode episode four – Evolution of Practices

A17.7 Grouped episodes of interest – TUM episodic change mode episode one

This section reviews individual episodes grouped within the final TUM activity mode of 'episodic change'.

A17.7.1 Appropriation Analysis - TUM episodic change mode episode one

The tabulation in tables A17.43, A17.44 and A17.45 below summarises the set of appropriation moves coded in 'episodic change mode episode one', by category.

It should be noted again that no '*direct use*' appropriation moves were coded against this episode.

App Move Category	**Normalised Frequency***
Constraint	Episodic Change %
6. Constraint - a. definition	
6. Constraint - b. command	
6. Constraint - c. diagnosis	
6. Constraint - d. ordering	
6. Constraint - e. queries	
6. Constraint - f. closure	
6. Constraint - g. status report	
6. Constraint - h. status request	
6. Constraint - i. query response	
6. Constraint - j. proposal	
6. Constraint - k. future status	100.0
6. Constraint - l. set-up request	
6. Constraint - m. diagnosis request	
** % of sources in which category coded*	
No of source items	1
TUM specific added moves	

Table A17.43: TUM episodic change mode episode one - Normalised Frequencies for 'Constraint' Appropriation Moves

App Move Category	Normalised Frequency*
Judgement	Episodic Change %
7. Affirmation - a. agreement	
7. Affirmation - b. bid agree	
7. Affirmation - c. agree reject	100.0
7. Affirmation - d. compliment	
7. Affirmation - e. bid improve	
8. Negation - a. reject	
8. Negation - b. indirect	
8. Negation - c. bid reject	
9. Neutrality - a. explicit	
9. Neutrality - b. refer to authority	
9. Neutrality - c. offer help	
** % of sources in which category coded*	
No of source items	1
TUM specific added moves	

Table A17.44: TUM episodic change mode episode one - Normalised Frequencies for 'Judgement' Appropriation Moves

App Move Category	Normalised Frequency*
Relate	Episodic Change %
2. Substitution - a. part	
2. Substitution - b. related	
2. Substitution - c. unrelated	
2. Substitution - d. bid	
2. Substitution - e. proposal bid	
3. Combination - a. composition	
3. Combination - b. paradox	
3. Combination - c. Corrective	
3. Combination-d. element request	
3. Combination-e. bid corrective	
4. Enlargement - a. positive	
4. Enlargement - b. negative	
5. Contrast - a. contrary	
5. Contrast - b. favored	100.0
5. Contrast - c. none favored	
5. Contrast - d. criticism	
** % of sources in which category coded*	
No of source items	1
TUM specific added moves	

Table A17.45: TUM episodic change mode episode one - Normalised Frequencies for 'Relate' Appropriation Moves

A17.7.2 Other Grounded Data – TUM episodic change mode episode one

Grounded data coded for 'episodic change mode episode one' is profiled below, based upon the tables from the original episode. The totals within these adapted tables have again been 'normalized' for ease of comparison. The normalised frequency table A17.46 below is an adaptation of the original table 6.5.

		Norm Freq	*Norm Freq*
Concepts	**Codes**	Codes %	Concepts %
activity	scripting	100.0	
activity	trial planning	100.0	200.0
AIT	AIT	100.0	
AIT	AIT Spirit	100.0	200.0
Breakdown	Breakdown	100.0	100.0
Collaboration	collaboration	100.0	100.0
control	freedom	100.0	100.0
culture	cultural issues	100.0	
culture	Student culture	100.0	200.0
env output	Formally scripted interactions	100.0	100.0
GVT	GVT	100.0	100.0
Metastructure	format	100.0	
Metastructure	Metastructure	100.0	
Metastructure	Metastructure Spirit	100.0	300.0
research	data	100.0	
research	paper	100.0	
Research	research design	100.0	
Research	Review	100.0	400.0
socio-emotional	context & technology-directed emotions	100.0	
socio-emotional	motivation	100.0	
socio-emotional	performance-driven emotions	100.0	300.0
task	Assessment	100.0	
Task	Learning task	100.0	
Task	Task	100.0	300.0
TUM Activity	Adjustment	100.0	100.0

Table A17.46: TUM episodic change mode episode one - Normalised Frequencies for Concepts and Codes

With the single data source which constituted this episode, the actual presence of a concept results in a frequency percentage of 100%, and multiple codes result in frequency percentages exceeding that. Nonetheless these values give some measure of the relative frequency of occurrence of the concepts and codes.

A17.7.2.1 Other Grounded Data 'Roles' - TUM episodic change mode episode one

Table A17.47 below augments the concepts of table A17.46 with the further concept of 'roles', drawn from the original table 6.5. While not separately tabulated in the original episode, for ease of comparison here 'role' as a concept is independently tabulated below.

		Normalised Frequency	*Normalised Frequency*
Concepts	Codes	Counts %	Subtotals %
Role	Coordinator	100.0	
Role	GVT Leader	100.0	
Role	Researcher	100.0	
Role	Undergraduate Student	100.0	400.0

Table A17.47: TUM episodic change mode episode one - Normalised Frequencies for Coded 'Roles'

A17.7.2.2 Other Grounded Data 'Time & Space' – TUM episodic change mode episode one

Table A17.48 below, provides normalized frequencies for the concepts of 'space and time', again drawn from the data of table 6.5 from the original episode.

		Normalised Frequency	*Normalised Frequency*
Concepts	Codes	Counts %	Subtotals %
Space	face to face	100.0	
Space	Location	100.0	200.0
Time	stages of scripting the project	100.0	
Time	Synchronize	100.0	
Time	Time	100.0	300.0

Table A17.48: TUM episodic change mode episode one - Normalised Frequencies for Coded 'Time & Space'

A17.7.2.3 Other Grounded Data 'Metastructures' – TUM episodic change mode episode one

The 'metastructures' coded within the body of the original episode, were not drawn out very explicitly in the text. As the first episode of the eight coded, this may have been a result of the analysis process, as much as the limited scope afforded by the single data source for the episode. Metastructures were however implicitly addressed in the episode (cf. 6.3.4.1) through the 'formally scripted interactions' of *GVT collaboration, information sheet, ethics approval process* and explicitly referred to when I reflected upon the design of the *international collaboration* as "the process of metastructure design in action" (6.3.4.3), and reflected upon our goal of infusing "a positive *metastructure spirit* into the learning design" to improve future outcomes.

The 2 dimensional visual summary section (figure 6.14) in the original episode, further portrayed the dynamics of the 'metastructure' design and TUM activities undertaken within the episode. Table A17.49 below briefly summarises selected metastructures excerpted from the episode.

Metastructures (in body of chapter)
GVT collaboration information sheet ethics approval process learning design international collaboration
Metastructures in 2D Visual Summary
Courses Assessments AUT specific learning goals Ethics approval Notes Collab DB Trial design Information sheet Collaboration

Table A17.49: TUM episodic change mode episode one - Featured 'Metastructures' in body of episode and Visual Summary

A17.7.2.4 Evolution of Practices – TUM episodic change mode episode one

Table A17.50 below portrays the evolution of practices within the extended temporal bracket augmenting the analysis for the episode. The 'TUM activities in focus' for this bracket, related to 'the proposed redesign of the collaborative trial'.

As the components within this bracket inherently extended over a year and a half in duration and beyond the '*episodic change*' 'TUM mode' of the episode (although showing the developing rationale for the change) , this portrayal is presented again for the sake of completing the picture of the episode rather than to enable direct comparison, between TUM activity modes.

Start Bracket	End Bracket	Desired Practice	Realised Practice	Dominant AIT
Semester 2/2002	11/11/2003	Students use 2D and 3D icebreaking modes in GVTs Students compare 2D & 3D icebreaking modes	Students used & compared 2D and 3D icebreaking modes Teamlink issues, some technical glitches. slow response, frozen screen, mixed icebreaking success (Reported at FIE2003 in a research paper)	Teamlink 3D CVE cybericebreaker with avatars Lotus Notes Collab DB Notes 2D icebreaker email
Semester 2/2003	11/11/2003	Students investigate role of avatars to enrich communication, investigate 3D interfaces in collab workspace Students free to choose own s/w, implicitly both synch and asynch Potentially with avatars	Notes Collab DB used in 2003 collaboration Caused upset for Uppsala students 2D interface only No evidence of 3D s/w used	No 3D collaborative technology Lotus Notes Collab DB Notes 2D icebreaker

Table A17.50: TUM episodic change mode episode one – Evolution of Practices

A17.8 Grouped episodes of interest – TUM episodic change - adjustment mode episode two

A17.8.1 Appropriation Analysis - TUM episodic change-adjustment mode episode two

The tabulation in tables A17.51, A17.52 and A17.53 below summarises the set of appropriation moves coded in 'episodic change adjustment mode episode two', by category.

It should be noted again that no '*direct use*' appropriation moves were coded against this episode.

App Move Category	**Normalised Frequency***	**Normalised Frequency***
Constraint	Episodic Change %	Adjustment %
6. Constraint - a. definition		
6. Constraint - b. command		
6. Constraint - c. diagnosis		
6. Constraint - d. ordering		
6. Constraint - e. queries		
6. Constraint - f. closure		
6. Constraint - g. status report		
6. Constraint - h. status request		
6. Constraint - i. query response		
6. Constraint - j. proposal		
6. Constraint - k. future status	100.0	100.0
6. Constraint - l. set-up request		
6. Constraint - m. diagnosis request		
** % of sources in which category coded*		
No of source items	1	
TUM specific added moves		

Table A17.51: TUM episodic change-adjustment mode episode two - Normalised Frequencies for 'Constraint' Appropriation Moves

App Move Category	Normalised Frequency*	Normalised Frequency*
Judgement	Episodic Change %	Adjustment %
7. Affirmation - a. agreement		
7. Affirmation - b. bid agree		
7. Affirmation - c. agree reject		
7. Affirmation - d. compliment	100.0	
7. Affirmation - e. bid improve		
8. Negation - a. reject		
8. Negation - b. indirect		
8. Negation - c. bid reject		
9. Neutrality - a. explicit	100.0	
9. Neutrality - b. refer to authority		
9. Neutrality - c. offer help		
** % of sources in which category coded*		
No of source items	1	
TUM specific added moves		

Table A17.52: TUM episodic change-adjustment mode episode two - Normalised Frequencies for 'Judgement' Appropriation Moves

App Move Category	Normalised Frequency*	Normalised Frequency*
Relate	Episodic Change %	Adjustment %
2. Substitution - a. part		
2. Substitution - b. related		
2. Substitution - c. unrelated		
2. Substitution - d. bid		
2. Substitution - e. proposal bid		
3. Combination - a. composition	100.0	100.0
3. Combination - b. paradox		
3. Combination - c. Corrective		
3. Combination-d. element request		
3. Combination-e. bid corrective		
4. Enlargement - a. positive		
4. Enlargement - b. negative		
5. Contrast - a. contrary		
5. Contrast - b. favored		
5. Contrast - c. none favored		
5. Contrast - d. criticism		
** % of sources in which category coded*		
No of source items	1	
TUM specific added moves		

Table A17.53: TUM episodic change-adjustment mode episode two - Normalised Frequencies for 'Relate' Appropriation Moves

A17.8.2 Other Grounded Data – episodic change-adjustment mode episode two

Grounded data coded for 'episodic change-adjustment mode episode two' is profiled below, based upon the tables from the original episode. The totals within these adapted tables have again been 'normalized' for ease of comparison. The normalised frequency table A17.54 below is an adaptation of the original table 6.33.

		Norm Freq	*Norm Freq*
Concepts	**Codes**	Codes %	Concepts %
GVT	GVT	100.0	100.0
Metastructure	Metastructure	100.0	
Metastructure	Metastructure Spirit	100.0	200.0
research	data	100.0	
research	diary note	100.0	
Research	research design	100.0	300.0
socio-emotional	performance-driven emotions	100.0	300.0
TUM Activity	Adjustment	100.0	
TUM Activity	episodic change	100.0	
TUM Activity	reinforcement	100.0	300.0

Table A17.54: TUM episodic change-adjustment mode episode two - Normalised Frequencies for Concepts and Codes

With the single data source which constituted this episode, again the actual presence of a concept results in a frequency percentage of 100%, and multiple codes result in frequency percentages exceeding that. Nonetheless these values give some measure of the relative frequency of occurrence of the concepts and codes.

A17.8.2.1 Other Grounded Data 'Roles' - TUM episodic change-adjustment mode episode two

Table A17.55 below augments the concepts of table 7.53 with the further concept of 'roles', drawn from the original table 6.33. While not separately tabulated in the original episode, for ease of comparison here 'role' as a concept is again independently tabulated below.

		Normalised Frequency	*Normalised Frequency*
Concepts	Codes	Counts %	Subtotals %
Role	Coordinator	100.0	
Role	developer	100.0	
Role	monitor	100.0	300.0

Table A17.55: TUM episodic change-adjustment mode episode two - Normalised Frequencies for Coded 'Roles'

A17.8.2.2 Other Grounded Data 'Time & Space' – episodic change-adjustment mode episode two

Table A17.55 below, provides normalized frequencies for the concepts of 'space and time', again drawn from the data of table 6.33 from the original episode.

		Normalised Frequency	*Normalised Frequency*
Concepts	Codes	Counts %	Subtotals %
Space	Location	100.0	100.0
Time	day	100.0	
Time	Time	100.0	200.0

Table A17.55: TUM episodic change-adjustment mode episode two - Normalised Frequencies for Coded 'Time & Space'

A17.8.2.3 Other Grounded Data 'Metastructures' – episodic change-adjustment mode episode two

The 'metastructures' coded within the body of the original episode, were explicitly catalogued in the text, including a design consciously informed by a *metastructure spirit* which aimed to improve GVT team performance outcomes.

The visual map section (figure 6.37) in the original episode, further portrayed the dynamics of the 'metastructure' design and TUM activities undertaken within the episode. Table A17.56 below briefly summarises selected metastructures excerpted from the episode.

Metastructures (in body of chapter)
Final evaluation questionnaire Online form Addressing team performance outcomes (metastructure spirit) AUTOnline features Group pages for GVTs1-9 Phase 2 discussion threads Lotus Notes database features Leader decision forms Posted website links Online evaluations
Metastructures in Visual Map
Final evaluation questionnaire – additional question

Table A17.56: TUM episodic change-adjustment mode episode two - Featured 'Metastructures' in body of episode and Visual Map

A17.8.3Evolution of Practices – episodic change-adjustment mode episode two

Table A17.57 below portrays the evolution of practices within the extended temporal bracket augmenting the analysis for the episode. The 'TUM activities in focus' for this bracket, related to 'the redesign of the final evaluation questionnaire – additional question'. This bracket extended back into the past for some years, and included two 'episodic change' events, one from five years earlier, and a subsequent 'adjustment-reinforcement' mode bracket.

Since the components within this bracket then, inherently extended beyond the '*episodic change*' 'TUM mode' of the episode, this portrayal is presented again for the sake of completing the picture of the episode rather than to enable direct comparison, between TUM activity modes.

Start Bracket	**End Bracket**	**Desired Practice**	**Realised Practice**	**Dominant AIT**
20/09/1999	27/05/2000	Groups to choose leader for GVTs	Variable outcomes some students confused, some leaders assumed, some lacked a leader, some leaders at LT level only (Reported in M. Phil, 2000)	Lotus Notes Collab DB - various features email
Sept 2004	Feb 2005	Goals to be achieved for global collaboration at GVT level	Goals achieved partially or not at all Some students confused LT vs. GVT levels	Lotus Notes Collab DB - various features email
13/10/2004	13/10/2004	Amend online final evaluation questionnaire to record GVT level performance All students to post icebreaker online evaluations	Final questionnaire amended Students yet to post Mostly AUT students post icebreaker online evaluations	final evaluation online questionnaire Notes forms icebreaker online evaluations
20/10/2004	30/10/2004	GVT synchronous chat sessions recorded via AUTOnline lightweight chat	Sessions recorded GVT5 only in AUTOnline Several solo sessions Several active sessions Local (Akl'd) member LT only, no offshore participants	AUTonline chat Chat recording feature

Table A17.57: TUM episodic change-adjustment mode episode two – Evolution of Practices

A17.9 Grouped episodes of interest – TUM episodic change mode - episode three

A17.9.1 Appropriation Analysis - TUM episodic change mode episode three

The tabulation in tables A17.58, A17.59 and A17.60 below summarises the set of appropriation moves coded in 'episodic change mode episode three', by category.

It should be noted again that no '*direct use*' appropriation moves were coded against this episode.

App Move Category	**Normalised Frequency***
Constraint	Episodic Change %
6. Constraint - a. definition	
6. Constraint - b. command	
6. Constraint - c. diagnosis	28.6
6. Constraint - d. ordering	14.3
6. Constraint - e. queries	
6. Constraint - f. closure	
6. Constraint - g. status report	
6. Constraint - h. status request	
6. Constraint - i. query response	
6. Constraint - j. proposal	14.3
6. Constraint - k. future status	14.3
6. Constraint - l. set-up request	
6. Constraint - m. diagnosis request	
** % of sources in which category coded*	
No of source items	7
TUM specific added moves	

Table A17.58: TUM episodic change mode episode three - Normalised Frequencies for 'Constraint' Appropriation Moves

App Move Category	Normalised Frequency*
Judgement	Episodic Change %
7. Affirmation - a. agreement	
7. Affirmation - b. bid agree	
7. Affirmation - c. agree reject	
7. Affirmation - d. compliment	14.3
7. Affirmation - e. bid improve	
8. Negation - a. reject	
8. Negation - b. indirect	
8. Negation - c. bid reject	
9. Neutrality - a. explicit	14.3
9. Neutrality - b. refer to authority	
9. Neutrality - c. offer help	
** % of sources in which category coded*	
No of source items	7
TUM specific added moves	

Table A17.59: TUM episodic change mode episode three - Normalised Frequencies for 'Judgement' Appropriation Moves

App Move Category	Normalised Frequency*
Relate	Episodic Change %
2. Substitution - a. part	
2. Substitution - b. related	
2. Substitution - c. unrelated	
2. Substitution - d. bid	14.3
2. Substitution - e. proposal bid	
3. Combination - a. composition	
3. Combination - b. paradox	
3. Combination - c. Corrective	
3. Combination-d. element request	
3. Combination-e. bid corrective	14.3
4. Enlargement - a. positive	
4. Enlargement - b. negative	
5. Contrast - a. contrary	
5. Contrast - b. favored	
5. Contrast - c. none favored	
5. Contrast - d. criticism	
** % of sources in which category coded*	
No of source items	7
TUM specific added moves	

Table A17.60: TUM episodic change mode episode three - Normalised Frequencies for 'Relate' Appropriation Moves

A17.9.2 Other Grounded Data – TUM episodic change mode episode three

Grounded data coded for 'episodic change mode episode three' is profiled below, based upon the tables from the original episode. The totals within these adapted tables have again been 'normalized' for ease of comparison. The normalised frequency table A17.61 below is adapted from the original tables 6.50a and 6.50b.

		Norm Freq	*Norm Freq*
Concepts	**Codes**	Codes %	Concepts %
Activity	configuration	14.3	
Activity	planning-meeting scheduling	14.3	
Activity	scripting	28.6	57.2
AIT	AIT	71.4	
AIT	AIT Spirit	14.3	85.7
Breakdown	Breakdown	42.9	42.9
Collaboration	collaboration	28.6	28.6
Control	authentication	14.3	
Control	authorization	28.6	
Control	Control	28.6	71.4
Culture	cultural issues	14.3	
Culture	Student culture	28.6	42.9
Data source	diary note	85.7	85.7
Environment	Environment	14.3	14.3
Freedom	freedom	28.6	28.6
GVT	GVT	28.6	28.6
Metastructure	Genre	42.9	
Metastructure	Metastructure	85.7	
Metastructure	Metastructure Spirit	71.4	
Metastructure	Runestone	42.9	242.9
Organizational unit	audiovisual unit - SLU	14.3	
Organizational unit	Inst för Informationsteknologi	14.3	
Organizational unit	IRB	14.3	
Organizational unit	Organizational unit	14.3	57.1
Research	data	14.3	
Research	PhD thesis	42.9	
Research	research design	85.7	
Research	Research Subject	14.3	157.1
Socio-emotional	context & technology-directed emotions	42.9	
Socio-emotional	motivation	28.6	
Socio-emotional	other-directed emotions	42.9	
Socio-emotional	performance-driven emotions	42.9	
Socio-emotional	Self-directed emotions	14.3	171.4
Task	Assessment	28.6	
Task	icebreaker	28.6	
Task	Learning task	71.4	128.6
TUM activity	Adjustment	28.6	
TUM activity	episodic change	57.1	
TUM activity	Reinforcement	14.3	100.0

Table A17.61: TUM episodic change mode episode three - Normalised Frequencies for Concepts and Codes

With the seven data sources which constituted this episode, while multiple occurrences of a code may have resulted in a concept frequency exceeding 100%, such values give some measure of the relative frequency of occurrence of the concepts and codes.

A17.9.2.1 Other Grounded Data 'Roles' - TUM episodic change mode episode three

Table A17.62 below augments the concepts of table A17.61 with the further concept of 'roles', drawn from the original table 6.50b. While not separately tabulated in the original episode, for ease of comparison here 'role' as a concept is again independently tabulated below.

		Normalised Frequency	*Normalised Frequency*
Concepts	Codes	Counts %	Subtotals %
Role	Coordinator	28.6	
Role	curriculum developer	14.3	
Role	Formal (teaching~research assistants)	14.3	
Role	Graduate Student	28.6	
Role	GVT Leader	14.3	
Role	Innovator	14.3	
Role	monitor	14.3	
Role	Offshore Technical Coordinator	57.1	
Role	paper coordinator	14.3	
Role	parental	14.3	
Role	Purpose agents - teacher	71.4	
Role	Researcher	85.7	
Role	SLU GIM Student	14.3	
Role	Support and Maintenance Team representatives	14.3	
Role	Undergraduate Student	57.1	
Role	Uppsala IT student	42.9	500.0

Table A17.62: TUM episodic change mode episode three - Normalised Frequencies for Coded 'Roles'

A17.9.2.2 Other Grounded Data 'Time & Space' – TUM episodic change mode episode three

Table A17.63 below provides normalized frequencies for the concepts of 'space and time', from the independently tabulated table 6.51 of the original episode.

		Normalised Frequency	*Normalised Frequency*
Concepts	Codes	Counts %	Subtotals %
Space	absence	14.3	
Space	face to face	85.7	
Space	international	28.6	
Space	Location	100.0	228.6
Time	day	14.3	
Time	experience	71.4	
Time	Synchronize	71.4	
Time	Time	71.4	
Time	Time separation	28.6	
Time Pressure	busyness	14.3	271.4

Table A17.63: TUM episodic change mode episode three - Normalised Frequencies for Coded 'Time & Space'

A17.9.2.3 Other Grounded Data 'Metastructures' – TUM episodic change mode episode three

The 'metastructures' coded within the body of the original episode, were explicitly catalogued in the text, including a design consciously informed by a *metastructure spirit* which aimed to improve GVT team performance outcomes.

The visual map section (figure 6.37) in the original episode, further portrayed the dynamics of the 'metastructure' design and TUM activities undertaken within the episode. Table A17.64 below briefly summarises selected metastructures excerpted from the episode.

Metastructures (in body of chapter)
Runestone project Comparative collaboration wiki collaborative spirit in wiki (metastructure spirit) student GVTs icebreaker task
Metastructures in Visual Maps
Icebreaker Runestone Project

Table A17.64: TUM episodic change mode episode three - Featured 'Metastructures' in body of episode and Visual Map

A17.9.3Evolution of Practices – TUM episodic change mode episode three

Table A17.65 below portrays the evolution of practices within the extended temporal bracket augmenting the analysis for the episode. The 'TUM activities in focus' for this bracket, related to 'the redesign of the collaborative task and the introduction of a quiz'. This extensive bracket extended into the future for approximately one year in duration, spanning two further collaboration cycles and included some 77 additional data sources.

Since the components within this bracket then, inherently extended beyond the '*episodic change*' 'TUM mode' of the episode, this portrayal is presented again for the sake of completing the picture of the episode rather than to enable direct comparison, between TUM activity modes.

Start Bracket	**End Bracket**	**Desired Practice**	**Realised Practice**	**Dominant AIT**
20/10/2004	22/10/2004	Collaborative task promotes collaborative activity and motivates GVTs to work together fruitfully	LTs fail to support US team activity, design of (website ranking) task too open, needed competition element to motivate US teams, students only do what is required	AUTonline, Notes collab DB
20/10/2004	3/06/2005	Collaborative task promotes collaborative activity and motivates GVTs to work together fruitfully	Students happier this time, task easier to follow, same time zone a big difference [AUT internal collaboration]	AUTonline, open source quiz s/w, VTeam Notes collab DB
20/10/2004	09/09/2005	Collaborative task promotes collaborative activity and motivates GVTs to work together fruitfully	Assignment amended removed assessment requirement for each GVT to submit a complete quiz, goal but LT as a fallback?	AUTonline, open source quiz s/w, VTeam Notes collab DB
20/10/2004	26/10/2005 – 3/11/2005	Collaborative task promotes collaborative activity and motivates GVTs to work together fruitfully	All 9 GVT quizzes completed and posted to Notes Collab DB, plus extras [international collaboration Uppsala & AUT]	AUTonline, open source quiz s/w, VTeam Notes collab DB
20/10/2004	26/10/2005 – 7/11/2005	Collaborative task promotes collaborative activity and motivates GVTs to work together fruitfully	26 final evaluations completed and posted to Notes Collab DB, only 6 Swedish evaluations	AUTonline, open source quiz s/w, VTeam Notes collab DB

Table A17.65: TUM episodic change mode episode three - Evolution of Practices

Appendix 18 – Action Research Cycles Conducted Within the Wider Research Programme

The table below excerpted from the author's M. Phil. thesis (Clear, 2000) depicts the action cycles undertaken up to that point, and insights progressively gained.

Action Cycle	Title of Action Research Cycle	Date	"Specifying Learning"
1	The Monash collaboration	Jun/Jul - 1997	• Email attachments and file transfer a 'nightmare', maybe groupware is a better option? • People risks with collaborating partners
2	The BBus MIS Course Internal collaboration	Semester 2 -1997	• Establishing infrastructure a "mission", but finally got there with students registered into local database • Need for good rapport with technical support staff • Browser access required rather than via Notes client
3	The GroupWare course (GW300) collaborative database development	Semester 2 -1997	• Groupware development concepts, issues and achievability. • Structured document hierarchy & discussion concept
4	Initial Testing, Refinement and Extension of features of the Collaborative database	Nov 1997 - Apr 1998	• Basic Notes & Domino Development concepts • How to upgrade and test features and functionality • Functions and use of generic collaborative database
5	Collaborative database BBus HCI course usability trial	Semester 1 -1998	• Usability features need major revamp • Navigation problems • Problems working and orienting within hierarchy
6	Collaborative database BBus IBS course collaborative exercise	Semester 1 -1998	• Collaboration is clumsy but viable • "Proof-of-concept" achieved
7	First Auckland - Uppsala collaborative trial sem 2 1998	Semester 2- 1998	• Collaboration is achievable and inventive uses give surprising results. • Generic structures a cause of some confusion • Need for structure and active facilitation • Some appropriations unfaithful to the spirit of the trial by use of email instead
8	BBus IBS internal and external collaborative exercises sem 1 1999	Semester 1 - 1999	• How to structure topics and better facilitate communication in online debates • Need for tight and specific structures to provide meaning (semantic layer)
9	Second Auckland - Uppsala collaborative trial sem 2 1999	Semester 2 - 1999	• Documented in M. Phil thesis (Clear, 2000)
10	Internal and external collaborative exercises sem 2 1999	Semester 2 - 1999	• Value of anonymity for course appraisals • Need for netiquette rules • Applicability of student contributions in resource sharing models of online course provision

Table A18.1: Action Research Cycles conducted early in the course of the overall collaborative research programme

Tables A18.2a & A18.2b below, depict the subsequent series of collaborative trials and action cycles, as far as semester one 2005, together with their resulting publications.

Action Cycle	Title of Action Research Cycle	Date	"Specifying Learning"	Resulting Publication (s)
1	Writing M. Phil Thesis [No Collaborative exercise conducted]	Semester 1 - 2000	• Applying the EAST model as an analytical tool • Applying and reviewing a critical action research model using "Dual cycle action research" • Developing a taxonomy of data in critical action research • Identifying several competing discourses in e-learning • Application of Reeves analysis to the collaborative learning model • Tensions between "student", "instructor" and "co-researcher" roles in emancipatory model of pedagogy • Group decision making for preference tasks supported • Embedded local practices transfer across groupware environments • And numerous other insights	Clear, (2000a, 2000b, 2000c, 2001a, 2001b, 2001c, 2002a, 2002b, 2002c) Clear (2004a), Clear & Daniels (2000), Klein et al.,(2000)
2	AUT - Uppsala collaborative trial sem 2 2000	Semester 2 - 2000	• 2D Cybericebreaker appears useful in building initial trust in GVT's • ways in which CC is used may mimic off-line habits gained in comparable genres, and also allow emerging transformative practices	Clear & Daniels (2001), Clear (2002c)
3	BBus IBS internal collaborative exercise sem 1 2001	Semester 1 - 2001	• ways in which CC is used may mimic off-line habits gained in comparable genres, and also allow emerging transformative practices	Clear (2002c)
4	AUT - Uppsala collaborative trial sem 2 2001	Semester 2 - 2001	• ways in which CC is used may mimic off-line habits gained in comparable genres, and also allow emerging transformative practices • technical infrastructure changes can prove disastrous mid-trial – monitoring external links, tech support and ready reaction capability vital, plus ability to close off confusing multiple sites	Clear (2002c), Clear (2003b)
5	BBus IBS internal collaborative exercise sem 1 2002	Semester 1 - 2002	• desktop set ups require common room and robustness, with active tech support • 3D application can support group collaboration on local site • ways in which CC is used may mimic off-line habits gained in comparable genres, and also allow emerging transformative practices	Clear (2002c), Clear & Foot (2002)
6	AUT - Uppsala collaborative trial sem 2 2002	Semester 2 - 2002	• 3D application can support group collaboration between remote sites • 3D icebreakers show some promise • 3D icebreakers require specific rules of netiquette • multiplicity of technology-use mediation roles required in GVT's with CVE's • research data from collaborative trials form a source of data for research in Masters Collaborative Computing course • distinction between space and place important when breaking the ice • client applications take effort to set up • poor performance (without response time diagnostics) can be disastrous	Clear (2003a), Clear (2004b), Clear & Daniels (2003)

Table A18.2a: Action Research Cycles conducted between M Phil Thesis and semester 1/2005 in the course of the overall collaborative research programme

Action Cycle	Title of Action Research Cycle	Date	"Specifying Learning"	Resulting Publication (s)
6	AUT - Uppsala collaborative trial sem 2 2002	Semester 2 - 2002	• 3D application can support group collaboration between remote sites • 3D icebreakers show some promise • 3D icebreakers require specific rules of netiquette • multiplicity of technology-use mediation roles required in GVT's with CVE's • research data from collaborative trials form a source of data for research in Masters Collaborative Computing course • distinction between space and place important when breaking the ice • client applications take effort to set up • poor performance (without response time diagnostics) can be disastrous	Clear (2003a), Clear (2004b), Clear & Daniels (2003)
7	BBus IBS internal collaborative exercise sem 1 2003	Semester 1 - 2003	• Student motivation in VTs & GVT's a critical and poorly understood concept - esp group motivation • Importance of socio-emotional tasks	Clear & Kassabova (2005)
8	AUT - Uppsala collaborative trial sem 2 2003	Semester 2 - 2003	• Student motivation in VTs & GVT's a critical and poorly understood concept - esp group motivation • Importance of socio-emotional tasks	Clear & Kassabova (2005)
9	BBus IBS internal collaborative exercise sem 1 2004	Semester 1 - 2004	• Student motivation in VTs & GVT's a critical and poorly understood concept - esp group motivation • Importance of socio-emotional tasks	Clear & Kassabova (2005)
10	AUT - Uppsala – St. Louis collaborative trial sem 2 2004	Semester 2 - 2004	• lack of common (moderately convenient) time window a severe problem • lack of experience working together an issue for facilitators • use of Blackboard a mixed blessing (complex interdependencies – student registration, email and group set up, involving coordinators at each site) • busy nature of academic life • difficulty of synchronising trial around different course and semester configurations • critical impact of schedule delays	In progress – this doctoral thesis Clear & Kassabova (2008)
11	BBus IBS internal collaborative exercise sem 1 2005	Semester 1 - 2005	• prior student knowledge of AUTOnline useful • no need to log in external collaborators and set up groups saves hassle • distinguishing LT vs. GVT important • value of clear and explicit instructions • Icebreaker task requiring sharing each others information and mirroring by posting on website useful and motivating [Uppsala design] • Choose leader task required – no opting out via self-managed team option • Simple Notes database linked via AUTonline useful • Importance of task design as a motivator -quiz has both a technical and a fun element • Teaching team experience and student expectation contributing factors – perhaps now a group history?	Clear & Kassabova (2008)

Table A18.2b: Action Research Cycles conducted between M Phil Thesis and semester 1/2005 in the course of the overall collaborative research programme

Appendix 19 – Naming Standards for extracted email files used in TUM coding with NVivo7 data and coding progression

As at 23/01/2007:
Naming Standards for extracted email files used in TUM coding – 16/08/2004

Text files to represent author date and time in consistent manner, coded as follows:

Author initials
Day month year
Underscore
Time of day (on email – local time?) by 24 hr clock

Pattern [aaddmmccyy_hhmm.txt)

This code to be a prefix (followed by underscore) to any attachments to link them to their appropriate email messages

Pattern [aaddmmccyy_hhmm_filename.extension)

To be resolved – what about multi-message files – delete past emails?

Note 1: discussed with Steve Mac (02/03/2006) and agreed that stripped individual email messages would be best as data items, but in some cases the sequence would be the more appropriate unit of analysis.

Note 2: (24/04/2004) in the event of duplicate timings for an email or file "hhmm" becomes "hhmmh" (where s is not second exactly but normally '5' for .5 of a minute)

Note 3: (29/05/2006) the subsequence collection (e.g. AP140902004_1932) seems to be a result of a triggering event, a "breakdown in Hettinga's terms. Representing a critical event different from the normal flow, which is an occasion for intervention. So this is a logical unit not a numerical one. (result of discussion with Steve Mac.)

Note 4: (21/09/2006) returning to the job, noted word files in directory of unpacked emails, duplicating text versions of same file. Word used for convenience on full emails to enable colour coding of individual embedded emails for extraction – sometimes take a bit of working out which is which with signatures and prefixed lines ">" [embedded content of earlier emails in response sections]

Note 5: (19/10/2006) naming convention for emails when unpacking sequences and translating to discrete text files for NVivo:

Pattern [aaddmmccyy_hhmm**ssofzz**.txt)
Where ss indicates sequence number of zz total embedded message segments.

Implication however that author initials 'nn' *may be correct as originator of overall sequence but not for each segment. This may require further consideration of naming standard. Maybe author initials and date for each embedded segment within overall*

sequence? [A separate set of files, clones/different view maybe??] May need to write a small routine to parse headers and rename files.

Note 6: (19/10/2006) naming convention for the attached files when translated to text for NVivo:

Email code to be a prefix (followed by underscore) to any attachments to link them to their appropriate email messages (followed by underscore_extension) to preserve file type of origin.

Pattern [aaddmmccyy_hhmm_filename**_extension**.txt)

Note 7: (16/01/2007) potential inconsistency noted

D:\post24032005\Res1_11012005\Tony_AUT\Thesis\TUM_data\UppsalaStLouis22004\emailsunpacked\DK04102004_064902of03.txt

Note: embedded email from Fredrik integral to this message so retained, even though will create a duplicate with Fredrik's of "DK04102004_064903of03.txt"

Further Note: (17/01/2007) embedded sequence of emails recording interchange between Felix and Fred over GIM course saved as both a single sequence D:\post24032005\Res1_11012005\Tony_AUT\Thesis\TUM_data\UppsalaStLouis22004\emails_unpacked\DK15062004_184502of09.txt and a subsequent series 03-09. Result again is inevitable duplication. Should these embedded sets be specifically identified?

Note 8: (16/01/2007) further potential inconsistency noted

In the process of parsing files, noted in email from Arnold [AP22092004_194103of04.txt] that it includes embedded caret characters for retained parts of original emails, and in some cases double carets – if caret characters stripped from files by file cleanse prior to running compare utility some data may be lost – but often may be difficult to determine originating email anyway?

Note 9: (20/01/2007) [revisiting Note 6 above] naming convention for the attached files for NVivo:

Email code to be a prefix (followed by underscore) to any attachments to link them to their appropriate email message sequences [+1 on embedded message total] (followed by underscore_extension) to preserve file type of origin, or with original filename and extension if preserved as .rtf or .doc file [readable by NViVo 7]. Note may be some inconsistencies in application of this standard.

Pattern a) [aaddmmccyy_hhmm**ssofzz**_filename**_extension**.txt)
Pattern b) [aaddmmccyy_hhmm**ssofzz**_filename**.rtf/doc**)

Note 10: (19/01/2007) Additional insight related to note 1 from:

Stubbe, M., Lane, C., Hilder, J., Vine, E., Vine, B., Marra, M., et al. (2003). Multiple Discourse Analyses of a Workplace Interaction. *Discourse Studies, 5*(3), 351-389.

Conversation analysis CA *("involve[s] a micro-analytic investigation of interaction sequences [p.353]*
…based fundamentally on a model of communication as a joint activity. Like dancing or joint musical performance it rejects the typical linguistic model of communication as sending and receiving messages
...Sequences are an important focus of an analysis and each utterance (or gesture) is understood as a step (action) in a joint activity. Thus one of the main focuses of CA is on how the interaction unfolds across sequences of actions by different participants. The significance of an utterance or a gesture is highly dependent on its position in a sequence, as well as being jointly negotiated, and this is one reason for conversation analysts reluctance to aggregate instances of utterance types for quantitative analysis [p.354])".
Unlike CA. an IS [Interactional Sociolinguistics] analysis explicitly recognizes the wider sociocultural context impacting on interactions [p. 358].

Yet to enable detailed level coding need to separate out detailed message segments, to avoid excessive rework. But may also need to re-code at sequence level in some cases, when investigating conversations highlighting phenomena of particular interest?? This analysis applying GT and AST may be a hybrid, with AST providing some wider contextual dimensions, and sequences demonstrating how interaction unfolds may be significant.

Note 11: (20/01/2007) further potential inconsistency noted

In the process of parsing files, noted in email from Fred [FN17082004_081403of05.txt] that it includes a header forwarding embedded email to himself [self-copy??] These will be saved as one embedded message [self copy – header and msg] then saved as a second file being the original email (the forwarded message itself – thus preserving the originator of that msg). This treatment will generate a necessary duplication of data.

Note 12: (21/01/2007) further potential inconsistency noted

In the process of parsing files, noted in email from Arnold [FN22092004_092502of02.txt] that it includes a header from an email of mine and Arnold's response is interleaved. This combined message will be saved as a single message. This treatment is consistent with the tenets of CA above, reflecting *how the interaction unfolds across sequences of actions by different participants.* This treatment will generate a necessary duplication of data.

Note 13 (Observation): the article above by Stubbe et al., (2003) refers to the transcription standards applied in the Wellington Corpus of spoken New Zealand English, with utterance numbers added for ease of reference. The authors also observe that while

this standard may be relatively neutral, any standard "*can only ever be an approximate and partial rendition of the recording on which it is based, and different approaches to discourse analysis have developed their own transcription systems precisely because they wish to address specific research questions which require varying degrees and types of detail in the way the data is represented on paper*".

This begs the question whether there exists or should exist a standard for transcription of email data for analysis purposes. The two distinct perspectives of email as 1) message exchanges (e.g. Shannon & Weaver (datacomms) or typical linguistics models) or 2) emerging sequences of social interaction (CA) suggest very different approaches to transcribing and analysing an email corpus.

Note 14 (Observation): (23/01/2007) on dates and times. Coding sometimes challenged by US dates on some emails (mm/dd/yy or yyyy) and 12 hour vs. 24 hour clock on others, meaning need to add 12 hours or subtract for 12:00 am. Coding based upon time on email header, presumably local time, and times of sending for original embedded emails preserved (although some anomalies, apparent where original date in a message within a longer thread has inherited the US format). Means that some messages occurring within thread sequences are out of data order by a day at times, because of local time vs. universal time as the standard. RFC3339 [*Request for Comments (RFC 3339) Date and Time on the Internet: Timestamps]* discusses some of the issues with time over the internet and standardising timestamps - http://www.ietf.org/rfc/rfc3339.txt.

Note 15: (23/01/2007) further potential inconsistency noted

In the process of parsing files, noted in email sequence from Diana [DK06102004_153203of04.txt t] embedded message from a student Fredrik forwarded earlier via Bridget without full name or date and time of origin. Therefore coding as a separate message is problematic. Tentatively [FX03102004_0745.txt].

Note 16: (23/01/2007) further potential inconsistency noted

Other messages with missing identifiers coded as XX prefixed to message name.

Note 17: (23/01/2007) further potential discrepancy noted, in header field names and contents:

"Date:" for message [AP20102004_210701of01.txt] 20/10/2004 9:07:41 p.m.

Whereas

"Sent:" for message [FN22102004_143002of02.txt] Wednesday, October 20, 2004 3:07 AM

3.6.1. The origination date field

The origination date field consists of the field name "Date" followed by a date-time specification.

orig-date = "Date:" date-time CRLF

The origination date specifies the date and time at which the creator of the message indicated that the message was complete and ready to enter the mail delivery system. For instance, this might be the time that a user pushes the "send" or "submit" button in an application program. In any case, it is specifically not intended to convey the time that the message is actually transported, but rather the time at which the human or other creator of the message has put the message into its final form, ready for transport. (For example, a portable computer user who is not connected to a network might queue a message

for delivery. The origination date is intended to contain the date and time that the user queued the message, not the time when the user connected to the network to send the message.)

Sent: does not appear to be a defined field, and the time here is earlier than the *Date* at which the email was introduced to the mail system. Is it representing local time in NZ? But 18h 34 min difference versus the approx 12 expected? Or did Arnold send (copy and forward) separate copies to different recipients?

Similarly occasional examples of semi-duplicates appear from tme to time, about 2 mins or so apart, maybe copies or forwarded messages, or perhaps date sent by email systems vs. originated by author?

22/01/2007
Observations on email structure from Perl email handling suite CPAN and Mail-Box

Cf. e.g.
http://search.cpan.org/~markov/Mail-Box-2.069/lib/Mail/Box/Thread/Manager.pod

directory
folder
sub-folder
Thread (linked list)
Node (one node in the linked list – contains message(s) with same msg-id – may be reply-to message/thread or may link to reply message(s))
message
message header
message body
message types (multipart – has attachments)
nested (contains message parts – messages which are encapsulated in the body of a message)

Note:
A (message-)*thread* is a message with links to messages which followed in reply of that message. And then the messages with replied to the messages, which replied the original message. And so on. Some threads are only one message long (never replied to), some threads are very long. [Mail-Box thread manager - http://search.cpan.org/~markov/Mail-Box-2.069/lib/Mail/Box/Thread/Manager.pod

Figure A19.1: Three directories for storing email messages for coding (downloaded originals, unpacked, working directory for export to NVivo)

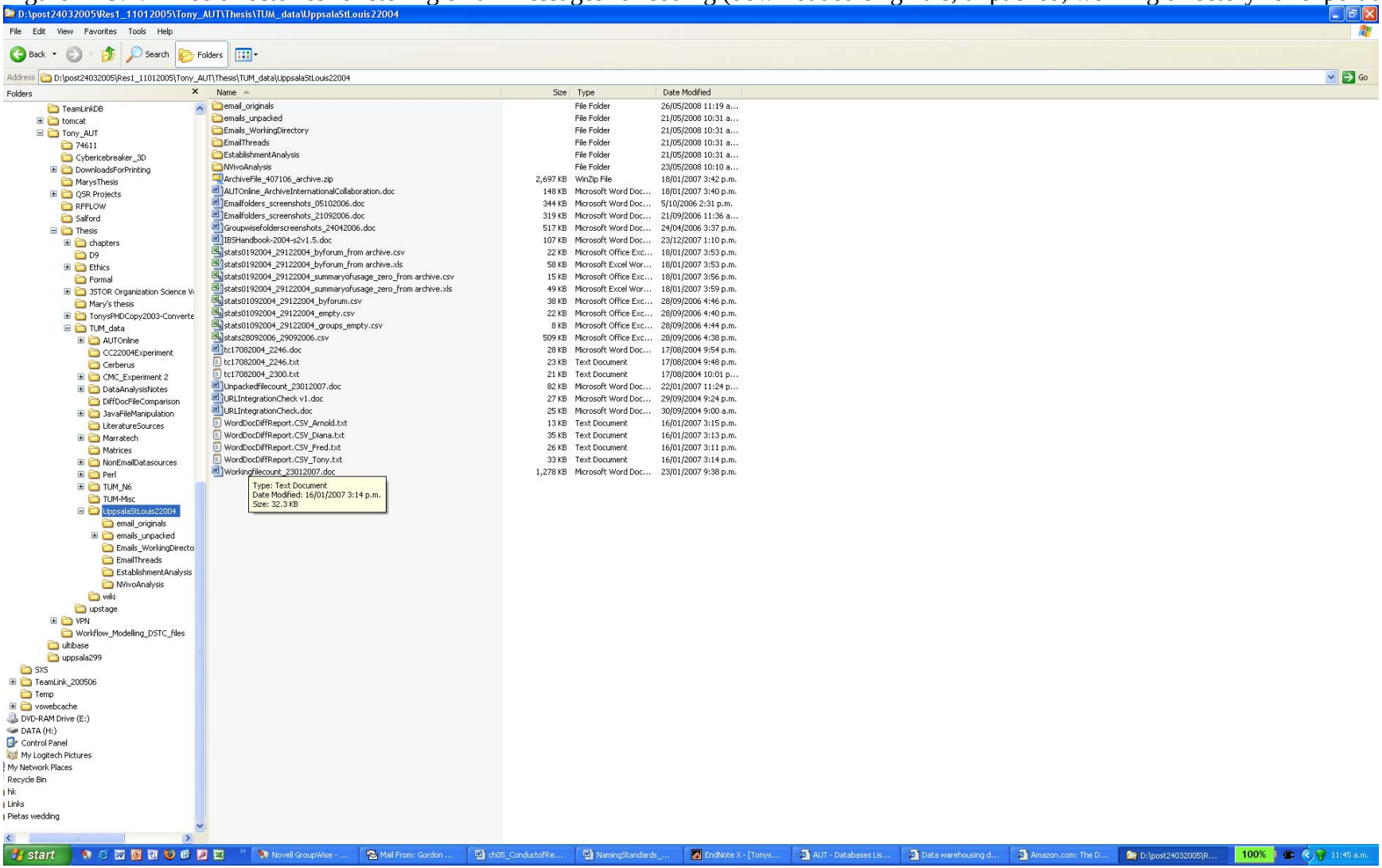


Figure A19.2:Directory of downloaded original email messages

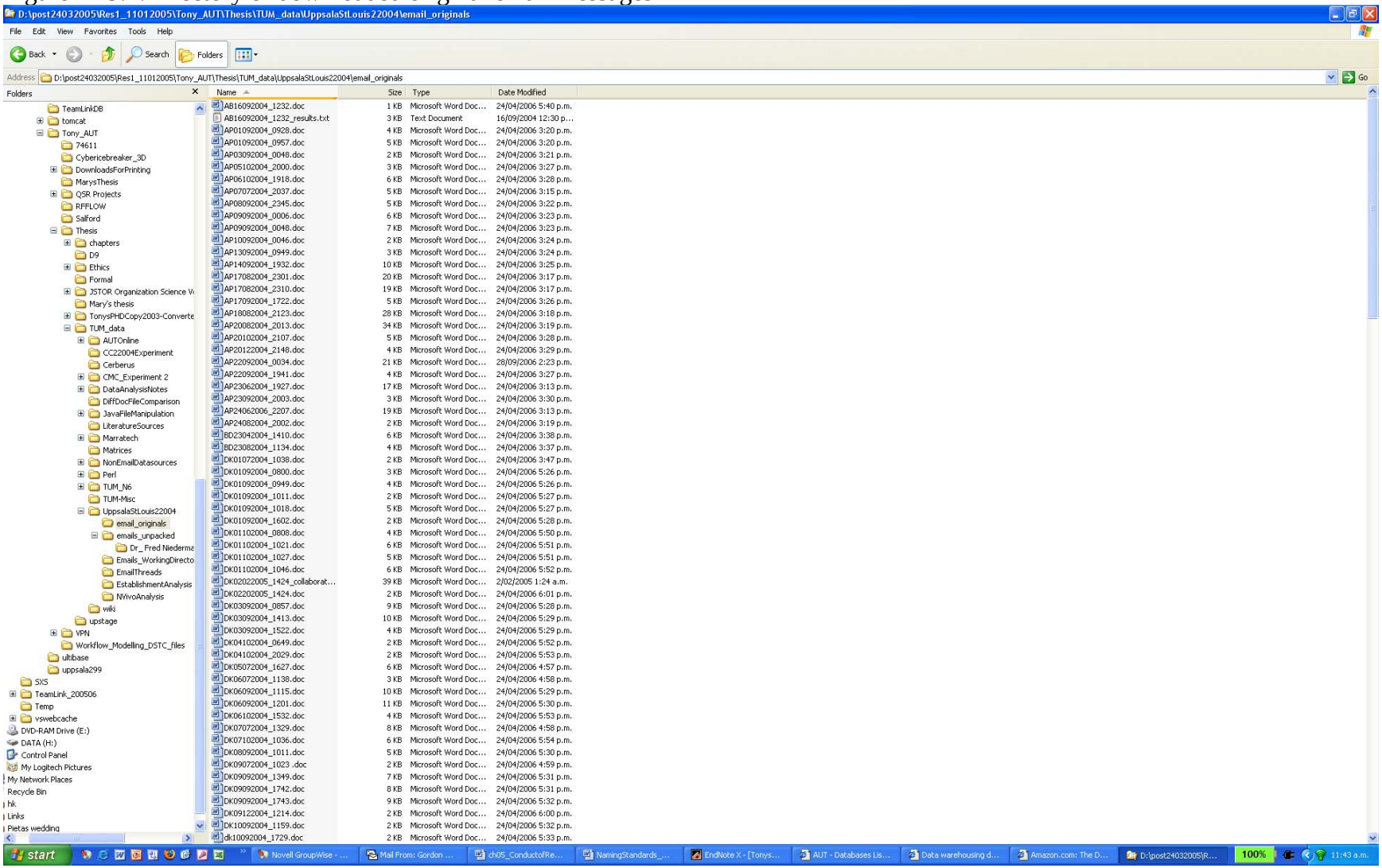


Figure A19.3: Directory of message sequences and unpacked message segments

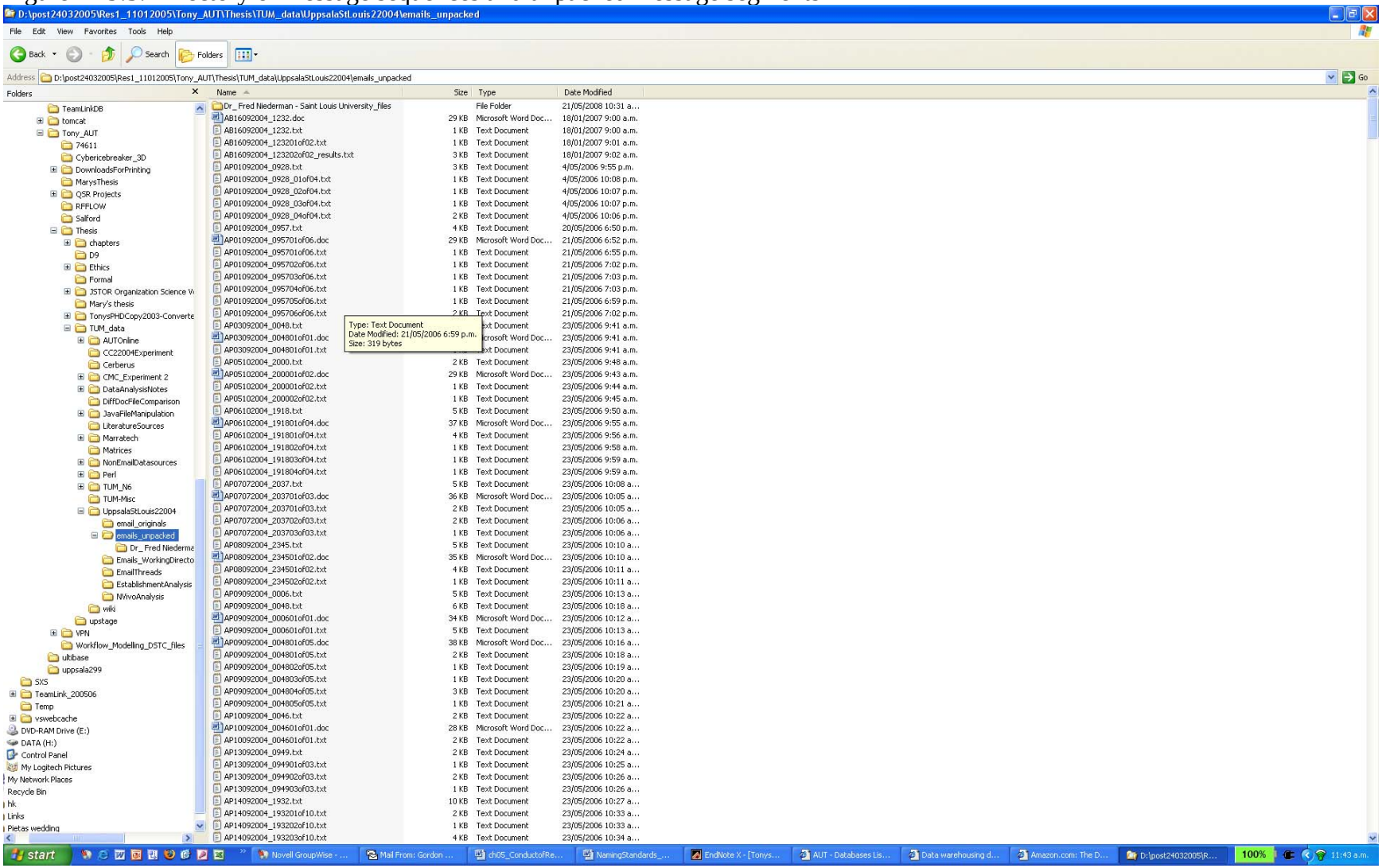


Figure A19.4: Directory of unpacked segments for importing into NVivo

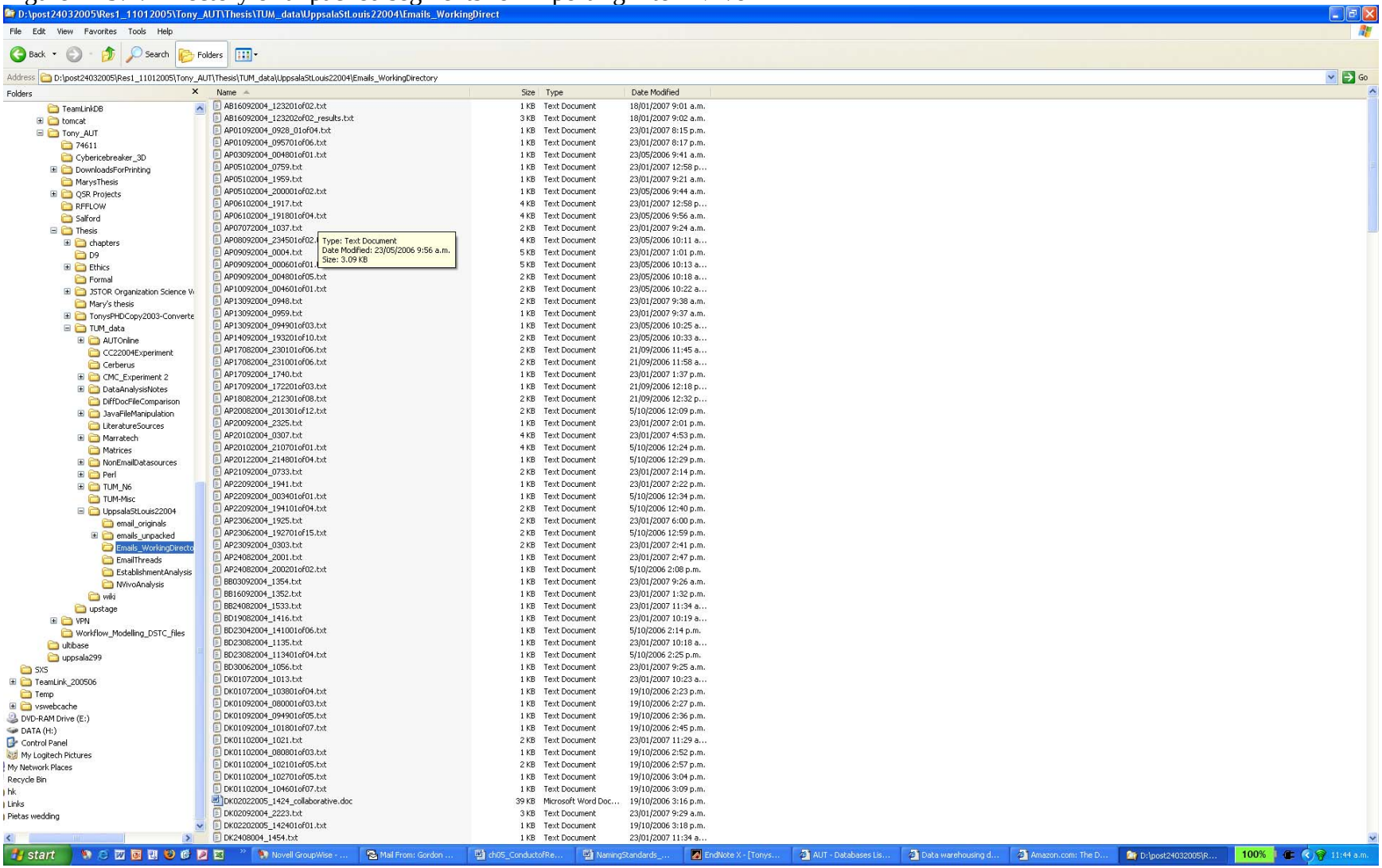


Figure A19.5: Directory of Documents Imported into NVivo

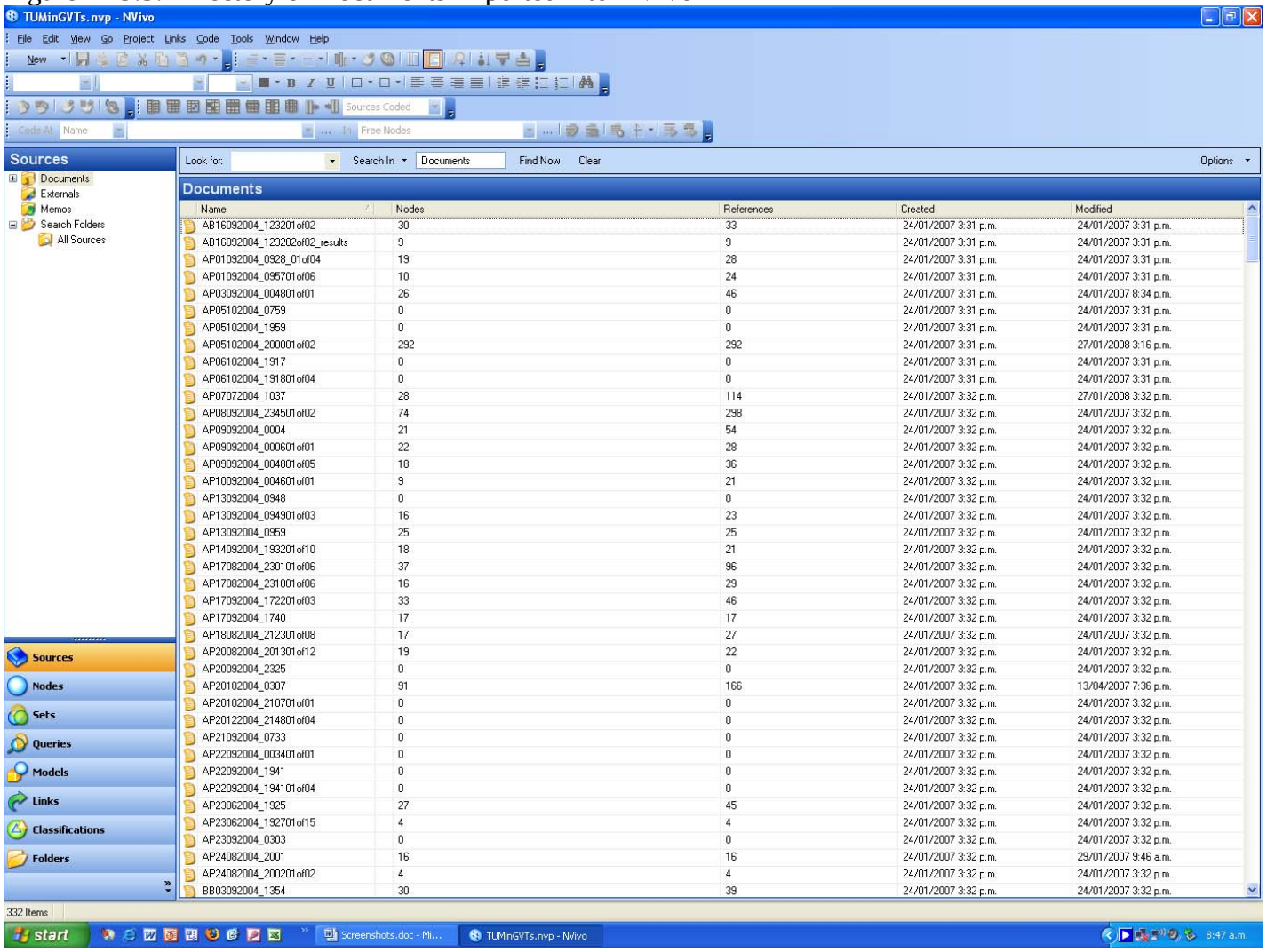


Figure A19.6: Subdirectory of Literature Sources Imported into NVivo

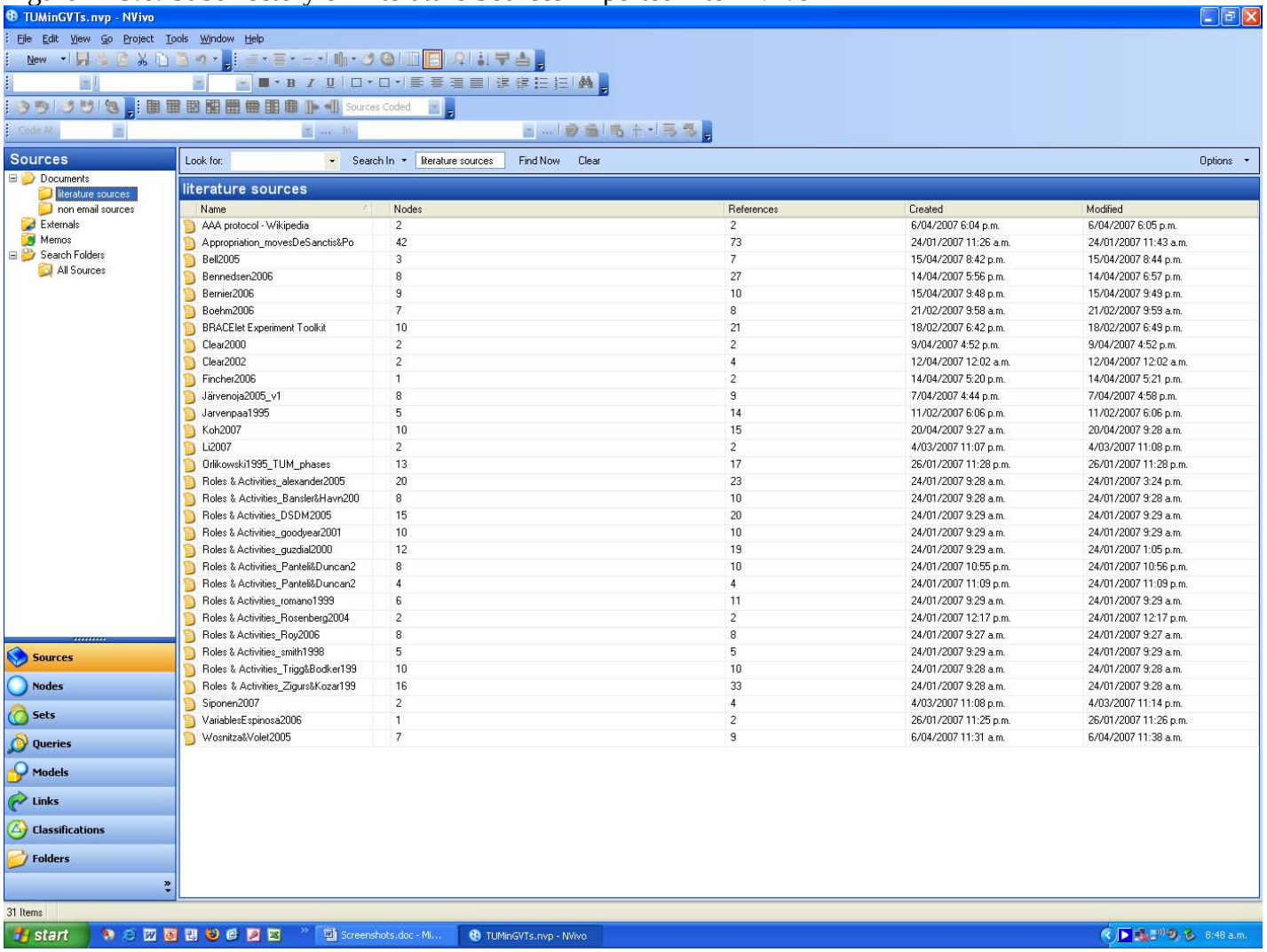


Figure A19.7: Subdirectory of Non Email Sources Imported into NVivo

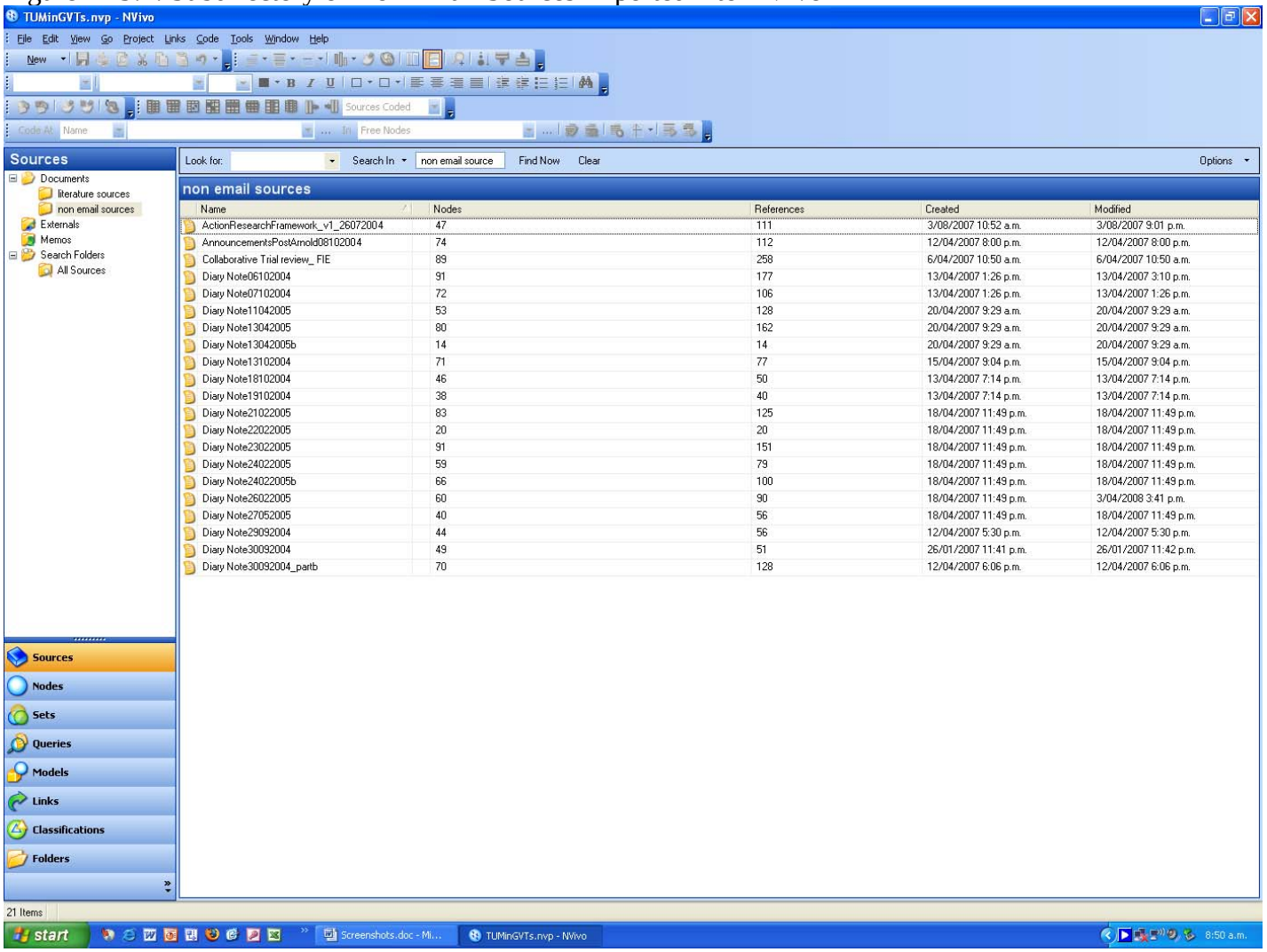


Figure A19.8: Sets Created in NVivo for each Episode - Adjustment-Reinforcement Episode 1 Sources

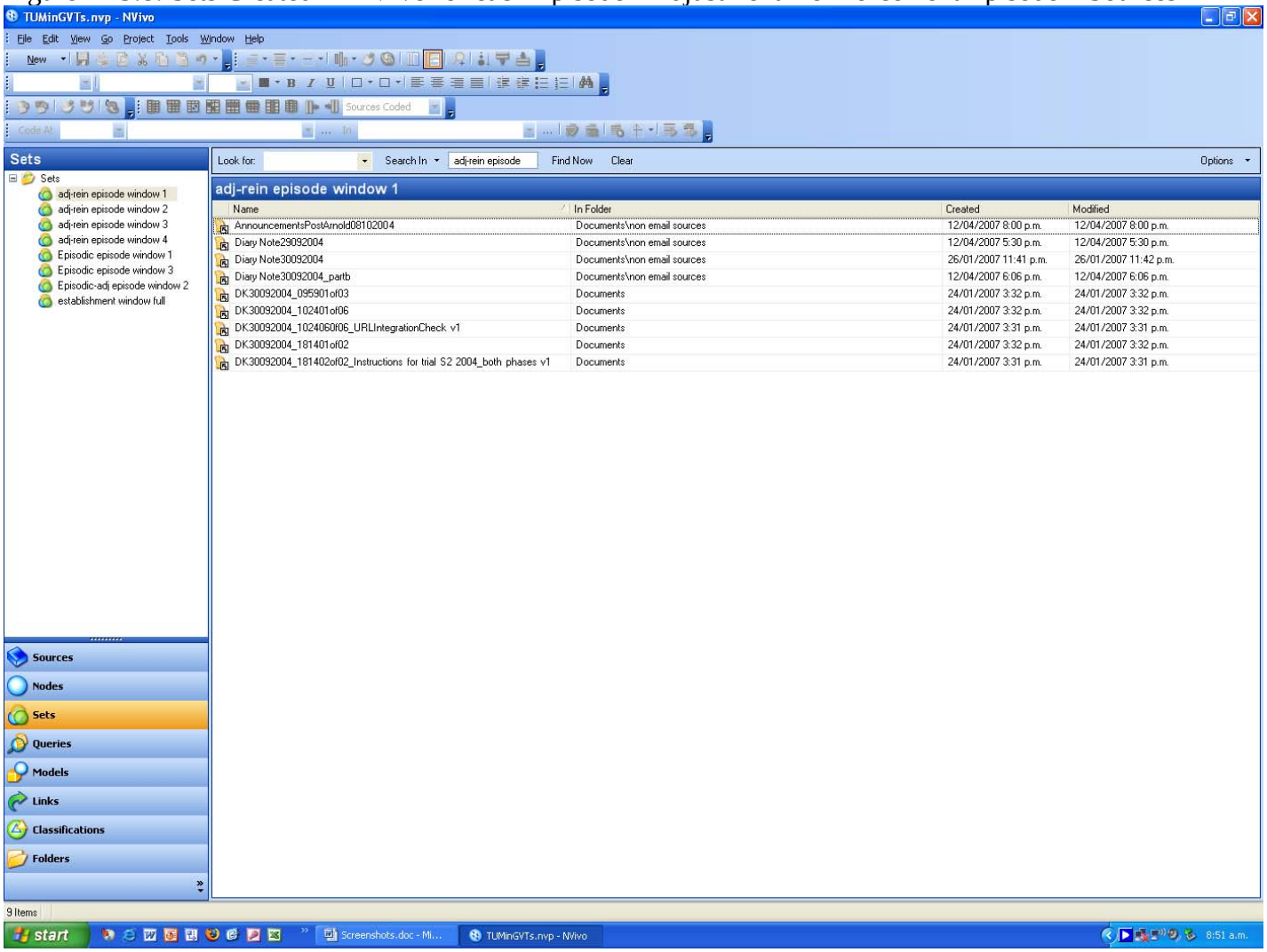


Figure A19.9: Sets Created in NVivo for each Episode – Adjustment-Reinforcement Episode 2 Sources

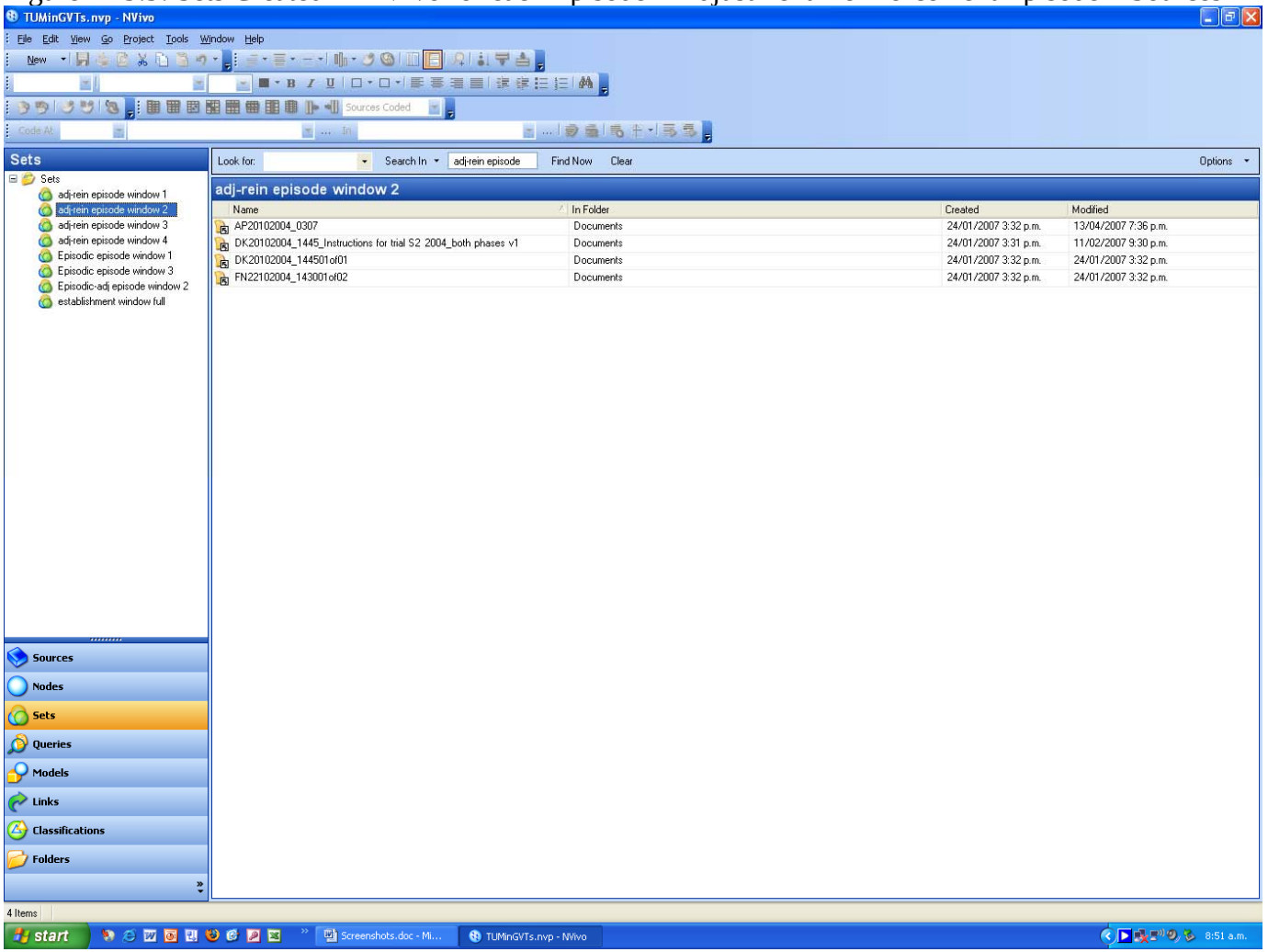


Figure A19.10: Sets Created in NVivo for each Episode – Adjustment-Reinforcement Episode 3 Sources

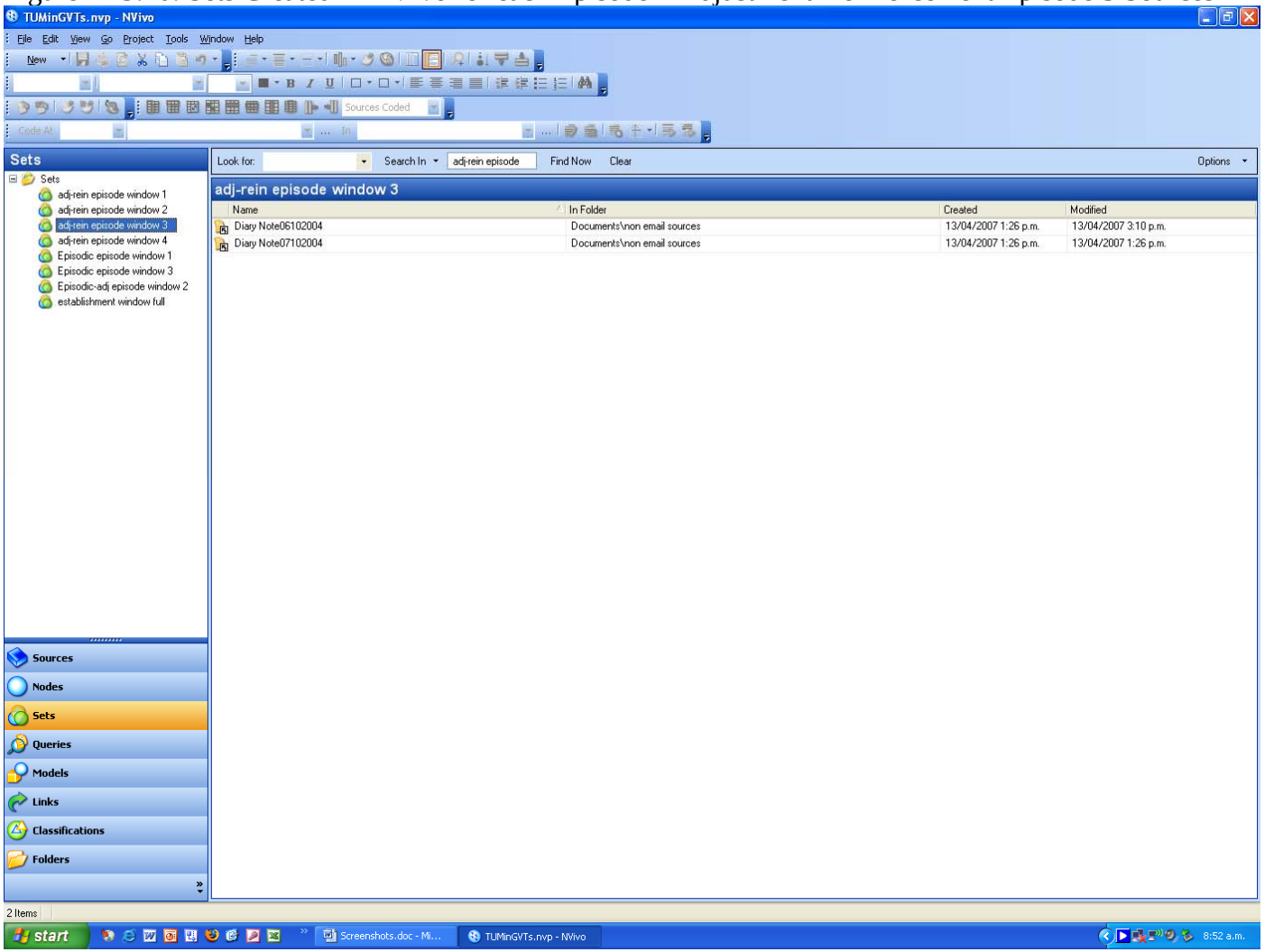


Figure A19.11: Sets Created in NVivo for each Episode – Adjustment-Reinforcement Episode 4 Sources

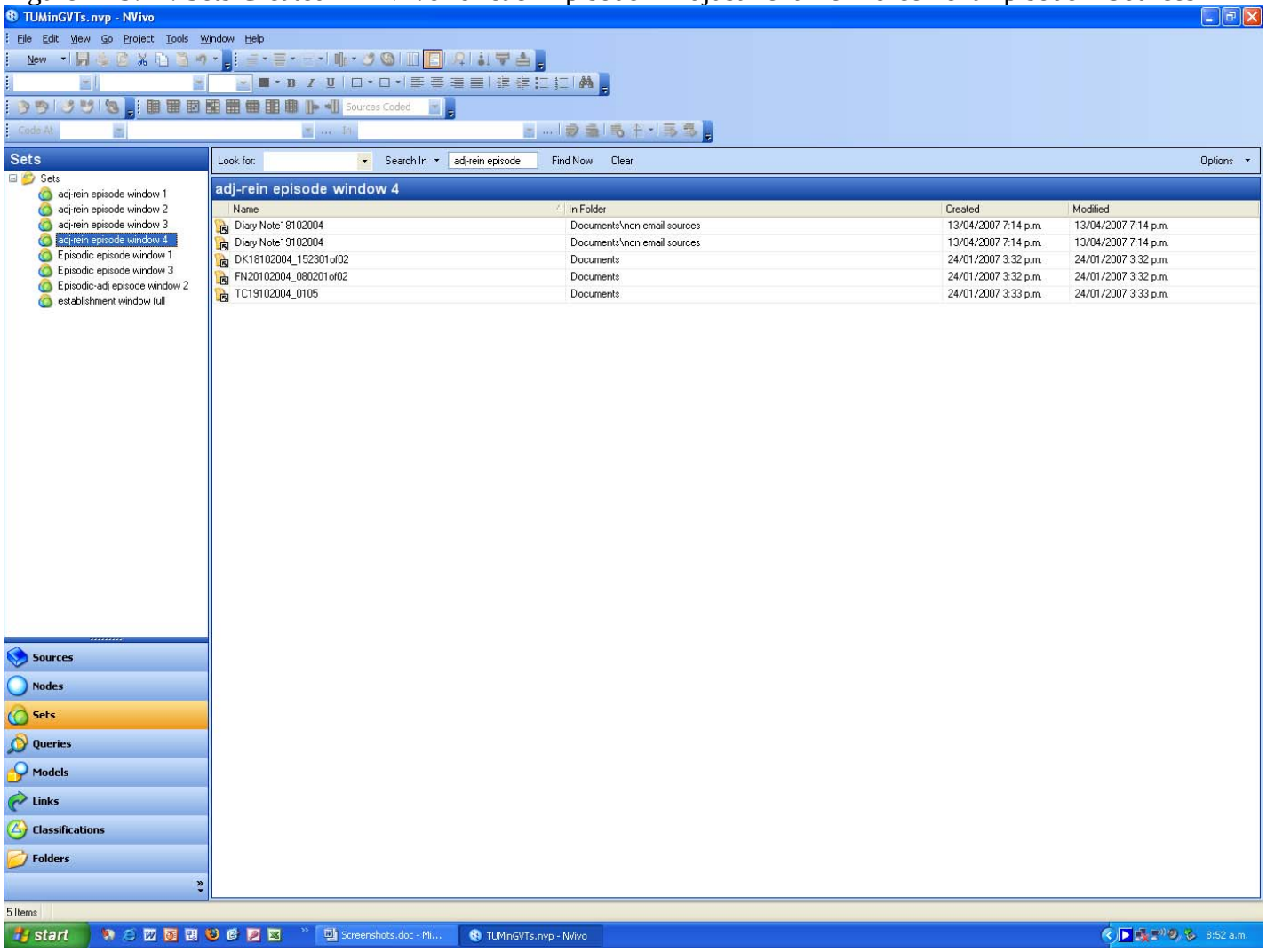


Figure A19.12: Sets Created in NVivo for each Episode – Episodic Change Episode 1 Sources

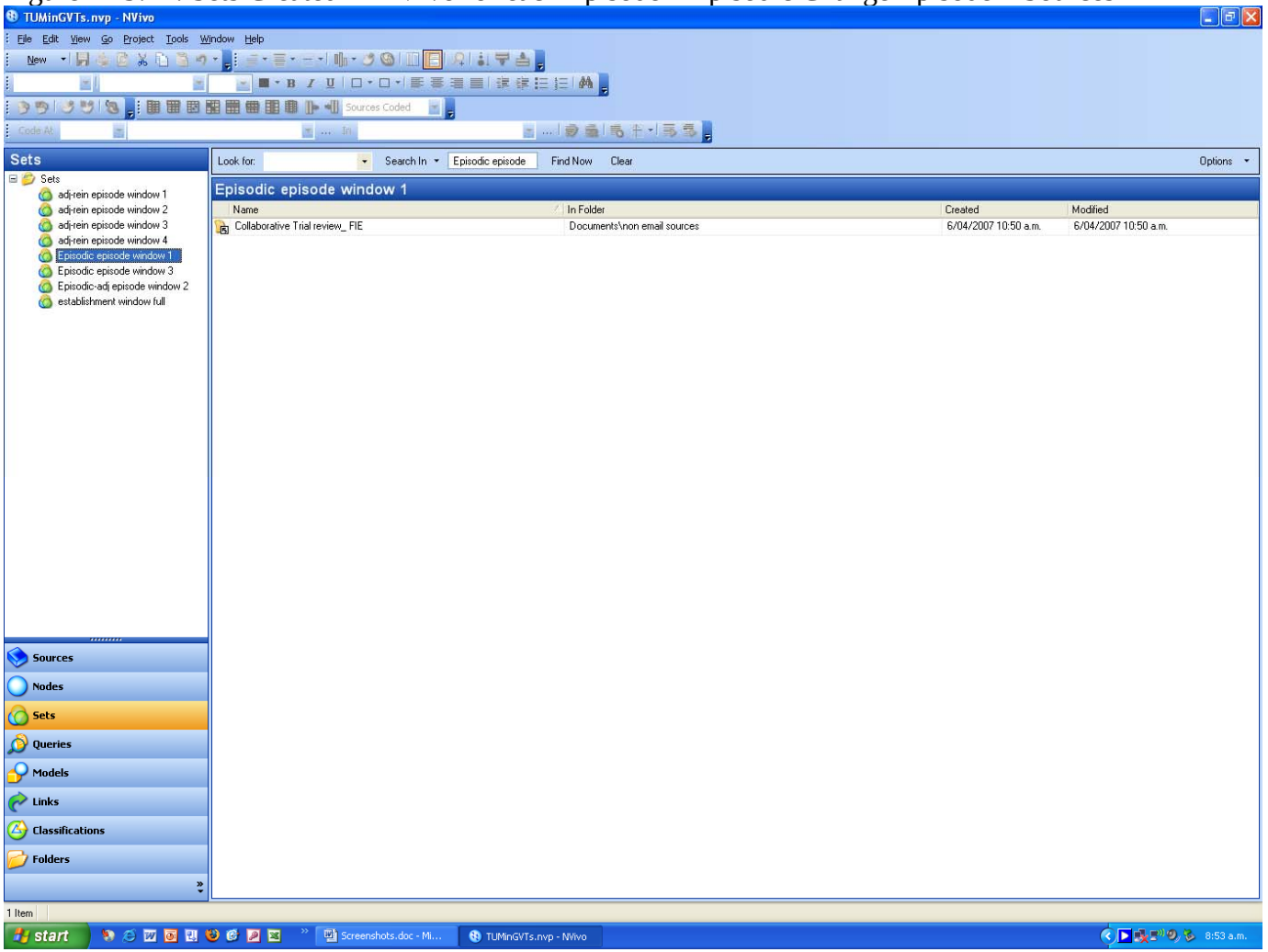


Figure A19.13: Sets Created in NVivo for each Episode – Episodic Change Episode 3 Sources

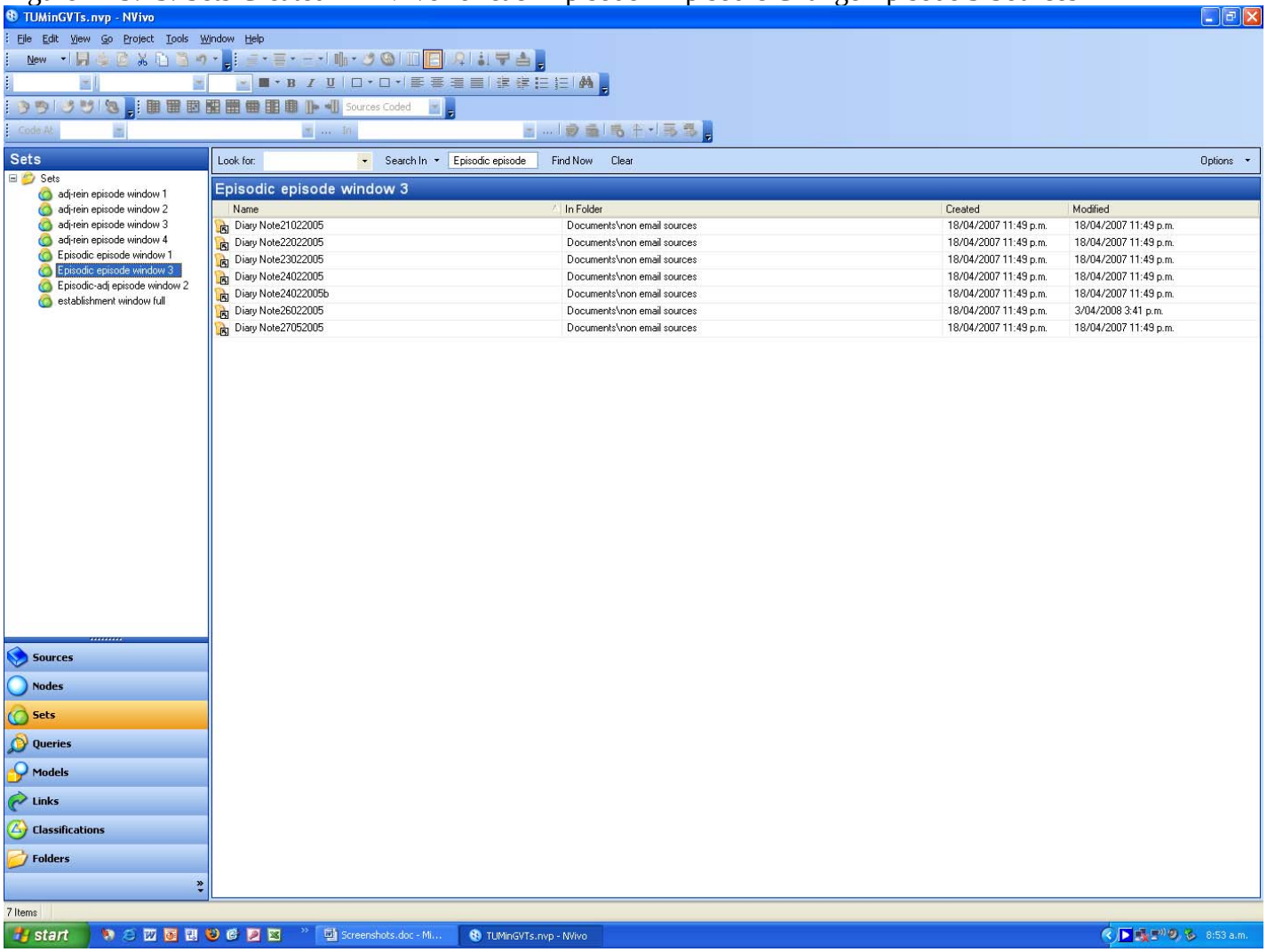


Figure A19.14: Sets Created in NVivo for each Episode – Episodic Change-Adjustment Episode 2 Sources

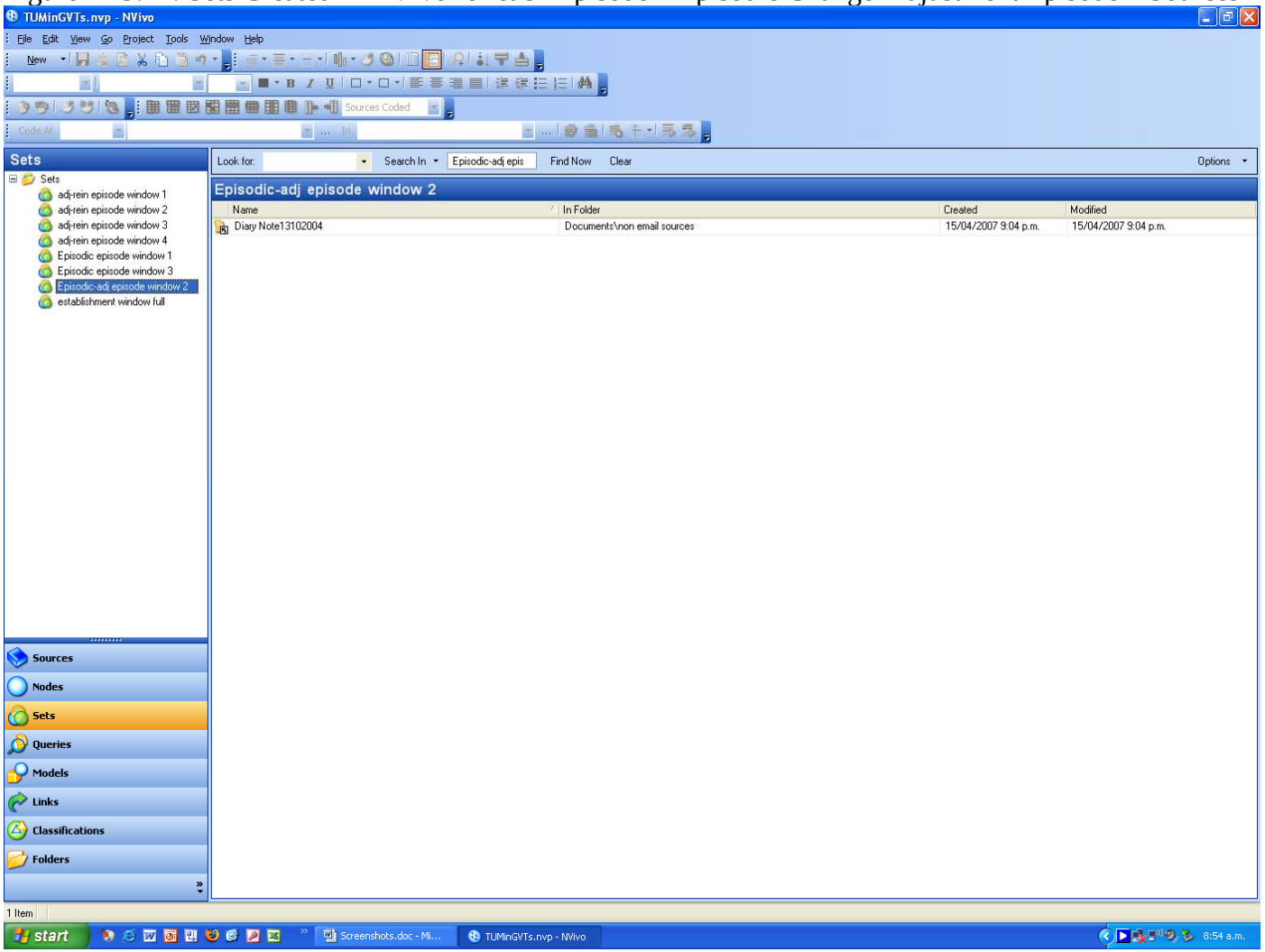


Figure A19.15: Sets Created in NVivo for each Episode – Establishment Episode Sources

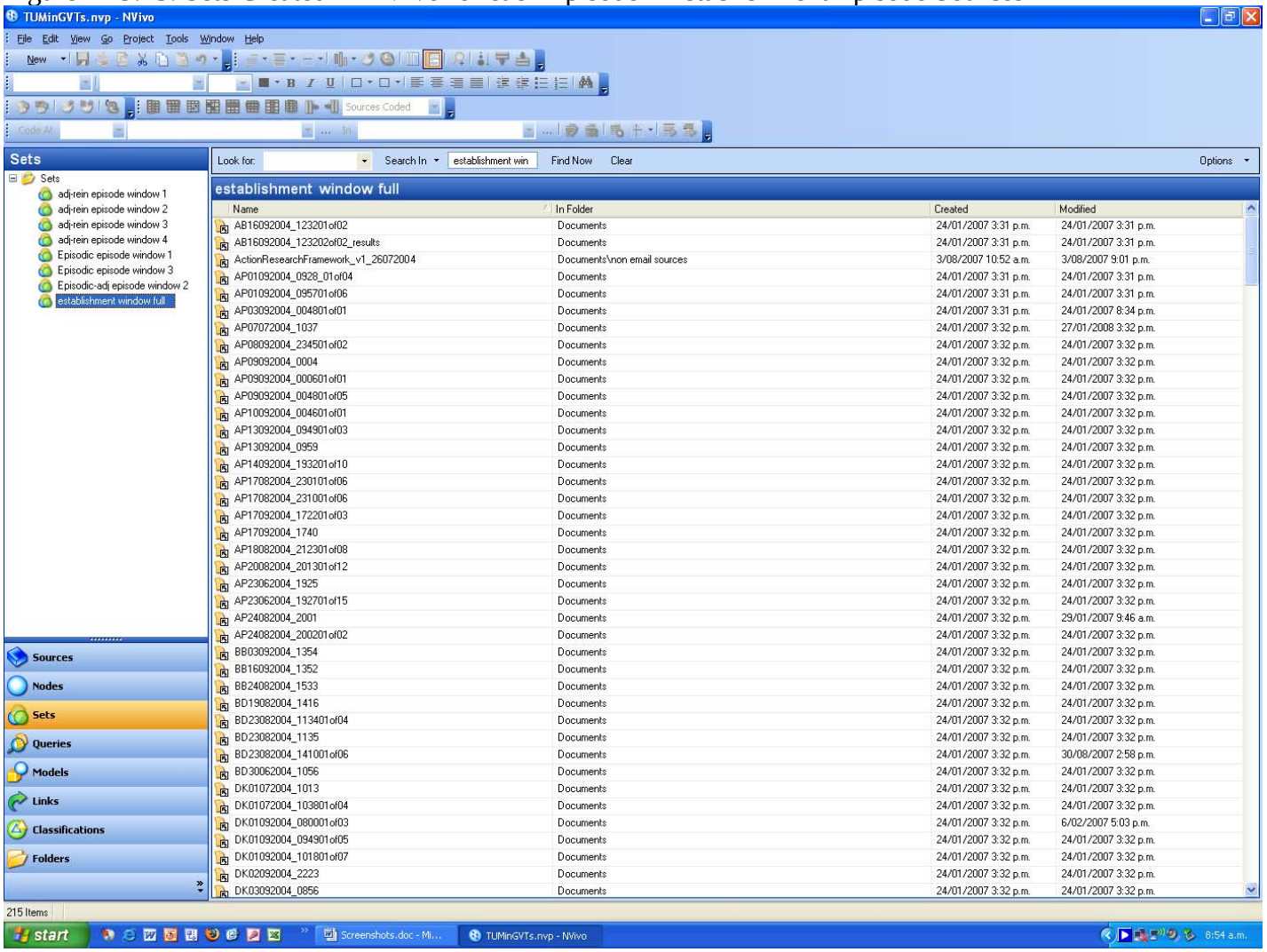


Figure A19.16: NVivo Coded Tree Nodes – Top Level

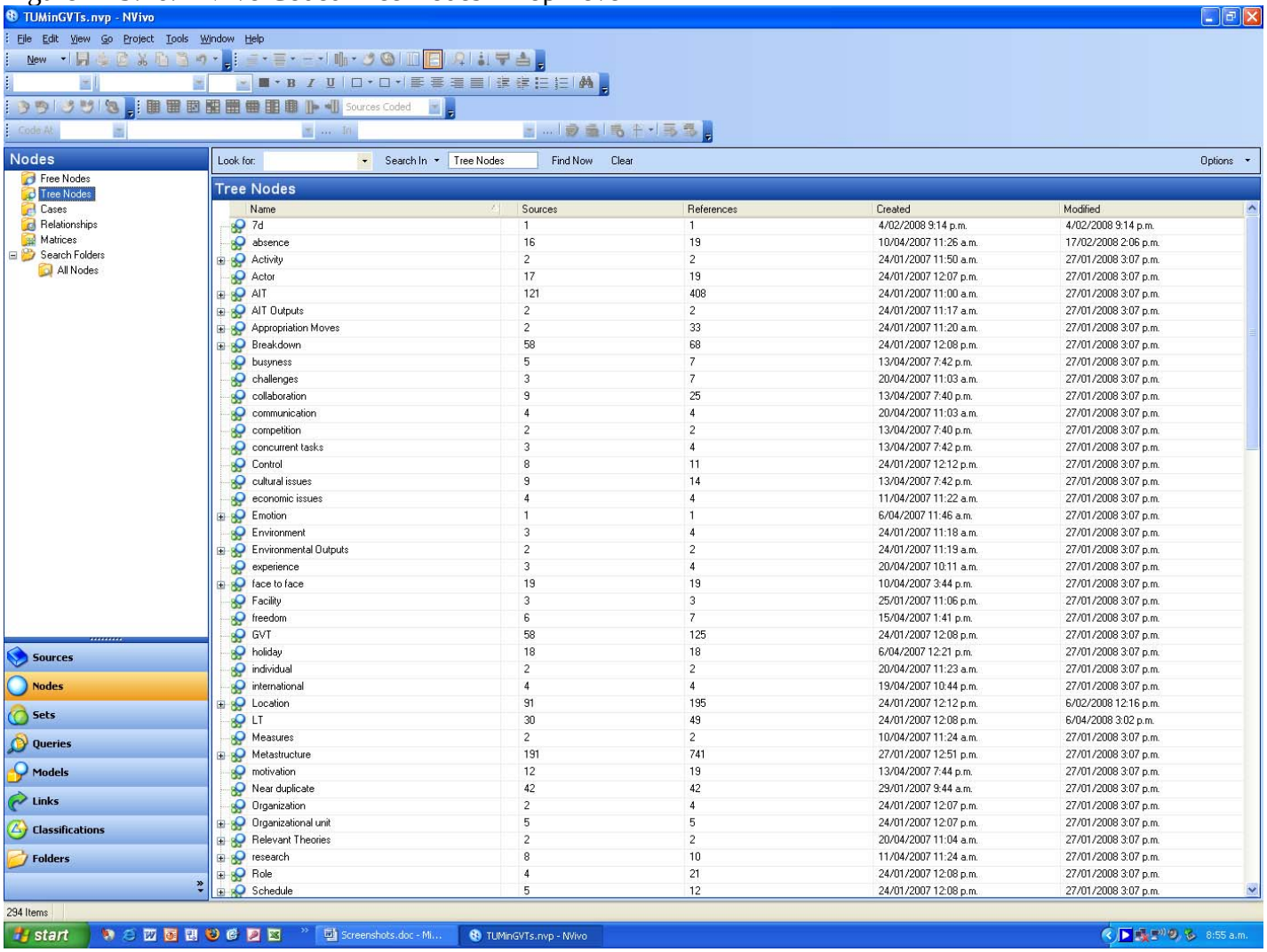


Figure A19.17: NVivo Coded Tree Nodes – Hierarchy for Constraint Appropriation Moves

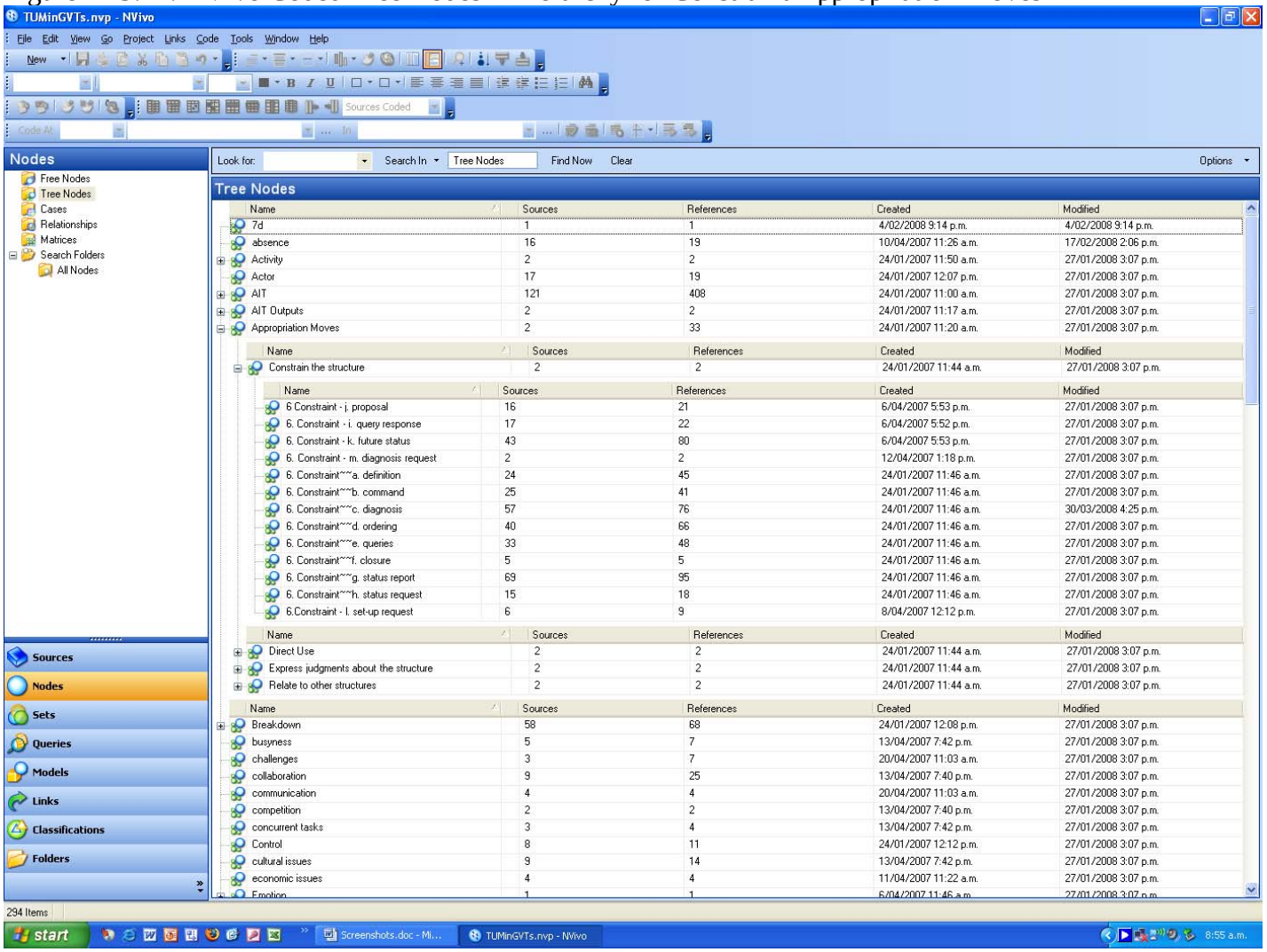


Figure A19.18: NVivo Free Nodes

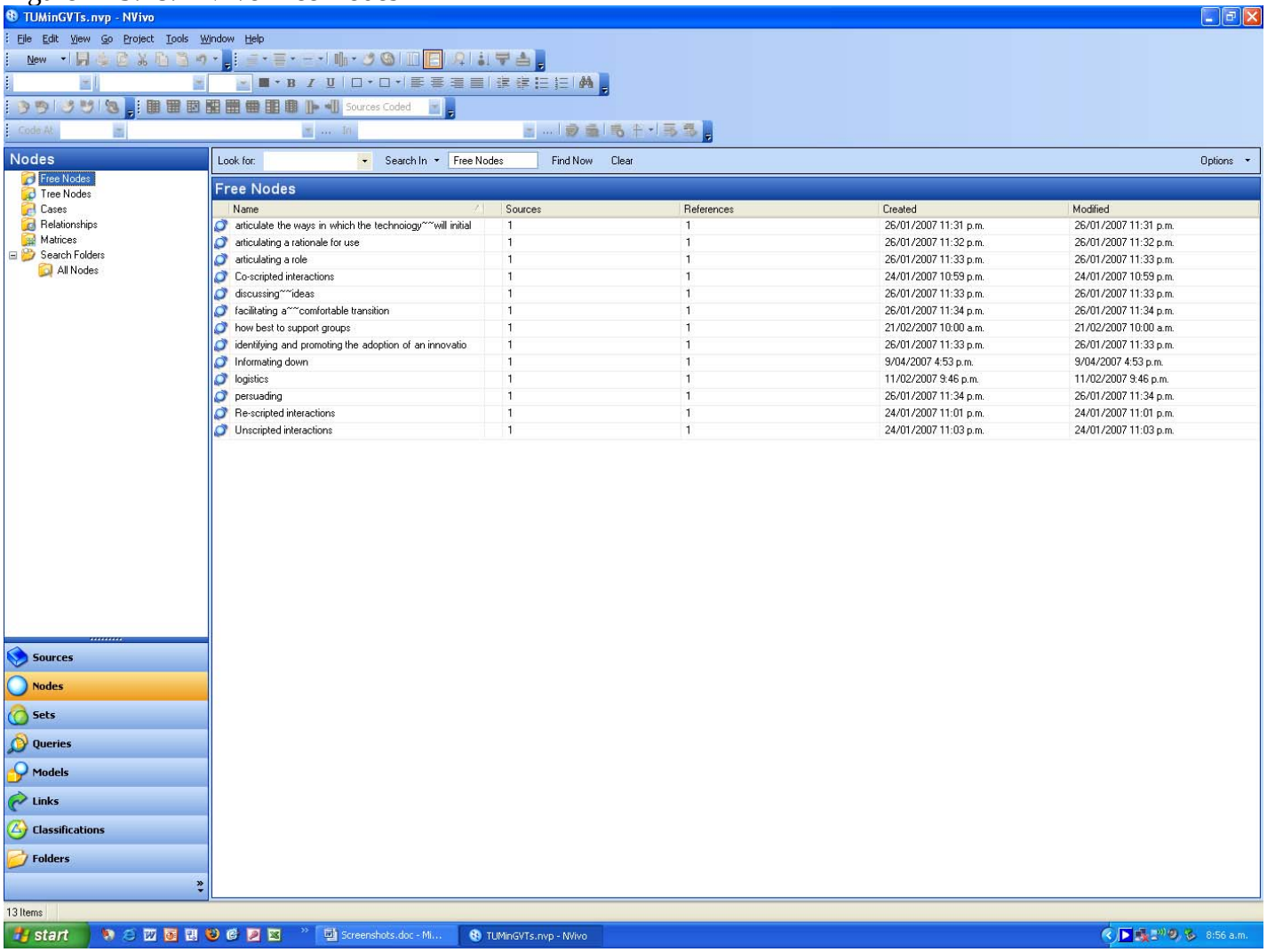


Figure A19.19: NVivo Queries

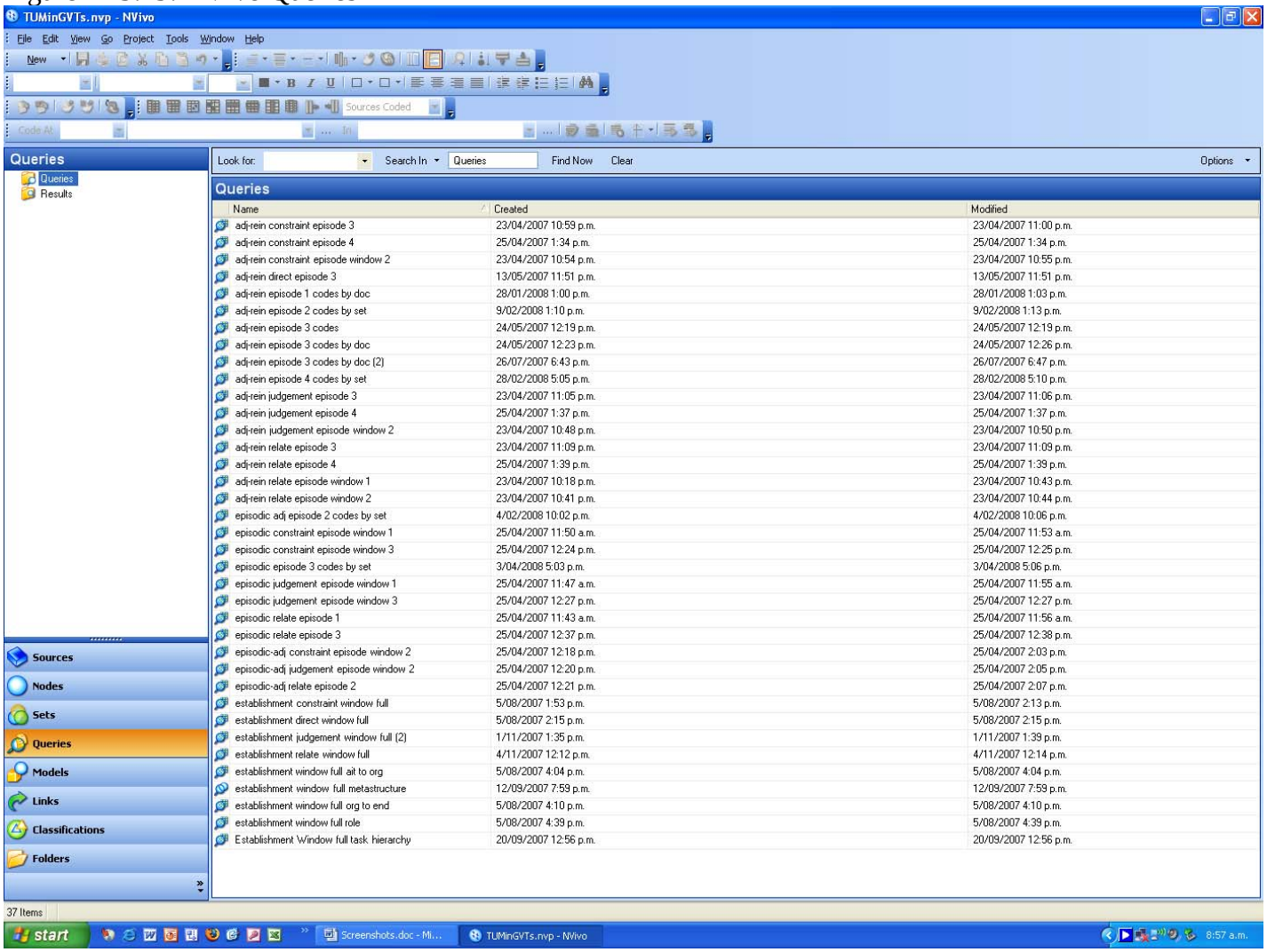


Figure A19.20: NVivo Query Results

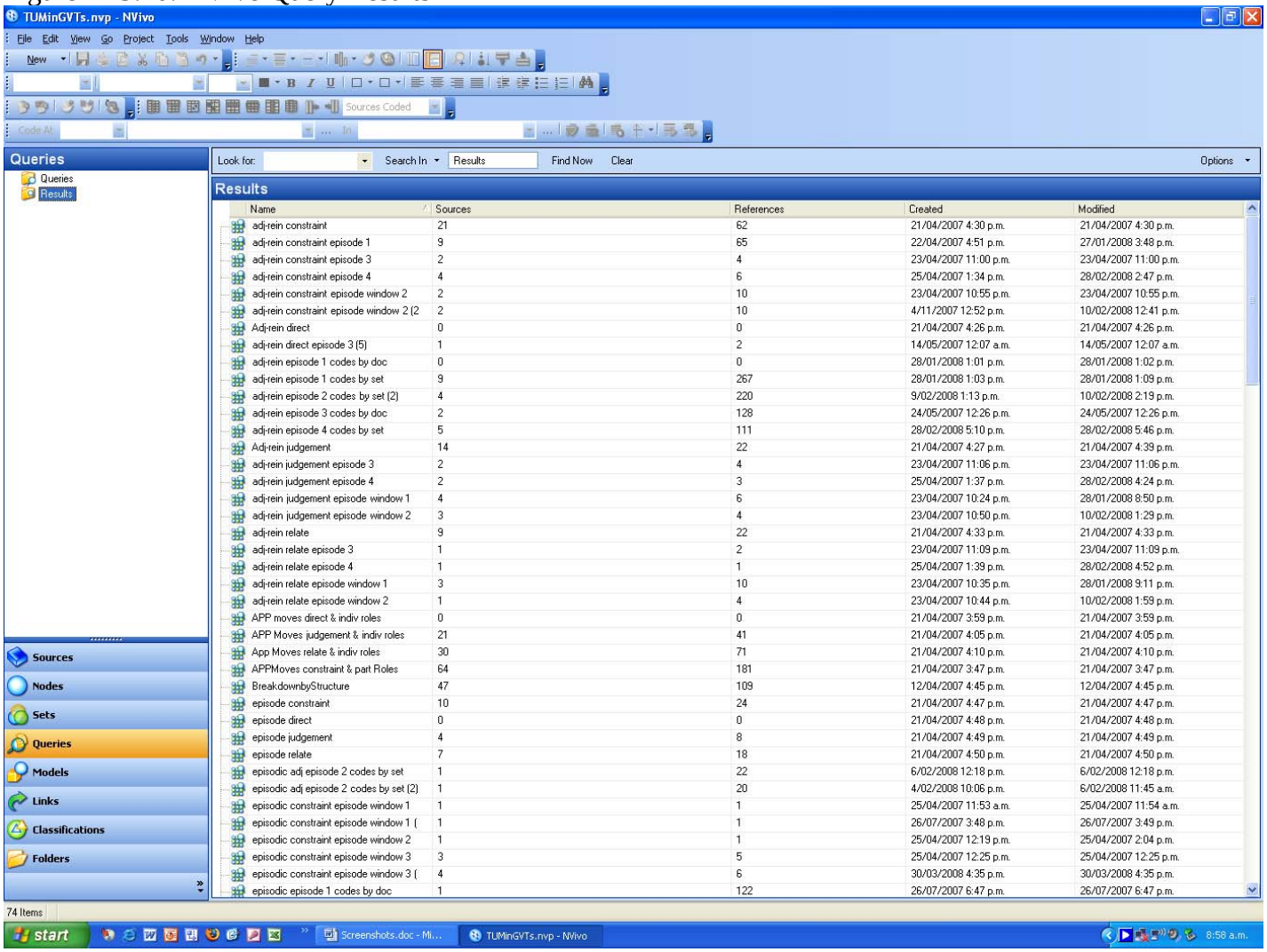


Figure A19.21: NVivo Matrix Query Properties

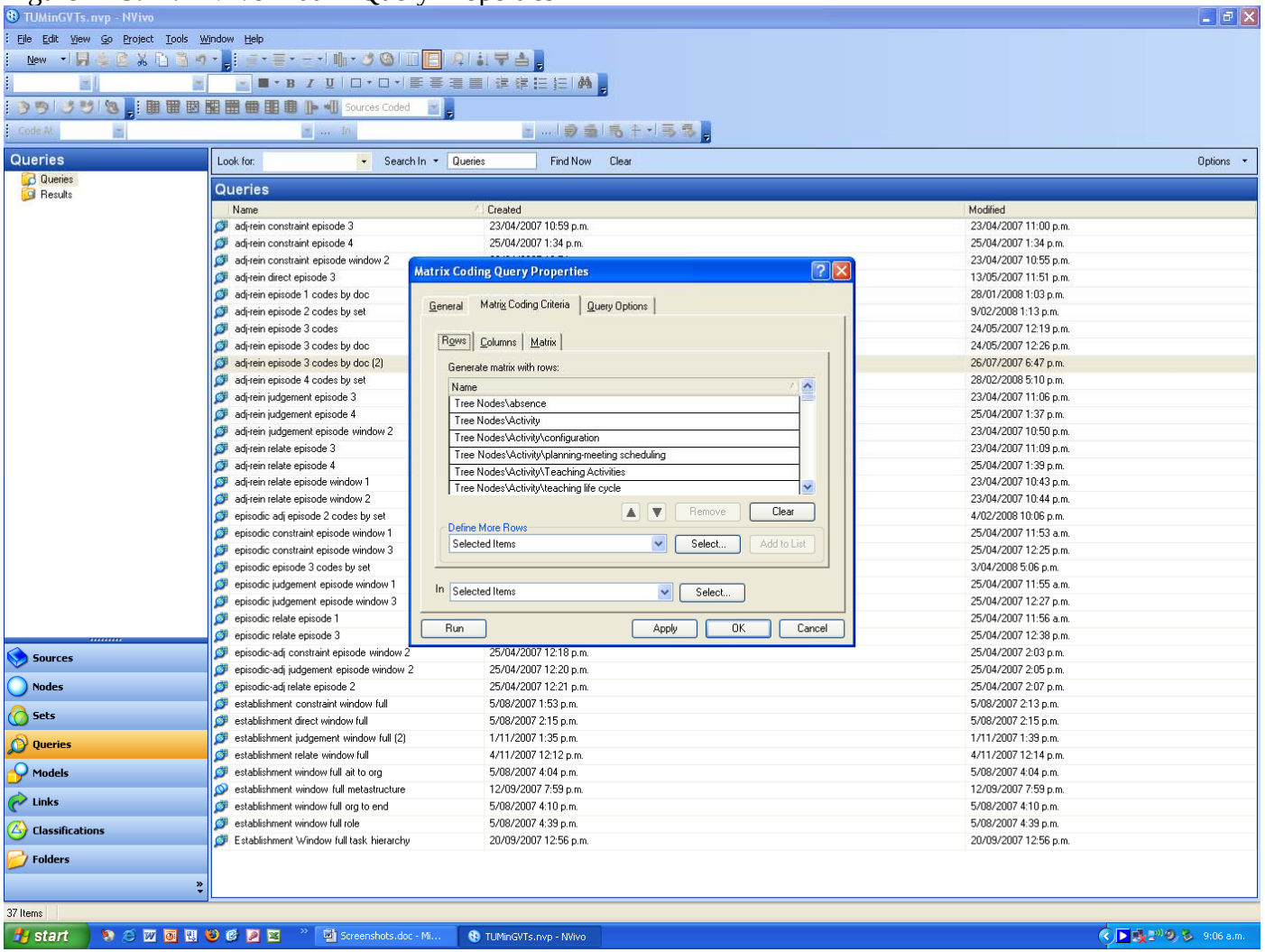


Figure A19.22: Query Results For Adj-Rein Constraint Episode 2

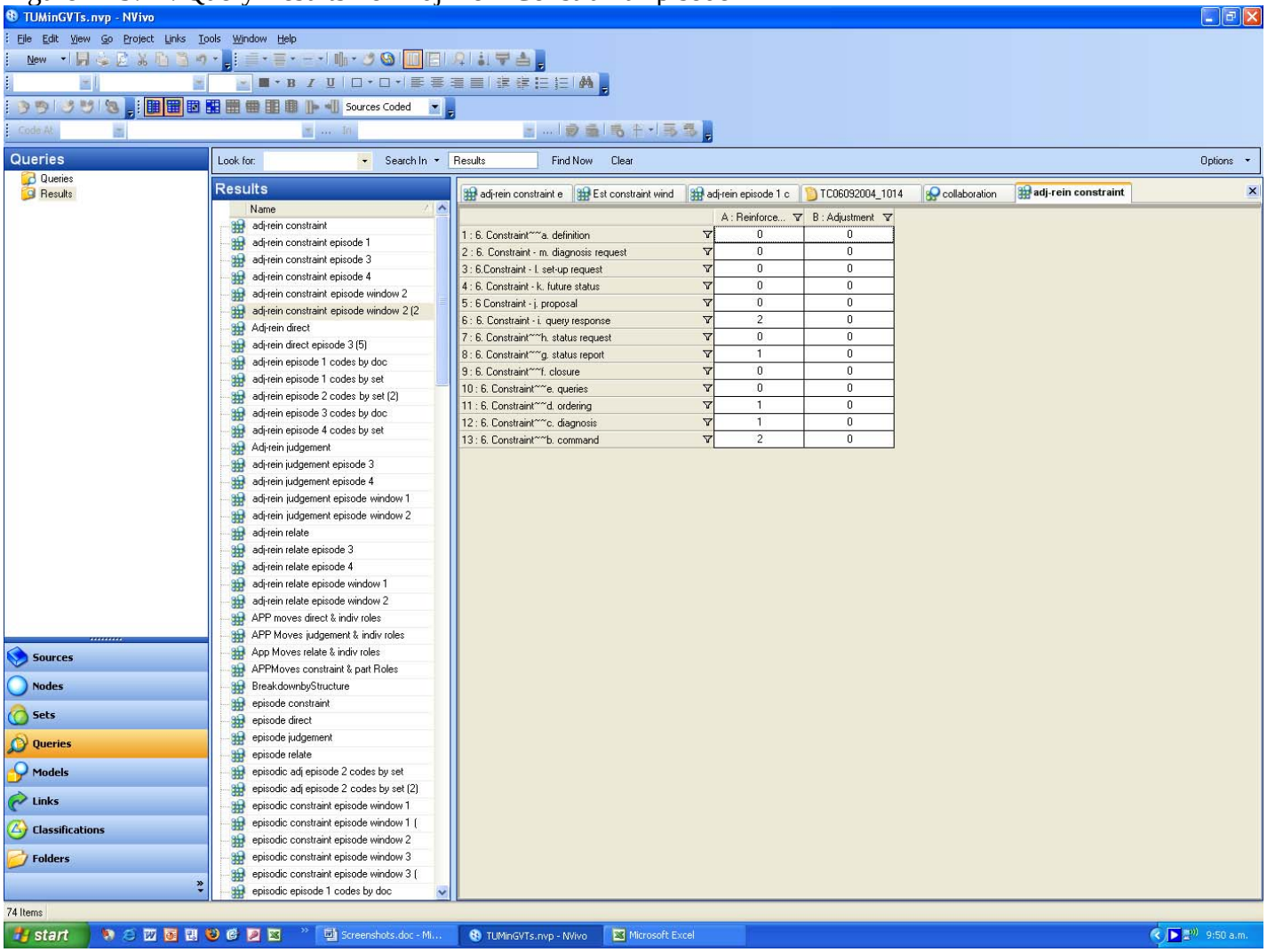


Figure A19.23: Query Results For Establishment Episode (Null Cells Removed)

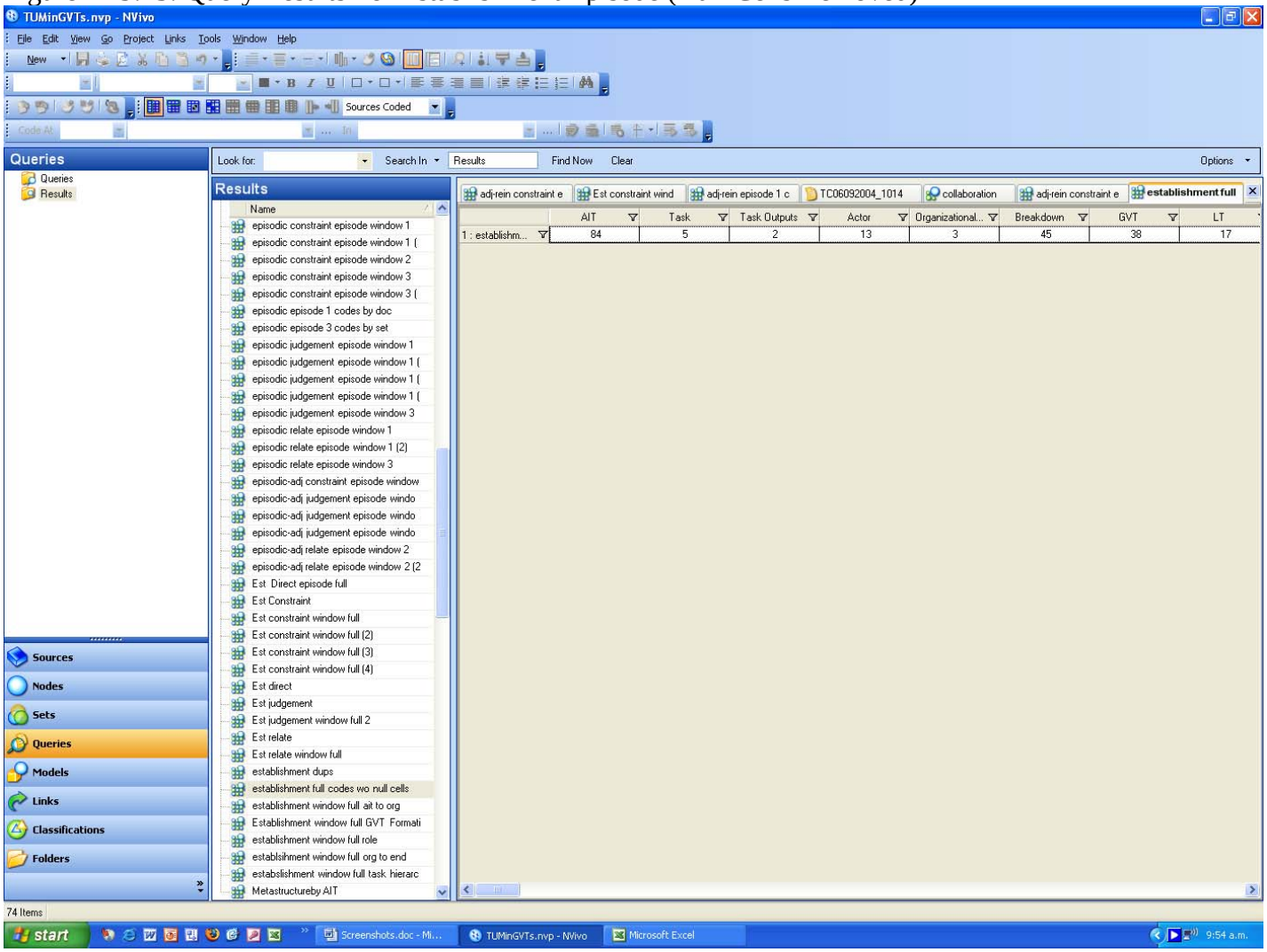


Figure A19.24: Query Results For Establishment Episode – Sample Data Drill Down on ‘AIT’ Code

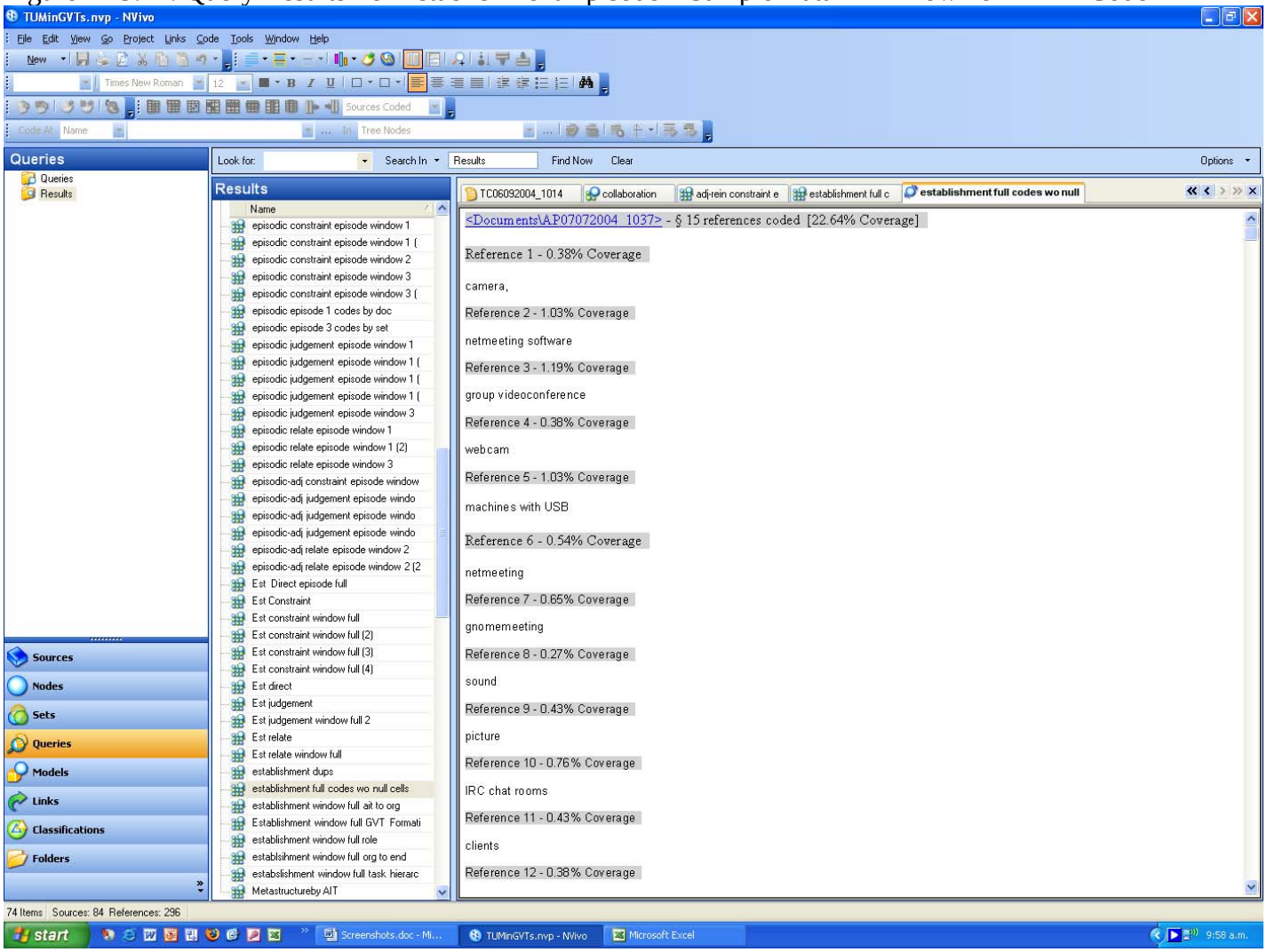
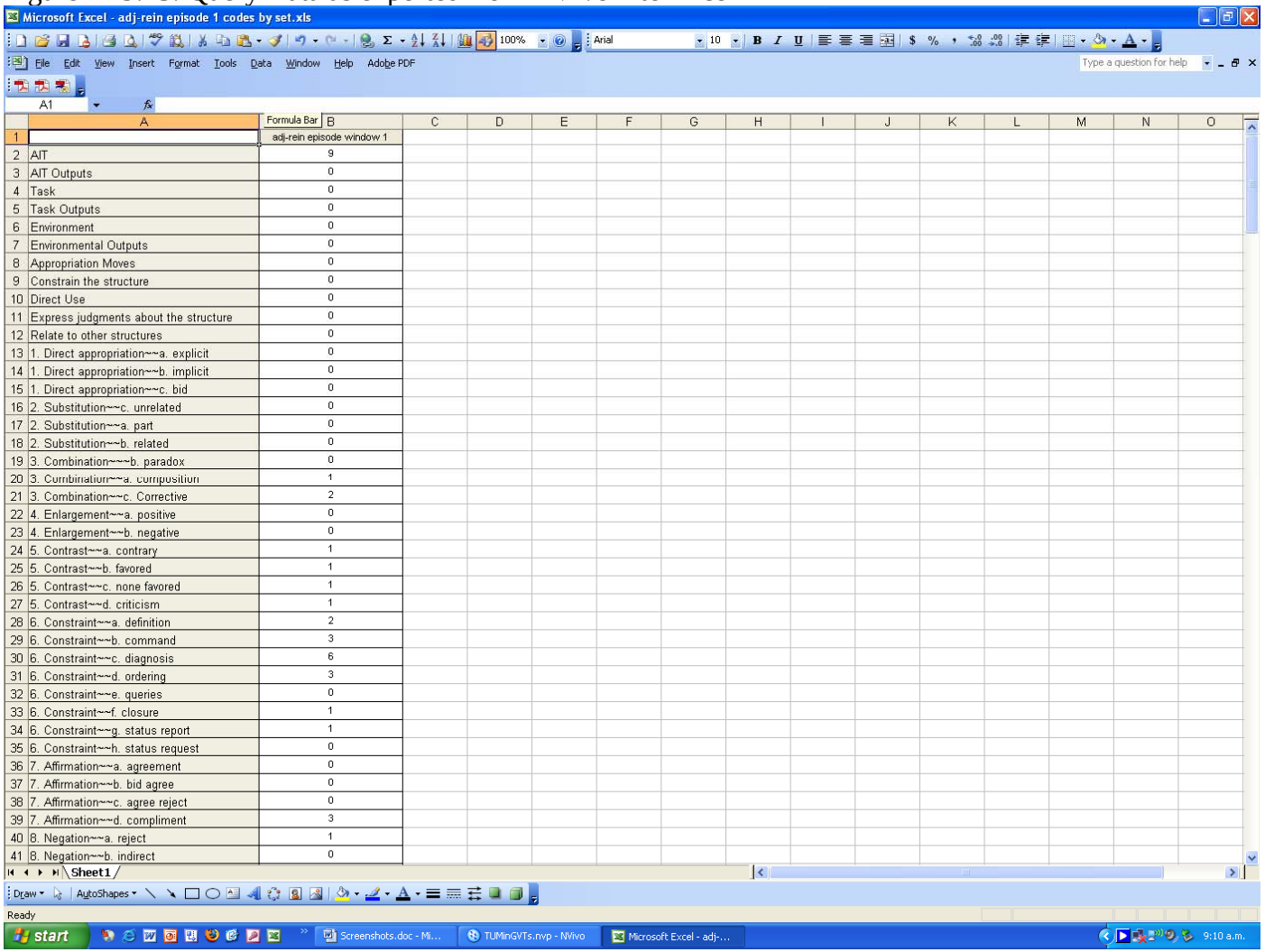


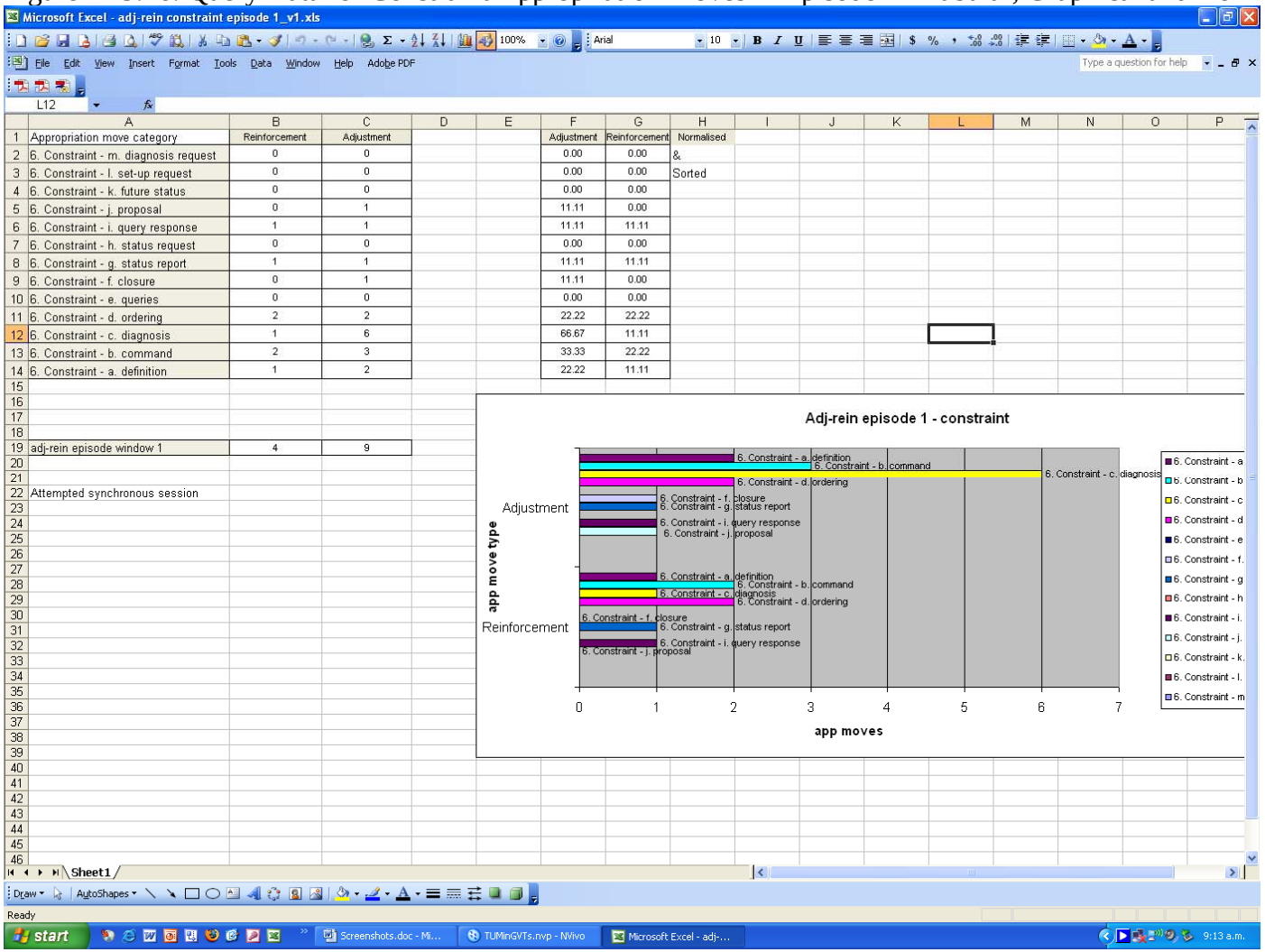
Figure A19.25: Query Data as exported from NVivo into Excel



Microsoft Excel - adj-rein episode 1 codes by set.xls

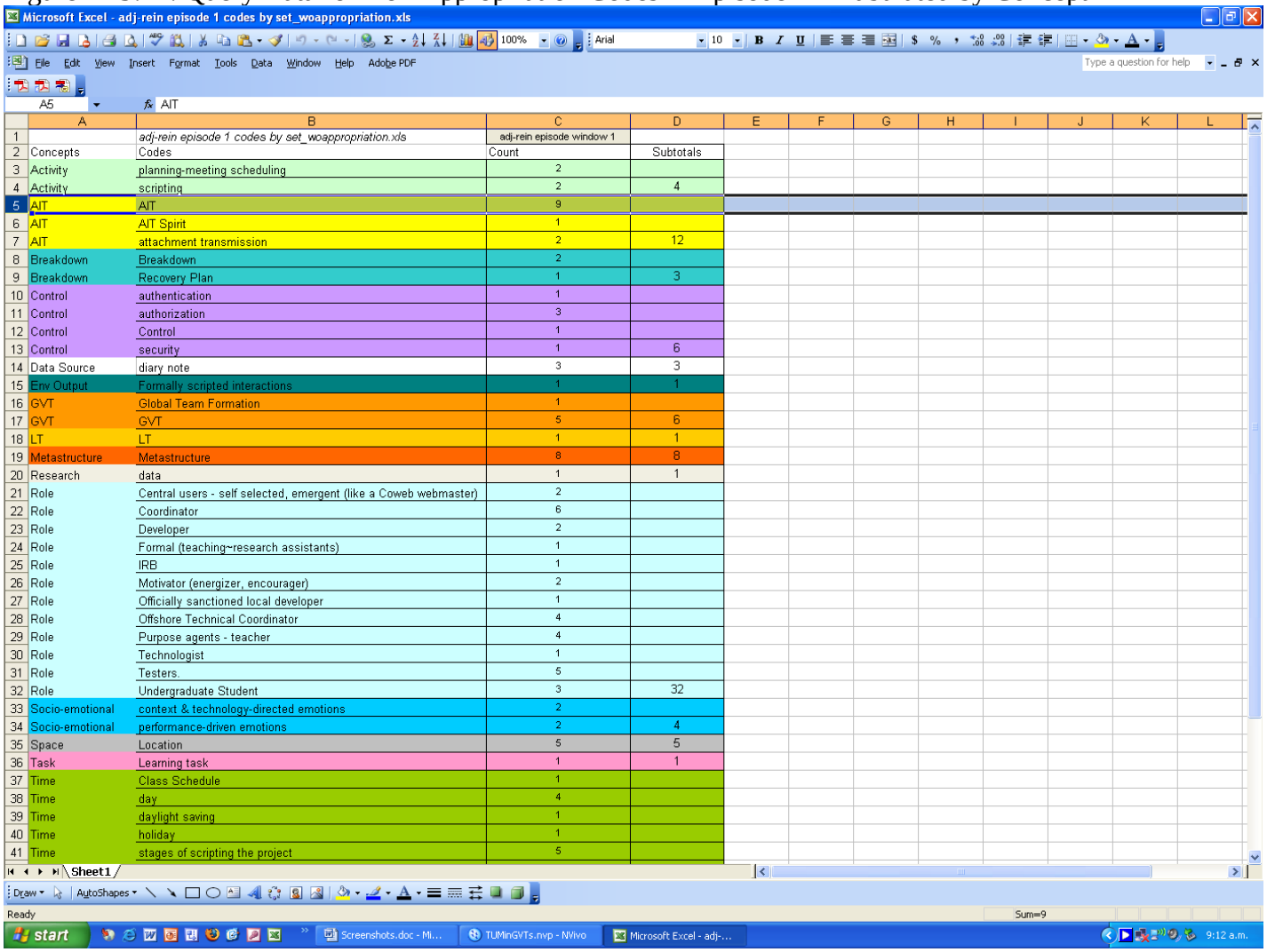
	A	B
1		adj-rein episode window 1
2	AIT	9
3	AIT Outputs	0
4	Task	0
5	Task Outputs	0
6	Environment	0
7	Environmental Outputs	0
8	Appropriation Moves	0
9	Constrain the structure	0
10	Direct Use	0
11	Express judgments about the structure	0
12	Relate to other structures	0
13	1. Direct appropriation~~a. explicit	0
14	1. Direct appropriation~~b. implicit	0
15	1. Direct appropriation~~c. bid	0
16	2. Substitution~~c. unrelated	0
17	2. Substitution~~a. part	0
18	2. Substitution~~b. related	0
19	3. Combination~~~b. paradox	0
20	3. Combination~~a. composition	1
21	3. Combination~~c. Corrective	2
22	4. Enlargement~~a. positive	0
23	4. Enlargement~~b. negative	0
24	5. Contrast~~a. contrary	1
25	5. Contrast~~b. favored	1
26	5. Contrast~~c. none favored	1
27	5. Contrast~~d. criticism	1
28	6. Constraint~~a. definition	2
29	6. Constraint~~b. command	3
30	6. Constraint~~c. diagnosis	6
31	6. Constraint~~d. ordering	3
32	6. Constraint~~e. queries	0
33	6. Constraint~~f. closure	1
34	6. Constraint~~g. status report	1
35	6. Constraint~~h. status request	0
36	7. Affirmation~~a. agreement	0
37	7. Affirmation~~b. bid agree	0
38	7. Affirmation~~c. agree reject	0
39	7. Affirmation~~d. compliment	3
40	8. Negation~~a. reject	1
41	8. Negation~~b. indirect	0

Figure A19.26: Query Data for Constraint Appropriation Moves in Episode 1 - Tabular, Graphical and Normalised Formats



	A	B	C	F	G	H
1	Appropriation move category	Reinforcement	Adjustment	Adjustment	Reinforcement	Normalised
2	6. Constraint - m. diagnosis request	0	0	0.00	0.00	&
3	6. Constraint - l. set-up request	0	0	0.00	0.00	Sorted
4	6. Constraint - k. future status	0	0	0.00	0.00	
5	6. Constraint - j. proposal	0	1	11.11	0.00	
6	6. Constraint - i. query response	1	1	11.11	11.11	
7	6. Constraint - h. status request	0	0	0.00	0.00	
8	6. Constraint - g. status report	1	1	11.11	11.11	
9	6. Constraint - f. closure	0	1	11.11	0.00	
10	6. Constraint - e. queries	0	0	0.00	0.00	
11	6. Constraint - d. ordering	2	2	22.22	22.22	
12	6. Constraint - c. diagnosis	1	6	66.67	11.11	
13	6. Constraint - b. command	2	3	33.33	22.22	
14	6. Constraint - a. definition	1	2	22.22	11.11	
19	adj-rein episode window 1	4	9			
22	Attempted synchronous session					

Figure A19.27: Query Data for Non Appropriation Codes in Episode 1 – Tabulated by Concept



Microsoft Excel - adj-rein episode 1 codes by set_woappropriation.xls

	A	B	C	D
1		*adj-rein episode 1 codes by set_woappropriation.xls*	adj-rein episode window 1	
2	Concepts	Codes	Count	Subtotals
3	Activity	planning-meeting scheduling	2	
4	Activity	scripting	2	4
5	AIT	AIT	9	
6	AIT	AIT Spirit	1	
7	AIT	attachment transmission	2	12
8	Breakdown	Breakdown	2	
9	Breakdown	Recovery Plan	1	3
10	Control	authentication	1	
11	Control	authorization	3	
12	Control	Control	1	
13	Control	security	1	6
14	Data Source	diary note	3	3
15	Env Output	Formally scripted interactions	1	1
16	GVT	Global Team Formation	1	
17	GVT	GVT	5	6
18	LT	LT	1	1
19	Metastructure	Metastructure	8	8
20	Research	data	1	1
21	Role	Central users - self selected, emergent (like a Coweb webmaster)	2	
22	Role	Coordinator	6	
23	Role	Developer	2	
24	Role	Formal (teaching~research assistants)	1	
25	Role	IRB	1	
26	Role	Motivator (energizer, encourager)	2	
27	Role	Officially sanctioned local developer	1	
28	Role	Offshore Technical Coordinator	4	
29	Role	Purpose agents - teacher	4	
30	Role	Technologist	1	
31	Role	Testers.	5	
32	Role	Undergraduate Student	3	32
33	Socio-emotional	context & technology-directed emotions	2	
34	Socio-emotional	performance-driven emotions	2	4
35	Space	Location	5	5
36	Task	Learning task	1	1
37	Time	Class Schedule	1	
38	Time	day	4	
39	Time	daylight saving	1	
40	Time	holiday	1	
41	Time	stages of scripting the project	5	

Figure A19.28: Tree Node for “ Absence” - Expanded View with Drill Down to Source Documents and Coding Stripes

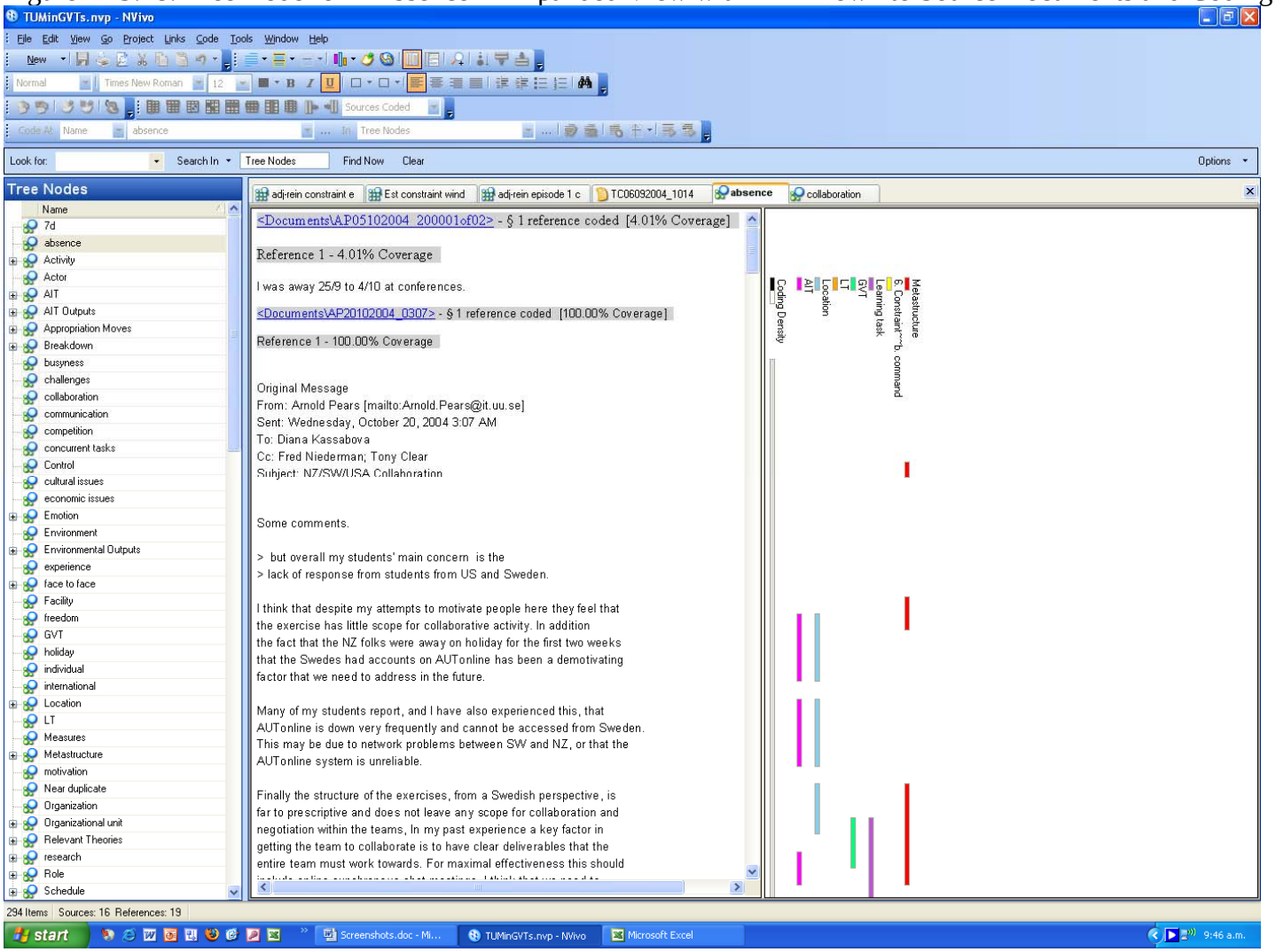
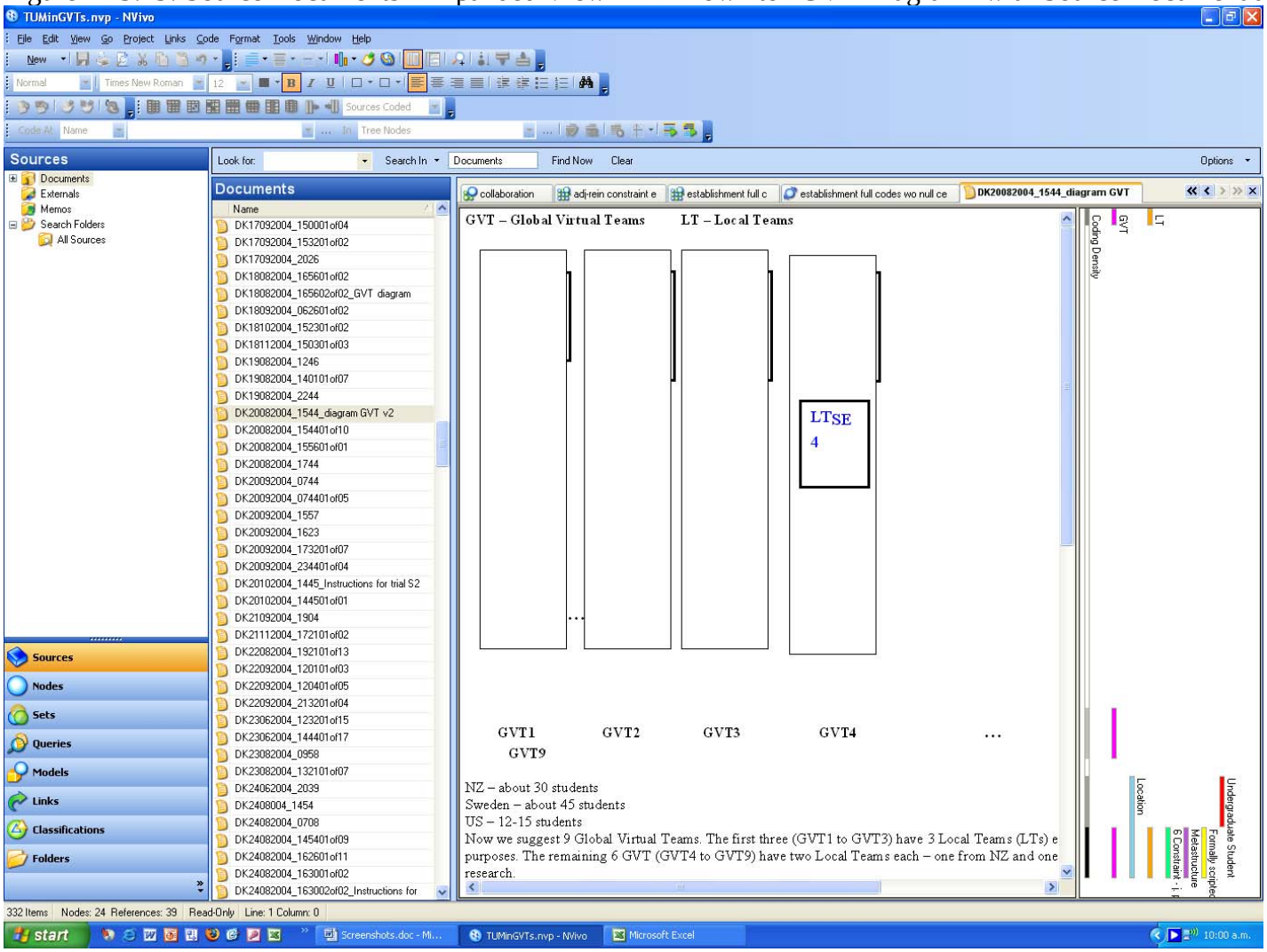


Figure A19.29: Source Documents - Expanded View Drill Down to “GVT Diagram” with Source Document and Coding Stripes



Appendix 20 – Episodes of Interest Continued

A20-6.5 Episode of Interest Profile: Adjustment-Reinforcement Episode One

A20-6.5.1 Episode Characteristics - Adjustment-Reinforcement Episode 1

Episode Characteristics	
Duration:	29/09/2004 – 08/10/2004
Supporting data: 1 1 1 3 2 1	 Diary Note 29/09/2004 Diary Note 30/09/2004 Diary Note (Part B) 30/09/2004 Email Messages: Diana Kassabova 30/09/2004 Files: Diana Kassabova 30/09/2004 AUTonline Announcement Posting Arnold Pears 08/10/2004
No of sources	9
Word count	2778
Actors:	Tony Clear, Diana Kassabova, Kitty Ko, Fred Niederman, LR (US Student), Arnold Pears

Table A20-6.25: Episode Characteristics - Adjustment-Reinforcement Episode 1

A20-6.5.2 Narrative summary - Adjustment-Reinforcement Episode 1

This episode consists of three diary notes on two successive days, a sequence of email messages and attached files on the second day, and an AUTonline announcement posting a week later. The episode relates to a mid-collaboration process of adjustment in readiness for phase two of the trial, and a set of reinforcement activities aimed at sustaining the collaboration. In the first diary note I had checked progress of the trial by reviewing new postings to the AUTonline environment in both the GVT groups and the tutors' discussion board. I had noted a posting by Arnold to the tutors' discussion board proposing a synchronous session, regarding which I had observed that it was "too hard", and to which thread I had duly responded. [Note: these thread entries are not included in this episode, as this data seems to have been lost from the archive when later retrieved]. In the second diary note the next day I had again checked progress of the trial by reviewing new student postings to the AUTonline environment within their GVT groups. In related observations I noted the need to check the trial instructions,

and that Diana had reported that the URL link from the Lotus Notes collaborative database was not working correctly. I checked two URL's after logging into AUTonline to see which was consistent from my point of view. In order to test this suitably I logged in using a student's username and password to view the system from the student perspective, and noted that for student login the link from the announcements section went to an inactive "group pages link". To rectify this, a student would need to link alternatively from the "organisations" section to get an active link. I further observed that the links appeared identical whether logged in as myself or as a student. The third diary note was interpolated at this point, in which I checked worldtimezone.com for a candidate time for a three way telephone call – (8:00 am Fri NZ; 3:00 pm Thu US; 10:00 pm Thu SE), but noted that there would be insufficient time for the others to review the draft instructions first, so decided to leave it for now (this note was recorded on Thursday morning). Returning to the second diary note, Diana, Kitty and I then jointly devised the phase two instructions for the trial. I observed the need to resynchronise with the others, noting that Fred was "a bit quiet" and Arnold had "his own plan". We discussed the email option for students, and agreed that default email would be the AUT email from ARION (the AUT student records system). I also observed the presence of a suspected software bug, with not all students [email addresses] displayed for some reason, and these email addresses unable to be changed by the user, which might suit corporate integration, but didn't suit staff or students.

Intervening chronologically at this point were two email messages from Diana relating to a problem with linking back to the AUTonline environment from the Lotus Notes collaborative database. Diana first recommended opening the collaborative database in a new browser window because that would enable the AUTonline connection to remain intact. In the next email message Diana sent me the diagnostic file I had previously sent her, requesting her to check consistency with my results from both onsite and offsite testing, including diagnostic comments about the constant return connection within AUTonline when exiting the Notes collaborative database. When connecting within AUT the problems did not seem apparent, so Diana hypothesised that the issue was related to connecting from outside AUT. Diana informed me that she was out of the office for while, but we could catch up later that day if desired. The diary resumed later at 9:10 pm in the evening, where I was now working from home. Logging in to the Notes collaborative database to check access from home I received an "access denied" error. Subsequently logging on via my secure VPN link to AUT I was able to

access the Notes Designer application (used in developer mode to modify Notes database software) in order to update the database links from the "Main navigator" and "about database" pages. However making changes was very slow with the dial-up 50,666 Kbps link. I further observed that I had forgotten that the VPN gave different results from open internet access, and therefore the error could not be duplicated when switching between applications. I selected the "open new window" option when switching from AUTonline because otherwise the embedded window was too small, and renamed the link to "Return to GVT welcome page" (outside the AUTonline organisation) as it offered the only viable return link to AUTonline without generating an access error message (despite still being logged in to the AUTonline application).

In the next email message Diana notified us all of the new set of instructions developed for phase two of the trial, and which were attached. Noting their general consistency with earlier work, Diana sought comments on the instructions, and observed that the names of the GVT team members from Sweden had now been included in the teams within the instructions. Further observations were the availability of a "DemoLT" and "DemoGVT" option for experimenting with the system, plus a feature giving the ability to subsequently delete "demo" entries. In addition the links to the prototype collaborative database were not yet made available to students, but could be accessed using the tutor only control panel feature of AUTonline, and it was intended that these links be made available to students once plans for the second phase of the collaboration had been confirmed. In the attached file a revised set of instructions to students was provided, with a clear sequence of activities to be performed in the second (group decision making) phase of the collaboration. This represented a significant adjustment activity considerably extending the earlier set of instructions, which had only covered the icebreaking first phase of the trial, since the final approach and content of the second phase had not been agreed at the stage of publishing the initial trial instructions to students. The final data source in this episode is an announcement posting made by Arnold a week or so later, in which he exhorted student GVT members to coordinate a synchronous team session as a "way of getting a really good start on phase 2", finalising leadership and team structure, and considering websites and communication tools to evaluate in the second phase. Arnold recommended using either the chat feature of AUTonline or a combination of IRC and ICQ chat software, using suggested downloadable open source applications to suit either Macintosh or PC environments. As a final request he indicated to the teams that it would be nice, once they had decided upon their times, if they invited the staff to participate. Note: while the focus in this

episode is on the adjustment process for phase 2 of the trial, this latter communication is also the culmination of an intermediate and inconclusive set of discussions (addressed previously in the episode of section 6.2) discussing the logistics of a synchronous session.

A20-6.5.3 Appropriation Move Patterns- Adjustment-Reinforcement Episode 1

Figures (A20-6.25 – A20-6.27) below depict the patterns of 'appropriation move types' and 'subtypes' (DeSanctis & Poole, 1994), which characterise this episode, and demonstrate the manner in which the technology has been appropriated.

A20-6.5.3.1 Appropriation Move Patterns – Adjustment-Reinforcement Episode 1 Direct

This episode contained no *'direct'* appropriation moves as it did not involve a direct case of technology use, but rather a snapshot of an adjustment and reinforcement process relating to technology use by others.

A20-6.5.3.2 Appropriation Move Patterns – Adjustment-Reinforcement Episode 1 Constraint

There are several moves categorised as *constraint*, where the 'structure is interpreted or reinterpreted'.

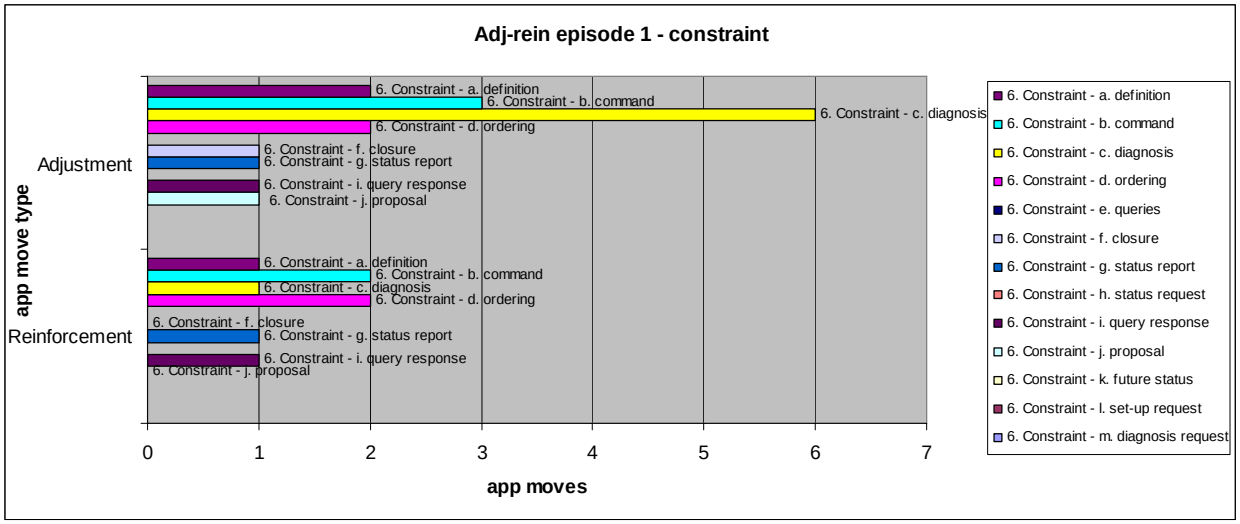


Figure A20-6.25: Adjustment-Reinforcement Episode 1 Appropriation Move Types – Constraint

A20-6.5.3.2.1 Adjustment-Reinforcement Episode 1 Constraint - Diagnosis

The moves coded in '*adjustment*' TUM activity mode as '*c - diagnosis*', where the

actors *comment on how the structure is working, either positive or negative* mostly relate to the diagnostic process relating to linking between the prototype Lotus Notes collaborative database and AUTonline the commercial VLE for phase 2 of the trial.

> It could be related to off site use (DK 30/09)
>
> URL's here appear constant and consistent, and when I return from the Collab DB it works fine, without requesting a login ?? (DK30/09 - TC)
>
> Diana Off site (from home)
> when I make the db to open in a new window its URL is
> http://online.aut.ac.nz/tony/2004/s2_2004.nsf/ (DK 30/09)
>
> Renamed link to
> Return to GVT welcome page as only viable return link without access error message (even though not actually locked out – still logged in and able to navigate AUTOnline) (TC 30/09)

This conversation relates to TUM activity in developer mode, determining whether inconsistent linking between the two databases is location dependent (on campus at AUT or offsite), user dependent (student or tutor), or technology dependent (such as access control or type of web browser for instance), and arriving at a viable workaround. Technology features in support for this diagnosis activity for developers and coordinators are noted in the message below. AUTonline access by role is related to the timing for linking the two applications once adequately tested, so that students can be given a functional interface, by making it 'visible' to them via the AUTOnline link. Thus the *AIT* features have been designed to specifically support the diagnostic mode for an online educator.

> Another point for the time being the link to the Collaborative DB from AUTonline/ 'External links' is not visible. Tutors can access it from Control Panel/External Links. (DK 30/09)

The more general 'diagnosis' comment below, observes a shortage in the available time for other coordinators to comment on the structure (in this case the draft trial instructions), whether positively or negatively

> but not enough time for others to view draft instructions first (TC 30/09)

A final 'diagnosis' segment comments in the negative on the email facility within AUTonline, where student email addresses are provided by a transfer from the main student registration system (ARION) to AUTonline. It appears that not all addresses are visible in the system for some reason, and nor can they be rectified or changed by the user.

> Discussed email option for students
> Default email AUT email from ARION
>
> S/w bug?? – not all displayed for some reason
> not able to be changed (TC 30/09 partb)

In the more passive '*reinforcement*' TUM activity mode (cf. glossary – "*training, monitoring, and follow-up with members and the group to reinforce the established guidelines*"), one negative *diagnosis* observation is coded. In this instance monitoring of the email traffic indicated that Brendan (the TA/RA originally intended to help with the collaboration, but who had withdrawn) was still on the mailing list. It is unclear who had the rights to remove him from the AUTOnline system.

Thus '*diagnosis*' activity in the above cases serves to explain an issue, in some cases propose and test a workaround solution, and in others indicate a form of impasse in which the team are dependent on technical assistance, which in the case of system design flaws or software bugs beyond local support capability may not be forthcoming. In such instances the coordinators need to demonstrate the skill set advocated by Jarvenpaa and Leidner (1999), namely "coping with technical uncertainty" and taking "individual initiative".

Other items in the 'constraint' category include '*a- definition*' (explaining the meaning of a structure or how it should be used) where communications address both use of the prototype collaborative database accessible via an AUTonline link available through the tutor only control panel feature, and the use of dropdown listbox features to test the collaborative database using demonstration groups, whose content could subsequently be deleted. For '*b- command*' move subtypes both 'reinforcement' and 'adjustment' TUM modes appear to be in action, with Arnold both reinforcing use of the AUTonline chat facility and proposing an adjustment to student GVT practice, by conducting a synchronous chat session, and more specifically when using the alternative IRC to designate a server and chat room for others to locate the session. Continuing the focus on student GVTs, the instructions to students have a clear set of commands giving directions to students on how to use the structures to be provided for phase two of the collaboration. Examples of '*d - ordering*', (specifying the order in which structures should be used) are given by the instructions to students with a clear sequence of steps to be followed, and in Arnold's announcement posting where he requested that once teams had set their synchronous session times they should ask the staff to participate. This latter posting was additionally coded as a TUM specific code '*i - query response' (answering questions about the structure's meaning or how to use it),* recognising that this recommendation was in response to an implicit question from both staff and students about how to use the synchronous technology. An example of '*closure*' (showing how use of a structure has been completed), was given in my diary note (TC

30/09), in which I recorded that I had checked the worldtimezone.com website for daylight saving time and times and day differences. An example of a '*status report*' was provided by the email notification from Diana that she had added the instructions for phase 2 to the existing introduction and instructions for phase 1. While this represented an '*adjustment*' TUM activity (cf glossary - *adjustment of definitions and usage rules for specific AIT features and occasional addition of new AIT features on request)* in augmenting the instructions for the trial, it was further coded as a '*reinforcement*' TUM activity since Diana had reinforced the existing base of agreement when she advised that:

> "I believe that we have structured the phase in line with our collaborative effort from a couple of months ago" (DK, 30/09).

The final item coded within this category of constraint is an example of a TUM specific code '*j – proposal*' (*suggesting how the structure should be used*), in which I had proposed a candidate telephone time for the three parties (8:00 am Fri NZ; 3:00 pm Thu US; 10:00 pm Thu SE), with the telephone here representing, if arguably an *AIT*, at least an example of a synchronous technology structure, with a need for coordination.

A20-6.5.3.2.2 Appropriation Move Patterns – Adjustment-Reinforcement Episode 1 Judgement

In contrast to '*constraint*' move types, this episode has comparatively fewer examples of *judgement* moves, where the actors express judgments about the structure.

Figure A20-6.26: Adjustment-Reinforcement Episode 1 Appropriation Move Types – Judgement

The episode has five segments coded as '*affirmation – d – compliment'* (*note an advantage of the structure*) with most of these dual coded to the 'adjustment' and 'reinforcement' TUM activity modes. The two primary excerpts relate to: 1) the ability of the collaborative database to support entry and deletion of demonstration entries to test out the application (DK 30/09); 2) the value of a synchronous chat session to support productive initialisation of phase 2, and tidy finalisation of phase 1 tasks (AP/08/10). These technology features were both presented in a positive light.

By contrast the excerpt below represents an example of '*negation – a – reject'* (*disagree or otherwise directly reject appropriation of the structure*),

> decided to leave it for now (TC 30/09)

a diary note wherein I had noted the barriers to a three-way phone call with the limited preparatory time available, so had decided not to proceed to arrange the call.

A20-6.5.3.2.3 Appropriation Move Patterns – Adjustment-Reinforcement Episode 1 Relate

This episode shows some examples of moves categorised as '*relate'*, where the actors 'relate to other structures' and where 'the structure may be blended with another structure'.

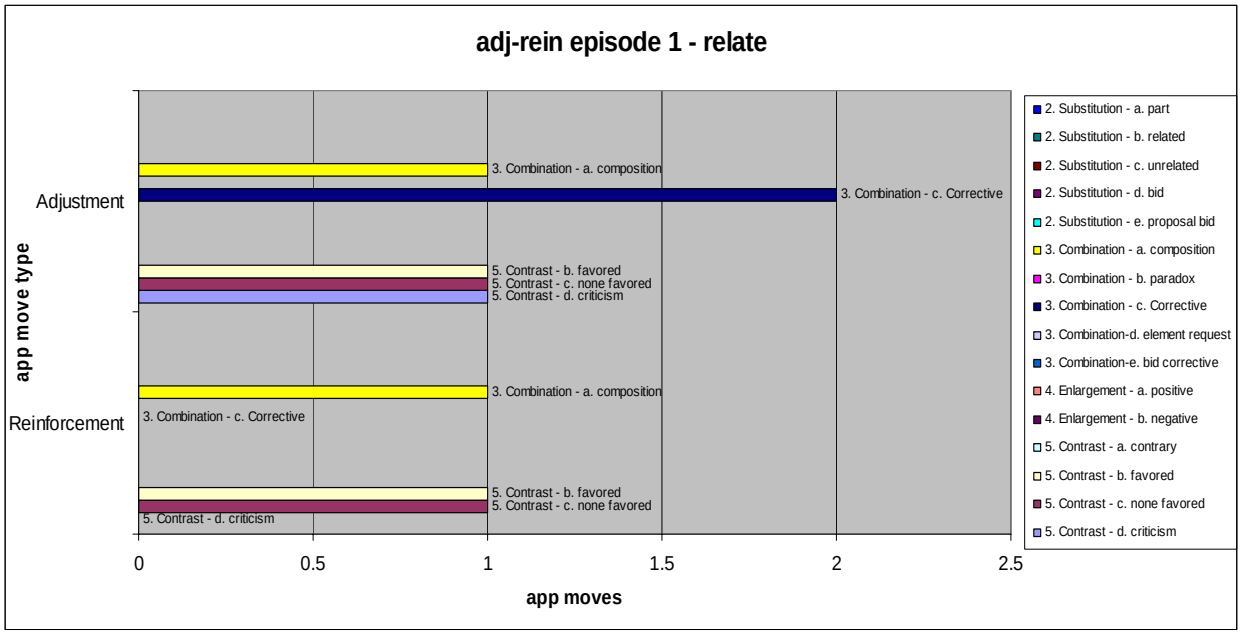


Figure A20-6.27: Adjustment-Reinforcement Episode 1 Appropriation Move Types - Relate

The episode contains excerpts which relate differing combinations and comparisons of technology features, including synchronous communication technologies, linkages between the collaborative database and AUTonline and AUTonline email features. The communication below represents an example of both '*combination - a composition*' (*combine two structures in a way consistent with the spirit of both*) and '*contrast –c none favored' (structures are compared with none favored over the others)*

> When doing this you can use the Lightweight chat available in AUTonline, or use a mixture of IRC and ICQ to setup a meeting. (AP 08/10)

Thus we see presented 1) an option for the specific combination of open source technologies or 2) alternative options of use of the standard AUTonline platform versus the specific combination of open source technologies. These would represent two differing appropriations of these complementary technology sets. Interestingly, since the lightweight chat option does have a recording feature to support the research work within a common archivable site, perhaps the IRC and ICQ option would violate the spirit of the collaboration as a research activity? This is not a negotiation we really entered into and the differing goals of the collaborating sites are apparent in this communication, with Arnold eager to encourage student use of multiple communication technologies.

In the communications below coded as '*combination - c corrective*' (*use one structure as a corrective for a perceived deficiency in the other*), we see an illustration of a

workaround in action,

> One way around this problem would be to make the db open in a new window, then the autonline connection remains intact. (DK 30/09)
>
> Renamed link to Return to GVT welcome page as only viable return link without access error message (even though not actually locked out – still logged in and able to navigate AUTOnline) (TC 30/09 partb)

This reflects action on my part in the developer role to ensure seamless integration of the two applications, evidently not a straightforward problem.

The remaining communications are coded respectively as '*contrast –b favored' (structures are compared with one favored over the others)* and '*contrast – d criticism' criticising the structure but without an explicit contrast)*. The first communication is very technology specific, in which Arnold advises students in the following manner:

> There are good IRC clients for Linux and Windows on the web to download, mIRC is the Windoze one that I have seen most often. (AP 08/10)

The second communication criticises the AUTonline email facility (as discussed previously coded under '*constraint*' and '*c- diagnosis*');

> S/w bug?? – not all displayed for some reason
> not able to be changed (TC 30/09 partb)

In this criticism we see not only some uncertainty but also concern over the constraints afforded by the context and the technology. A later record in the same diary note observed that this design (namely preset email addresses fed from ARION - the main AUT corporate student registration system) may suit "corporate integration, doesn't suit staff or students". In this case students external to AUT were proving a complicating factor, although innate to the collaboration process.

A20-6.5.4 Other Grounded Data -– Adjustment-Reinforcement Episode 1

Concepts	Codes	Count	Subtotals
Activity	planning-meeting scheduling	2	
Activity	scripting	2	4
AIT	AIT	9	
AIT	AIT Spirit	1	
AIT	attachment transmission	2	12
Breakdown	Breakdown	2	
Breakdown	Recovery Plan	1	3
Control	authentication	1	
Control	authorization	3	
Control	Control	1	
Control	security	1	6
Env Output	Formally scripted interactions	1	1
GVT	Global Team Formation	1	
GVT	GVT	5	6
LT	LT	1	1
Metastructure	Metastructure	8	8
Research	data	1	
Research	diary note	3	4
Socio-emotional	context & technology-directed emotions	2	
Socio-emotional	performance-driven emotions	2	4
Task	Learning task	1	1
TUM Activity	Adjustment	9	
TUM Activity	Establishment	5	
TUM Activity	Reinforcement	4	18

Table A20-6.26: Adjustment-Reinforcement Episode 1 – Concepts and Codes

Table A20-6.26 above provides indicative counts for the grounded theoretic 'open codes', 'concepts' and/or 'categories' derived from the data sources in this episode. These have been derived using the same approach as adopted in section 6.2.4 above, and a similar form of structurational analysis is applied below. The coding for the concepts of 'role' and 'space and time' have been excluded from this set and are instead addressed independently below.

AIT stands out as a dominant concept in this episode with a wide range of technologies and their features in evidence. These features are tabulated in tables A20-6.27a & b below, to give an indication of the richness and specificity of this data.

Technology (*AIT*)	Feature	Comment
AUTonline	then the AUTonline connection remains intact.	
	login	
	Announcements	Area for posting global messages
	Organizations	Repositories for online course equivalents
	External links is not visible	
	Control Panel/External Links	Tutor only linking feature (for use in setup/test mode)
	a collaborative database prototype that is accessible from within AUTonline.	
	External Links>Collaborative database	
	the navigation panel on the left	
	Members of each GVT need to … reach a consensus for ranking the web sites that they have uploaded and evaluated. The process will be carried out online in the Group pages for each GVT.	
	Any combination of the following communication channels supported by AUTonline can be utilised: Group Forum, Lightweight Chat and Email.	
	Chat Meetings	
	tutor's discussion board	
	New thread added	
	Replied to thread	
	for student login announcements link on LHS window goes to inactive "group pages link"	
	need to link it from organisations to get active "group pages" linkage.	
	Discussed email option for students, Default email AUT email from ARION, S/w bug?? – not all displayed for some reason, not able to be changed	
URLs	Link between applications	Inconsistent return
Email	Attached file	
	sent email to instructors	
Synchronous Chat	One way to really get a good start on Phase 2 is to have a synchronous chat session.	
	the Lightweight chat available in AUTonline, or use a mixture of IRC and ICQ to setup a meeting.	
	There are good IRC clients for Linux and Windows on the web to download, mIRC is the Windoze one that I have seen most often. When you use IRC you should designate an IRC server where you will meet and the name of the chatroom that you will create.	
Websites	Checked worldtimezone.com for daylight saving time and times and day differences	

Table A20-6.27a: Adjustment-Reinforcement Episode 1 – *AIT* Features

Technology (*AIT*)	**Feature**	**Comment**
Lotus Notes Prototype Collaborative Database	Main Navigator with a number of links grouped in 4 main groups: Team Management, Website Evaluation, Scoring and Ranking, Student Reviews	Lotus Notes terminology for Main menu equivalent
	At the bottom of the Navigator there is a link that takes you to the Announcements page that leads you to GVT Group Discussion Pages.	
	New [browser] window	To keep both applications open
	Drop Down boxes with Demo LT and Demo GVT	Testing feature
	At top of forms there is a link 'delete entry'	Delete feature
	upload and evaluate Web sites related to chosen collaborative technologies	
	Website Evaluation => View Websites/Create Evaluation	
	Identify the Web sites uploaded by your GVT. Click on the name of the Author (contributor of the site) and a form will open for you in `Edit` mode so you can see information about the site that was entered by the contributor.	
	Members of each GVT view their evaluations and the total scores for each site (scores are worked out automatically by the database)	
	Scoring&Ranking => View Website Evaluations by GVT	
	LTs can also make use of `Ranking forms` in `'Draft'` status to support their discussion.	
	Scoring and Ranking => Enter Website Rankings Select 'Draft' ranking status on the form	
	As a result of your discussions within the GVT the decision making process should reach a consensus. At this point someone (the leader or a nominated member) needs to submit a `confirmed Ranking form` with the final ranking (use status 'Confirmed' in the form). One Ranking form is needed for each GVT.	
	Renamed link to Return to GVT welcome page as only viable return link without access error message (even though not actually locked out – still logged in and able to navigate AUTOnline)	
	Students can view the forms submitted by all GVTs by using the following step: Scoring and Ranking => View Website Rankings	
VPN	Logged onto VPN to change main navigator & about database URL's	AUT secure network access Notes menu and 'splash' screen
Lotus Notes Designer	Very slow with Designer at 50,666 link	Lotus Notes Development Environment Dial-up access

Table A20-6.27b: Adjustment-Reinforcement Episode 1 – *AIT* Features

This large number of different types of *AIT* and their features partly results from inclusion of the very detailed set of instructions to students in this episode. The NVivo counts – which merely total documents in which the code is present – tend to

significantly understate the frequency of coded concepts, although it is noteworthy that *AIT* occurs in all 9 coded source items. It is reassuring therefore that although this thesis is based in part on "the view of 'technology as structure' in which structures have been embedded as rules and resources by designers of the technology, which are then appropriated in different ways during use' (Orlikowski & Iacono, 2001), the technology features are pervasive throughout the data. They are innately embedded in the context, with *GVT* for instance as a frequently occurring concept and tightly coupled with technology. The conscious and highly specific inclusion of technology features throughout the TUM activities of *reinforcement* and *adjustment*, indicates how TUM is innately an activity in which technology is present. To this extent the thesis avoids the criticisms levelled against Information Systems Research that "Information Technology is not a major player in its own playing field" where "IT artifacts are either absent, black-boxed, abstracted from social life or reduced to surrogate measures" (ibid.). For endeavours such as this which are reliant on technology and arguably at the 'bleeding edge', technology is an unavoidable dimension. In fact we see in the above table, for instance in the linking between the prototype database and the proprietary VLE, clear evidence of the assertion by Orlikowski & Iacono (2001) that "such technologies are rarely fully integrated, flawless and unfailing" and we also see some evidence of the kinds of "workarounds" necessary to patch together constellations of software to support the overall project goals. For instance commenting on the student email facilities provided through AUTonline and fed from the central student registration system I had noted that the *AIT Spirit* of this design was not supportive of our endeavour, with the email addresses unable to be changed by the user, "which might suit corporate integration, but didn't suit staff or students" (TC 30/01 partb), who might wish to use an alternate email address. This latter segment was also coded under the *authorization* and *control* categories, since the primary actors in the collaboration lacked the authority to perform their tasks. Continuing the control theme, coded as *security* was my need to use the VPN to access [Lotus Domino] Designer to work in Lotus Notes developer mode from home, as the university had placed strict controls over access to the Lotus Notes environment. Coded as *authentication* was my 'borrowing' and use of a student login to the AUTonline system, in order to test the student view of the system, when debugging the problem of linking between the two applications. While this episode is named as an *adjustment/ reinforcement* episode, with much of this activity already having been investigated in section 6.5.3 above) aspects have been additionally coded to the *TUM activity* of *establishment,*

representing the fact that initiating phase 2 of the project with both a new set of student instructions (which were both the formalization of the *learning task* and an item of *research data*) and a new database to support this phase were in effect delayed *establishment TUM activities*. Had we the time and degree of consensus over the conduct of the collaboration we would ideally have completed this work prior to beginning the collaboration. Therefore in that context, this work represented a significant *adjustment* to the trial.

Items coded as *metastructures* are varied, from instructions for the trial, GVT and LTs, synchronous chat sessions, URLs, and features of the applications (such as announcements, GVT groups, tutors' discussion board, main navigator, two week break) and the VPN. For *breakdown* and *recovery plan* we have the interactions regarding linking between applications, with the inconsistent URL return from the prototype collaborative database to AUTonline being an issue, and the *recovery plan* involving opening the database in a new window so the AUTonline connection would stay intact. Coded under the *activity* of *scripting* were two interactions: one noting that Diana, Kitty and I had jointly devised the instructions for phase 2 of the trial, and another commenting on Arnold's wish for a synchronous session with my observing that it was "too hard". The other *scripting* activity of *planning-meeting scheduling* included Arnold's announcement posting to students exhorting them to arrange group synchronous chat sessions, and once arranged to advise the staff so they could participate, and my note with tentative timings at each site for a three way phone call.

The socio-emotional category figures again in this episode, with *context & technology-directed emotions* evidenced in my separate observations about the synchronous chat session being "too hard", the AUTonline email "suiting corporate integration but not staff or students", and also coded as a case of *performance –driven emotion* that using Designer over the 50,666kb dial up link was "very slow". A further example of *performance –driven emotion* was recorded against my diary note in which I decided against the three way phone call because there was "not enough time for others to view draft instructions first".

A20-6.5.4.1 Roles -– Adjustment-Reinforcement Episode 1

The data in table A20-6.28 below indicates a multiplicity of roles involved in this episode (12 independently coded roles).

Role	Central users - self selected, emergent (like a Coweb webmaster)	2	
Role	Coordinator	6	
Role	Developer	2	
Role	Formal (teaching~research assistants)	1	
Role	IRB	1	
Role	Motivator (energizer, encourager)	2	
Role	Officially sanctioned local developer	1	
Role	Offshore Technical Coordinator	4	
Role	Purpose agents - teacher	4	
Role	Technologist	1	
Role	Testers.	5	
Role	Undergraduate Student	3	32

Table A20-6.28: Adjustment-Reinforcement Episode One –Coded 'Roles'

While some of these roles may to some extent overlap (as do those in the establishment section 6.4.4.2), the majority are specific and distinctive roles each contributing to the TUM activities in this episode of the collaboration. This section will touch on selected roles and how they are evidenced. The *coordinator* and *offshore-technical coordinator* roles encompass the key actors coordinating activities for the collaboration at each site (Diana, Fred, Arnold and myself), and address the full range of activities being coordinated within this episode (e.g. instructions, synchronous sessions, technology diagnosis and adaptation, synchronizing activities cross sites etc.). An example of the o*fficially sanctioned local developer* role is provided in the instructions to students, where they are requested to use the features of AUTonline to *develop* a homepage

> You can create your own Homepage by accessing Tools>Edit your web page. (DK30/09)

This is a suitable extension of the *undergraduate student* role for computing students, but also accessible to those with limited technical skills (given the support provided by the AUTonline environment). The *undergraduate student* role is evident in several interactions, frequently by a distinction between the student and teacher roles, which reinforces the importance of *roles* as distinct from people. For instance in Diana's email with the revised instructions (DK30/09) she noted that Swedish student names had been added to the GVTs in the instructions, and advised that once the coordinators had agreed on the instructions, the link in AUTOnline would be made visible to

students. Likewise when diagnosing the faulty linking between applications (TC 30/09) I had logged on in the student role to confirm the system functionality across system access levels, and in observing the constraints with AUTonline email for students the *undergraduate student* role is again apparent. The *developer* role is evident, in which I logged on using the VPN and Designer (the Notes Development environment) from home; investigated, debugged and adapted the links between Notes and AUTonline applications; at the same time enlisting the support of Diana in the *tester* role to confirm the diagnosis and the fix. The interactions between Diana and myself over linking the two applications saw us both in the *tester* role, checking to determine whether the problem was related to on campus or offsite use, and consistent across logged in user roles. An example of the *tester* role for a wider audience was provided with the demo GVT feature in the collaborative database, designed specifically to support testing, and later deletion of test entries, by coordinators or students at each site. Coded against the *technologist* role was Arnold's announcement posting in which he outlined a variety of different technical options and platforms for conducting a synchronous chat session. One communication from Diana (DK 30/09) was coded against *Central users - self selected, emergent (like a Coweb webmaster),* in which Diana advised that once phase 2 was confirmed, she would make visible to students the link to the Notes database from AUTonline (currently only accessible via the instructors control panel). In similar fashion within the instructions to students, Diana advised how to record an online chat session, in which instance a student member would have to assume the role of a central user, in performing a more global function to support others in the group. Coded to the *motivator* role are two "signing – off" email phrases, "best regards" (DK 30/09) and "regards to all" (AP 08/10). There does appear to be a conscious and active attempt on the part of coordinators to word their email messages in a positive light and with a supportive tone, so this is perhaps an attempt to overcome the impersonal nature of email as a communication medium and infuse it with more humanity and warmth. This behaviour echoes the observations by Fulk et al., (1990), who reported low social presence media such as email being "used for high social presence tasks" including "socioemotional uses such as getting to know someone, maintaining relationships" (ibid, p. 131). While a fuller discussion is not appropriate here, it may be that this behaviour is aimed at increasing social presence "the degree to which the medium facilitates awareness of the other person and interpersonal relationships during the interaction" (Fulk et al., 1990 p. 118). To conclude this section one item was coded to the *IRB* role, namely the diary note (TC

30/09) in which I had logged in as a student to test the student view of the system. I had randomly selected one of the St Louis students for whom I had username and access details, but simultaneously noted that I would need to anonymise his details if cited – since I did not have St Louis IRB board approval to include him as a research subject.

A20-6.5.4.2 Duality of structure - Adjustment-Reinforcement Episode 1

In this episode again we see the interplay between action, structures and technology as closely intertwined elements. The *draft phase 2 instructions to students* provide a good example of a *metastructure* through which planned actions and technology are to be shaped. The draft instructions represent clear evidence of technology-use mediation, serving to bind together structures and *metastructures* provided by the context, shaping the desired actions of the students and academic staff *establishing, adjusting* and *reinforcing* use of the technology features. As a draft for circulation the instructions also provided an opportunity [not necessarily taken] for the other coordinators to suggest changes, to shape the collaboration in ways consistent with the institutional and technology structures at their own sites.

The *GVT Formation* outlined in the instructions, enabled the IRB restricted St Louis students to participate as students, within an overall GVT and LT structure which supported both the teaching and research objectives of the collaboration. At the specific technology feature level, dropdown listboxes (for demo*GVT* and demo*LT* entries), and (delete options for test entries) were designed into the Notes collaborative database to enable testing of the online forms.

Reflecting the draft nature of the instructions and the prototype nature of the Notes database, the AUTonline 'control Panel' feature enabling instructor level access for linking to the prototype database and testing functionality before release for student use, demonstrated *role* delimited action. This action in turn was supported by institutional *security* policies relating to *authorization,* and equivalent technology structures. In testing linkages between the two technology platforms, I took advantage of AUT's institutional *security* policies relating to *authentication* and *authorization,* and the supporting AUTonline technology features to view the system in student mode by logging in as a St Louis student, (who must remain nameless in this publication - as a non eligible research subject, under the institutional stipulations of the St Louis *IRB*).

A20-6.5.4.3 Time and Space – Adjustment-Reinforcement Episode 1

The episode as indicated in table A20-6.29 below has several coded items related to the concepts of time and space.

Space	Location	5	5
Time	Class Schedule	1	
Time	day	4	
Time	daylight saving	1	
Time	holiday	1	
Time	stages of scripting the project	5	
Time	Synchronize	5	
Time	Time	3	
Time	Time separation	3	
Time	time zone	1	24

Table A20-6.29: Adjustment-Reinforcement Episode One – Coded 'Space & Time'

The significance of *location* can be seen in the process of diagnosing the linking problem between the collaborative database and the AUTOnline application. Diana observed that "it could be related to *offsite use*" (DK 30/09), and the file of diagnostic links which Diana had cross-checked, distinguished between 1) links functioning "*onsite at AUT*" and 2) "Diana *offsite (from home*)". In my diary note (30/09) I had also experienced difficulty in my *developer* role logging on to the Notes system *from home*, receiving an "access denied error", which then meant that I had to log in via the VPN. *Location* is also apparent in the allocation of *GVTs*, with Swedish students names now included in the instructions by GVT, and the GVTs themselves representing combined *locations*, with US student LTs allocated to the first three GVTs only.

> Nine Global Virtual Teams. The first three (GVT1 to GVT3) have 3 Local Teams (LTs) each. The remaining 6 GVT (GVT4 to GVT9) have two Local Teams each – one from NZ and one from Sweden. (DK 30/09)

A combination of impact of both *location* and *time* can be seen in the message below from the instructions to students:

> Please note that students from New Zealand have a two week break between the 20th of September and the 3rd of October. Members of GVTs are encouraged to carry on with the icebreaking process using any of the above communication channels. (DK 30/09)

One *time* specific coding is that of *class schedule* in which the start and end dates for the collaboration are presented in the instructions, with specific intermediate due dates for each step of the process, and with the holiday break above clearly identified. A broader representation of the above code can be seen in the *time* coded *stages of scripting the project*, which was expressed in 1) the email (DK 30/09) including the

instructions for *phase 2* of the project, and 2) through the instructions themselves the *phase 1: icebreaking stage*, and the *phase 2; group decision making stage* (further coded more loosely as *time*), 3) *phase 2* is explicitly noted in the diary note re Arnold's synchronous session and Arnold's announcement to students about getting started on the new *phase*, and 4) *phase 2* is referred to in the diary note recording Diana, Kitty and I having devised the new instructions.

Coded as synchronize are five segments: 1) Diana noting that she would be absent for a dental appointment but available again in the afternoon suggesting

> "If youare in we should look at it again" DK (30/09).

2) Arnold requesting in his announcement that students invite the staff to join once they had arranged their GVT synchronous chat sessions (also coded simply as *time),* 3) my observation that Arnold's desire for a synchronous session was "too hard" and also coded as *time separation*, 4) a candidate set of telephone call times for a three way call (also coded as *time* and *time separation* further acknowledging the lack of time to view the draft instructions and so not initiated,) 5) a note to myself observing the state of progress:

> Need to resynchronise with others – Fred a bit quiet and Arnold with his own plan (TC 30/09 part b)

Also coded as *time separation* was the excerpt below:

> I believe that we have structured the phase in line with our collaborative effort from a couple of months ago. (DK 30/09)

Time zone and daylight saving codes are evident in the dairy note excerpt below

> Checked worldtimezone.com for daylight saving time and times and day differences (TC 30/09)

Day is coded in several sources including the above, but mostly diary notes, whereas in the above excerpt and the diary note excerpt with candidate times and days for the three way phone call the actual day is significant, as a weekend day in one location versus a week day in another may invalidate a joint session.

As can be seen from the above, time and space are again significant actors in the collaboration, framing and constraining activity in some respects, but helping shape it in others through the detailed set of tasks and the timelines outlined in the instructions. The content of the episode appears broadly consistent with McGrath's Time Interaction and Performance (TIP) theory "proposition 6: that a temporally efficient flow of work in groups requires complex matching of bundles of activities to particular periods of time" (McGrath, 1991).

A20-6.5.4.4 Reflexivity of the actors – Adjustment-Reinforcement Episode 1

This episode depicts a series of activities in which the actors were highly aware of the context and their *roles* in the setting. As an episode evidencing the *TUM activities* of *adjustment* and *reinforcement* complemented by *establishment* in preparing for *phase 2* of the collaborative trial, it represents a conscious set of design and configuration activities: collaboration design, application design, *learning task* design, design of the instructions for students and attempts at technology mediated communication design.

Awareness of *technology* constraints, the differences between *on campus* and *off site* use, and levels of user and access (*instructor* versus *student*) is evident in the interactions related to linking the two applications for a seamless collaboration, such that a viable if not ideal workaround solution (maintaining each application open in a separate window) was devised. Focusing on an instance of *breakdown* as remarked in section 6.2.4.3 above, here generated conscious reflection on the situation leading to the resultant design. The testing process and the availability of "pre-production" environments/mechanisms for *testers* (*instructor*-only visible links, *demoGVT and demoLT* entries) indicated a consciousness of the deficiencies of the *technology* and the need to confirm and implement the desired functionality and stabilise it before release to student use.

The student instructions demonstrate an awareness of *technology*, the context at each *location* and the *time* constraints. The *schedule* accommodates the two week intervening *holiday* break at the *New Zealand site*, and encourages members of *GVT*s to continue with *the icebreaking phase* during that period, recognising the likely drop-off in student activity over this period.

The proposal by Arnold for student *GVT*s to organise *synchronous* chat sessions, evidences a difference in awareness and intentions for *technology* use at each site. It is unclear to what extent this difference was fully apparent to us as coordinators of the collaboration. For instance the instructions to students excerpted below indicated that students could choose a variety of communication channels within *AUTonline.* For the l*ightweight chat* technology there were instructions regarding how to record chat sessions, [which would provide a helpful record of GVT communication for subsequent research purposes] but no specific directive to do so.

> The means for communication are to be agreed on by the students themselves. Any combination of the following communication channels supported by AUTonline can be considered: Group Forum, Lightweight Chat, Email and Individual Home pages. (DK 30/09)

> Light Chat is available by clicking on Communication>Collaboration>Join Lightweight chat. Please note that if you want to record your session in Lightweight Chat you will need to manually record it by doing the following:
> Click on 'Begins archive recording' button at the start of the session and at the end do not forget to click on 'Stops archive recording'. Both buttons are at the upper right corner on the Chat window. (DK 30/09)

Arnold's posting contradicted these instructions to students, in extending the technology set for students to use, and was further potentially in conflict in not outlining any session recording mechanism for the IRC and ICQ options.

> When doing this you can use the Lightweight chat available in AUTonline, or use a mixture of IRC and ICQ to setup a meeting. (AP 08/10)

The deficiencies with AUTOnline email resulted in my conscious criticism of the *AIT Spirit* of this *technology*, which had been implemented with a *control* orientation at AUT, which may have suited

> "corporate integration but doesn't suit staff or students" (TC 30/09).

Thus it is apparent that at least some of the actors in this episode, in the conduct of their TUM activities, have adopted a reflexive stance towards the *technology* and related *metastructures* involved in the episode.

A20-6.5.5 Visual Mapping – Adjustment-Reinforcement Episode 1

The radar chart in figure A20-6.28 below represents a visual 'map' of selected aspects of the episode, similar to the approach of section 6.4.5 above. Since this is a relatively brief episode, with limited room for development of concepts within its boundaries, the *metastructure* of '*draft phase 2 instructions for the trial*' is selected here for analysis. It may also serve as an artifact to highlight directly related aspects of the episode associated with its production and dissemination. As previously in section 6.4.5, the six constituent elements of the selected *metastructure* are compared across the three sites, to illustrate the extent to which they serve to support this collaborative venture. This depiction is again left at this stage to speak for itself, with further analysis to be conducted in subsequent chapters. Nonetheless figure A20-6.28 below does depict a degree of difference in approach across sites, although broad compatibility in the collaboration appears to have been achieved.

The other primary metastructures evident in this episode are *AIT* related, and will be addressed separately in the more extended temporal analysis of section A20-6.5.6 below.

The map below depicts the operation within this episode, of the *metastructure* represented by the *draft phase 2 instructions to students* at each site.

Each element is briefly tabulated in table A20-6.30 below.

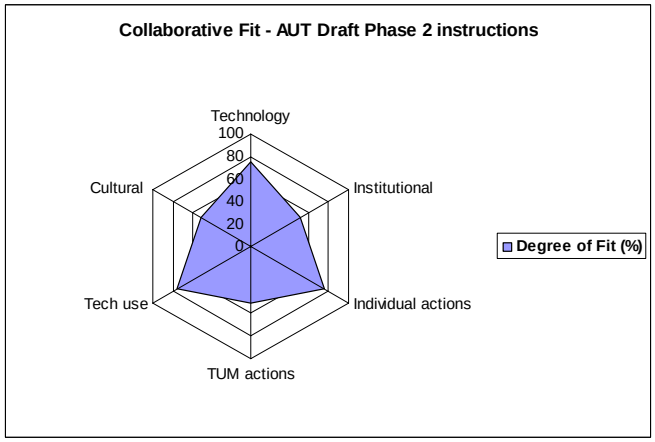
AUT
Technology – includes full set of features for collaboration, AUTonline & Notes DB, external email assumed operational
Institutional – issues with external student email support
Individual actions – Diana, Kitty & Tony agree, propose as draft
TUM - Phase 2 Instructions agreed at AUT based on prior concepts outlined to others, checked time zones & no time for 3 way phone call to confirm
Tech use - email, MS-word attachment, full set of features for collaboration proposed, no telephone call made
Cultural – Detailed guidelines suit AUT students, AUT holiday break just before phase 2, AUT coordinators 3 days before end of mid-semester break

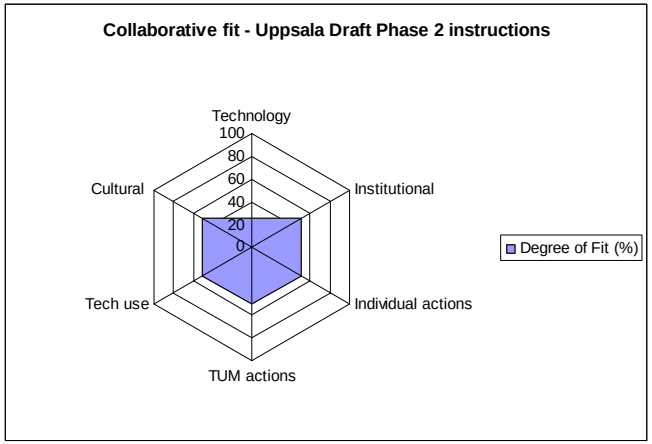
St Louis
Technology – includes AUT hosted full set of technology features for collaboration, external email assumed operational
Institutional - – issues with external student email support
Individual actions - Fred to review and confirm
TUM - Fred out of touch for a while, so agreement assumed broadly based on prior discussions
Tech use - email, MS-word attachment, full set of AUT hosted features for collaboration reviewed
Cultural – may have lost some momentum at St Louis site (students & coordinator), with NZ break intervening?

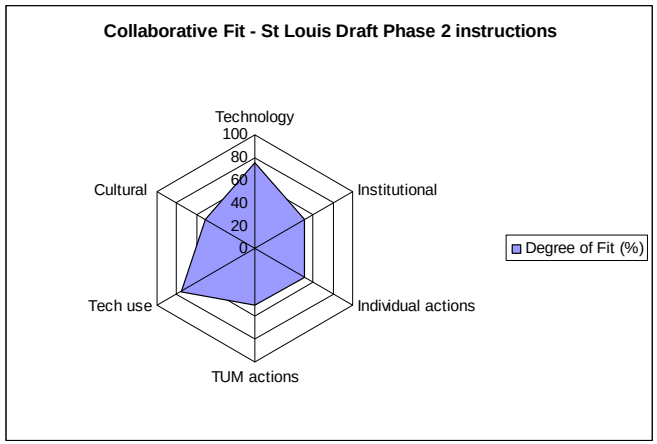
Uppsala
Technology – includes AUT hosted full set of technology features for collaboration, external email assumed operational, not open IRC & ICQ apps
Institutional - – issues with external student email support
Individual actions – Arnold to review and confirm, Arnold proposes synch chat session, posts announcement to students
TUM - proposes student driven synch chat AUTonline or Open Source tech options, no recording options considered, posts announcement to students
Tech use - email, MS-word attachment, full set of AUT hosted features for collaboration reviewed, open IRC & ICQ apps proposed as alternatives
Cultural – Open source solutions preferred, more student choice of technologies, chat session proposed to regain lost momentum at Uppsala site?

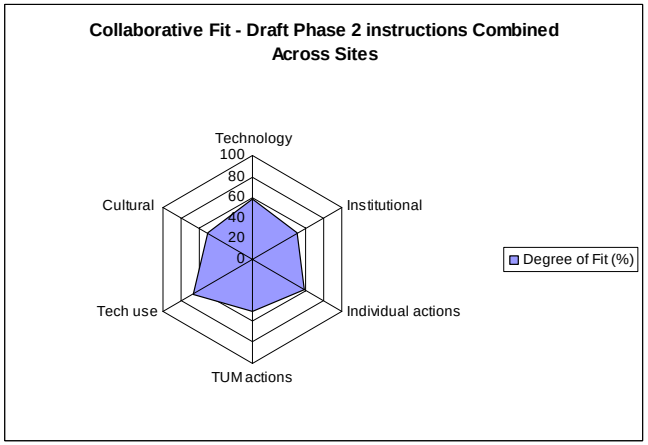
Table A20-6.30: Adjustment-Reinforcement Episode 1 – *Metastructure* of *draft phase 2 instructions to students*

Figure A20-6.28: Radar Charts – Adjustment-Reinforcement Episode 1 - *Metastructure* of *draft phase 2 instructions to students*









Degree of Fit Scale (%)

100% - full collaborative fit (CF)

75% - moderate CF

50% - partial CF

25% - limited CF

0% - no CF

A20-6.5.6 Temporal Bracketing – Adjustment-Reinforcement Episode 1

This temporal bracket, while largely based on data within the temporal bracket of the episode itself, does includes a slightly widened lens to better analyse how changes have occurred over time. Several aspects of the episode did not readily generate developments over time, for instance: the addition of the phase 2 instruction set is obviously an addition to the phase 1 instructions, and the dialogue for agreement of those could be further explored, but with limited time for disagreement they appeared to be readily adopted by all coordinators, bar the use of synchronous collaborative technologies (which is addressed below); the development and testing of the application were relatively self contained activities, and a cursory review of subsequent student use indicates that the technologies were largely appropriated in the manner intended, even if apparently more strongly at the *LT* than *GVT* level. Thus the relatively narrow focus of interest in this review of the episode (synchronous technologies and AUTonline email technology use) helps in this extension of the temporal bracket.

A partial temporal analysis of this episode has previously been presented in figure 6.10, where in extending the window for 'adjustment/reinforcement episode 3', the use of synchronous collaborative technologies was explored. That extended window included data items from this episode, namely Arnold's announcement posting (8/10) and my diary notes regarding conducting a synchronous session and arranging a three-way phone call (29/09 and 30/09).

A selective extension of the episode resulted in the set of related data sources for analysis, which are summarised in Table A20-6.31 below.

Extended Episode Characteristics	
Duration:	23/08/2004 – 3/11/2004
Supporting data:	Email Message: (MN -DK) 23/08/2004 Email Message: (MN) 23/08/2004 AUT Intelligent Business Systems Assignment 2, Part 1: Groupware Assessment: (DK) 31/08/2004 Email Message: (DK) 31/08/2004 Group pages GVT1 Screenshot: 30/09/2004 Tuesday List Users in Group GVT1 Screenshot: 30/09/2004 Tuesday Modify User Properties Screenshot: 30/09/2004 Tuesday Email Message: (DK) 14/10/2004 Email Message: (TW)14/10/2004 AUT Intelligent Business Systems Students – (8) Reflective Reports (31/10/2004 – 3/11/2004)
No of sources	17 – focal lens of TUM activity related to synchronous and email communication technologies
Actors:	Mark Northover, Tony Clear, Arnold Pears, Fred Niederman, Diana Kassabova, AUT student (TW), AUT Students, Swedish Students

Table A20-6.31 Extended Episode Characteristics - Adjustment-Reinforcement Episode 1

While having some overlap with the material already covered in figure 6.10, the analysis below relating to the use of synchronous technologies does include the additional item of 'assessment instructions for AUT students' (31/08), namely:

> Identify five key issues that you have experienced during the trial and collect at least five pieces of evidence related to these issues. (DK 31/08)

These introduce a further rationale for students recording a synchronous chat session, and the outcome for a set of eight student assignments (dated between 31/10/2004 and 3/11/ 2004) is mapped. These outcomes though indicate that recorded chat sessions were not included as evidence in these assignments. Students had the option of choosing items evidencing their collaboration, so presumably they chose not to include synchronous chat data, although evidence is lacking for the exact reasons.

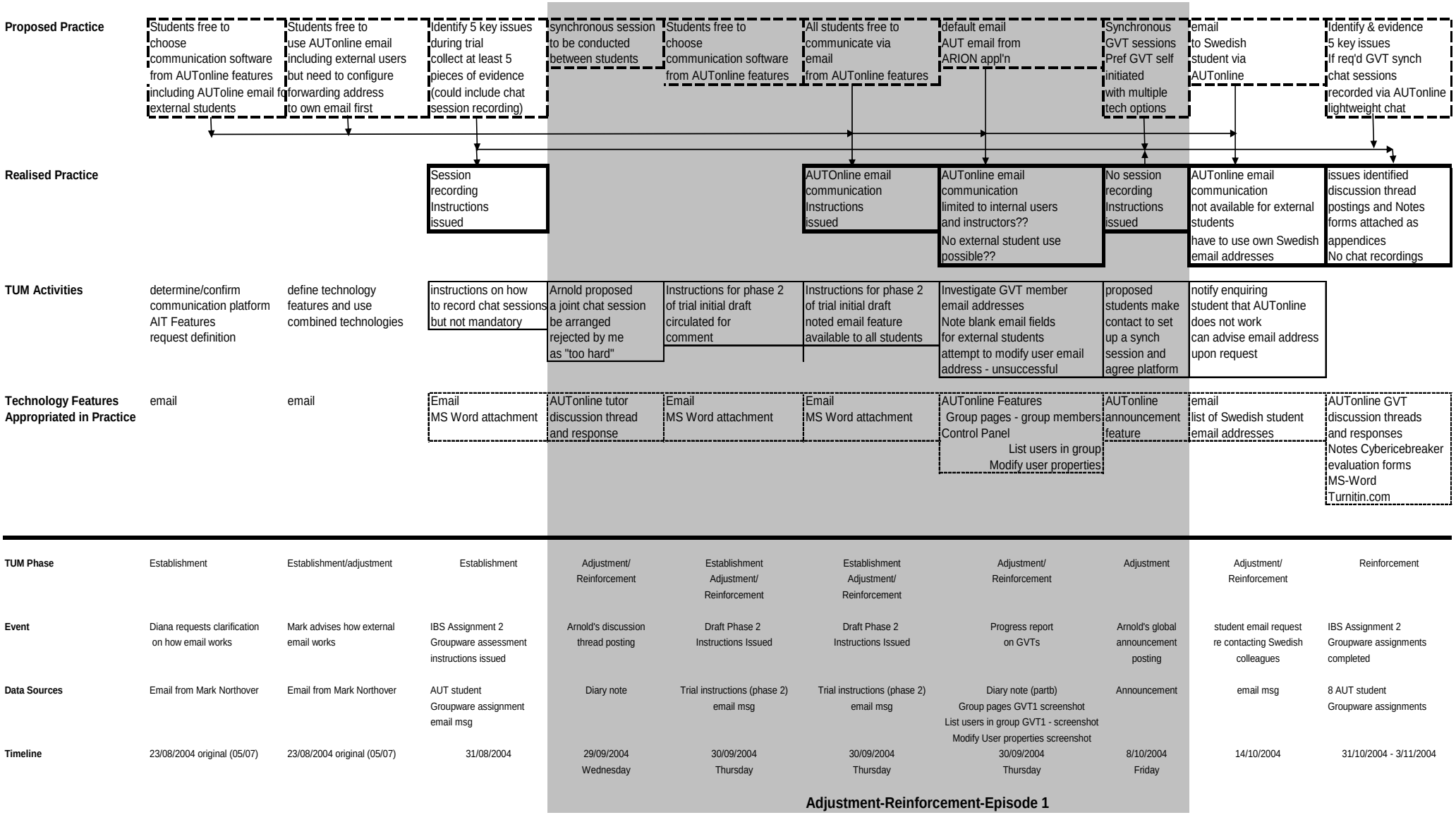


Figure A20-6.29: Temporal Bracket: Extended Adjustment-Reinforcement Episode 1 - Evolution Over Time

As noted in figure A20-6.29 above, an additional topic in this episode relates to the student email facility within AUTonline, with the instructions to students indicating the following:

> You can email other GVT members by accessing Communication> Send email (DK 30/09)

However in perusing AUTonline I had noted that student email addresses were "not all displayed for some reason", and were "not able to be changed" (TC 30/09), suspecting a software bug. Therefore this extended episode includes further items to explain this anomaly.

Augmenting the diary note data for this episode (within the episode's own time window, shaded grey in figure 6.29 above) were three 'screenshots' (which I had recorded that same day, and retained in my hard copy "East- Light" folder). These revealed that email addresses for external students with user names such as 'ext000101' were missing. Thus it appeared that email functionality for external students via AUTonline was not actually available as had been originally thought. Outside the time window in an extended bracket was an AUT student email message (interestingly in *TUM reinforcement* mode) to her GVT members, copied to Diana:

> i hope that you all get this email and find it encouraging more than nagging to join us on the boards and start posting. We arent that scary at all, just wanting to get to know all of you etc (DK 14/10 – TW)

Diana subsequently responded communicating the deficiency of AUTOnline email for contacting Swedish students, and indicating a resolution to the problem, requiring an active *TUM adjustment activity* on both the student and Diana's part, since Diana had individual email addresses for Swedish students.

> I'm not sure which email addresses you are using for this email to your Swedish counterparts. If you are emailing from within autonline you need to be aware that the Swedish students do not use the aut email addresses and won't get your email. You need to use their own email addresses; if you need them, let me know and I'll forward them to you. (DK 14/10)

As earlier noted in section 6.4.6 above, email for external students effectively went into a "black hole", so their designated home or university email addresses had to be used instead.

On further tracking back through the source items for the establishment episode, I uncovered the following interaction within what Lee has referred to as a "mosaic message" (Lee, 1994), namely a series of forwarded messages creating a "cumulative mosaic" of negotiated meaning in a lengthy thread. Unpacking these threads often causes confusion in determining the originator of a message and the date for that segment. Thus the two emails coded to Mark Northover (MN 23/08) in this extended episode are actually far earlier messages, one from Diana on the 5/07 at 11:52 am and a response from Mark on the same day at 17:17pm, (as noted in section 5 above, this reflects a potential flaw in the naming standard devised for individual email segments within such "mosaic messages"). In this excerpt Diana had communicated with Mark Northover (manager of the Learning Technology Services unit) to clarify how email would work for external students:

> I just want to double check with you the issue with email addresses for the overseas students form US and Sweden - I'm still unsure if I got it right. My understanding is that there are a couple of ways to upload them in autonline:
> 1) they are assigned an AUT email address and they use it for the purpose of the exercise; all students who are participating in the exercise could email each other from within autonline.
> 2)any email they get to their AUT address is automatically forwarded to their preferred email address. This means they do not have to use AUT email addresses but if they want to email other students, they will have to do so from their own mailing systems.
> Please let me know that the above is correct. (MN 23/08 – DK)

The response from Mark follows:

> The answer to your query is that both of the points you make below are correct. When student accounts are created in AUTonline they will be given AUT accounts, with an associated email address. This is the email address that Blackboard uses. However, the students can have an alternate address (their preferred one) set up as a diversion address. This can now (as of about two days ago) be done by the students themselves from off-campus, using the form at https://webmail.aut.ac.nz.
> A bit of work in setting up, but only has to be done once. (MN 23/08)

This 'reality in use' of the AUTonline email then, where external students did not have an apparent AUTonline email address, actually contradicted the initial advice about operation of external email accounts which we had been given from our Learning Technology Services unit.

The focus on communication technologies then, in this temporal bracket, reveals some failure over time of both synchronous chat technologies and AUTonline email.

The first failure related largely to student acceptance of the technology and their willingness to arrange their own chat sessions for their purposes. The discussion concerning the related analysis of figure 6.7 in section 6.2.6.2 above has expanded further upon the window of use of synchronous technologies.

The second failure relates to a misunderstanding about the operation of a technical feature within AUTonline. The outcome, namely no functional email for external students integrated within the AUTonline system, seemed to be a technical, and probably institutionally imposed, limitation on the part of the AUTonline system. However this limitation had not been apparent to our Learning Technology advisors, who in turn were relying on advice from Technology Services and perhaps Blackboard as the vendor of the commercial VLE. This episode graphically illustrates the reliance of those involved in TUM activities, on multiple parties, often in a "cumulative mosaic" of negotiated meaning, and, like many technology related communications, perhaps vulnerable to the knowledge level of particular parties. This *AIT* failure theme could be further investigated and undoubtedly there are other communications in the repository of data related to this deficiency with external email accounts, however for now the point is made. It may well have been that the functionality to create AUTonline email accounts existed for internal students, and for persons loaded to AUTonline as instructors, but not for external students. At this point of analysis it appears that this fact was not known to those supporting this use of the system in a manner

extending beyond typical usage with students internal to the university. Evidently as an *AIT*, AUTonline here provided a concrete example of the fact that "such technologies are rarely fully integrated, flawless and unfailing" (Orlikowski & Iacono, 2001). Diana's email to TW in response to this situation,

> You need to use their own email addresses; if you need them, let me know and I'll forward them to you. (DK 14/10)

furnishes a particular example of *TUM adjustment activity* in which Diana as collaborative trial coordinator engaged in the "kinds of workarounds…and forms of articulation work that make dynamically complex systems work in practice" (Orlikowski & Iacono, 2001).

A20-6.6 Episode of Interest Profile: Episodic Change-adjustment Episode 2

A20-6.6.1 Episode Characteristics – Episodic –adjustment Episode 2

Episode Characteristics	
Duration:	13/10/2004
Supporting data:	Diary Note 13/10/2004
No of sources	1
Word count	47
Actors:	Tony Clear

Table A20-6.32: Episode Characteristics - Episodic Change–adjustment Episode 2

A20-6.6.2 Narrative Summary - Episodic Change–adjustment Episode 2

This episode consists of a brief excerpt from a diary note in which I had recorded my actions working from home early in the morning, reviewing progress of the collaboration by checking entries against several *AIT* features (*GVTs 1-9, Phase 2, leader decision, websites and evaluations*). In addition the diary note recorded a revision which had I made to the Notes collaborative database by adding a new question to the final online evaluation questionnaire for the trial. This question addressed the "team performance outcomes (or at least the perceptions thereof)", and was worded as "our global virtual team successfully achieved its goals".

A20-6.6.3 Appropriation Move Patterns- Episodic Change –adjustment Episode 2

Figures (A20-6.30, A20-6.32, & A20-6.33) below depict the patterns of 'appropriation move types' and 'subtypes' (DeSanctis & Poole, 1994), which characterise this episode, and demonstrate the manner in which the technology has been appropriated.

A20-6.6.3.1 Appropriation Move Patterns – Episodic Change –adjustment 2 - direct

This episode was coded as containing no *'direct'* appropriation moves as it involved not a case of direct technology use, but rather a review of past technology use and an

adaptation of the technology design for future use. An alternate coding strategy, (in which review of progress on the trial did require use of the AUTonline and Notes database features - in view mode), could equally see these moves coded as "*direct appropriation*", where the actors "*openly use and refer to the structure*".

A20-6.6.3.2 Appropriation Move Patterns – Episodic Change –adjustment 2 - Constraint

There is one singly coded appropriation move categorised as *constraint*, where the 'structure is interpreted or reinterpreted'.

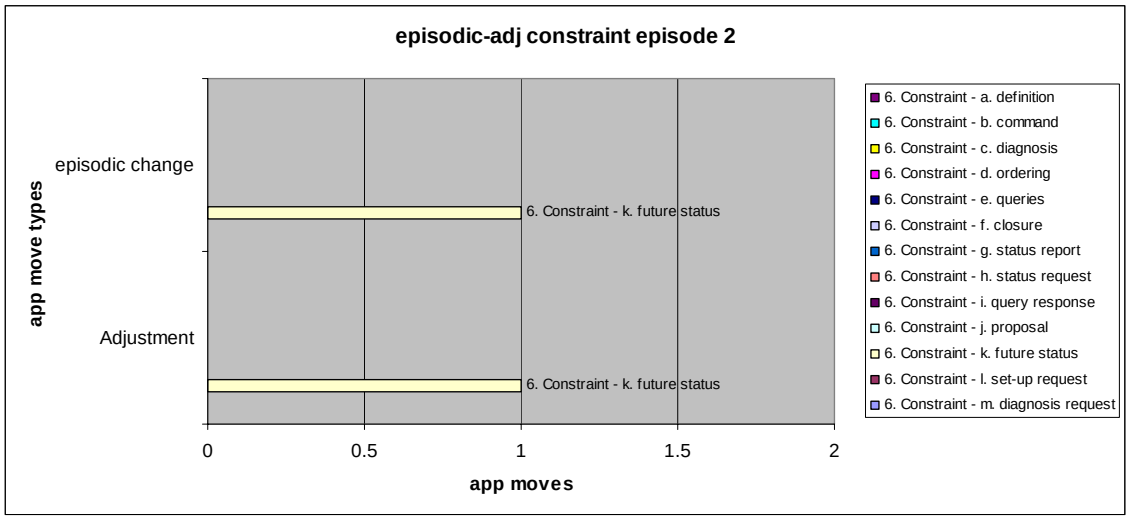


Figure A20-6.30: Episodic Change –adjustment 2 Appropriation Move Types – Constraint

The above move coded as 'k –future status' (*stating what is proposed to be done with or to establish the structure*) and excerpted below, demonstrates an example of a *TUM activity* in both *adjustment* and *episodic change* modes:

> Added new question to final evaluation questionnaire
> "our global virtual team successfully achieved its goals" (TC 13/10)

As an activity in the midst of an active collaboration this represented an *adjustment* to the existing online questionnaire, but this change had earlier roots, making it an *episodic change* in modifying a research instrument (which on perusing prior sets of questionnaires had been fairly stable over time – from 1998 – 2000 containing 8 Likert scale questions; from 2001 containing 10 Likert scale questions; and from second semester 2004 - *through this addition* - containing 11 questions). This online questionnaire form and set of Likert scale questions are portrayed in figure A20-6.31 below.

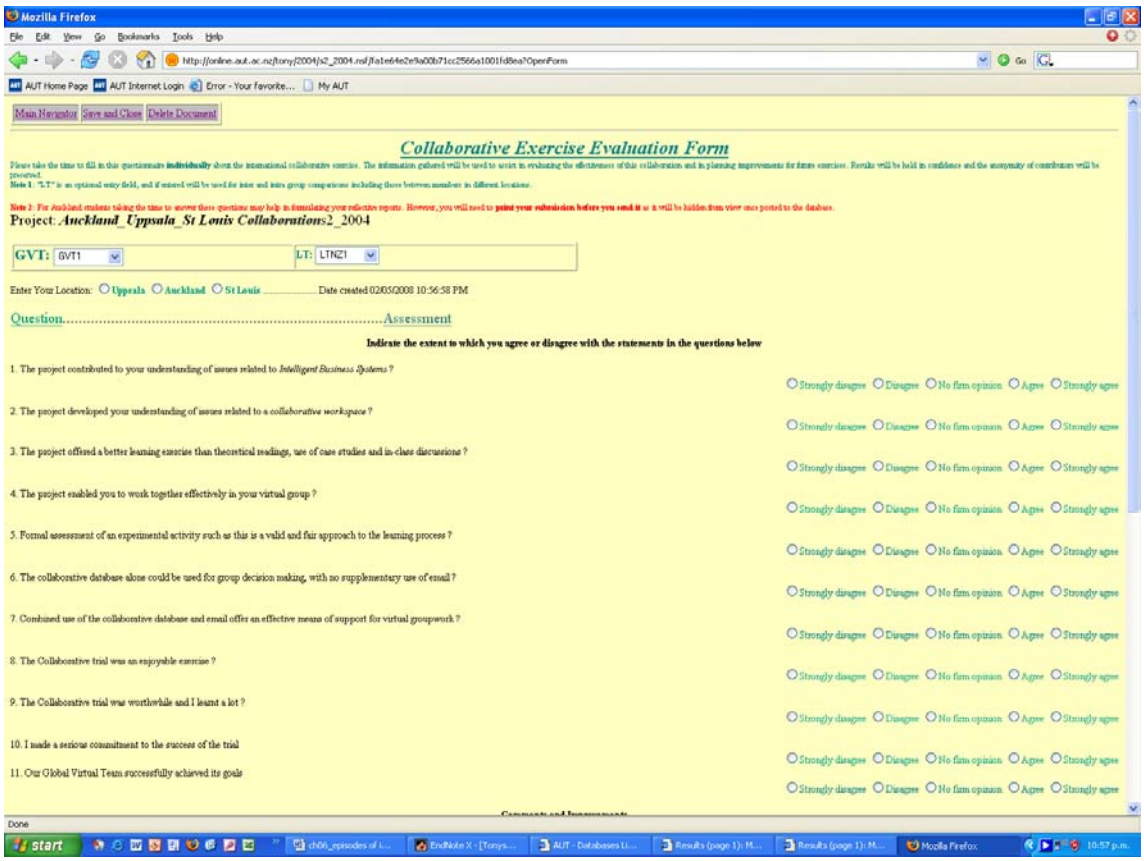


Figure A20-6.31: Notes Collaborative Database Online Evaluation Questionnaire

In the above appropriation move the design process for the Lotus Notes Collaborative Database is illustrated, through a tailored adaptation of a custom developed prototype application *to establish the structure* of a revised online questionnaire. Such local development is consistent with the earlier claim about groupware technologies by Orlikowski & Hofman (1997) "Such technologies are typically designed with an open architecture that is adaptable by end users allowing them to customize existing features and create new applications". The functionality here developed is highly specific, as indicated in the screenshot of the questionnaire in figure A20-6.31 above and demonstrates the adaptability of Lotus Notes as an application development environment within a middleware framework (Bernstein, 1996). To this extent the more powerful Notes Development platform differed from AUTonline, (the commercial Blackboard VLE environment), which could also be termed an end user 'configurable' form of groupware technology.

A20-6.6.3.3 Appropriation Move Patterns – Episodic Change - adjustment 2 Judgement

This episode has two examples of a *judgement* move, where the actors express judgments about the structure. Both are coded in figure A20-6.32 below, to the

episodic change category of TUM activity, as they express judgements based upon a historically developed perspective.

The first move coded as *'affirmation- d compliment'* describes the purpose of the added question as "*addressing team performance outcomes*". This question was added, I believe, to enable a better understanding of *GVT* versus *LT* performance. This rationale is based on a review of my notes of progress in the original copy of the same day's diary note (summarised at overview level only in the coded section). My check on responses to questionnaires evaluating the icebreaking phase of the trial at that stage had shown mostly Auckland student responses. This raised the question of whether the trial would succeed for some teams solely at the *LT* level, and would students perceive that as successful, although not consistent with the spirit of the whole exercise? Past collaborations had indicated some student confusion between the two levels of team and therefore differing effectiveness at *LT* and *GVT* levels *(Clear, 2000 p. 199, Clear & Kassabova, 2005).* Since the questionnaire responses captured merely student perceptions, this new data would enable triangulation with actual empirical data on team performance, and comparison between *actual* success in achieving goals at *GVT* or *LT* level and *perceived* success at *GVT* level. Thus to "*addressing team performance outcomes*" I had added the ironic modifier "*- (or at least perceptions thereof)"*, given my reservations about student perceptions of the exercise. This appropriation move was coded as *'neutrality – a explicit' "expressing uncertainty or neutrality towards use of the structure*".

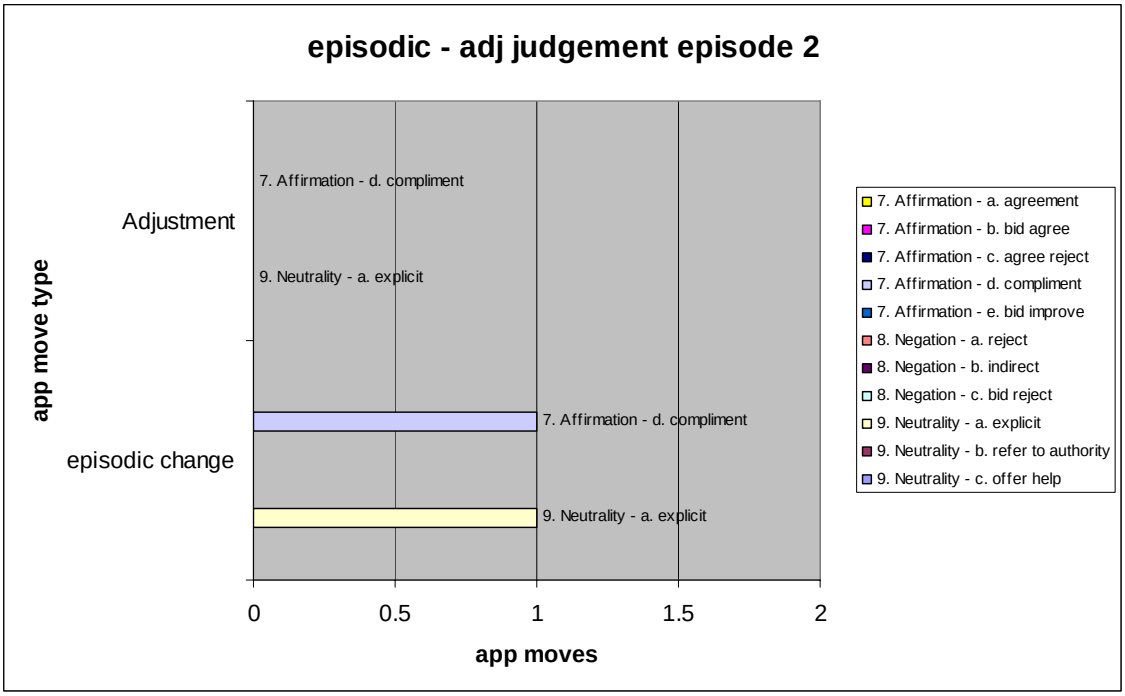


Figure A20-6.32: Episodic Change –adjustment 2 Appropriation Move Types - Judgement

A20-6.6.3.4 Appropriation Move Patterns –Episodic Change- adjustment 2 Relate

This episode shows an example of a move categorised as '*relate'*, where the actors 'relate to other structures' and where 'the structure may be blended with another structure'.

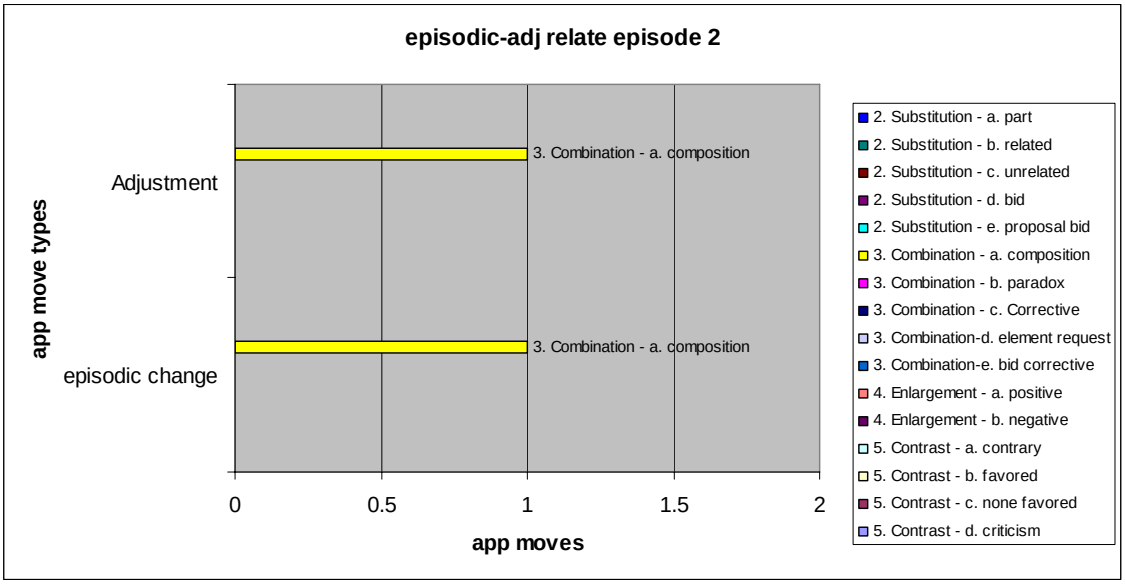


Figure A20-6.33: Episodic Change - adjustment 2 Appropriation Move Types - Relate

The single move coded here as '*combination – a composition*' in which the actors '*combine two structures in a way consistent with the spirit of both*' is mapped to both TUM activities of *adjustment* and *episodic change*.

The specific move "added new question to final evaluation questionnaire", represents a relatively minor technical adjustment to the Lotus Notes form, and an addition of one further Likert scale question to the research instrument within a logical grouping on the evaluation form. Thus adding a further element to the *metastructure* of the 'online questionnaire' was consistent with the spirit of each feature, in this case not only at the technology level, but also with the institutional (sanctioned development, course context & research design) and cultural dimensions (professional researcher, student).

A20-6.6.3 Other Grounded Data -–Episodic Change – adjustment Episode 2

Concepts	Codes	Count	Subtotals
GVT	GVT	1	1
Metastructure	Metastructure	1	
Metastructure	Metastructure Spirit	1	2
Research	research design	1	
Research	data	1	
Research	diary note	1	3
Role	Coordinator	1	
Role	monitor	1	
Role	Developer	1	3
Socio-emotional	performance-driven emotions	1	1
Time	Time	1	
Time	day	1	2
Space	Location	1	
TUM Activity	Reinforcement	1	
TUM Activity	Adjustment	1	
TUM Activity	episodic change	1	3

Table A20-6.33: Episodic Change – adjustment Episode 2 – Concepts and Codes

Table A20-6.33 above provides the grounded theoretic 'open codes', 'concepts' and/or 'categories' derived from the data source in this episode. Again these have been derived in a manner similar to those in section 6.2.4 above, and structurational analysis is conducted below.

A20-6.6.3.1 Duality of structure - Episodic Change – adjustment Episode 2

In this episode again we see the interplay between action, structures and technology as closely intertwined elements. The *metastructure* of a 'final evaluation questionnaire' links the action of *research design* through modifying a research instrument in order to capture research *data*, with the institutional/professional theme of *research*, implemented through an online form supported by Lotus Notes technology, into which the *metastructure spirit* of "addressing team performance outcomes" at the *GVT* level (or student 'perceptions' of team performance) was infused.

In the *coordinator* and *monitor* roles I had checked progress on the collaboration. This action engaged the TUM activity of *reinforcement*, reviewing student postings against the *metastructures* of various *AIT* features (AUTOnline features - Group pages for *GVT*'s 1-9, phase 2 discussion threads; Lotus Notes database features - leader decision forms, posted website links and online evaluations). These *metastructures* implemented as technology artefacts, acted to link the institutional aspects of the

teaching, learning and research tasks, as a result of conscious design, with student appropriation of the technology bringing this design to fruition. As the earlier discussion about *GVT* versus *LT* confusions indicates, student appropriation of the technology had not always conformed to the spirit of the learning or research design.

A20-6.6.4.2 Time and Space – Episodic Change – adjustment Episode 2

The concepts of *time* and *space* present in this episode, serve merely to mark the date, *day* of week and *time* the diary note was written (8:45 am) and indicate the *location* "from home". This illustrates a pattern of working where in *reinforcement* mode I would regularly check progress on the collaboration. Early morning gave a window before I went in to the daily interruptions at work, to check whether any progress had been made overnight – typically new contributions from offshore students. The twelve hour time zone difference enabled activity analogous to "round-the-clock development" (Herbsleb et al., 2000, Lacity & Rottman, 2008) or "*follow the sun* development strategies" (Casey & Richardson, 2006), where collaborative partners on one side of the globe sleep and on the other side are active. The *location* here is also relevant, since while Notes development from home was slower using the VPN over a dial-up link, in my *developer* role it enabled the necessary concentration through interruption free working, as opposed to working from my office at the University.

A20-6.6.4.3 Reflexivity of the actors – Episodic Change –adjustment Episode 2

Activity in the *coordinator* and *monitor* roles here indicated an awareness of the collaborative process and its relation to the technology and institutional context. The desire to check contributions by students to the *AIT* and if necessary engage in more active *TUM reinforcement activity*, illustrated *TUM* in action, here primarily in a passive mode of *reinforcement* by simply monitoring progress and change. A more active *TUM activity* in the *establishment* and *adjustment* modes was represented through the *developer* role, where the *AIT* features were consciously and deliberately augmented to address perceived deficiencies in the *research design* and the supporting instruments for collecting research *data*. The decision to adjust the instrument arose in the course of reflection, past and present, and based upon my *performance driven emotions* relating to team performance outcomes in these collaborations. In addition to my own reflections and assessments of GVT performance, the very phrasing of the question would require students when responding to be *socio-emotionally* reflective about their own context and performance. At that concluding point in the collaboration

of course, it would not enable them to act on these reflections to recursively shape the team experience.

A20-6.6.5 Visual Mapping – Episodic Change – adjustment Episode 2

The diagram in figure A20-6.34 below represents, as in prior episodes, a visual summary, or 'map' of the episode, focusing on the micro level *metastructure* '*Final Evaluation Questionnaire - Additional Question'*. Although a seemingly minor technology feature, it is here argued that the '*Additional Question*' does act as *a metastructure* in possessing institutional, cultural and technology properties which enable it to serve a mediating role in shaping technology use.

The map in figure A20-6.34 below depicts the operation within this episode, of the *metastructure* represented by the *Final Evaluation Questionnaire - Additional Question* at each site. Each element is briefly tabulated in table A20-6.34 below.

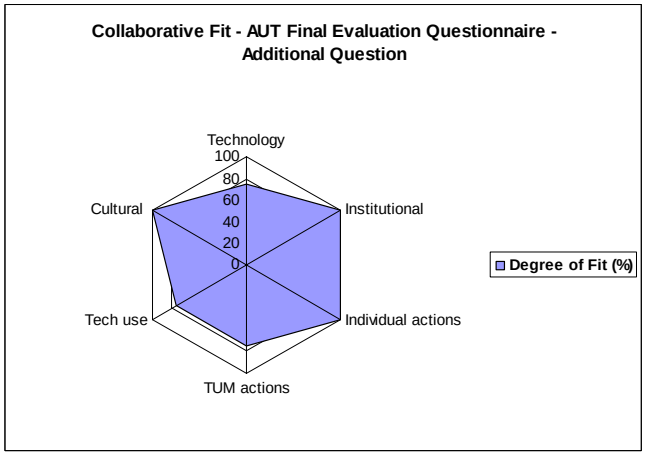
AUT
Technology – Lotus Notes Final Evaluation Form, Label & Radio buttons [Lotus Domino Designer, VPN - implicit]
Institutional – supports Research and Teaching & Learning design
Individual actions – Tony adds new question via Notes DB
TUM - reinforcement & reflection on icebreaker responses, establishment & adjustment, design & implementation
Tech use - Lotus Notes Final Evaluation Form, Label & Radio buttons [Lotus Domino Designer, VPN - implicit]
Cultural – AUT students respond to icebreaker questionnaire, additional question consistent with research & teacher roles

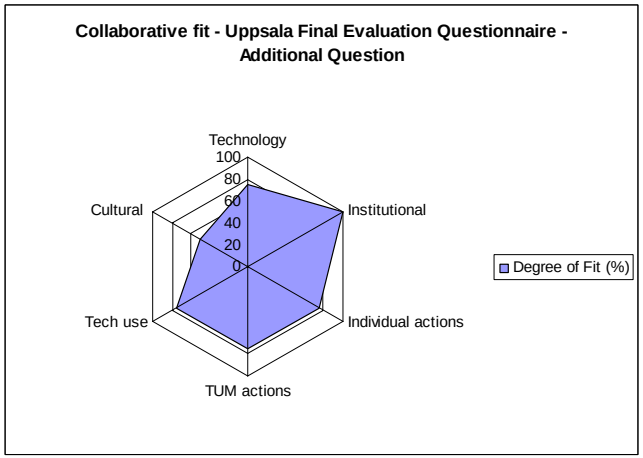
St Louis
Technology – Lotus Notes Final Evaluation Form (as future users only)
Institutional – supports only Teaching & Learning design
Individual actions – nil until use
TUM - nil
Tech use - Lotus Notes Final Evaluation Form (as future users only)
Cultural – Unable to report St Louis student responses, additional question consistent with reflective teacher role

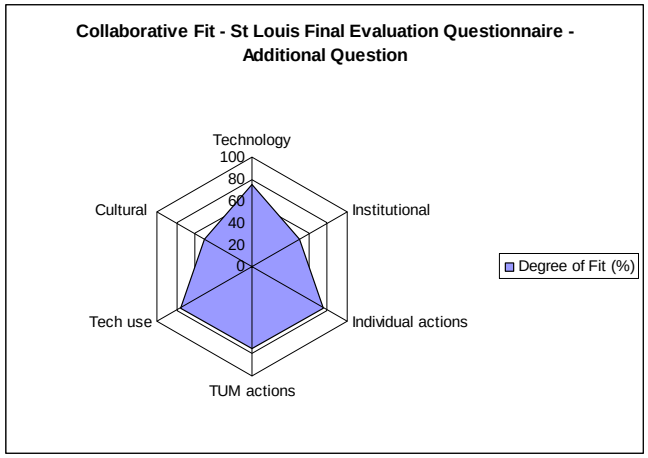
Uppsala
Technology – Lotus Notes Final Evaluation Form (as future users only)
Institutional – supports Research and Teaching & Learning design
Individual actions – nil until use
TUM - nil
Tech use - Lotus Notes Final Evaluation Form (as future users only)
Cultural – Uppsala students limited response to icebreaker questionnaire, additional question consistent with research & teacher roles

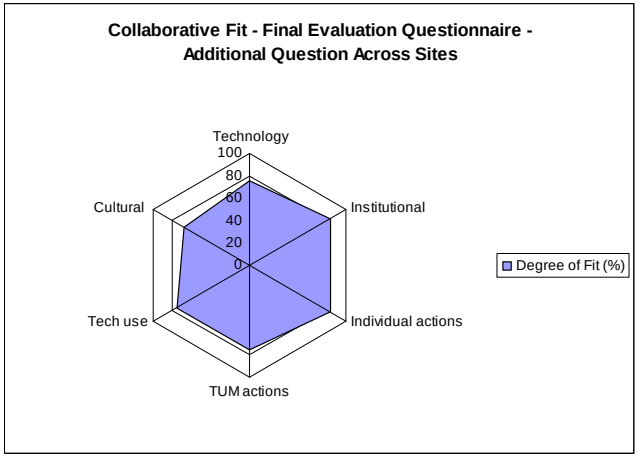
Table A20-6.34: Episodic Change – adjustment Episode 2– *Metastructure* of *Final Evaluation Questionnaire - Additional Question*

Figure A20-6.34: Radar Charts – Episodic Change – adjustment Episode 2– *Metastructure* of *Final Evaluation Questionnaire - Additional Question*









Degree of Fit Scale (%)

100% - full collaborative fit (CF)

75% - moderate CF

50% - partial CF

25% - limited CF

0% - no CF

A20-6.6.6 Temporal Bracketing – Episodic Change – adjustment Episode 2

This episode, with its single and very brief data source, offers limited scope for temporal analysis and affords restricted scope for showing any progression of events. Yet like the previous episode in section A20-6.5.6, as an instance of TUM involving episodic change and adjustment, this episode inherently has a past and a future briefly touched upon in the discussion above. The temporal analysis below extends the window of analysis by widening the temporal bracket. The 'TUM activity in focus' for the extended temporal bracket is the redesign of the *Final Evaluation Questionnaire - Additional Question.*

Therefore this episode is extended to include this broader perspective, with the addition of the further source items outlined in table A20-6.35 below.

Extended Episode Characteristics	
Duration:	20/09/1999 – 30/10/2004
Supporting data:	M. Phil Thesis (Clear, 2000) 20/09/1999 – 27/05/2000 ACE 2005 paper (Clear & Kassabova, 2005) draft & final versions 1/09/2004 – 1/02/2005 AUTOnline chat session recordings (20/10/2004 – 30/10/2004)
No of sources	4 – focal lens of TUM activity related to the redesign of the *Final Evaluation Questionnaire - Additional Question*
Actors:	Tony Clear, Diana Kassabova, AUT Students, Swedish Students

Table A20-6.35 Extended Episode Characteristics – Episodic Change-adjustment Episode 2

The issue of differential *LT* and *GVT* performance has had a long history in this series of collaborations. As noted above, I had commented on the issue in my M. Phil thesis (Clear, 2000 p. 199), and in the paper reviewing 2003 to semester one 2004 collaborations, which Diana and I presented to the ACE2005 conference (Clear & Kassabova, 2005). That paper could be regarded as the outcome of a reflective cycle of "specifying learning" (Susman & Evered, 1978) in the overall action research programme, and had been submitted about a month prior to this episode, so the issue had no doubt been percolating in our minds. Variable team level performance had become apparent again in this episode through reviewing student responses to the

icebreaker evaluation step where AUT respondents were predominant. The discussions relating to team performance with synchronous technologies in earlier episodes (cf. 6.2.6.2 and figure 6.7 above) have also highlighted the issue, since those synchronous sessions appear to have functioned to some degree at *LT* level but not at *GVT* level.

As can be seen from figure A20-6.35 over page the differential performance across LT and GVT levels persists in this collaboration too, as does a degree of student confusion. However this is not a new phenomenon, as can be seen in the excerpt from a Swedish student in the 1999 collaboration below:

> 12/10/99 Hi!
> "I have a question concerning the nailcare project. I am the groupleader in group009SE017 and we are working together with group009NZ009. Are we supposed to work together with the other Swedish group009SE018 who also evaluates the same nailcare programs as we are? They have already come to an conclusion and I'am not sure that they are aware of that they should collaborate with the same NZ-group that we are. So are we supposed to collaborate with group009SE018 or not? Please answer as soon as possible. (Clear, 2000, p.199)

This issue will be further addressed in a subsequent episode (cf. section A20-6.7.4.1.2 below) where the student confusion with, and the coordinators perceptions of the LT versus GVT distinction will be canvassed.

By way of contrast, the entry in figure A20-6.35 below regarding student performance in arranging a synchronous chat session, appears to reflect not confusion, but either limited competence in arranging a GVT session, or simply frustration at being unable to gain co-operation across sites resulting in making more achievable arrangements at the local or LT level.. It must be observed that students act here in peer relationships with their global colleagues, a phenomenon upon which Powell Galvin & Piccoli (2006) have commented “short lived virtual teams student teams with no prior history…suffer from no power structure within the group”. Therefore the skills of leadership in such environments based upon peer influence may need to be more developed, since the powerfully coercive levers of money and career sanctions in industrial GVT settings are not available to them. Perhaps the educational task may constitute too weak a “formal script” (Panteli & Duncan, 2004) to encourage the forms of leadership required to generate active and sustained participation by GVT members. Indeed the studies by Kayworth & Leidner (2002) and Pauleen (2003) indicate that a highly sophisticated skill set is required of the virtual group leader. The demands of “behavioral complexity” where “effective leadership is dependent on ability to display multiple contrasting styles in complex settings” (Kayworth & Leidner, 2002) may be simply too demanding, so mixed outcomes are perhaps natural then for student GVTs.

Students may lack the skills to manage the "social and cognitive complexity" of balancing "social as well as task awareness" (ibid.). The role of LTs in this global virtual team dynamic is complex, with Pauleen (2003) reporting a successful study contradicting an earlier finding that "collocated sub teams can create faultlines that increase conflict and reduce trust". Perhaps resorting to local working is a natural tendency to reduce Kayworth & Leidner's "social and cognitive complexity" of the leadership role. Furthermore this apparent student tendency to 'think global but act local' supports the arguments of Carmel and Abbott (2007) who list the following advantages of "Nearshore' working, namely its: proximity advantages; real-time overlaps ; cultural/historical similarities; linguistic relationships; political/economic similarities and other locational advantages.

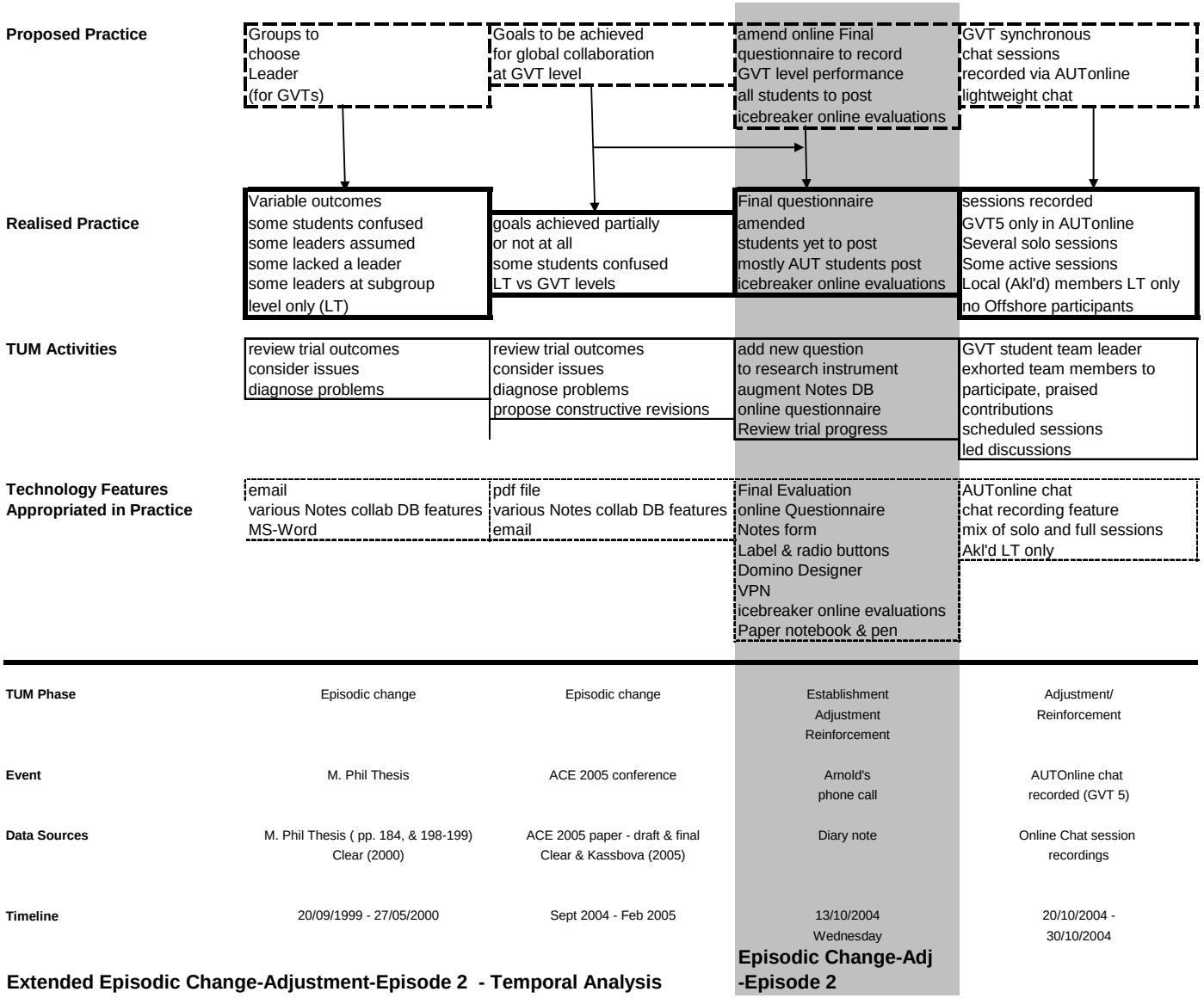


Figure A20-6.35: Temporal Bracket: Extended Episodic Change –adjustment Episode 2 - Evolution Over Time

As a further extension of this temporal bracket, the final GVT performance outcomes posted by students (between 27/10/2004 and 04/11/2004) are presented in table A20-6.36 below.

Final Evaluation Questionnaire Results s2/2004 Q.11

Q11. Our Global Virtual Team successfully achieved its goals

GVT	Location	Result	Numeric	Mean	LT member Totals		Response rates
4	Akl	disagree	0.25		Akl	3	66.67
	AKl	disagree	0.25		SE	2	0.00
				0.25			
5	AKL	disagree	0.25		Akl	4	100.00
	AKL	disagree	0.25		SE	3	0.00
	AKL	disagree	0.25				
	AKL	disagree	0.25				
				0.25			
6	Akl	disagree	0.25		Akl	4	75.00
	Akl	no firm opinion	0.5		SE	3	0.00
	Akl	disagree	0.25				
				0.33			
7	AKL	no firm opinion	0.5		Akl	4	75.00
	SE	disagree	0.25		SE	2	150.00
	SE	disagree	0.25				
	SE	no firm opinion	0.5				
	AKl	disagree	0.25				
	AKl	disagree	0.25				
				0.33			
8	Akl	disagree	0.25		Akl	5	60.00
	Akl	no firm opinion	0.5		SE	3	0.00
	AKl	disagree	0.25				
				0.33			
9	Akl	agree	0.75		Akl	4	100.00
	Akl	no firm opinion	0.5		SE	3	33.33
	Akl	no firm opinion	0.5				
	SE	agree	0.75				**overall response rate**
	AKL	no firm opinion	0.5				
				0.60			
n =					**23**	**40**	**57.5**

Note: scale - strongly disagree to strongly agree (0 - 1)

strongly agree	1
agree	0.75
no firm opinion	0.5
disagree	0.25
strongly disagree	0

Table A20-6.36 Final Evaluation Questionnaire – 'Perceived GVT Performance' Summary of Student Responses

The table includes only six of the 9 GVTs, with GVTs 1 -3 being excluded, since the data from St

Louis members was unavailable for research purposes. As can be seen from the results, GVT performance in goal achievement was generally perceived by students to be less than successful (rated between 'disagree' and 'no firm opinion'), with very few Swedish student responses. GVT7 results appear anomalous with 3 Swedish responses against their two members in the team – but this entry if not in error may have reflected the addition of a new member to the team later in the course? GVT9 does appear to be the exception with a more positive view of outcomes from the exercise. The reasons for this outcome could be further investigated, but at this stage it suffices to round off the episode with the demonstration of the (admittedly less than ideal, but empirical findings) demonstrating outcomes achieved as a result of the establishing TUM activity profiled in the episode.

A20-6.7 Episode of Interest Profile: Adjustment-Reinforcement Episode Two

A20-6.7.1 Episode Characteristics – Adjustment-Reinforcement Episode 2

Episode Characteristics	
Duration:	20/10/2004 – 22/10/2004
Supporting data:	1 Email message – Arnold Pears – 20/10/2004 1 Email Message Diana Kassabova - 20/10/2004 1 File Diana Kassabova - 20/10/2004 1 Email Message Fred Niederman - 22/10/2004
No of sources	4
Word count	3373
Actors:	Tony Clear, Arnold Pears, Diana Kassabova, Fred Niederman, students at all three sites

Table A20-6.37: Episode Characteristics - Adjustment-Reinforcement Episode 2

A20-6.7.2 Narrative Summary - Adjustment-Reinforcement Episode 2

This episode consists of a three way interchange of email messages between the trial coordinators, Fred, Arnold and Diana. With time running out and just over a week remaining for the collaboration, the coordinators shared their concerns about their students' understanding and the progress of the exercise, and reflected upon what might be improved for future collaborations. Diana's response included as *reinforcement* to her colleagues an attached file of the original instructions to students.

The first message was from Diana to Fred in response to a prior email which Fred had sent me and I had forwarded. Diana began with a supportive response to Fred's concerns about the way the exercise was going, noting that she shared them since students were constantly asking "why there is so little response from their overseas counterparts", and thanked Fred for outlining his difficulties. In a philosophical aside Diana observed that students were the same everywhere, and did not read instructions! But they were also afraid of making mistakes and being embarrassed. She further

commented that she had formed the view that it was unrealistic for students to go away and conduct the exercise on their own. Therefore she typically engaged in active facilitation to offer support and encouragement in the classroom environment (constant reminders about due dates, encouraging questions, constantly referring to the instructions, frequent large screen demonstrations in class of the collaborative database, and sometimes one to one guidance to students). The main AUT student concern was lack of response from US or Swedish students. Diana suggested that Fred let his students know that their responses were eagerly awaited, which might have them become more active. Likewise, using the group forums to ask the NZ LTs for help "could give some additional boost to the collaborative process".

Diana then gave a response to two specific questions (embedded from Fred's prior email) relating to student confusion: 1) they were unsure how many sites they needed for each group and whether to evaluate only their team's sites or all the sites; 2) they were a bit perplexed as to why they were seeing the whole list of sites for all GVTs. For question 1): each LT needed to upload 2 sites (for GVTs1 -3 giving 6 sites to evaluate), each LT should use one evaluation form per site, i.e. Each LT should upload 6 evaluation forms. For question 2): they could see all groups in the collaborative database as there was no security implemented, and as a collaborative rather than competitive exercise this should not be a problem, and it may have helped through sharing knowledge of other teams' sites to learn more about groupware. In conclusion Diana noted her willingness to clarify anything else, and as a reminder also attached in her reply the original instructions to students.

In the subsequent message Arnold picked up on the conversation, outlining a number of reasons for the lack of response from Swedish students. Among these were: despite Arnold's "attempt to motivate people here" they felt there was "little scope for collaborative activity"; the absence of NZ students on holiday during the first two weeks that Swedish students had accounts on AUTonline had been demotivating; both students and Arnold reported AUTonline frequently being down and inaccessible from Sweden (unsure whether due to network problems between NZ and Sweden or unreliability on the part of AUTonline); the structure of the exercises was felt to be too prescriptive leaving no scope for collaboration and negotiation between the teams. Arnold argued that a "key factor in getting the team to collaborate is to have clear deliverables that the entire team must work towards", and for maximal effectiveness online synchronous chat sessions were crucial. Arnold suggested that before the next

year's collaboration we would need to have a clear idea of the exercises involved and how they would promote collaborative activity.

Responding to the GVT/LT related confusions, Arnold identified the LT structure as problematic in that it "encourages the team to work as geographically collocated disparate entities", suggesting that to encourage participation it would be good to refer "to the entire team and not to have a notion of local subteams". A further recommendation was that we "specify clearer guidelines for 'processes' that we expect the entire GVT to go through in collaboration". This would need to include an expectation that course participants work outside normal hours as the only way to get the project to work given the timezones involved. Arnold then briefly concurred with the groupware view being open to all groups, and acknowledged he had been glad to be part of the collaboration, but that it would need to be thought through and redesigned for next year.

Providing a clear contrast to Arnold's email, Fred's response was more optimistic, while acknowledging deficiencies that could be addressed in future. Fred began by affirming that from his perspective the exercise had been very successful as it had given the students a chance to see international collaboration in action, even if not as smoothly as they might have wished. Since they would be likely to teach the course only every two years at St Louis, he added some comments as food for thought.

Again the local groups were not considered to have worked well at the US site, with more teams with one or more individuals from each site being preferable, a design which would incidentally provide a larger 'n' for research purposes. Fred felt a more structured introduction would have been helpful, for instance "find out 5 things that interest you about the country where each student lives". He added that this introduction could be by email exchange as "students were shy about posting personal information to a general outlet". Again the two week vacation dissipated early momentum, and they also had trouble getting students on for the first time. This was a subtle problem as "with sharper timing" they could have reserved a lab and spent lab time with the students performing the task. As it was Fred gave demos on the projector in the classroom, but left students to work outside of class only. In a classroom session the local teams could have been seated together, so it would have helped with that issue too.

Regarding the website rating task, Fred suggested that it could have been broken into more component parts, perhaps with a prize for the websites voted most helpful, since

students in the US culturally tended to be motivated by a little competition "(too much and they get too intense about the game and forget about the purpose)". US students also seemed to want to know what was required and what was optional and usually only did what was required. Fred concluded by noting that he had asked all three groups to input at least 2 websites, evaluate the six sites for their group participate in ranking discussions and write up a paper reflecting on the experience.

A20-6.7.3 Appropriation Move Patterns- Adjustment-Reinforcement Episode 2

Figures (A20-6.36 – A20-6.38) below depict the patterns of 'appropriation move types' and 'subtypes' (DeSanctis & Poole, 1994), which characterise this episode, and demonstrate the manner in which the technology has been appropriated.

A20-6.7.3.1 Appropriation Move Patterns – Adjustment-Reinforcement Episode 2-direct

This episode contained no *'direct'* appropriation moves as it did not involve a direct case of technology use, but rather a set of reflections upon technology use (and moreover technology non use), together with some proposals for future use.

A20-6.7.3.2 Appropriation Move Patterns – Adjustment-Reinforcement Episode 2-Constraint

There are several coded *reinforcement* moves categorised as *constraint*, where the 'structure is interpreted or reinterpreted'.

The move coded in figure 6.39 below as 'b –command' (giving directions or ordering others to use the structure) excerpted below demonstrates an example of a *TUM reinforcement activity*:

> > Each LT need to upload 2 sites, i.e. each of GVT1, GVT2 and GVT3
> > should have 6 sites to evaluate). Each LT should use one evaluation
> > form per site, i.e. each LT should upload 6 evaluation forms (this
> > includes evacuating the 2 sites uploaded by them) (AP 20/10 – DK)

Here Diana's directions to Fred, (embedded within Arnold's email), outline and clarify the process for students to follow. This excerpt prefaced by Diana's introductory "Below I 'll try to answer your questions:" is also coded as a *TUM* specific move, 'i-query response' (answering questions about a structure's meaning or how to use it).

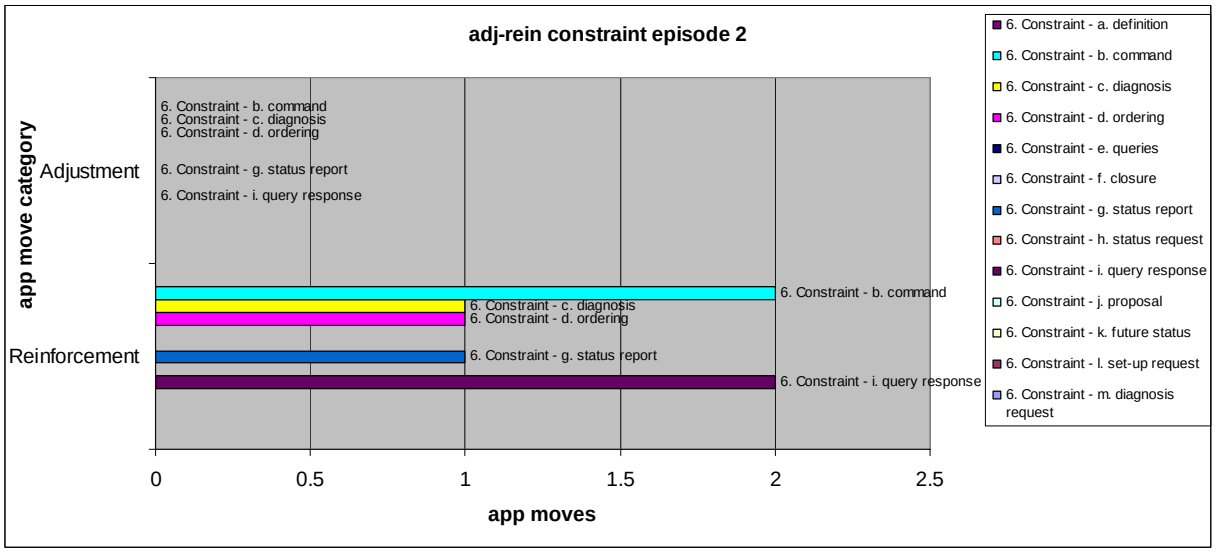


Figure A20-6.36: Adjustment-Reinforcement Episode 2 Appropriation Move Types - Constraint

The less directly worded instructions below represent a further example of a *command* move:

> Perhaps if you let your students know that their responses and actions are very eagerly expected by the teams here, and reenforce the rules of the game, they will become more active. Also, they could use the group forums to ask the NZ LTs for help, this could give some additional boost to the collaborative process.

A further item coded as a *TUM* specific move, 'i-query response' (answering questions about a structure's meaning or how to use it), relates to the views provided in the collaborative database:

> >>they are a bit perplexed as to why they are seeing the whole list.
> They can see all groups in the Collaborative data base as there is no security implemented in the prototype. We believe that as this is a collaborative (as opposed to a competitive) exercise this shouldn't be a problem. Besides, this way they can benefit from looking at other teams' sites and learn something more about groupware. (DK 20/10)

The excerpt below advising concerns about progress of the collaboration is coded as 'g-status report' (state what has been or is being done with the structure):

> I can tell you that there are still a few people who are unsure how to do this or that, but overall my students' main concern is the lack of response from students from US and Sweden. (DK 20/10)

The messages below coded as 'd – ordering' (specifying the order in which structures should be used), illustrate TUM activity indicating the order of the process and the sequence in which entries should be made:

> So I've been trying to deal with all this by providing my students with different forms of facilitation reminding them the due dates for the different phases, encouraging them to ask questions about anything to do with the exercise, constantly referring to the

> instructions…Quite often I bring up the site and the Collaborative database on the large screen in class and demonstrate to student how they should make their entries there.
>
> Often I just sit in class with some students and go through the steps one by one. (DK 20/10)

The subsequently coded excerpt 'c diagnosis' (commenting on how the structure is working positive or negative), indicates Diana's rationale for adopting the above forms of active facilitation:

> I have figured for myself that it is not realistic to expect that students would go away and do the collaborative tasks without further support and some ongoing encouragement. (DK 20/10)

A20-6.7.3.3 Appropriation Move Patterns – Adjustment-Reinforcement Episode 2 Judgement

This episode has examples of *judgement* moves in *reinforcement* mode, where the actors 'express judgments about the structure'.

The move coded in figure 6.40 below as *'affirmation- e bid improve'* (request suggestions to improve the structure) is an example of a *TUM* specific *reinforcement* move, illustrated by Diana's request to Fred below:

> If you need further clarification of any aspect of the tasks, please let me know and I will be happy to reply. (DK 20/10)

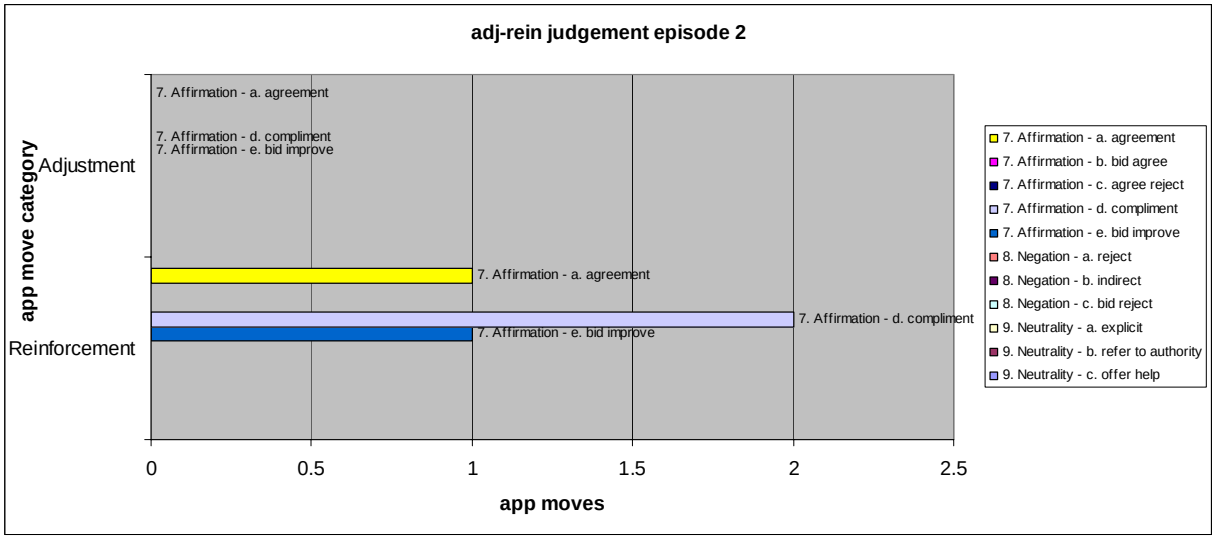


Figure A20-6.37: Adjustment-Reinforcement Episode 2 Appropriation Move Types - Judgement

The move coded as *'affirmation- d compliment'* (note an advantage of the structure) is evidenced in the positive introduction to this email from Fred:

> I want to be very clear in my mind this exercise has been very successful. It has given the students a chance to see international collaboration in action, even if what they've seen hasn't been as smooth as we'd like. I appreciate the invitation to participate in this project with you all and would look forward to doing so again in the future. (FN 22/10)

A further example also coded above under categories of 'constraint' and 'i - query response', relates to the collaborative database views being open to all groups, where the advantages were outlined:

> >>they are a bit perplexed as to why they are seeing the whole list.
> They can see all groups in the Collaborative data base … this way they can benefit from looking at other teams' sites and learn something more about groupware. (DK 20/10)

Reinforcement for this design was given in the email from Arnold, where the move coded as *'affirmation- a agreement'* (agree with appropriation of the structure) was evidenced:

> This seems fine. I see no reason to limit the groupware view further. (AP 20/10)

A20-6.7.3.4 Appropriation Move Patterns – Adjustment-Reinforcement Episode 2 - Relate

This episode shows examples in *adjustment* mode of moves categorised as '*relate'*, where the actors 'relate to other structures' and where 'the structure may be blended with another structure'.

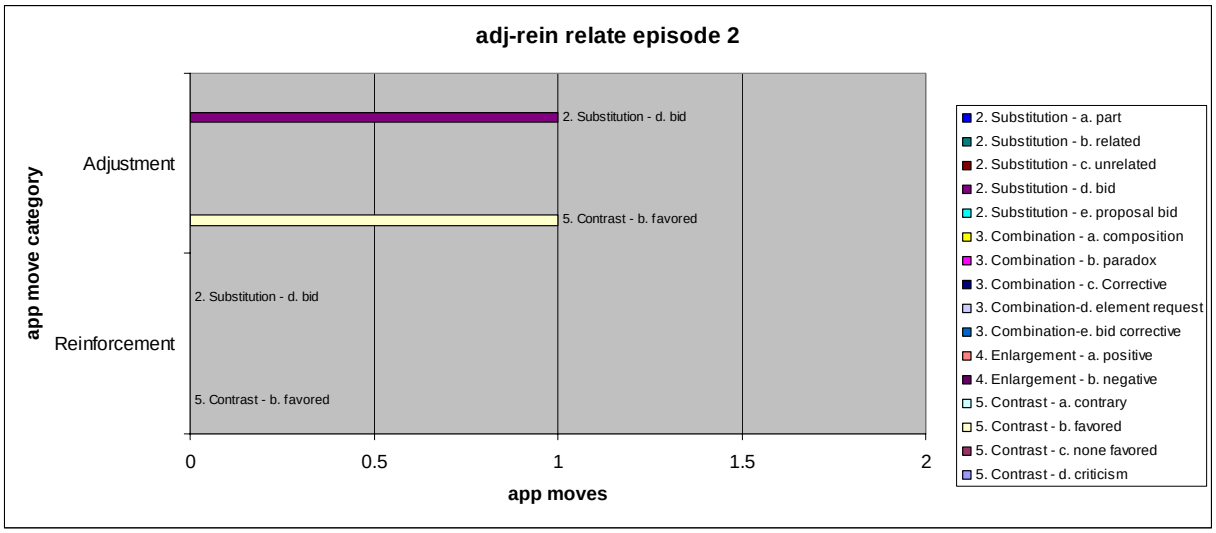


Figure A20-6.38: Adjustment-Reinforcement Episode 2Appropriation Move Types – Relate

The moves dual coded as '*contrast b - favored'* (structures are compared with one favored over the others) and '*substitution - d bid'* (propose use similar structure instead of the structure at hand and seek confirmation), are evidenced in the following two excerpts where the local team structures and introductory processes are criticised with preferred alternatives being proposed:

> I don't think the local groups worked well here in the US. We'd have been better off with more teams one individual on each team from Sweden, US, and NZ. From a research perspective, this would also mean a larger N for statistical purposes. I realize that we have different numbers of students at each site, so some might double up. (FN 22/10)
>
> I think we could have used a more structured introduction. Find out 5 things that interest you about the country where each student lives and their country of origin if different (or wherever else they have lived) for oral presentation something that requires some creativity and discussion. Perhaps this would be done by one to one emails I think the students are shy about posting personal information to a general outlet. (FN 22/10)

As a set of suggestions critiquing the existing model, without explicitly confirming these designs for the next collaboration cycle, these excerpts have here been categorised as cases of *TUM adjustment activity*, rather than *episodic change*.

A20-6.7.4 Other Grounded Data -– Adjustment-Reinforcement Episode 2

Concepts	Codes	Count	Subtotals
Activity	trial planning	1	
AIT	AIT	4	
AIT	AIT Spirit	1	
AIT	attachment transmission	1	6
Breakdown	Breakdown	1	
collaboration	collaboration	1	
competition	competition	1	
Control	Online Registration	1	
Control	security	2	3
Culture	cultural issues	1	
Culture	Student culture	3	4
GVT	Global Team Formation	1	
GVT	GVT	3	4
LT	LT	4	
Metastructure	Instructions	1	
Metastructure	Metastructure	4	5
Organization	Organization	1	
Research	research design	2	
Role	Central users - self selected, emergent (like a Coweb webmaster)	1	
Role	Coordinator	3	
Role	Facilitator	1	
Role	Officially sanctioned local developer	1	
Role	Offshore Technical Coordinator	3	
Role	Purpose agents - teacher	2	
Role	trainers	1	
Role	Undergraduate Student	3	15
Socio-emotional	context & technology-directed emotions	2	
socio-emotional	motivation	2	
Socio-emotional	other-directed emotions	2	
Socio-emotional	performance-driven emotions	2	
Socio-emotional	Self-directed emotions	1	9
Task	Assessment	1	
Task	Learning task	3	
Task	Each GVTs participants become acquainted	1	
Task	select a leader or self-managed option for GVT	1	6
TUM Activity	Adjustment	2	
TUM Activity	Reinforcement	4	6

Table A20-6.38: Adjustment-Reinforcement Episode 2– Concepts and Codes

Table A20-6.38 above provides indicative counts for the grounded theoretic ‘open

codes', 'concepts' and/or 'categories' derived from the data sources in this episode. Codes for the concepts of 'Time and space' have been excerpted and will be addressed separately below. The codes have been derived in a similar fashion to those in section 6.2.4 above, and a similar form of structurational analysis is applied below.

A20-6.7.4.1 Duality of structure - Adjustment-Reinforcement Episode 2

In this episode again we see the interplay between action, structures and technology as closely intertwined elements. The episode provides rich evidence of this interplay. Technology is pervasive in the episode, with *AIT* heavily present (both explicitly and implicitly) in all four sources. With the *metastructure* of 'instructions for the trial' incorporated in the episode, lengthy tables of *AIT* features similar to tables A20-6.27a and A20-6.27b above could again be extracted, but that is not considered necessary here.

A review here of selected *metastructures* identified in the episode may prove a useful means to demonstrate the 'duality of structure' in operation. Tables A20-6.39a – A20-6.39c below display the three interrelated facets of: 'structure' (realised through *metastructures*); 'action'; and 'technology' (*AIT*). As can be seen, a diverse range of structures, actions and technology features are traversed within the episode, and many of these are tightly interwoven.

Metastructure	Action	Technology (*AIT)*
NZ/SW/USA Collaboration exercise	despite my attempts to motivate people here they feel that the exercise has little scope for collaborative activity. (AP 20/10)	Various, implicit
structure of the exercises	far to prescriptive and does not leave any scope for collaboration and negotiation within the teams (AP 201/0)	Various, implicit
deliverables that the entire team must work towards.	clear deliverables that the entire team must work towards…a key factor in getting the team to collaborate (AP 20/10)	Various, implicit
online synchronous chat meetings.	For maximal effectiveness this should include online synchronous chat meetings. (AP 20/10)	online synchronous chat
LT	encourages the team to work as geographically colocated disparate entities (AP 20/10)	Various, implicit
GVT	To encourage more participation, at least from my students it would be politically good to refer to the entire team, and not to have a notion of local subteams I think that we should also specify clearer guidelines for "processes" that we expect the entire GVT to go through in collaboration. Part of the expectation should be that participants in the course will work outside normal class hours, since that is the only way that we can get the project to work given the timezones that are involved. (AP 20/10)	Various, implicit
Collaborative data base	They can see all groups We believe that as this is a collaborative (as opposed to a competitive) exercise this shouldn't be a problem. Besides, this way they can benefit from looking at other teams' sites and learn something more about groupware (DK 20/10)	- Collaborative data base - no security in the prototype - groupware.
Instructions	I must say that students are just the same everywhere, must be part of the human nature they do not read instructions! They are also afraid that they might make a mistake and everyone else will see the mistake and laugh at them! (DK 20/10)	Various, implicit
Message exercise	Tony forwarded to me your message and I can see your concerns with the way the exercise is going. They are very much my concerns too as I'm constantly being asked by my students why there is so little response from their overseas counterparts. (DK 20/10)	Email Various, implicit

Table A20-6.39a: Adjustment-Reinforcement Episode 2– *Metastructures* and the 'Duality of Technology'

Metastructure	Action	Technology
Phases Exercise Instructions Collaborative database Site	So I've been trying to deal with all this by providing my students with different forms of facilitation reminding them the due dates for the different phases, encouraging them to ask questions about anything to do with the exercise, constantly referring to the instructions (from the very beginning I handed out a hard copy of the file and it is also available on the site). Quite often I bring up the site and the Collaborative database on the large screen in class and demonstrate to student how they should make their entries there. Often I just sit in class with some students and go through the steps one by one. (DK 201/0)	Collaborative database Site
international collaboration	I want to be very clear in my mind this exercise has been very successful. It has given the students a chance to see international collaboration in action, even if what they've seen hasn't been as smooth as we'd like. (FN 22/10)	Various, implicit
Introduction Email	I think we could have used a more structured introduction. Find out 5 things that interest you about the country where each student lives and their country of origin if different (or wherever else they have lived) for oral presentation something that requires some creativity and discussion. Perhaps this would be done by one to one emails I think the students are shy about posting personal information to a general outlet. (FN 22/10)	- one to one emails - general outlet (homepages, discussion forums) - Various, implicit
Online registration Lab Projector Classroom Project Class LT	WE also had trouble getting the students on for the first time. This is a subtle problem; if our timing were sharper, we (in the US) could have reserved a lab and spent lab time with the students performing the task. As it is I gave demos on the projector in the classroom, but left them to work on the project outside of class only. In the lab, we could have seated the local teams together, so this might have taken care of that problem also. (FN 22/10)	Lab Projector Various, implicit
GVT Websites Ranking discussions Paper Set of questions Email Experience	For this year, I have asked all three student groups to input at least 2 websites, to examine and evaluate at least the six sites for their group, to participate in ranking discussions, and to write up a paper regarding a set of questions (I think I sent this to you in a prior email) reflecting on the experience. (FN 22/10)	Websites Ranking discussions Various, implicit email

Table A20-6.39b: Adjustment-Reinforcement Episode 2– Metastructures and the 'Duality of Technology'

Metastructure	Action	Technology
Research Websites Assignment Groups (GVTs) Ranking Prize Paper Discussion Competition Game Required task Optional task	From a research perspective, I understand the idea of rating the websites, but we might want to split this assignment into some smaller bits identify the websites and argue why yours are the best. Everyone look at at least 10 websites from other groups, indicate why you thought these might be the most interesting, and rank them from 110; perhaps we could have a small prize for the websites voted most helpful. Do something with the content of the websites, either a paper or discussion. Students here tend to be motivated by a little competition (too much and they get too intense about the game and forget about the purpose), this might be a little bit cultural; but some discussion about things to create more student participation might be worthwhile. At least with our students, they seem to always want to know what is required and what is optional and usually they only want to do what is required. (FN 22/10)	Websites Various, implicit
Instructions Email Attachment	I also attach here the instructions (DK 20/10)	Email Attachment (MS-Word)
AUTOnline	Many of my students report, and I have also experienced this, that AUTonline is down very frequently and cannot be accessed from Sweden. This may be due to network problems between SW and NZ, or that the AUTonline system is unreliable. (AP 20/10)	AUTOnline Network

Table A20-6.39c: Adjustment-Reinforcement Episode 2– *Metastructures* and the 'Duality of Technology'

A20-6.7.4.1.1 *AIT* - Adjustment-Reinforcement Episode 2

The broad range of concepts identified in table A20-6.38, have been addressed in large part through the operation of the *metastructures* portrayed in tables A20-6.39a – A20-6.39c. To highlight a few concepts, *AIT* is clearly evident and *AIT Spirit* appears in the conversations relating to the collaborative database views and their wide visibility – a deliberate design feature (there being "no *security* implemented in the prototype"). This resulted in a *control* orientation consistent with the inherent spirit of *collaboration* rather than *competition* in the exercise. The complexity of the features of 'AUTonline' as a technology platform has been addressed in tables A20-6.27a and A20-6.27b of the previous episode above. Of interest may be the classification by Beise et al., (2003) whereby Lotus Notes was classified as a Distributed Group Decision Support System (DGSS), and "Learning systems such as…WebCT [which] combine media (e.g. email, bulletin boards, chat) in ways that are difficult to separate" were classified as "general DGSS". Therefore 'AUTOnline' would be classified as a general DGSS within that framework, but would equally, for a GSS researcher, have a limited ability to be compared directly with a GSS such as Group Systems.

A20-6.7.4.1.2 *LT* - Adjustment-Reinforcement Episode 2

In the discussions about *LT* structures the question of *AIT Spirit* is raised, with the view being expressed by Arnold that "local subteams" proved detrimental to overall *GVT* functioning:

> "it would be politically good to refer to the entire team, and not to have a notion of local subteams". (AP 20/10)

Fred expressed a similar view:

> I don't think the local groups worked well here in the US. We'd have been better off with more teams one individual on each team from Sweden, US, and NZ. (FN 22/10)

As I have noted earlier (cf. section A20-6.6.6), the question of the value of the *LT* structure was a vexing one. Clearly *LTs* were an artificial structure for Swedish and US student groups, although Fred suggests above that had he conducted lab sessions and "seated the local teams together" they may have become functional. In contrast for AUT students the LTs had specific meaning, as students had worked together with their LT members on an earlier group assignment in the Intelligent Business Systems paper. A relevant excerpt from Diana's email within a prior episode (cf. table 6.9a above) is given below:

> As our groups have just been formed in relation to another piece of assessment in the same course, we already have 9 groups (between 2 and 4 students in a group) and would like to stick to them.

Therefore it appears that the *LT* concept originated from the Auckland site, where it represented real groups with some institutional history of prior work. Thus the Auckland *LTs* could be categorised as "groups undergoing development… [i.e.] composed of members that have a limited history as a group" (Mennecke & Hoffer, 1992). In contrast the Uppsala and St Louis *LTs* could be categorised as "ad-hoc groups…composed of members who have not previously worked together in a decision- making meeting and who have little or no personal knowledge about other group members (i.e. they have no significant group history)" (ibid.). Perhaps this added to the challenges of *GVT formation* as the Uppsala and St Louis groups may have needed to forge bonds at the local level in addition to those at the global level. In effect, they had to become familiar with not just one "ad-hoc group" the virtual team at the global level, but another virtual team at the local level. For the Auckland *GVT* members the *LTs* with their limited history, acted as a supportive local *metastructure*. Thus the three *organizations* in effect experienced the *collaboration* differently.

In the previous episode I have reported that a study by Pauleen (2003) contradicted an earlier finding that "collocated sub teams can create faultlines that increase conflict and reduce trust". However Fred and Arnold (in tables 6.39a & 6.39b above) clearly took issue with the *LT* design. Fred had previously remarked that "I don't think the local groups worked well here in the US (FN 22/10). Arnold argued that local subteams detracted from global team cohesion as it "encourages the team to work as geographically colocated disparate entities" (AP 20/10), he therefore recommended it as "politically good to refer to the entire team" (AP 20/10). In this interaction then, the influence of institutional forces such as *learning tasks* and *assessments*, *student culture* and *metastructures (GVTs, LTs, instructions,)*, have served to shape the supporting *AIT*. Features had been designed for both *LT* and *GVT* use, and in turn these elements shaped the action of students at each site, in a manner inconsistent with the overall *AIT spirit* of achieving *collaboration* successfully at the *GVT* level.

A20-6.7.4.1.3 *Culture* - Adjustment-Reinforcement Episode 2

Multiple dimensions of *culture* are highlighted through the *metastructures* of this episode (table A20-6.39a - A20-6.39c above), with differences in both *student culture* and *professional* educator *culture* visible at each site. Arnold's comments about the

design of the exercise leaving "little scope for collaborative activity" and being "far to prescriptive", echoes his earlier reported comments in 6.2.4.4 about the exercise being "too locked down and overspecified" for the Swedish students. This preference may also reflect a deliberate pedagogical emphasis at Uppsala upon Open Ended Group Projects (OEGPs), of which this collaboration was but one component in an overall undergraduate degree strategy (Hauer & Daniels, 2008). In contrast Diana related her classroom practices of active facilitation, in which she almost led the students by the hand through the exercise, to overcome an observed reluctance on the part of AUT students to "make a mistake" lest they be "laughed at" by everyone else. Fred's recommendations in section A20-6.7.3.4 above for "a more structured introduction" with more component parts, suggests a style similar to that of Diana's with a more deliberately designed task. However, there may have been a valid argument for Arnold's contrasting desire for a more open ended *task* that required *collaboration* across the entire *GVT*, who would be left to select their own process. In their study of global virtual team dynamics, Maznevski & Chudoba (2000) found that "*degree of interdependence required* seemed to be a critical aspect of the task's characteristics". They proposed a continuum of task interdependence from "low (pooled), through moderate (sequential) to high (reciprocal)". Arnold seemed to be arguing here for 'high task interdependence', whereas the website evaluation task could perhaps have been categorised as having only 'moderate task interdependence'. The critical *motivational* role of the *task* in distributed facilitation has also been noted by Romano et al., (1999), who recommended that facilitators "select a task(s) in which participants have high vested interests". Thus the interactions between *task* and both 'professional' and 'student' *culture* appear significant in this global collaboration.

In response to Fred's question about St Louis students' confusion, Diana generalised the issue "students are the same everywhere, they do not read instructions!". Consistent with the AUT experience Fred observed that they too in St. Louis "had trouble getting the students on for the first time". This appears to have been partly due to an institutional *control* theme with delays in *online registration*, but was partly an aspect of US *student culture* and *undergraduate student* inaction in their roles. Had Fred known to plan ahead sufficiently, he could have booked a computer lab and conducted the more active forms of facilitation engaged in by Diana in her *teacher*, *trainer* and *facilitator* roles, with the side effect of local teams (which had not developed any sense of *group culture)*, perhaps becoming more meaningful groupings. In the context of resource

planning here *institutional culture* intruded, with ad-hoc resource bookings not able to be readily accommodated. As a further factor for US students the reluctance to perform work outside of class hours was noted, "they always want to know what is required and what is optional and usually they only want to do what is required". By contrast Arnold had advocated specifying clearer process guidelines to address the issues raised by *international culture*, making it a clear expectation of the course that students "work outside normal class hours, since that is the only way we can get the project to work given the timezones that are involved". The realities of the established AUT Intelligent Business Systems *student culture* in this collaboration, (revolving around the scheduled classroom session) as observed in prior episodes (cf. 6.4.4.1.6) could make implementing such a policy challenging.

A final dimension of *student culture* is reflected in Fred's suggestion that a small prize be offered "for the websites voted most helpful", based upon his observation that St Louis students "tend to be motivated by a little competition (too much and they get too intense about the game and forget about the purpose)". This *socio-emotional* focus on *motivation* serves to raise the interesting tension between *collaboration* and *competition* in such a model of learning. For instance Berglund (2005, pp. 179- 195) has reflected upon the different understandings of *competition* within the Runestone *collaboration*, where Uppsala students were assigned pass/fail grades as opposed to those at Grand Valley State University Michigan where a graduated scale was applied and grade point averages were of keen interest to the US students. The concerns expressed by US students were that the Uppsala students would not put in much effort, since they simply had to pass the course, and in this interdependent *collaboration* would put the US students' grades for the course in jeopardy. In actuality this was far from the truth and the Swedish students were spurred by *motivation* to perform highly for the good of the team as a whole. Applying an internal grading scheme within the Runestone project itself, Swedish students in fact performed at a level slightly higher than their US counterparts.

6.7.4.1.4 *Socio-Emotional* - Adjustment-Reinforcement Episode 2

The episode has several instances of items coded in the *socio-emotional* category. As an example of *performance driven emotions* the following excerpt indicates a significant problem with the collaboration:

> but overall my students' main concern is the lack of response from students from US and Sweden. (DK 20/10)

While the issues associated with *student culture*, reluctance to initiate activity and *motivation* discussed in the above section, no doubt contributed to this outcome, they do not fully explain the problem. Fred's subsequent observation (again coded to *performance driven emotions)* adds to the explanation:

> As Arnold said, the two week vacation while understandable in terms of how we had to proceed dissipated early momentum. (FN 22/10)

A further explanation may be contributed by the segment coded as *breakdown* of 'AUTonline' (representing both an *AIT* and a 'technology' *metastructure)*:

> Many of my students report, and I have also experienced this, that AUTonline is down very frequently and cannot be accessed from Sweden. This may be due to network problems between SW and NZ, or that the AUTonline system is unreliable. (AP 20/10)

I remember at the time we were puzzled at the Auckland site by this report, as we had not experienced any problems with AUTOnline availability. This intriguing issue will be explored further in section A20-6.7.6.1.3 below.

More generally the lack of response may simply reflect the phenomena reported in the following excerpts from the literature, where distance, timeliness of response and non participation combine to disrupt the performance of virtual teams:

> "Face time is sometimes needed to 'increase the perception of accountability'. Physical presence can also gain commitment from team members through peer pressure"….A team split geographically appeared to be on track whenever they were together, but lost focus as soon as they returned to their respective offices. Beise, Niederman & Mattord (2004)

> "The problem…when working virtually in getting people to do things in a timely manner" (Pauleen, 2003)

> "many members simply do not login and participate..Feedback is much slower than group members anticipated. Participants feel alone on the system without immediate feedback and therefore disengage" (Romano et al., 1999)

A further set of generic barriers is also noted in the literature, relating to institutional *control* and the processes of becoming registered to a collaborative system (*online registration* in this episode), suggesting that these remain enduring issues:

> "More than a month was needed to initially establish collaborative connectivity among the sites…surprisingly technical difficulties only consumed a few of these days…remainder spent locating the right people, convincing them to get involved, getting authorization for them to participate" (Romano et al., 1999).

This reported experience is not dissimilar to that of getting our students registered (hinted at in this episode - cf. also section 6.4.5 above) , but as Fred and Arnold both observed, the lengthy process caused a *delay* in progress, and a consequential clash with the vacation window for AUT students, with its resultant impact on *motivation*:

> the fact that the NZ folks were away on holiday for the first two weeks that the Swedes had accounts on AUTonline has been a demotivating factor (AP 20/10)

The experience does however resonate with the quote below:

> "Underscores the importance of network infrastructure…the need to iterate through processes to perfect them and the need to manage expectations" (Beise, Evaristo, Niederman, 2003).

Motivation is actively canvassed in this episode, with *demotivation* being discussed above. The previous discussion in this section about *LTs*, the issues raised under *student culture* and strategies for increasing student *motivation* all have a *socio-emotional* focus.

Context and technology-directed emotions are evident in Arnold and Fred's closing comments affirming the worth of the exercise for the students, even if in Fred's terms "what they've seen hasn't been as smooth as we'd like", and in Arnold's in relation to *research design* "we might need to reflect and redesign before next year".

Other-directed emotions have been observed above in the discussion on *student culture* and students concerns not to be laughed at for making a mistake. Fred made a similar subsequent comment on students being shy about posting personal information to a general outlet. In the excerpt below Diana in her *coordinator* role exhorts the other *offshore technical coordinators* to reinforce the notion of an active GVT and the "rules of the game" with their students in order to generate more collaborative activity:

> Perhaps if you let your students know that their responses and actions are very eagerly expected by the teams here, and reenforce the rules of the game, they will become more active. (DK 20/10)

A20-6.7.4.1.5 *Attachment transmission* - Adjustment-Reinforcement Episode 2

The use of email and *attachment transmission* has been a common *AIT* use across many previous episodes. In table A20-6.39c the *attached file* from Diana to Fred is a vehicle conveying the *metastructure* of 'instructions'. It is used as a *TUM activity* of *reinforcement* reminding Fred of specific student *tasks* and their sequence, such as '*each GVTs participants become acquainted'*, and '*select a leader or self managed option for GVT'*. Heavy use of e-mail and attachments is also reported in the literature on virtual teams' technology use, "participants overwhelmingly use e-mail most frequently, regardless of project task… [and] liked email due to the ability to quickly distribute and share project information via attachments, such as Word and Excel, with which many of them said they get a lot of work done (Beise, Niederman & Mattord, 2004).

A20-6.7.4.2 Time and Space – Adjustment-Reinforcement Episode 2

The episode has several coded items related to the concepts of time and space.

Concepts	Codes	Count	Subtotals
Space	Location	4	
Space	Absence	1	5
Time	Class Schedule	3	
Time	Delay	1	
Time	experience	1	
Time	Future	2	
Time	holiday	3	
Time	Schedule	1	
Time	stages of scripting the project	2	
Time	Synchronize	1	
Time	Time	1	
Time	time zone	1	16

Table A20-6.39: Adjustment-Reinforcement Episode 2–Coded 'Time and Space'

For the concept of *Space* items coded as *location* are prevalent in this episode. This set of data sources were captured while the collaboration was active, with some challenging issues to be addressed before the impending conclusion of the exercise. Thus the global span of the GVT, and its variable realisation at both the global and local levels, brings the notions of *space* and *location* strongly into play.

Arnold's email message (AP 20/10) begins with a reflection on the critical impact of *location* interlinked with *time* from the outset. The *NZ folks* being away on *holiday* for the *first two weeks* that the *Swedes* had accounts on *AUTOnline* had been a demotivating factor. Arguably this paraphrased excerpt contains four distinct locations (NZ, away, Swede[n], AUTonline). The *absence* of the '*NZ Folks'* represented them in an *alternate location*, while AUTOnline was a virtual *AIT location* in which the *GVTs* 'resided'. The *holiday* break of course had been planned into the *schedule* for the collaboration from the outset, but the *delay* in setting up the AUTOnline accounts and "getting the students on for the first time" at Uppsala and St Louis *locations* meant a two week overrun at a critically formative stage of the collaboration, which stalled the initiative before it had fully begun.

The remaining *location* based topics in Arnold's email relate to: the virtual *location* 'AUTonline' "being down very frequently" and inaccessible from Sweden; this problem was tentatively diagnosed as "network problems between SW and NZ" – physical *locations* linked by technology; the students at the Swedish *location* finding the task too

prescriptive; and the *LT structure* functioning to shift the *location* from the virtual *GVT* to the local "geographically collocated disparate entities", whereas the global entity should be reinforced through "processes for the entire team to go through in collaboration". This link between 'processes' and *location* is intriguing, suggesting that a GVT as an artificial virtual *location* can be sustained by a set of 'processes'. Yet this apparently metaphysical linkage may be consistent with the distinction made by Harrison and Dourish (1996) between "space" and "place". While the metastructure of a GVT may have resided virtually within an AIT *location*, this bland virtual location really only constituted a "space", in which there were no accompanying social structures or rules of behaviour. This virtual location needed to be transformed into a "place" "invested with understandings of behavioural appropriateness, cultural expectations and so forth" (Harrison and Dourish, 1996). Applying these authors' conception to other collaborative technology developments, I have remarked in relation to 'Teamlink' a prototype 3D virtual world, "Therefore the application needed to take the leap from 'space… the opportunity' to 'place…the understood reality' (Clear, 2007c). In our attempts within this collaboration: the design of the collaboration; the GVTs; the tasks; the configuration of the *AIT;* and the instructions, were all geared to achieving this outcome where the *GVT* as a virtual 'place' became a meaningful and inhabited structure. Clearly Arnold questioned whether we had achieved our goals, and progress at this stage did not indicate great success.

The next source item is the set of instructions for the collaboration (DK 20/10). *Location* is apparent in the mention of the three countries collaborating, the GVTs, websites (a further virtual *location*), the LTs (a local virtual structure), the Notes Collaborative Database. Arguably further *locations* were resident in the *sublocations* or 'features' within AUTonline and the Collaborative Database, where individual *URLs* (even if reached as an online form via a command button or hyperlink) could be regarded as *locations*. Thus the *AITs* here constituted in effect a 'collection' of virtual *spaces* or *locations*.

Diana's email message (20/10) made mention of *location* in remarking on students questions about the lack of response from their "overseas counterparts" and "from students from US and Sweden". In her suggestions for encouraging other students, she proposed use of "the group forums to ask the NZ LTs for help". The term 'overseas counterparts' had an interesting ring to it, suggesting the *absence* of implicitly coupled groups of individuals, the *GVTs* who have not yet gelled. The proposed solution namely linking

with the local teams in NZ, was an attempt to forge a bond with a virtual team structure (even if local) that was functioning.

Fred's email (FN 22/10) had elements of *space* but also a link with *time*. Commenting on the classroom presentation style for the collaboration, Fred observed that "This is a subtle problem; if our timing were sharper we (in the US) could have reserved a lab and spent lab time with the students performing the task". Thus a *timing* issue impacted on the available physical *location* for the collaboration, with the 'classroom' being used by Fred for projector demos, while the students worked "on the project outside of class only". He indicated that had the 'lab' been used as a *space* for students to work together, the *LTs* (being introduced *face-to-face* in physical *space*) may also have functioned more effectively. Therefore even in this supposedly 'virtual' team context we see the criticality of both *time* and *space*. Supporting Fred's suppositions regarding the *LT* functioning, perhaps the observations by Kraut et al., (2002) are salient: namely that "proximity increases frequency of communication…people communicate most with those who are physically close by"; and "proximity with collaborators is useful both during the initiation phase of a collaboration, when people are sizing up potential partners and refining vague ideas, and during the execution phase". Further support is given by both Maznevski & Chudoba (2000) and Lee-Kelley & Sankey (2008) who have argued that for virtual teams "to achieve optimum performance it was necessary to operate initially in a face-to-face meeting". Whether a set of *LT* meetings would equally contribute to this performance, when there was no chance for the full *GVT* to meet, is a matter of conjecture.

The next references to *location* in Fred's email refer to *websites* as elements of *task* for evaluation. These sites are associated with a *GVT*, as either a set of *websites (*freely identified from the World Wide Web) for a specific *GVT*, or websites from other *GVTs* for evaluation. Thus *task* and *location* here become intertwined, and mutually constitutive as the 'what' and the 'where' of 'website evaluation'.

In the final *location* based reference Fred refers to students *here* (in the US) being "motivated by a little competition" thereby illustrating the linkage between *location* and *culture*, a more commonly understood relationship, with authors such as Hofstede (1980) relating *culture* to the nation state, a geographically based entity.

There are numerous and varied *Time* related codes, in table A20-6.39 above, for this episode. The *schedule* for the *collaboration* outlined in the instructions, identifies the start and end dates for the two collaboration phases: 1) the 'icebreaker' phase "6th and the

19th of September"; and 2) the 'group decision making' phase "Monday, the 4th of October and Monday, the 1st of November"); plus 3) an intervening 'phase' "two week break between the 20th of September and the 3rd of October" (constituting the *holiday* break for the NZ students). The impact of this intervening *holiday* break was considerable, with both Arnold and Fred commenting respectively:

> "the fact that the NZ folks were away for the first two weeks that the Swedes had accounts on AUTOline has been a demotivating factor that we need to address in the future" (AP20/10)
>
> "the two week vacation while understandable in terms of how we had to proceed dissipated early momentum" FN 22/10)

As in earlier episodes (cf. section 6.4.4.4) we see again the clash between the varied forms of time highlighted in table 6.19 above (Arrow, Poole et al., 2004). Arnold referred implicitly to the two week *delay* in arranging AUTOnline accounts for the Swedish students (cf. section 6.4.6 above), which had the effect of impacting the "predictable event" *time* of the *schedule* for the collaboration, overrunning into the also "predictable event" *time* of the *holiday* break, with a resulting spatial impact - namely the *absence* of the NZ students. As Cramton (2001) has reported "human and technical errors in information distribution may be common in dispersed collaboration, particularly during the early phases of activity. If these are interpreted as failures of personal reliability, they are likely to inhibit the development of trust". Romano et al., (1999) have also observed that "minimal or no feedback makes participants feel all alone, and may cause them to question whether their efforts are warranted or will even be noticed", and Kanawattanachai & Yoo (2007) have found that "early and frequent task-oriented communications play a critical role in forming the initial beliefs and trust of team members about each other's specialised knowledge. We also found that the volume and frequency of task-oriented communication is a significant determinant of team performance in the initial phase of the project. Furthermore, once such beliefs and trust set in they appear to be difficult to change". Therefore the critical absence of communication from AUT students at the perceived start of the collaboration by the offshore participants, may have generated a disastrous lack of trust inhibiting the subsequent progress of the whole collaboration. This may demonstrate the fragility of such collaborations at key points in their development, and the "need to iterate through processes to perfect them" (Romano et al., 1999). In this case the key process which had failed and caused the delay was the (assumed in place but in fact unproven) *online registration* process.

Both the *schedule* and the *holiday* events were themselves delineated by "clock" *time* with specific start and end dates for each *collaboration* phase and *holiday* event. The phases within the collaboration represented in turn an example of "lifecycle" *time*, as the development and progression of the project was orchestrated through the instructions and their *stages of scripting the project*. Also represented in this interchange is the notion of "cyclical" *time* with the intersemester *holiday* break inherent in the succession of each academic semester, and the seasons of each year – this being the winter break in New Zealand.. The immovability of these events and the need to synchronize across Northern and Southern hemisphere academic calendars meant that we were unlikely to be able to avoid a holiday induced gap in future collaborations – but maybe the placing of that gap would be open to slight adjustment. This semester incidentally, AUT University has decreed a shortening of the academic semester from thirteen teaching weeks to twelve, the precise impact of this on our collaboration has not yet been determined but it may telescope the joint collaboration window further.

Fred's suggestions for a *future* collaboration, again demonstrates many of these forms of time acting in concert:

> we may be offering this course every two years, so I would be pleased to participate in discussions and offer feedback but will probably not be teaching the course again for some time.
> I think we could have used a more structured introduction. Find out 5 things that interest you about the country where each student lives and their country of origin if different (or wherever else they have lived) for oral presentation something that requires some creativity and discussion. (FN 22/10)

The alignment of future collaborations with the repetition of the relevant courses, their *class schedules* and academic year cycles, illustrates both "cyclical" time and "predictable event" *time* in operation. Fred's feedback here on the "introduction" relates to "lifecycle" *time* in redesigning the *stages of scripting the project.*

The *class schedule* provided another "clock" *time* related code, evident in the earlier *space* related discussion about Fred's email and use of a lab versus a classroom at the scheduled student contact time. The "temponomic" notion of "time as a scarce resource" (McGrath & Kelly, 1986, p.61) is evident here, both in the rationing of face-to-face *time* with students and in the rationing of spatial resources in the University. These physical resources required booking [well?] in advance, thus limiting the flexibility required in facilitating the global virtual collaboration.

Again in the context of the *class schedule* "clock" *time* is visible, with *reinforcement* through specific deadlines suggested for each step in the instructions e.g. "Complete the

above by end of Sunday, 17th of October and move on to the next".

A different focus on clock time occurred in Arnold's recommendations relating to students working at times that would enable mutual timezone boundary spanning:

> Part of the expectation should be that participants in the course will work outside normal class hours, since that is the only way that we can get the project to work given the timezones that are involved. (AP 20/10)

As earlier noted under *student culture* (A20-6.7.4.1.3) this demanded a change in the student mindset, which appeared to be very "clock" *time* oriented in the NZ and US contexts, where students' *time* was managed as a "scarce resource". It is true that there are considerable *time pressures* on today's students, with 55% of NZ students reporting working more than 10 hours per week on top of full time study (NZUSA, 2006). Perhaps then, there was a natural reluctance to extend their schedule to accommodate what Orlikowski & Yates (2002) have termed "universal" *time* (global, standardized acontextual), in addition to their already *pressured* "particular" *time* (local, situated, context-specific), as students. Such realities may militate against the desire expressed by Arnold below to have more synchronous sessions in *future*.

> For maximal effectiveness this should include online synchronous chat meetings. (AP 20/10)

The cultural issues noted in A20-6.7.4.1.3. above, whereby students appeared reluctant to initiate activity, may be a further barrier to attempts to *synchronize* communication events, not to mention the more general problems of student "*motivation*" (Clear & Kassabova, 2005) and "non participation" (Romano et al., 1999).

The role of past time is apparent in the items coded to *experience*, one of which relates to Arnold confirming student reports about AUTOnline being down, because he had a personal *experience* of the same problem. In the second item Arnold uses his past *experience* with global collaboration to recommend an approach to engender improved GVT performance.

> In my past experience a key factor in getting the team to collaborate is to have clear deliverables that the entire team must work towards. (AP 20/10)

In this way a link with the *past* is used to chart a path for the *future*.

A20-6.7.4.3 Reflexivity of the actors – Adjustment-Reinforcement Episode 2

As an episode with a considerable focus on reflection, reviewing what has not gone so well to date, what can be done short term to rectify the problems identified, and what could be considered for a future collaboration, the actors are all actively reflexive in

their use of the technology and supporting structures, and in their proposals to encourage effective student use of the technology. The excerpts in tables 6.39a – 6.39c above, all indicate differing forms of conscious reflection about the technology, breakdowns, the task design, the team structure, student culture, motivation to collaborate, process design, research design, timings and timezones, resources, degree of structure, status reports, the success of the collaboration as a learning exercise for students (even if a failure in part), and recommendations for improvements.

A20-6.7.5 Visual Mapping – Adjustment-Reinforcement Episode 2

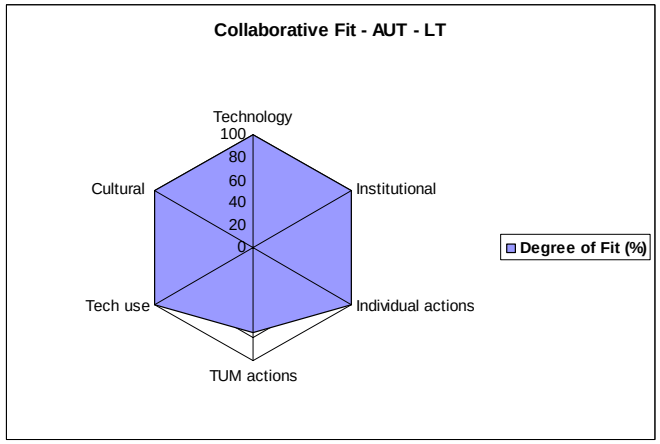
The diagram in figure A20-6.39 below represents, as in prior episodes, a visual summary, or 'map' of the episode, focusing on the *metastructure* of a '*local team'* or '*LT'*, which possessed combined set of institutional, cultural and technology properties that enabled it to serve a mediating role in shaping technology use. The charts speak for themselves in demonstrating the wide divergence across *locations*, in the meaning of this particular *metastructure*, where the fit with the AUT context is apparent, in stark contrast to its value at the other sites. At one level this demonstrates a failure in TUM, where the AUT *GVT* and *LT* design (which shaped the collaboration) was incompatible with the situation and the needs of the other sites. This may be illustrative of a "mutual knowledge problem", where "failure to communicate and retain contextual information" (Cramton, 2001) occasioned a design which, while functional for the coordinating site at the local level, proved problematic at the local level for the other sites and as a consequence impacted performance at the global level.

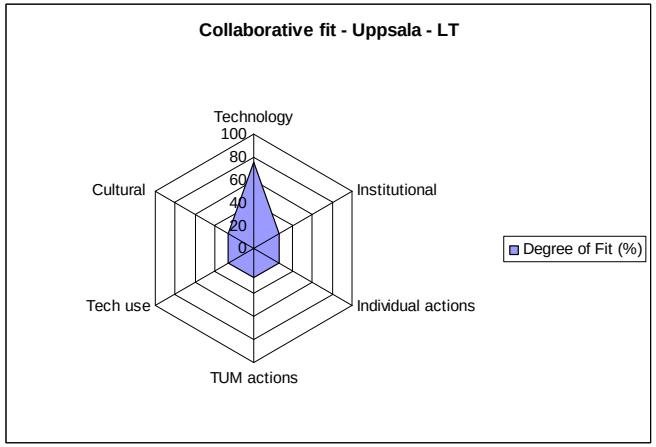
The radar charts in figure A20-6.39 below depict the operation of the *metastructure* represented by the *LT* at each site. Each element is briefly tabulated in table A20-6.40 below.

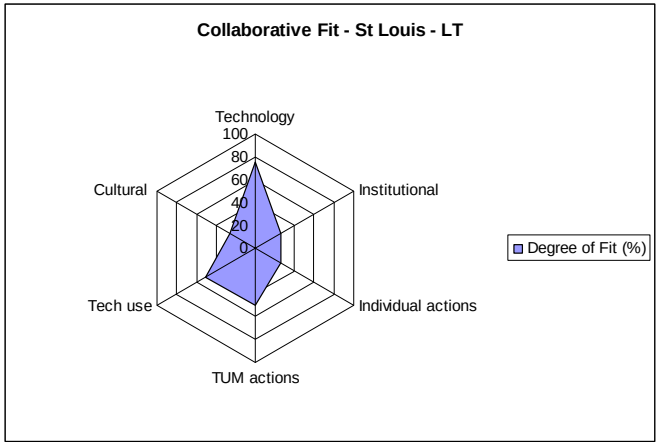
AUT	
Technology -	AUTonline group pages (GVT level), Lotus Notes DB (GVT & LT levels), Open GVT views, Word Instruction file with GVT/LT diagram attachment
Institutional –	LTs had experience working together from prior group assignment, LTs could work together in closed lab classroom
Individual actions –	Students worked in assignment groups, Diana demonstrated system, facilitated in class working, students worked together in class in collaborating LTs, outside class?
TUM -	AUT team defined GVT & LT structure, Diana demonstrated system, facilitated in class working, responded to Fred's query, reminded with attached instructions, recommended use of group forums & NZ LT help, Diana, Kitty and I puzzled by AUTOnline downtime reports
Tech use –	AUTOnline features, group pages, Collab DB features, large screen in class, email + attachment, hard copy instructions
Cultural -	AUT LTs based on earlier course groups, LTs designed to support research + tchg & multi-site GVT design, local support, students prefer very explicit instructions
St Louis	
Technology -	AUTonline group pages (GVT level), Lotus Notes DB (GVT & LT levels), Open GVT views, Word Instruction file with GVT/LT diagram attachment
Institutional –	LTs have no experience working together, unable to work together in class sessions – no lab booking possible
Individual actions –	students don't work together in LTs, Fred facilitates in instructor mode in class, students [don't] work outside class
TUM -	AUT team defines GVT & LT structure, Fred advises US LT members, requests assistance on LT responsibilities, demos of system on projector, unable to have students work in lab, unable to have LTs sit together
Tech use –	AUTOnline features, group pages, Collab DB features, projector in class, email
Cultural -	LTs artificial groups, LTs designed to support tchg, US students slow to get on to system, respond to competition & reward, students query open views in Collab DB, students prefer very explicit instructions
Uppsala	
Technology -	AUTonline group pages (GVT level), Lotus Notes DB (GVT & LT levels), Open GVT views, Word Instruction file with GVT/LT diagram attachment
Institutional –	LTs have no experience working together, working together not facilitated in tutorial sessions?
Individual actions –	Students don't work together in LTs, Arnold facilitates in instructor mode in class?, students [don't] work outside class
TUM -	AUT team defines GVT & LT structure, Arnold advises UU LT members, reports AUTOnline frequently offline
Tech use –	AUTOnline features, group pages, Collab DB features, frequently unable to access AUTonline
Cultural –	LTs artificial groups, LTs designed to support research + tchg, SE students slow to get on to system, respond to Open Ended Group tasks?

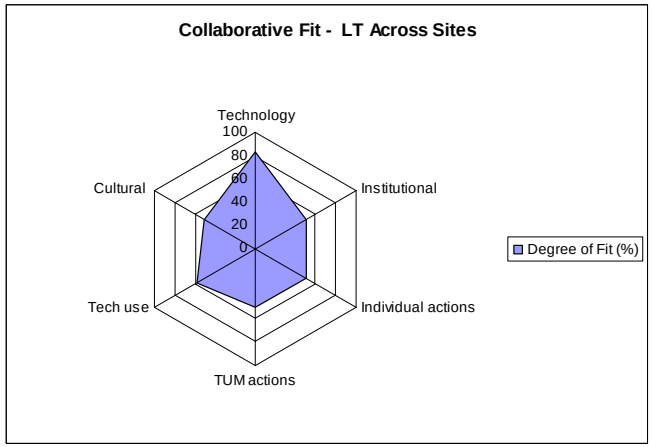
Table A20-6.40: Adjustment-Reinforcement Episode 2 – Metastructure of *LT*

Figure A20-6.39: Radar Charts – Adjustment-Reinforcement Episode 2 – Metastructure of *LT*









Degree of Fit Scale (%)

100% - full collaborative fit (CF)

75% - moderate CF

50% - partial CF

25% - limited CF

0% - no CF

A20-6.7.6 Temporal Bracketing – Adjustment-Reinforcement Episode 2

This episode, with its four tightly spaced data sources, offers limited scope for temporal analysis demonstrating any significant progression of events. But again this episode inherently has a past and a future hinted at in the discussion above. The problematic events within the episode (coded as *breakdown* and *delay*), link to themes from the literature of: "connectivity difficulties" where a "user may have difficulty accessing the system" (Romano, et al., 1999); and "uncertainty about silence" (Cramton, 2001). The review below widens the window of analysis, to focus on the history and the outcomes of such events. This extended temporal bracket explores the TUM activity related to these connectivity difficulties and their outcomes, with the addition of the further source items outlined in table A20-6.41 below.

Extended Episode Characteristics	
Duration:	11/11/2003 – 24/02/2005
Supporting data:	Diary Note - 24/06/2004 (embedded reference to 11/11/2003 meeting) Email Message – Tony Clear 29/06/2004 Diary Note - 2/07/2004 2 Email Messages – Diana Kassabova 5/07/2004 2 Email Messages – Diana Kassabova 22/08/2004, 23/08/2004 Email Message – Mark Northover 23/08/2004 2 Files – Draft Phase 1 & Phase 2 instructions (24/08/2004 & 30/09/2004) Post-it Note – Tony Clear 16/09/2004 Email Message – Aterea Brown 16/09/2004 (plus handwritten note) Email Message – Arnold Pears 17/09/2004 Email Message – Fred Niederman 21/09/2004 Email Message – Diana Kassabova 21/09/2004 Email Message – Fred Niederman 22/09/2004 Email Message – Diana Kassabova 21/09/2004 Email Message - Fred Niederman 24/09/2004 Email Message - Diana Kassabova 22/09/2004 Email Message - Diana Kassabova 06/10/2004 Email Message – Tony Clear 21/10/2004 Email Message – Tony Clear 23/10/2004 Final Online Questionnaire Responses - 27/10/2004 – 4/11/2004 Diary Note - 17/12/2004 Diary Note – 24/02/2005
No of sources	25 – focal lens of TUM activity related to "connectivity difficulties"
Actors:	Tony Clear, Diana Kassabova, AUT Students, Swedish Students

Table A20-6.41 Extended Episode Characteristics – Adjustment-Reinforcement Episode 2

A20-6.7.6.1 Narrative Summary – Extended Adjustment-Reinforcement Episode 2

The additional source items above have been separated into three groups. The TUM

activity focus of the first grouping is largely on the *establishment* mode. The second grouping has a combination of *establishment, adjustment and reinforcement* modes. The third grouping combines *adjustment and reinforcement* modes and touches on *episodic change*. Each of these thematic groupings will be summarised below to support the accompanying diagrams.

A20-6.7.6.1.1 Establishing AUTOnline as the Technology Platform

The first grouping relates to the process of establishing AUTOnline as the technology platform for the collaboration. In a diary note (24/06) I had observed that we would incorporate a group leader or group roles from Mats' suggestions for an icebreaker (from our FIE 2003 meeting) and possibly support these through AUTOnline discussion threads, which would raise the issue of requiring usernames and passwords. In the next email to Diana (29/06), I pointed her to a Lotus Notes Discussion Forum template as another "relatively simple collab technology option", noting that the default username was anonymous, "but easy enough to set up a login process I think", then asked the question "Do you think Blackboard is a better option?" The following diary note (2/07) records Diana, Kitty and I engaged in a collaborative trial planning meeting, where we had defined a role for AUTOnline to support the icebreaker task "5) Blackboard upload own website as exercise for icebreaking". This proposed use was in combination with other tasks and AUTOnline & Notes Database features. The next email (05/07) from Diana to Mark Northover [Manager of Learning Technology Services and responsible for the AUTOnline platform] thanked him for a useful meeting and for his support for the international collaborative trial. Diana subsequently emailed Fred (05/07) confirming the use of the AUT hosted Blackboard system [AUTOnline} as the joint platform for the collaboration. The final two emails in this grouping pick up the thread six weeks or so later. The first email (22/08) from Diana to a learning technology services staff member, queried a lack of response from Mark to Diana's request a couple of days earlier to set up the system on AUTonline. Diana recounted the history of the project and her prior supportive discussions with Mark, noting she was not sure how to proceed now, and querying whether Mark was away. Mark responded the next day:

> I have created the Organisation, 407106_International, with yourself as Leader, and your student account (dianakstudent) enrolled as a standard user.
> It will be best to organise the addition of the overseas students through Bridgit, as I will be away for six weeks following the end of this week. Bridgit will be able to set all the rest up for you.(MN 23/08)

Diana's relief was apparent from her response:

> Thanks for your email, I was worried what would happen with our little project if you were away on holiday in Fiji or another nice and warm place :-) (DK 23/08)

The final two items are the instruction files for the collaboration produced in two stages - initially for phase 1 of the collaboration and then updated for phase two - which operationalise the use of the AUTOnline and Notes Collaborative database platforms and their specific features.

A20-6.7.6.1.2 Registering External students to the AUTOnline Platform

The second grouping relates to the process of registering external students to the AUTOnline platform. The first two items are drawn from the East-Lite folders which contained a combination of hard copy items largely in chronological order, (and mostly duplicating the electronically stored records), but augmented with my personal annotations made at the time. Thus the first item was a small yellow Post-it® note of my discussion (16/09) with Aterea Brown (the Systems Support Consultant from IT Services) who advised that there was no subsystem in place to transfer ad-hoc students so he had completed a subsystem workaround. He was "entering students online & should be ok today". He sent an email the same day confirming that the students were in, and attaching a file with usernames and passwords. In a handwritten note on the printed email, I had further remarked that Diana had to advise that there were 9 missing students and it took a second attempt to get it going, involving significant telephone time. In a status report from Uppsala, Arnold's email (17/09 - Friday in NZ and Thursday in Sweden) advised that he would need to check but as of the Wednesday (16/09 Sweden), no user accounts existed for Fred or Arnold's students. The next pair of emails (20/09 & 21/09) reflects an interchange between Diana and Fred about St Louis students having difficulty accessing the system, Diana successfully checking from home using the offshore student ids, and Fred undertaking to check from his office, suggesting it may have been a browser related problem. Fred asked Diana to confirm that he had been sent the right usernames and passwords. Diana emailed Fred (21/09) expressing the hope that his students had been able to log in by now.

A20-6.7.6.1.3 'Connectivity Difficulties' of a More Intermittent Nature

The third grouping picks up from the second, as although the students could now access the site, 'connectivity difficulties' of a more intermittent nature were being experienced. In the first email (22/09) Fred advised Diana:

> "this is too strange I couldn't get into the site all morning (domain name not found) then 5 minutes before class got in and all the student ids worked perfectly".

Then again (24/09) Fred advised "oddly enough the site was being found later in afternoon on Tuesday". Fred also reported advice from his IT "folks" that they add an 's' to the http[s] address, "to allow for it being a secure site". Diana's email response (24/09) countered this advice with the details of the URL for the site http://autonline.aut.ac.nz and noting that it defaulted to http://autonline.aut.ac.nz/webapps/portal/frameset.jsp. From diagnosis and counter diagnosis the interactions then moved on to adopt more of a status reporting and reflective mood. Diana emailed the group of coordinators (06/10) with a more positive form of *reinforcement*, "as we can see there has been a lot more activity on the site for the last couple of days". My own message (21/10) to Arnold suggested an *adjustment* whereby (if AUTOnline happened to be down) the Swedish students could default direct to the collaborative database via the site URL - http://online.aut.ac.nz/tony/2004/s2_2004.nsf. In a more reflective vein to Fred in the next email (23/10) I acknowledged the impact of delay:

> "Yes the initial delay and two week break has been a killer this time :-) – but we find we often have to work around such constraints to synchronise with Northern and Southern hemisphere semesters. It does make the trial vulnerable to even brief delays though.

The two subsequent dairy notes (17/12/2004 & 24/02/2005) recorded some surprising new information explaining the intermittent connectivity issues. In the first note, Diana and I, while conducting a debriefing session on the International Collaboration with Mark Northover, received the following information about AUTOnline:

> "2 hrs overnight downtime ⟶ 5 mins with addn'l server (not notified)"

In other words the AUTOnline system had a two hour scheduled window of operational downtime every night. This was not notified to us at any stage. To the best of my recall this meeting (six weeks after completion of the collaboration) was the first occasion on which we learnt about the situation. On the positive side, the addition of a new server would reduce this window to 5 minutes, but came a little too late for our overseas compatriots. This topic was covered again when I met up with Arnold at the SIGCSE conference in St Louis. As we shared experiences of the collaboration in the hotel bar, Arnold noted that between 2 – 5 pm each day his students had been unable to log in to AUTonline. I was able to respond finally with a diagnosis, namely that it was a result of our "scheduled but not advised downtime".

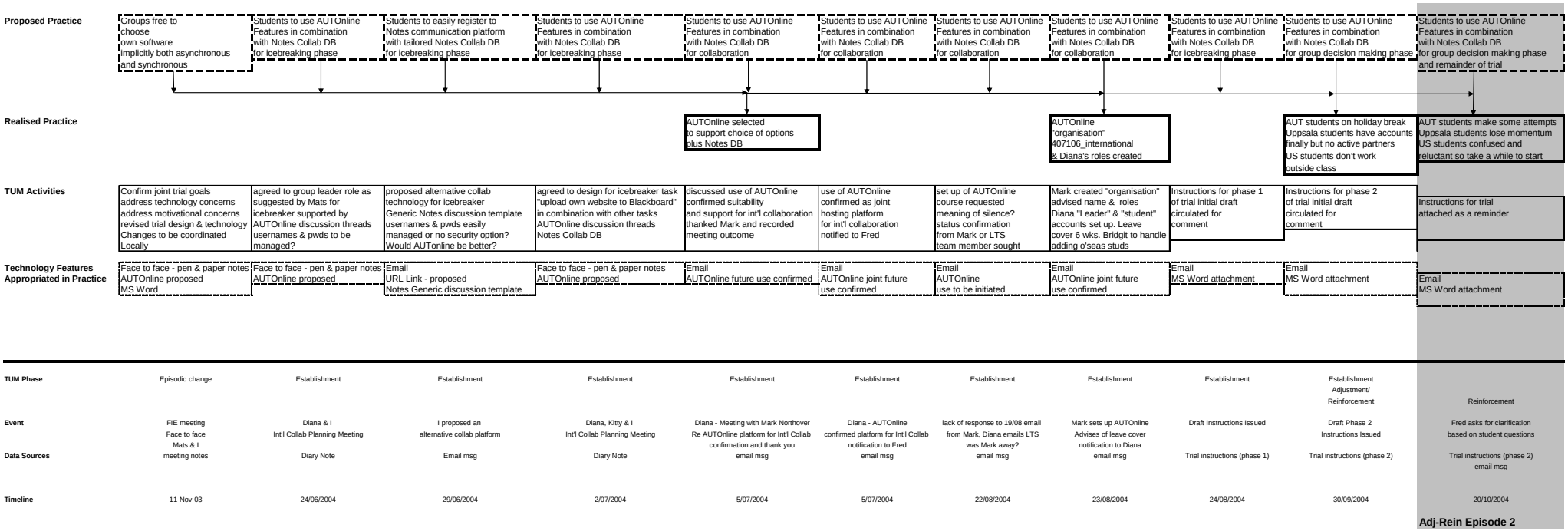
It is of course a matter of speculation whether we would have been able to adjust, had

we received the information about this scheduled downtime. Naturally this set of events was not without impact on the collaboration. As one set of outcome measures, the student response rates (posted 27/10 – 04/11) to the final evaluation questionnaire give an indication of the success of the venture. These have been tabulated in a prior episode (episodic-change adjustment episode 2), in table A20-6.36 above. The overall response rate of 57.5% is not especially good, but when broken down by location, the Uppsala student response rates of 20% indicate a greater negative impact than that for Auckland students.

Some counter to this pessimistic view is provided by comments from each of the coordinators:

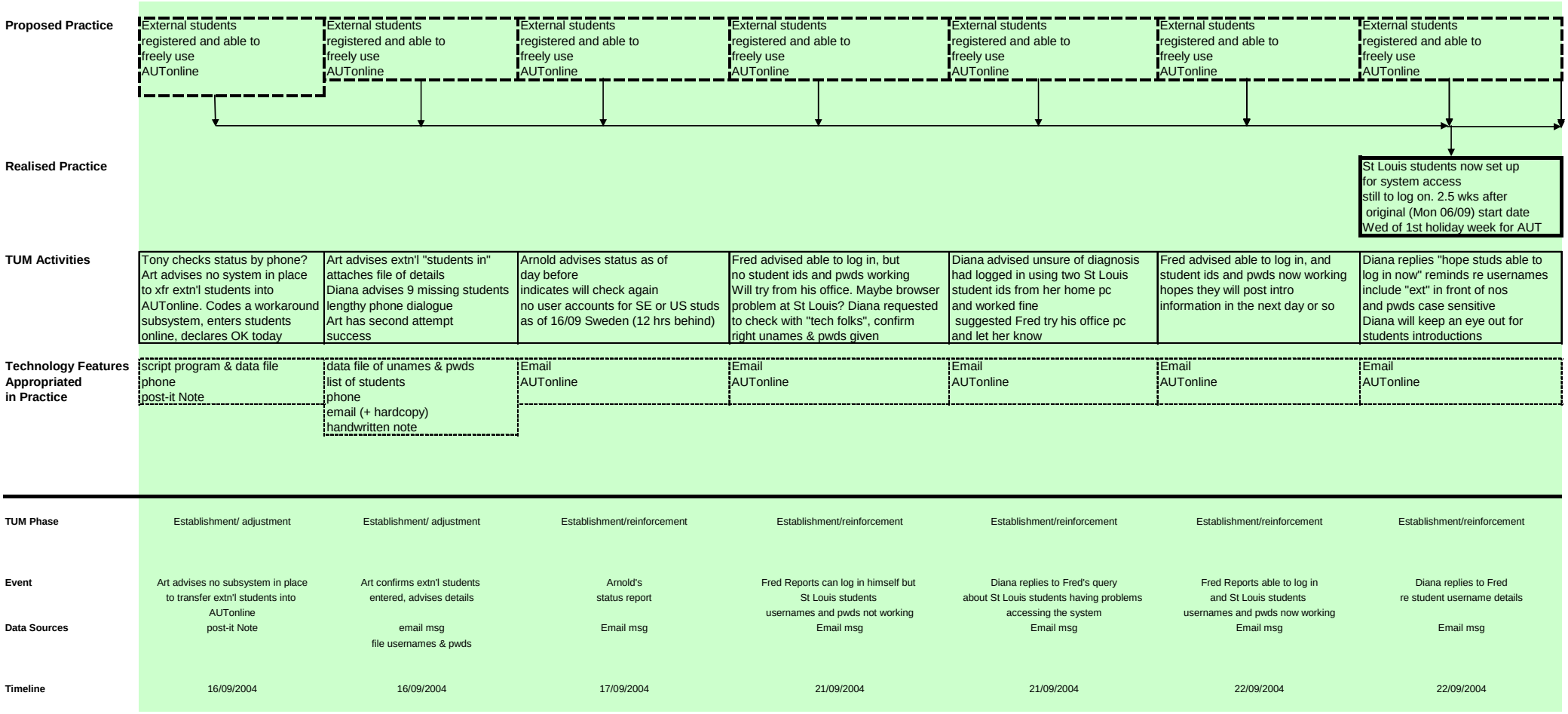
> Glad to have been a part of this, but I think that we might need to reflect and redesign before next year. (AP 20/10)
>
> I want to be very clear -- in my mind this exercise has been very successful. It has given the students a chance to see international collaboration in action, even if what they've seen hasn't been as smooth as we'd like. (FN 22/10)
>
> I'm glad you do feel it has been worthwhile so far. I have come to the conclusion over time that if students only learn that this stuff is not a no-brainer [we have the technology so life is sweet!! etc.] then we have achieved something of value.
> From looking at the database there does seem to be some convergence of GVTs and activity related to the group decision making task. So this at least is heartening. (TC 23/10)

This extended set of data for the episode is displayed from a temporal perspective in figures A20-6.40 – A20-6.42 below.



Extended Adjustment-Reinforcement Episode 2 - Temporal Analysis

Figure A20-6.40: Temporal Bracket: Extended Adjustment-Reinforcement Episode 2- Establishing AUTOnline as the Technology Platform



Extended Adjustment-Reinforcement Episode 2 - Temporal Analysis

Figure A20-6.41: Temporal Bracket: Extended Adjustment-Reinforcement Episode 2- Registering External Students to AUTOnline

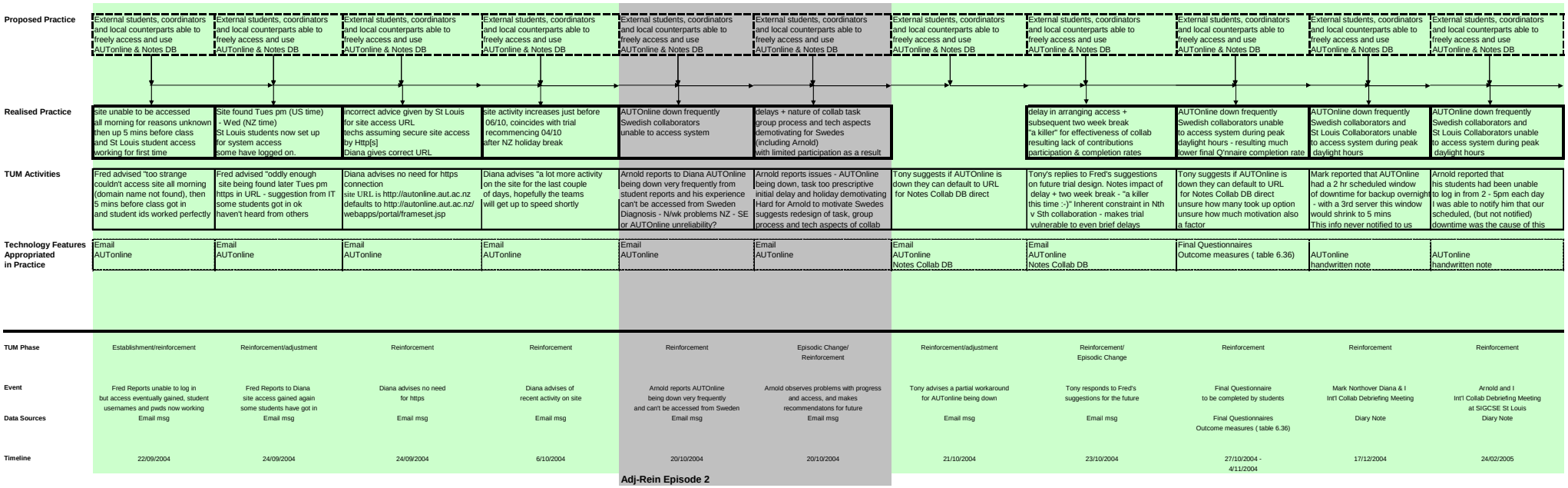


Figure A20-6.42: Temporal Bracket: Extended Adjustment-Reinforcement Episode 2- Connectivity Difficulties of a More Intermittent Nature

As can be gleaned from the above, the significant issues with establishing the AUTOnline platform, getting students registered to the system, and working around intermittent access problems, conspired to damage the success of the collaboration. Each of the three temporal brackets depicted above, shows not only the evolution of events over (what were in some cases considerable) windows of time, but also the fragility of the whole process at key points, with even brief delays potentially concatenating disastrously and derailing the whole project. The picture portrayed is also one of optimism, largely cooperative and supportive parties, and active facilitation, but often in a situation where the environment was not under the coordinators' control. Moreover key pieces of information were often missing, surprises eventuated in establishing infrastructure or applications assumed to be in place, and key champions could be away at critical junctures. The local institutional factors take precedence over the needs of global partners, and the whole endeavour is fraught with uncertainty. Nonetheless some degree of success had been achieved, if the 'process' and learning dimension is valued rather than simply that of the 'product' being the tangible result of the exercise. As I have observed above:

> I have come to the conclusion over time that if students only learn that this stuff is not a no-brainer [we have the technology so life is sweet!! etc.] then we have achieved something of value. (TC 23/10).

The crucial point to come though from the above temporal brackets however, is the critical roles that *time* and *timing* had to play in this venture. Any analysis of such work without accommodating the temporal dimension would inevitably be deficient. The subtle evolution of events and their causal interrelationships in this episode, support the applicability of a "process research model" rather than a "factor research model" for this form of investigation. Newman & Robey (1992) have drawn the distinction that "process models focus on sequences of events over time in order to explain how and why particular outcomes are reached", whereas a factor research model by contrast, generates "inferred processes of development". This temporal analysis as an example of a "process research model" has focused specifically on the sequence of events and their implications as they unfolded over time.

Interestingly for the study of TUM processes, this episode illustrates a non linear development of the TUM activities proposed by Orlikowski et al., (1995). As depicted in Figure 4.5 above, the processes of TUM observed by Orlikowski and her colleagues followed in a sequence of phases from 1) *establishment*, through 2) *reinforcement and adjustment* to 3) *episodic change*. The EAST model as outlined in Clear (1999) implied an arguably linear TUM development model. In the episode above, we see

differing combinations of the different modes of TUM activity within the three temporal brackets. The first grouping was largely consistent with the Orlikowski three phase cycle model of TUM activities, but did contain an event which combined *establishment, adjustment and reinforcement* modes. The second grouping contained events with a combination of *establishment, adjustment and reinforcement* modes and the third grouping combined *adjustment and reinforcement* and included the *episodic change* mode within discrete events.

Significantly, while these brackets may be considered only 'micro-level' views of the TUM activity, they may indicate that TUM activities unfold in a more temporally linked and dynamic manner than earlier models have suggested. For instance the seeds for an *episodic change* would normally be sown at an earlier point, (as in the above brackets during the *adjustment* and *reinforcement* activities). It is unclear however, whether the subtleties of these patterns hold at a more macro level, when the actual activities occur in broadly distinguishable phase patterns. Therefore it may be that the temporal dimensions of the EAST framework (Clear, 1999a) need further development, as the theory may not be "time scale complete" (Arrow, Poole et al., 2004). A tighter prescription of the temporal dimensions may help researchers applying the framework to "make theory-driven choices of observation, recording, and aggregation intervals" (ibid.).

A20-6.8 Episode of Interest Profile: Adjustment-Reinforcement Episode 4

A20-6.8.1 Episode Characteristics – Adjustment-Reinforcement Episode 4

Episode Characteristics	
Duration:	20/10/2004 – 22/10/2004
Supporting data:	2 Diary Notes – Tony Clear – 18/10/2004 & 19/10/2004 1 Email Message Diana Kassabova 18/10/2004 1 Email Message Tony Clear 19/10/2004 1 Email Message Fred Niederman 20/10/2004
No of sources	5
Word count	894
Actors:	Tony Clear, Diana Kassabova, Fred Niederman

Table A20-6.42: Episode Characteristics - Adjustment-Reinforcement Episode 4

A20-6.8.2 Narrative Summary - Adjustment-Reinforcement Episode 4

This episode begins with a diary note late on the evening of Monday the 18/10, in which I observed that I had had "no time today" with PhD proposal document submission, supervision and teaching commitments. I noted that I had responded to Daniel over the Notes online server upgrade tomorrow [the platform on which the collaborative database was hosted] – for which they had "organised testing and a backup plan – keep fingers crossed". A meeting for us to conduct the testing had been scheduled for the next day about midday. The note then records my checking progress on the collaborative database and the AUTonline site, with new postings dated 18/10/2004 being noted by feature (e.g. "Ldr decision GVT5 latest update 181/0 – self managed", "Upload websites (GVT3, GVT4, GVT5) 18/10", "Evaluations GVT1 18/10"). The next brief email from Diana with a subject header "Fwd: Re upgrades to both servers…" recorded Diana noting she would be in the office, which is picked up in the diary note next day recording Diana and I making a telephone call to Fred (after getting his phone number from the website), but having to leave a message. The Notes servers had been

upgraded by Ross Hawkins – our external Notes consultant brought in to oversee the process - and had been tested and were Ok. I noted that validation with Javascript was still not working on the web [Notes functionality differed between client and web versions], and Ross advised that I needed to use a 'webquerysave' agent. Ross gave a few additional pointers on Notes features to improve our application and its interface, and indicated he would be happy to visit the class any time. This sequence of events was followed by an email to Fred shortly afterwards. I began with sharing some of my own research articles related to a just received special issue of Database on IT Personnel for which Fred had been the editor. I then advised Fred that we had tried to ring today "figuring that our time zones sort of aligned", and hoped that we could get in touch to get some feedback on how things were going at the St Louis end and what we could do to help. I concluded by advising that I had put in a doctoral consortium submission to the ACM SIGCSE conference in St Louis next year Feb 23- 27 and was hoping to have it accepted. Therefore I was hoping we could meet up as Mats and Arnold might be there as well. I also indicated that I would be happy to come and talk at St Louis University on collaborative computing or another suitable topic if the timings could be arranged to fit. The final email message for the episode was Fred's reply, thanking us for calling and noting that "normally I'd have been in but we are on a kind of minibreak for midterms and grading midterms until Thursday". Fred then thanked me for the articles, and observed that while the special issue had been fun to work on he was glad it was over, and a second issue with a different focus would be forthcoming in a year or so. Regarding the exercise, Fred reflected that the students seemed not to know what they had to do, and weren't inclined to say "here is a neat tool let's see what it can accomplish". Practically speaking they didn't know whether to find and upload site individually, how many sites for each group, unsure whether to evaluate only their own team's sites, or all the sites and were a bit perplexed as to why they are seeing the whole list. Any suggestions to clarify these matters would be helpful. Fred concluded by indicating his interest in my proposed visit and arranging perhaps a panel discussion on campus, if possible timed to fit with their Friday seminar schedule. After generally outlining some of the features of St Louis, Fred finished with the hope that my proposal would be accepted.

A20-6.8.3 Appropriation Move Patterns- Adjustment-Reinforcement Episode 4

Figures (A20-6.43 – A20-6.45) below depict the patterns of 'appropriation move types'

and ‘subtypes’ (DeSanctis & Poole, 1994), which characterise this episode, and demonstrate the manner in which the technology has been appropriated.

A20-6.8.3.1 Appropriation Move Patterns – Adjustment-Reinforcement Episode 4-direct

This episode contained only one ‘*direct appropriation*’ move coded ‘*a explicit’* where use of the telephone to ring Fred when we “rang and left a message”, presented a case of *‘openly use and refer to the structure*. Moreover this was an example of a less than satisfactory appropriation at that. Direct cases of technology use do not predominate in the episode, but rather a series of processes of TUM activities in the *adjustment* and *reinforcement* modes, with their accompanying appropriation moves.

A20-6.8.3.2 Appropriation Move Patterns – Adjustment-Reinforcement Episode 4-Constraint

The episodes contains a few moves categorised as *constraint*, where the ‘structure is interpreted or reinterpreted’.

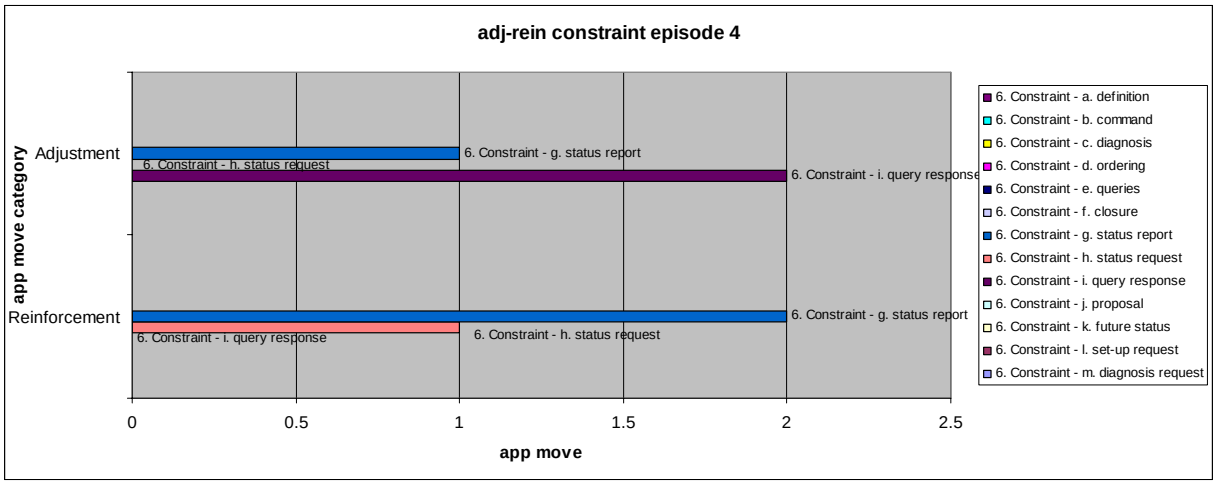


Figure A20-6.43: Adjustment-Reinforcement Episode 4 Appropriation Move Types – Constraint

The appropriation moves coded as ‘*i–query response*’ (answering questions about the structure’s meaning or how to use it) excerpted below furnish examples of TUM *adjustment* activity. The first one is a hardware infrastructure related *adjustment* associated with making arrangements for a managed server backup, and the other a software related *adjustment* soliciting suitable options for fixing a software validation ‘bug’ in one of the Notes collaborative database online forms.

> Response to Daniel about midday over online server upgrade tomorrow – organised testing and a backup plan – keep fingers crossed. (TC 18/10)
> Validation still not working on the web - Ross advised need to use webquerysave & use an agent set document context for the web session (TC19/10)

In the next move, coded as '*h- status request*' (question what has been or is being done with the structure), we asked Fred for feedback on progress:

> Hope we can get in touch before too long, to get some feedback from you on how things are going from your end, (TC 19/10)

This move suggests the use of TUM activity in *reinforcement* mode in an attempt to remedy the problem noted by Cramton (2001) where distributed teams had difficulty "interpreting the meaning of silence".

The move below, coded as '*g - status report*' (state what has been or is being done with the structure), demonstrates the use of TUM in *reinforcement* mode to somewhat opportunistically share information with Fred and maintain a sense of progress in the collaboration:

> BTW We tried to ring today figuring that our time zones sort of aligned. (TC 18/10)

A second segment coded in the same way, came from my diary note recording student contributions to the collaborative database or the AUTonline site (e.g. postings of leader choice, website evaluations, rankings etc.). This represented a more passive form of *reinforcement,* but was a necessary activity to monitor progress, from which any issues could be picked up and use of the system could be further reinforced.

In the *adjustment* mode Fred provided a *status report* and sought input to help shift his students' mindset and clarify what was required in the exercise. While this segment could equally be coded in the *reinforcement* mode, it appears that Fred needed more than a simple reiteration of the existing instructions. Perhaps some form of modification of the technology environment or the usage rules was implicit here:

> Regarding the exercise, I think throughout the students have a sense that they don't know what to do they aren't ones to say here is a neat tool let's see what it can accomplish. Very practically speaking, they don't know whether to find and upload sites individually; they don't know how many sites they need for each group; and they aren't sure whether to evaluate only their own team's sites (which are a handful) or all the sites and they are a bit perplexed as to why they are seeing the whole list. Any suggestions that clarify these matters will be helpful. (FN 20/10)

A20-6.8.3.3 Appropriation Move Patterns – Adjustment-Reinforcement Episode 4 Judgement

This episode contains examples of *judgement* moves, (where the actors express judgments about the structure) in both TUM *adjustment* and *reinforcement* modes.

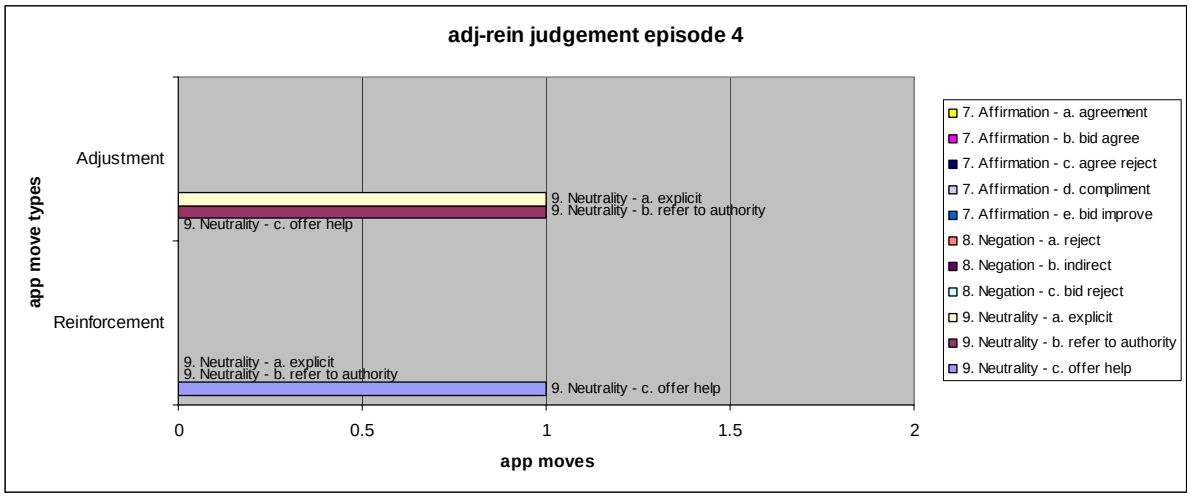


Figure A20-6.44: Adjustment-Reinforcement Episode 4 Appropriation Move Types - Judgement

The move coded as *'neutrality – a explicit'* (expressing uncertainty or neutrality towards use of the structure) relates to Fred' s email excerpt at the end of 6.8.3.2 above, where he notes the confusion on the part of his students, who demonstrate *uncertainty* about appropriating the features of the *AIT* supporting the collaboration. The same message is also coded in TUM *adjustment* mode as *'neutrality – b refer to authority'* (acknowledge uncertainty towards use of the structure and need to consult an authority). As this last sentence indicates, Fred was prepared to make *adjustments* to enable the exercise to make progress:

> Any suggestions that clarify these matters will be helpful. (FN 20/10)

The final *judgement* segment presents a case of TUM in the *reinforcement* mode, coded as *'neutrality – c offer help'* (query uncertainty towards use of the structure and offer assistance). It evidenced my desire to renew contact with Fred and help out with any confusion or other matters related to the exercise.

> BTW We tried to ring today figuring that our time zones sort of aligned. Hope we can get in touch before too long, to get some feedback from you on how things are going from your end, and anything we can do to help out. (TC 19/10)

A20-6.8.3.4 Appropriation Move Patterns – Adjustment-Reinforcement Episode 4 - Relate

This episode shows an example of a move categorised as '*relate'*, where the actors 'relate to other structures' and where 'the structure may be blended with another structure'.

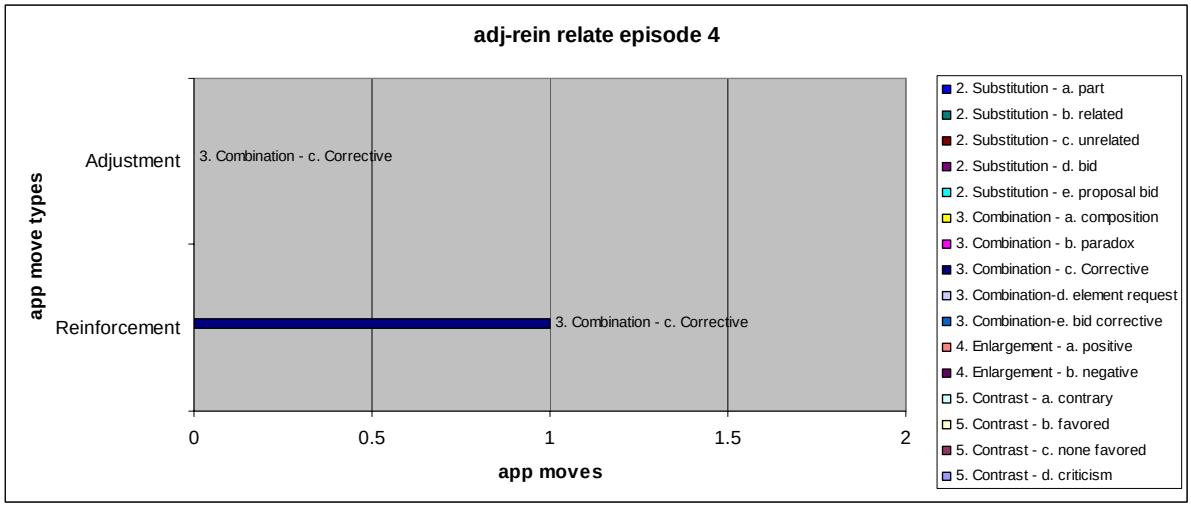


Figure A20-6.45: Adjustment-Reinforcement Episode 4Appropriation Move Types - Relate

This move coded as '*combination – c corrective'* (use one structure as a corrective for a perceived deficiency in the other) relates to our attempted phone call to Fred, where in the absence of making voice contact we had to leave an answer-phone message, thus converting a synchronous communication event into an asynchronous one, which would at least indicate our attempt to make contact, and to augment the 'normal' communication channel of email:

1-314 -977-3845 Fred's no. from website - rang and left a message (TC 19/10)

A20-6.8.4 Other Grounded Data -– Adjustment-Reinforcement Episode 4

Concepts	Codes	Count	Subtotals
Activity	planning-meeting scheduling	2	2
AIT	AIT	5	5
Breakdown	Breakdown	1	1
Culture	Student culture	1	1
GVT	GVT	1	1
LT	LT	1	1
Metastructure	Metastructure	5	5
Research	research	1	
Research	paper	2	
Research	diary note	2	5
Role	socio-emotional group-bldg and mtce roles	1	
Role	Motivator (energizer, encourager)	2	
Role	Coordinator	5	
Role	Developer	1	
Role	External consultants (infrastructural)	1	
Role	Offshore Technical Coordinator	2	
Role	Purpose agents - teacher	1	
Role	Researcher	2	
Role	Undergraduate Student	1	
Role	Support and Maintenance Team representatives	1	
Role	Testers.	2	
Role	Lotus Notes administrator	1	19
Socio-emotional	other-directed emotions	1	
Socio-emotional	context & technology-directed emotions	1	
Socio-emotional	motivation	1	3
Task	Learning task	1	1
TUM activity	Reinforcement	4	
TUM activity	Adjustment	4	
TUM activity	episodic change	2	10

Table A20-6.43: Adjustment-Reinforcement Episode 4– Concepts and Codes

Table A20-6.43 above provides counts for the number of data sources containing at least one occurrence of the grounded theoretic 'open codes', 'concepts' and/or 'categories', which have been derived from the data sources comprising the episode. These have been derived in a similar fashion to those in section 6.2.4 above, and a similar form of structurational analysis is applied below.

The *activity* of *planning-meeting scheduling* is evident in two excerpts relating to advising Daniel our *Lotus Notes administrator* about the next day's meeting with Diana to test the Notes application after the server migration, and Diana's confirmation that she would be "in the office' for the meeting.

AIT is present in all five data sources. Examples include: "Upgrades to both *servers*"

(DK 18/10); Fred's reference to the collaborative technology set as a "*neat tool*" and to his students' confusion over *upload of 'sites'*; "*online server upgrade* tomorrow – organised *testing and a backup plan*" (TC 18/10); Fred's no. from *website - rang and left a messag*e (TC 19/10); "BTW we tried to *ring* today" (TC 19/10); "*collaborative computing topic*" (TC 19/10). While each of these *AIT* references is meaningful the core technology at the heart of this event, was the Lotus Notes Server hosting the collaborative database. The planned server upgrade (should it fail) had the ability to become a 'showstopper' event which would destroy our whole collaboration, thus our deliberate intervention in *TUM adjustment* mode to ensure a suitable "testing and backup plan" was in place. Coded here as *breakdown* in anticipation, perhaps *recovery plan* would have been an equally appropriate code. *Student culture* is evident in Fred's observations about his students' apparent confusion about the *learning task* and reticence to experiment with the application:

> Regarding the exercise, I think throughout the students have a sense that they don't know what to do they aren't ones to say here is a neat tool let's see what it can accomplish. (FN 20/10)

This phenomenon has been discussed previously, where Diana had made similar points about the initial reticence of AUT students to post online (partly through fear of making a mistake and being laughed at), to counter which she had engaged in active in-class facilitation of the exercise (cf. section A20-6.7.4.1.3 above).

Student postings do nonetheless appear under the *GVT* and *LT* codes here, which refer to the diary note in which I had tracked new student online postings under their respective *GVT* and *LT* headings.

The notion of a *metastructure* is also prevalent in the episode, with selective examples of the *metastructure(s)* occurring in each source item identified in the following discussion. The servers as 'technology' *metastructures* are at the core of the episode, with the notion of a 'server upgrade' as a further *metastructure* with additional 'institutional and professional' elements of 'testing and backup plans', 'the Notes collaborative database', 'AUTonline', *GVT*, *LT*, 'Fred's phone number', 'websites', 'meetings', 'minibreak' 'midterms' and 'an answer-phone message' are further examples at differing levels of granularity. The arrangements for a talk at St Louis highlighted further "genre like" (Yates et al., 1999) *metastructures* such as: 'session here on campus', 'visit', 'panel discussion', 'seminar' and collaborative computing 'topic'.

Research and the *researcher* role have some focus in this episode, through the collegial

discussion about Fred's special issues in Database, the sharing of my *research papers*, and the reference to my *paper* submission to the 'SIGCSE doctoral consortium'. My *researcher* hopes were shared that the submission would be accepted, and thus enable me to gain the funding to travel to St Louis and meet with Fred.

Not only is *role* the numerically dominant concept in this episode, but a multiplicity of *roles* are present. Under the category of *socio-emotional group building and maintenance roles* we see Fred's communications about the visit to St Louis, with the idea of bringing Arnold, Mats Fred and myself together (incidentally for the first time face to face):

> Perhaps we can bring the whole crew and have a panel discussion. (FN 20/10)

Reinforcing this was a later passage, additionally coded against the *motivator (energiser encourager)* role, in which Fred expressed enthusiasm about meeting with me and even mentioned the local attractions, which we might visit:

> I will look forward to meeting you in any case and if time permits (your time in particular) show you some of the subtler niceties of the area. For example, there is an eagle nesting area along the Mississippi that is spectacular if the birds haven't flown off yet; (FN 20/10)

Actions in this passage are consistent with those observed by Jarvenpaa and Leidner (1999) where "social communication" and "communication of enthusiasm" helped build trust early in a global virtual team's life. Additional passages coded under the *motivator* role provided similar examples. For instance Fred thanked me for the articles I had sent and in commenting about the *Database* Special issue noted that it was "fun to work on but I'm glad it is finished" since there would be a second issue coming out in a year or so. Even in his signing-off message "take good care" Fred maintained an *encouraging* and supportive tone. Likewise my earlier phone call to Fred, even though only able to leave a voicemail message, was an attempt to *motivate* and offer *encouragement*.

The *coordinator role* was the most prevalent in the episode, with each interchange demonstrating the author of the communication variously coordinating meetings, test plans, phone calls, future visits and panel discussions, student activity, technology upgrades and refinements and research activities. These activities in turn involved actions by further *roles.* As an extension of the *coordinator role*, Fred operated in the *role* of *offshore technical coordinator* interacting with us over how his students might better use the technology platform, and Mats and Arnold in the same *roles* were mentioned in relation to the planned St Louis panel discussion. The *undergraduate*

student role was also evident as Fred in his *teacher role* talked about his students' concerns. A further set of roles came into play when the Lotus Notes server upgrade was being planned and executed. I worked closely with Daniel Ismail as the *Lotus Notes administrator* and AUT *support and maintenance team representative*, and Ross Hawkins in the role of *external consultant (infrastructure) as noted in my diary below:*

> Notes servers upgraded by Ross Hawkins – tested & Ok (TC 19/10)

Thus Ross, Diana and I also operated in the role of *testers.* At the same time I took the occasion to call on Ross' expertise as an advanced Lotus Notes *Developer* to address an application bug with forms validation using Javascript in the collaborative database.

> Validation still not working on the web - Ross advised need to use webquerysave & use an agent set document context for the web session (TC 19/10)

Thus Ross in his professional Lotus Notes *developer role* assisted me in my occasional and rather self-taught Lotus Notes *developer role*. This elaboration of the many *roles* involved in this small episode graphically illustrates how many parties and different roles may need to come into play when undertaking *TUM activity* in the *adjustment* mode – in this case to accommodate an externally imposed infrastructural change.

While aspects of *socio-emotional roles* have been touched on above, there were further items coded directly under the *socio-emotional* category. Fred's expression of enthusiasm above about our meeting at St Louis (I will look forward to meeting you) was coded as a case of *other-directed emotions*. *Context and technology-directed emotions* were evident in the apprehensive 'crossed fingers' tone of the note below:

> Response to Daniel about midday over online server upgrade tomorrow – organised testing and a backup plan – keep fingers crossed. (TC 18/10)

Finally coded as *motivation* was the excerpt below, where *student culture* (as previously discussed in this section) and *motivation* went hand in hand:

> Regarding the exercise, I think throughout the students have a sense that they don't know what to do they aren't ones to say here is a neat tool let's see what it can accomplish. (FN 20/10)

While this episode focused largely on *TUM activities* of *adjustment* and *reinforcement*, the final TUM code to consider was the *TUM activity* of *episodic change.* This *change* related to the arrangements for the visit to St Louis, where a *face-to-face* meeting of the hitherto 'global virtual' trial coordinators would represent a new stage in the evolution of this *global virtual team*. The event itself, as an occasion for reflection, could potentially generate changes for subsequent collaborations.

A20-6.8.4.1 Duality of structure - Adjustment-Reinforcement Episode 4

In this episode again we see the interplay between action, structures and technology as closely intertwined elements. The episode illustrates how an institutionally imposed change in the technology infrastructure underpinning the collaboration (the Lotus Notes Server upgrades), occasioned unplanned extra work and triggered necessary *TUM activity* to manage the risks of the change on the part of the trial coordinators. It called into play a variety of actors internal and external, and made visible an extended set of roles played by the actors in this collaboration, in particular the internal "second level" and external "third level support" roles (Shultze & Boland, 2000, Schultze, 2000) underpinning the continued stable operation of the university's computing infrastructure. Interestingly in the study of "outsourced computer systems administrators" conducted by Schultze & Boland (2000) such work was deemed "commodity work" and "non value-adding" by the senior management of the company in the study. So it appears that this vital work and the cadre of personnel engaged in it frequently disappear like plumbing into the woodwork of organizations. As expressed by Hettinga (2002, p.16), "when action is proceeding smoothly, the used artefacts are 'ready-to-hand' and action is transparent. When situated action becomes problematic in some way, action is made accountable and aspects of the used tools are revealed. This nonobviousness of a situation is called a breakdown". The crisis of '*breakdown*' or at least '*potential breakdown*' occasioned here by the server upgrade, made visible the secondary world (*as Winograd & Flores, (1986) have described the notion of breakdown),* of the technical infrastructure, and its supporting cast of actors. The tension between the roles performed by these actors is also revealed, as our concern as *coordinators* for the health of our collaboration vied with the *Lotus Notes administrators'* concern for the health of their servers. When we reinforced the need for testing and backup plans, we exemplified the "ambivalence" expressed towards the roles of *technicians* by "*professionals* and *user*s who resented their dependence" as observed by Barley (1996). Barley found that this "ambivalence surfaced in the dilemma over whether *technicians* were servants or experts" (ibid). In performing the upgrade we saw the '*technicians*' as 'servants' performing a service on our behalf, but in consulting with Ross the *External Consultant* over my Notes application software bugs and deficiencies, I saw him as an 'expert'. Barley defines technicians who "were primarily responsible for creating or maintaining the technical infrastructure that enabled other people to do their work" as acting in the role "of a broker" (ibid.). In

Barley's terms "brokers bridged two communities: the users they served…and the technical community associated with the technology for which they were responsible. The work entailed adapting the technical community's knowledge and products to the contextually specific needs of users, clients or customers" (ibid.). In many ways this "broker" role mirrors the forms of *TUM activity* engaged in by the *coordinators* themselves, so to this extent the *coordinators* themselves encompass this so-called *technician* role within their repertoire. Yet the *coordinators* as academic *educators* and *researchers* inherently viewed themselves as *professionals*. So in contrast to the view of *technicians* performing work deemed "commodity" and "non value-adding" (Schultze, 2000), the reality here was rather more complex. We see some evidence of the "trouble" that Barley identified "for vertical forms of organization" arising from the nature of technicians work and decoupling of the "authority of position' from the "authority of expertise". These so-called 'technician roles' and the *TUM activities* in which they engaged, were often highly skilled, demanding and intertwined with other professional roles co-existing within the same person. But we also see the prevalence of the "broker" role, a role that in Quinn's "competing values framework of leadership" (cited in Roy et al., 2006, cf. figure A20-6.46 below) has been deemed a key leadership role which is externally focused, and demands "transformational leadership" with an inventive and risk-taking style.

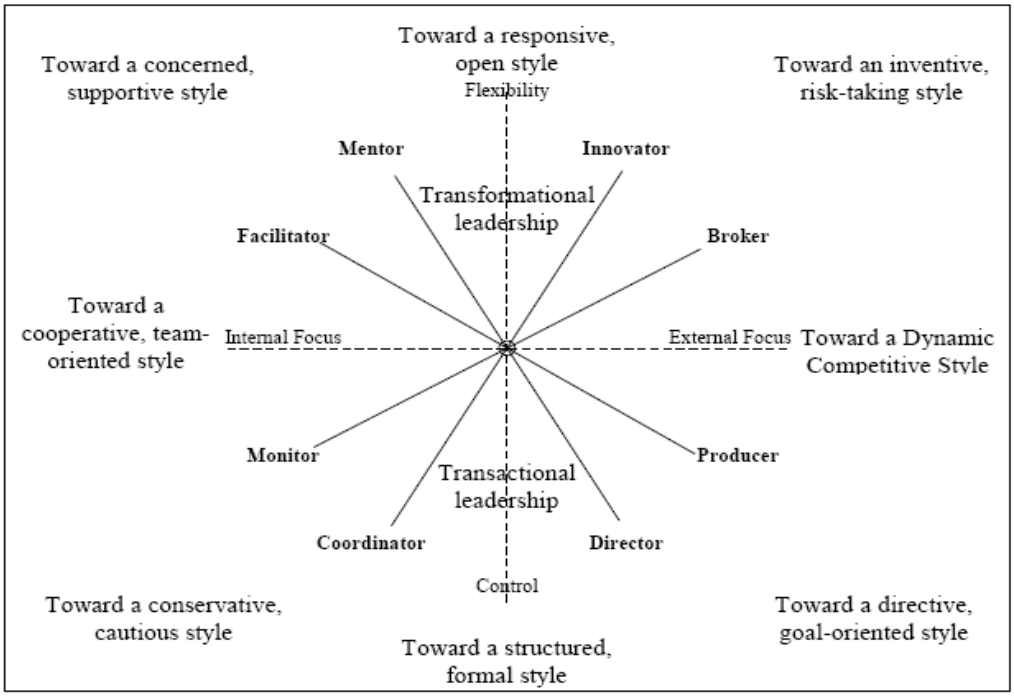


Figure 1. Competing Values Framework of Leadership Roles (Quinn, 1988)

Figure A20-6.46 Competing Values Framework of Leadership Roles (Quinn, 1988) ex. Roy et al., (2006)

This style of leadership is normally valorised in the managerial literature, so why has this key aspect of the *technician* role as identified by Barley (1996), been given the status of "non value adding work" in the study by Schultze & Boland (2000)? Perhaps we see here roles which challenge the role of managers in the hierarchical style of organization, and the struggles of organizations to adjust to more distributed models of expertise. As Barley (1996) concluded "hierarchical practices and ideologies have a way of reemerging even when managers are sincere about adopting more collaborative practices" and "potential difficulties include learning how to value and reward careers of achievement played out within the confines of an occupational community". In our *coordinator* roles by contrast, we were positioned in the "conservative, cautious' quadrant of Quinn's competing values framework, and in performing as '*testers*' of the Notes database after the server upgrade we gave effect to Quinn's *monitor* role. It should be noted here that these additional roles augmented our standard academic roles of teacher and researcher.

This augmented set of roles serves further to illustrate the complex nature of TUM, from an institutional perspective. While Orlikowski et al., (1995) have defined TUM as a "sanctioned, explicit, deliberate and ongoing set of activities", it is questionable to what extent these coordination and testing activities on our part were even known or visible to the institution. While the broader teaching and research context for the collaboration had been formalised through a variety of metastructures and formal scripts, and the system administrator and consultant functions had been sanctioned by the institution, our adaptations and augmentation of their activities and processes during the upgrade were largely informal (being based upon personal knowledge and influence, and thankfully a joint concern for the wellbeing of the students). Nevertheless I argue that this represented a bona fide instance of TUM, despite the degree of institutional sanction being somewhat unclear. Perhaps this is inevitable in a pioneering venture of this nature, where the traditional academic roles have expanded to incorporate additional roles and activities, some of which might typically be assumed by teaching or research assistants acting in a supporting technical role. As highlighted earlier (cf. section 6.4.4.2 above) we did not have the luxury of such support at the AUT University site, so these additional 'technician' roles were assumed by the academics as *coordinators* themselves.

A20-6.8.4.2 Time and Space – Adjustment-Reinforcement Episode 4

The episode has several coded items related to the concepts of *time* and *space*. *Time* in particular, as depicted in table A20-6.44 below (and as viewed against the prior table A20-6.43), represents the second most frequent concept in the episode.

Concepts	Codes	Count	Subtotals
Space	Location	3	
Space	face to face	2	5
Time	Delay	2	
Time	Synchronize	5	
Time	holiday	1	
Time	Time	3	
Time	time zone	1	
Time	day	3	15
Time Pressure	busyness	1	
Time Pressure	concurrent tasks	1	2

Table A20-6.44: Adjustment-Reinforcement Episode 4 – Coded 'Time and Space'

Beginning with the concept of space, '*location*' is evident in two contexts: the first relating to a meeting to conduct the Notes application tests, in which Diana confirmed her availability for a joint session (yes, I'll be in the office. DK 18/08); the second context, also coded as '*face to face*', relating to my intended opportunistic visit to St Louis,

> I have also put in a Doctoral consortium submission to the ACM SIGCSE conference in St Louis next year Feb 23 27, and optimistically hoping to have it accepted. So hope we can meet up, I think Mats Daniels and Arnold might be there as well. TC 19/10
>
> I'd also be more than happy to come and talk at SLU on a collaborative computing topic or something that you think might interest faculty over there, TC 19/10

In response Fred graciously offered,

> I very much look forward to your visit and will try to arrange a session here on campus.
>
> We generally have seminars on Friday so we'll see how that fits your schedule.
>
> Perhaps we can bring the whole crew and have a panel discussion. (FN 20/10)

In this second communication we see a plan being developed for the first potential *face to face* meeting of several members of the GVT some four months ahead. A joint academic conference on computing education for me and my Uppsala colleagues provided an occasion for a meeting, coinciding with Fred's home city, (even if not with Fred's academic discipline of Information Systems). The peripatetic nature of

academic life is evident here, as is the global nature of the work involved in participating in international communities.

In addition to this spatial aspect, the global dimension of academic work finds its further expression in terms of *time*. The excerpts below highlight an interchange in which several aspects of time are present.

> 1-314 -977-3845 Fred's no. from website - rang and left a message (TC 19/10 D. Note)
>
> BTW We tried to ring today figuring that our time zones sort of aligned. Hope we can get in touch before too long, to get some feedback from you on how things are going from your end, and anything we can do to help out. (TC 19/10)
>
> Thank you very much for calling. Normally I'd have been in but we are on a kind of minibreak for midterms and grading midterms until Thursday. (FN 20/10)

This interchange relates a failed phone call in an attempt to *synchronise* activities across sites, resulting in a need to leave follow-up messages by voice mail and email. It highlights a *delay* imposed, (despite an attempt to work across a compatible *time zone* window*)*, by divergent academic calendars and *holiday* breaks. While this break was no doubt an example of "predictable event" *time* (Arrow, Poole et al., 2004), there was clearly a "mutual knowledge problem" (Cramton, 2001) about the St Louis midterm 'minibreak'. On reviewing the syllabus for the ST Louis Global Information Management (GIM) course, this break had been specifically advised (cf. table A20-6.45 below) for the session of 19th Oct, but the exact start and end dates of the 'minibreak', and the implications for Fred's availability on campus had not been made clear.

Session	Reading (to be determined)	Topic	In Class Activity
Oct. 7			
Oct. 12		Review	
Oct. 14			Midterm exam
Oct. 19		NO CLASS – FALL BREAK	
Oct. 21		VISITOR	
Oct. 26		Class project discussion	Team projects due

Table A20-6.45 Excerpt from ST Louis GIM Course Syllabus (16/08/2004 update)

In the above incident we see an illustration of the phenomenon identified by Treinen and Miller-Frost (2006), where "the local team would have benefited from being aware

of cultural aspects such as the holidays and work week for the remote team". This failed attempt to *synchronize* activities also complements the observation by the same authors that, "anyone who has tried to schedule a truly global meeting knows that it is impossible to find a time that is acceptable for all participants" (ibid.). Here not only time, but space and culture have combined to frustrate communication attempts.

While I had left a message for Fred, I had no idea when he would receive it, other than an expectation of a window of somewhere between twelve and twenty four hours. The voicemail and follow-up email message constituted what Massey and Montoya Weiss (2006) have termed a "repair event" in the process of knowledge conversion (KC). These authors distinguish between two modes of repair "parallel" and "serial", where 'parallel repair' enables activity to continue "with repair occurring off-line (i.e., clarification can be added at a later time)" and 'serial' concludes that "further KC is unattainable without immediate clarification…We might describe parallel repair as a bump in the road, whereas serial repair is a roadblock to progress" (ibid.). This event sat somewhere between the two, and was analogous to the situation in 'follow the sun global software development' described by Treinen and Miller-Frost (2006), where when one team's tasks are not completed then the other team "effectively loses an entire day waiting for the other team to sleep, wake up, compete their tasks, and hand them over 24 hours behind schedule".

A related theme is visible in the segment containing the concept of '*time pressure'*, coded as *busyness* and *concurrent tasks*, where I had noted to myself in a late night dairy note, (11:13 pm was noted as the clock *time)*:

> No time today – working on PhD, D9's, Julia's M. Comp & collab computing reviews. (TC18/10)

Thus the *busy* nature of academic life and the extent to which it is ruled by a "temponomic" (McGrath & Kelly 1986, p.61) form of 'clock *time'*, is portrayed here, with multiple *concurrent tasks* and peak workloads to meet *pressing* deadlines being commonplace. Here I was acting in the multiple roles of student, reviewer, thesis supervisor, teacher/grader, researcher and trial co-ordinator. While the normal pattern of academic working hours may be an open question, this event does resonate with the comment by Treinen and Miller-Frost (2006) that "leaders of teams (if not the whole team itself) are often forced to work well outside of their working hours. This is inconvenient at best and completely unworkable at worst". In this context the role "leaders of teams" should equally be substituted by "coordinators of global collaborations", whose significant TUM roles bring similar burdens.

In addition to *time* of day as 'clock *time*' the episode contains several items coded to *day* of week. Two of these are relatively straightforward diary notes of *Monday* 18/10 and *Tuesday* 19/10 denoting the working *days* on which the notes were recorded. Although not apparent in this episode, these *days* might have borne significance, for instance in a pattern noted by Treinen and Miller-Frost (2006) where the working week and weekend overlap across time zones worked to the advantage of teams located in Canberra, Australia and Boulder, Colorado. Two more significant patterns based upon *day* of week are evident within the episode: 1) where the day of week delimited the break:

> we are on a kind of minibreak for midterms and grading midterms until Thursday (FN 20/10)

2) where the day of week supported a regular departmental cycle at St Louis:

> We generally have seminars on Friday so we'll see how that fits your schedule. (FN 201/0)

These instances illustrate the further dimensions of time of Arrow, Poole et al., (2004), through the "predictable event" time of the "clock time" scheduled break, within the broader 'cyclical time" of the annual seasons and local academic rhythms, and the narrower "cyclical time" of the regular departmental seminar.

Concluding this review of *time* and *space* within the episode, are two interchanges coded as *synchronize*. In the first Diana confirmed that she would be in the office, for a joint meeting to test the Notes collaborative database for continued functionality after the server upgrade noted below:

> Response to Daniel about midday over online server upgrade tomorrow – organised testing and a backup plan – keep fingers crossed. Meeting tomorrow about midday. (TC 18/10)

This incident demonstrated the need for local coordination to *synchronize* actions in *time* and *space* through *face to face* meetings on the part of technology-use mediators, even when conducting global virtual collaborations. It also demonstrates the need for coordinated action when performing information technology infrastructure upgrades at critical junctures, and their being subject to an application non-interference test cycle before migrating to production use. These activities in turn must be *synchronized* across several parties, coordinators, system administrators, vendors [not explicitly visible in this interchange], and third-level support consultants. *Synchronization* across technical *spaces* was also required, as the new server production environment and the old server environment were distinct, as were the Notes databases resident on each

server. In the event of failure a reversion capability was required, in which should the 'new' server *space* be proven inadequate, the old server *space* would be retained until a migration path could be stably achieved.

A20-6.8.4.3 Reflexivity of the actors – Adjustment-Reinforcement Episode 4

As in prior episodes the actors demonstrate a reflexive awareness of their context, the role of technology within that context, and engage actively in mediating technology use and shaping the technology to suit their aims. For instance the Notes server upgrade was a notified event, with significant disruptive potential for the collaboration. The actors were aware of this and consciously and deliberately acted to put in place a testing plan and a backup plan. These specific risk management initiatives were instigated by the coordinators of the collaboration themselves, rather than being imposed by the IT Services group, who had their own broader plan which was not fully clear to the trial coordinators. These circumstances highlighted the absence of autonomy for actors inherent in these contexts.

Further evidence of conscious awareness on the part of actors in this episode, is evident in the conversation with the Notes external consultant about enhancing the Notes database functionality, where in the developer role I was conscious of deficiencies in the application (e.g. forms validation not working in the browser version, database views and user interface standardization) and sought technical input to rectify them. As previously observed (cf. section A20-6.4.4.5), functioning in the developer role inherently involves engaging in a 'design process' through which a 'future use process' is conceived for others. Designing with "tailorable" (Germonprez, Hovorka & Collopy, 2007, Orlikowski 1996, Orlikowski & Hofman, 1997) forms of technology, such as Lotus Notes, represents a highly conscious form of technology shaping and TUM.

Fred's response regarding the confusion of his students about the exercise and what they were to do was a good example of a response indicating a reflexive stance. A doubly reflexive stance could be interpreted in this response where Fred asked us for any suggestions to clarify the confusions, thus seeking to focus our additional reflexive capabilities on the issues through a joint process of TUM in the *reinforcement* mode.

A final indicator of reflexive mindset on the part of the actors was the process of tentative planning for a joint "panel discussion" at the St Louis campus some four months out. As a retrospective on the collaboration process, this session would

inherently function at a meta-level from the action itself, and potentially serve as a trigger for further TUM in the *episodic change* mode.

A20-6.8.5 Visual Mapping – Adjustment-Reinforcement Episode 4

The diagram in figure A20-6.47 below represents, as in prior episodes, a visual summary, or 'map' of the episode, focusing on the *metastructure* of the '*server upgrade'*, which possessed a combined set of technology, institutional and cultural properties that enabled it to serve a mediating role in shaping technology use. The narrative in table 6.46 below and the accompanying charts speak for themselves in demonstrating the dynamics which were in operation at the central AUT site where the servers were housed. These were invisible to the other sites which played no role in this potentially devastating activity for the collaboration. Thus the context was one which was distributed in terms of people and dispersed in terms of organizational units.

The interplay between the coordinators and the IT service providers illustrates a rather delicate set of tensions as discussed in section A20-6.8.4.1 above, with me as the coordinator of the collaboration requiring a further level of testing before confirming the cutover of the new server. As noted previously the ambivalence of professionals towards technicians in this incident, "surfaced in the dilemma over whether *technicians* were servants or experts" (Barley, 1996). In performing the upgrade we saw the '*technicians*' as 'servants' performing a service on our behalf, while at the same time possessing expertise and resources to which we did not have access. Yet, had this relationship not been based on a degree of mutual trust and understanding, (which I had built over some time with our Lotus Notes Administrator cf. section A20-6.8.6 below) we may not even have been consulted over the change. In that case, had the upgrade encountered any difficulties our collaboration would have suffered a severe and probably irreparable *breakdown*, given the brief window of time remaining and the negative impact of the prior delays, which we were now just beginning to overcome.

The second *metastructure* depicted in this section is that of the proposed 'panel session' at St Louis, which would provide a stage upon which the protagonists in this virtual play would physically encounter one another for the first time. As an essentially retrospective and reflective act, this event could potentially serve as a trigger for *episodic change* in future collaborations. Therefore, while the episode consists of TUM activities in the *adjustment* and *reinforcement* modes, the interchange relating to

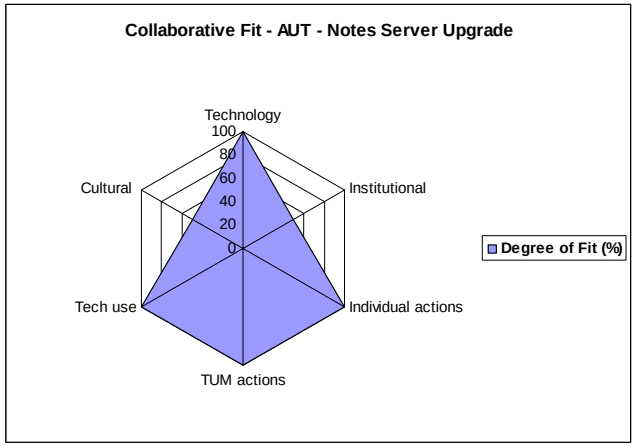
the ‘panel session’ may also foreshadow the *episodic change* mode, and shed further light on the role that key events and face-to-face meetings play in generating these more significant developments. The dynamics of this event across sites is depicted in figure A20-6.48 and accompanying table A20-6. 47. As can be seen, the fit for the St Louis site is excellent, for the AUT site reasonably good and for the Uppsala site was still dependent upon a number of factors. This difference was not unreasonable as at the time of depiction the panel session was simply a proposal, dependent upon acceptance of my submission to the conference at St Louis. Therefore it seemed premature to embark on the next stage of coordinating the session with my Uppsala colleagues. It is interesting to speculate in hindsight whether this was a mistake, because neither Mats nor Arnold were able to participate in the eventual panel session which was held at St Louis on 21/02/2005. A further speculative question arises when viewing the chart for Uppsala in figure A20-6.48, and whether this uneven pattern of fit may have been a predictor of our inability to coordinate the panel sessions with Uppsala colleagues present. If so it may be that selection of certain *metastructures* before the event and mapping the degree of collaborative fit for a location, may highlight at an early stage issues that need to be addressed for a future global collaborative activity to succeed. This panel session will be addressed in the next episode so will not be covered in further detail here.

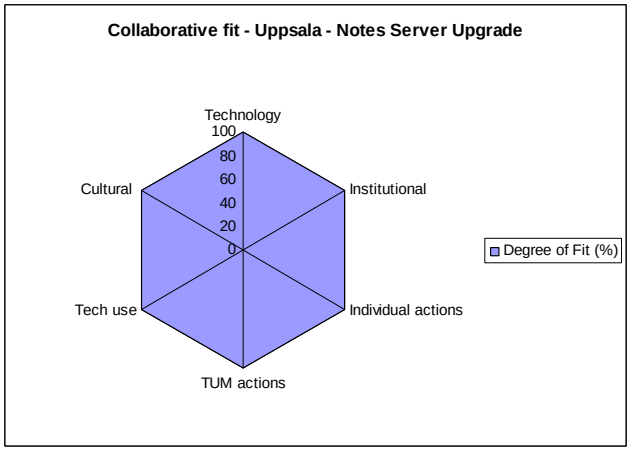
The radar charts in figure A20-6.47 below depict the operation of the *metastructure* represented by the *Server Upgrade* at each site. Each element is briefly tabulated in table A20-6.46 below.

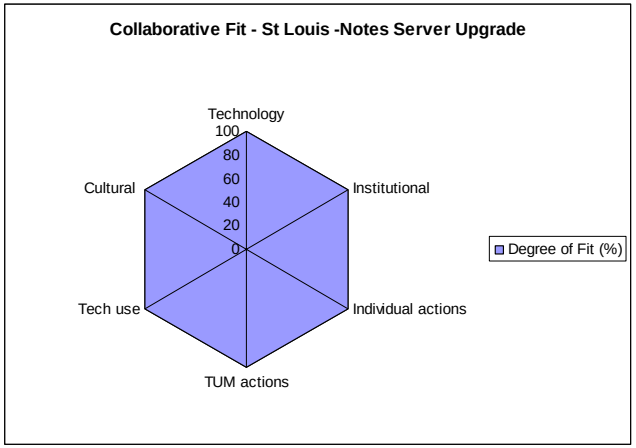
AUT	
Technology -	Hardware and operating software for old and new Lotus Notes Servers, network connections, Lotus Notes Domino Server, Administrator and Designer software, & Lotus Notes old and new Collaborative Databases
Institutional –	ITG initiated, Lotus Notes Administrator & External Consultant implemented upgrade, Coordinators as users advised of need for upgrade
Individual actions –	Lotus Notes Administrator consulted coordinators as users, & with External Consultant implemented upgrade, Coordinators required testing & backup plans & planned & met to conduct tests & confirmed success
TUM -	Notes administrator advised of upgrade, implemented upgrade with external consultant, coordinators required a testing and backup plan to manage risk for collaboration, technical staff conducted own infrastructure tests, coordinators planned & met to conduct application tests and confirmed success
Tech use –	Email for communication, server hardware and operating software, network connections established, Lotus Notes Domino Server and Administrator level software, Notes Designer software and application databases
Cultural -	Professional technician culture vs. academic culture, broader service maintenance responsibilities vs. short term project risk management, external expert service provider professional culture and accommodation of service requirements, ambiguity of master-servant relationship?
St Louis	
Technology -	No action required
Institutional –	No action required
Individual actions –	No action required
TUM -	No action required
Tech use –	No action required
Cultural -	No action required
Uppsala	
Technology -	No action required
Institutional –	No action required
Individual actions –	No action required
TUM -	No action required
Tech use –	No action required
Cultural –	No action required

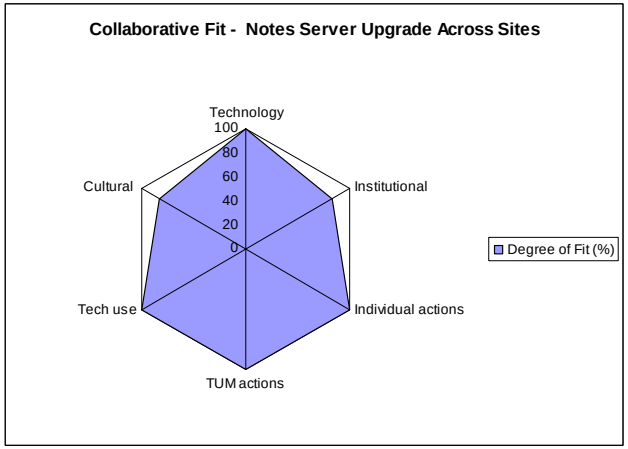
Table A20-6.46: Adjustment-Reinforcement Episode 4 – Metastructure of *Server Upgrade*

Figure A20-6.47: Radar Charts – Adjustment-Reinforcement Episode 4 – Metastructure of *Server Upgrade*









Degree of Fit Scale (%)

100% - full collaborative fit (CF)

75% - moderate CF

50% - partial CF

25% - limited CF

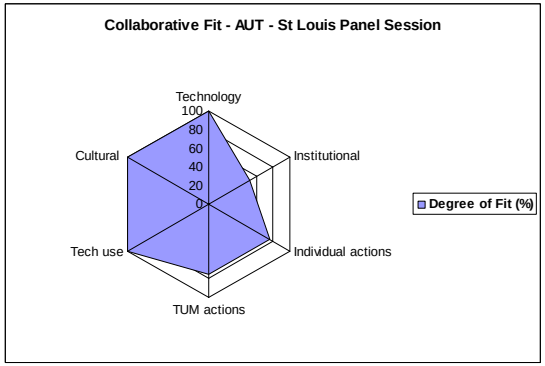
0% - no CF

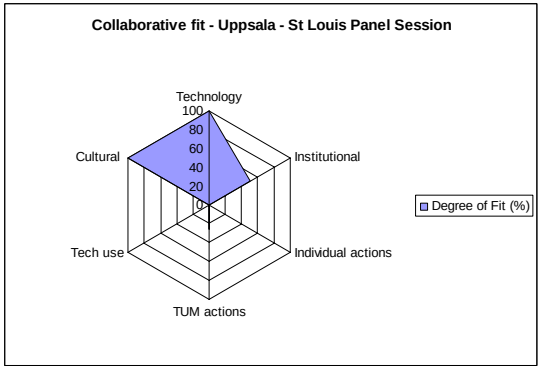
The radar charts in figure A20-6.48 below depict the operation of the *metastructure* represented by the *St Louis panel session* at each site. Each element is briefly tabulated in table A20-6.47 below.

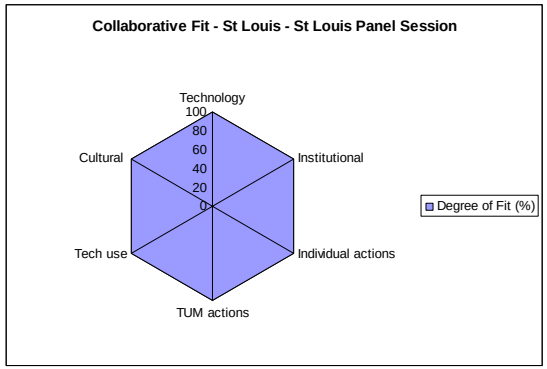
AUT	
Technology -	Email to arrange, face to face session to present, Web Browser & Powerpoint or similar demonstration software
Institutional –	Dependent upon AUT funding - only provided for approved academic conferences which result in research outputs, dependent upon SIGCSE Doctoral consortium submission acceptance & ACM co-funding
Individual actions –	Tony submits proposal to SIGCSE doctoral symposium, notifies Fred of potential attendance, timings and willingness to speak at St Louis, also notifies Fred of Mats and Arnold's likely attendance, Diana unable to attend without accepted paper and accompanying funding
TUM -	Tony submits proposal to SIGCSE doctoral symposium, notifies Fred of potential attendance, timings and willingness to speak at St Louis if timings can be made to fit, also notifies Fred of Mats and Arnold's likely attendance at SIGCSE
Tech use –	Email, MS-Word (symposium submission)
Cultural -	Professional and International - Global academic culture of collaborative knowledge sharing, my offer to speak set within practice of Universities hosting visiting speakers, plus role of academic conferences in sustaining global academic communities
St Louis	
Technology -	Email to arrange, face to face session to present, Web Browser & Powerpoint or similar demonstration software
Institutional –	St Louis University location coincident with SIGCSE conference, established practice departmental cycle of Friday seminars
Individual actions –	Fred notifies Tony of willingness to host a visit, advises weekly seminar schedule, proposes a joint panel session
TUM -	Fred confirms willingness to host a visit, advises scheduled day for weekly dept'l seminars, proposes a joint panel session
Tech use –	Email
Cultural -	Professional and International - Global academic culture of collaborative knowledge sharing, invitation to speak set within practice of Universities hosting visiting speakers, plus role of academic conferences in sustaining global academic communities
Uppsala	
Technology -	Email to arrange, face to face session to present, Web Browser & Powerpoint or similar demonstration software
Institutional –	Dependent upon Uppsala academic calendar, commitments and conference arrival and departure dates
Individual actions –	None within this communication window
TUM -	Tony indicated to Fred Mats and Arnold's likely attendance at SIGCSE, still to coordinate with Mats and Arnold
Tech use –	None
Cultural –	Professional and International - Global academic culture of collaborative knowledge sharing, invitation to speak set within practice of Universities hosting visiting speakers, plus role of academic conferences in sustaining global academic communities

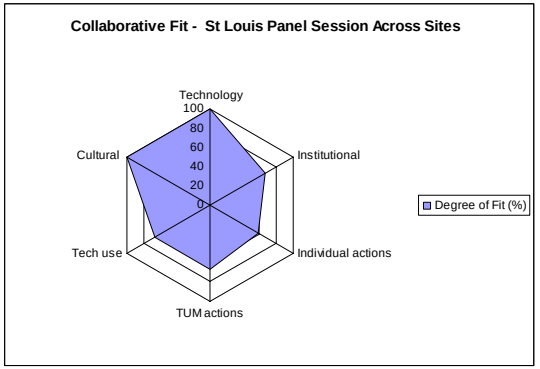
Table A20-6.47: Adjustment-Reinforcement Episode 4 – Metastructure of *ST Louis Panel Session*

Figure A20-6.48: Radar Charts – Adjustment-Reinforcement Episode 4 – Metastructure of *St Louis Panel Session*









Degree of Fit Scale (%)

100% - full collaborative fit (CF)

75% - moderate CF

50% - partial CF

25% - limited CF

0% - no CF

A20-6.8.6 Temporal Bracketing – Adjustment-Reinforcement Episode 4

This episode, with its five tightly spaced data sources, offers limited scope for temporal analysis demonstrating any significant progression of events. But the episode had its origins in past activity and institutional and professional relationships. The server upgrade aspects of the episode illustrate TUM activity in the *adjustment* mode, performed to *prevent* the occurrence of problematic events such as *breakdown* and *delays.* As in the previous episode, where operational maintenance of the AUTonline server had caused unplanned downtime for participants, there is an implicit link to the theme from the literature of: "connectivity difficulties" where a "user may have difficulty accessing the system" (Romano, et al., 1999). In this case the link arises not as a result of such downtime, but as an active and conscious intervention to prevent its occurrence. The review below widens the window of analysis, to focus on the history of the incident. This extended temporal bracket explores the TUM activity related to the Notes server upgrade, with the addition of the further source items outlined in table A20-6.48 below.

Extended Episode Characteristics	
Duration:	28/09/2004 – 30/09/2004
Supporting data:	2 Diary Notes - 28/09/2004 & 29/09/2004 3 Email Messages – Tony Clear 30/09/2004 2 Email Messages – Peter MacLaren 30/09/2004 3 Email Messages – Daniel Ismail 30/09/2004
No of sources	8 – focal lens of TUM activity related to "Notes Server Upgrade"
Actors:	Tony Clear, Daniel Ismail, Peter Maclaren, Ross Hawkins

Table A20-6.48 Extended Episode Characteristics – Adjustment-Reinforcement Episode 4

A20-6.8.6.1 Narrative Summary – Extended Adjustment-Reinforcement Episode 4

The additional source items above help fill in the picture of the 'Notes server upgrade' and its associated rationale.

In the first diary note on 28/09/2004 I had recorded a voicemail received from Daniel Ismail our Lotus Notes administrator about an earlier call I had put in regarding a student who had been unable to access the Notes server for our postgraduate collaborative computing course (which I was teaching with Diana). I rang Daniel back and we resolved the undiagnosed issue by Daniel rebooting the server at my request, as no-one else was logged in. Daniel also mentioned a request by Peter Maclaren Projects Manager of our Centre for Professional and Educational Development, (also the

reporting unit for the Flexible Learning Services team which supported AUTonline). Peter had (for the reasons eventually outlined below) requested an upgrade to the current Notes server software version to version 6.5. In response I had noted "I think clients are version 6.0.1.2??"

In a brief addition to the diary note, dated 29/09/2004 I recorded that I would "need to check timing and impact on the collaborative trial?"

The next day 30/09/2004 saw a flurry of email communication developing plans for the server upgrade.

The first message came from Peter Maclaren to Daniel (9:25 am) directing him to a link containing a "guide to upgrading from Notes R5 to R6 - may be of use?"

In response(10:24 am) Daniel informed that he had read the guide and spoken to Ross Hawkins our external Lotus Notes consultant, who had advised that

> "the upgrade [to] Domino 6.x should take no more than around 15-20 minutes and is relatively painless – I'll probably get him in to ensure a smooth transition".

In addition to this commitment to manage the risk of the change by bringing in expert third-level support, Daniel's service orientation was apparent in the next sentence. He committed to "wait for a green light and a suitable time from you guys", before proceeding to avoid disruption of any activity on the servers. In concluding Daniel sought confirmation that both the (production) ONLINE and (development) NOTES servers would be upgraded.

In my reply to Daniel (10:31 am) I confirmed that upgrading both servers would be good, as it might provide a resolution for a problem we had been experiencing with Javascript validation of web forms, which I had then putatively diagnosed as due to incompatibility between the server software version and the client version (Designer 6.01). I also suggested a suitable timing for the upgrade:

> "our current collaboration is due to end on 2nd November so ideally a couple of weeks out from that should suit us"

Daniel came back quickly (10:52 am) with the advice that "v6.5.3 of the Notes/Designer/Domino software is now available", and a proposal to upgrade full client users to the same version as the new server software. Daniel then requested an indication of numbers of clients involved [as we were using the full set of Notes and Designer client software for both academic staff and students in the collaborative computing course, who were using it for Notes development].

In response I advised (11:05 am), that the Notes and Designer clients were on the

standard classroom image, and there were about four or five lecturer copies if they have different set ups (for instance I had a laptop). We also had a copy of the CD with the install if master's students wanted to work from home or install software in the graduate laboratory where some of the images were non standard. This all fitted with the IBM academic licensing terms. As a concluding comment I remarked that the Notes server was inaccessible again, and could he please check it out, or should I log a job for it [with the helpdesk]?

Daniel responded quickly (11:28 am) advising that the Domino service had been restarted, as he had seen that a student user was having problems but should be ok now. He also advised that he could

> "possibly create a 'Zenapp' to remotely and automatically install the client(s) – and will make a copy available to you guys to distribute where necessary"

I replied (11:49 am) thanking Daniel and noting that [the remote install facility] would be quite useful. I also sought further advice on the student who was having trouble logging in to the Notes server from the web using her user account, but was ok from the Notes client – any thoughts??

The concluding message in this sequence came from Peter Maclaren (12.24 pm) who advocated more urgent action on the upgrade. The critical use for the Notes server was the Blackboard Course Utility database which academic staff at the University accessed via the web, and while activity was low at that time, it would increase rapidly at the end of semester. Peter also had to make changes to the database to allow for 2005 courses and would like to do so asap, in addition to which he wanted to "sort out LDAP" which he thought would be easier with 6.5. Thus the central university needs would take precedence over those of our collaboration.

This sequence of messages then had set the scene for the TUM episode of *adjustment* and *reinforcement* reviewed earlier in this section. The sequence focuses primarily on the *adjustment* mode of TUM called into play by the server upgrade incident. This historical sequence is now linked to the evolution of events through the extended set of data for the episode, as displayed from a temporal perspective in figure A20-6.49 below.

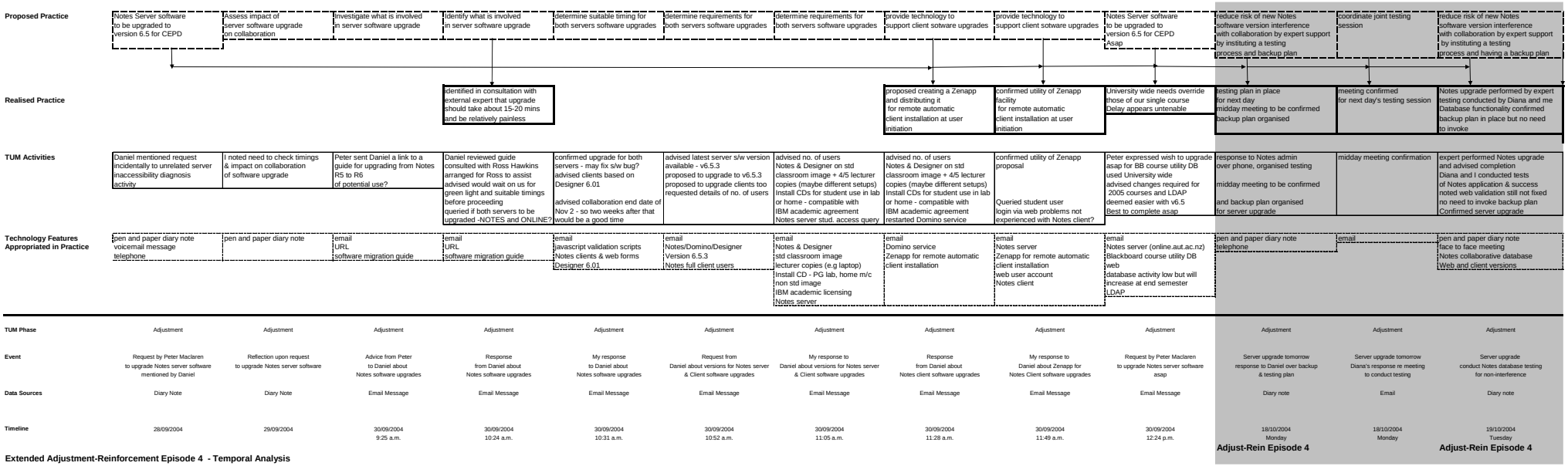


Figure A20-6.49: Temporal Bracket: Extended Adjustment-Reinforcement Episode 4- Evolution Over Time

The evolution of the upgrade depicted in figure A20-6.49 above, illustrates the complex and interrelated nature of TUM in a field setting, where several work streams and technology applications are concurrently in operation. The global collaboration is depicted as one element in a much wider context, with institutional, cultural, and technology dimensions of the *metastructure* of the 'Notes Server Upgrade' being tightly interwoven. The upgrade can be seen as tightly linked to the server hosting the University wide Blackboard Course Utility database; to the students' use of Notes and Designer (the Notes development environment) for the graduate level collaborative computing course; to the academic lecturers' use of Notes and Designer for the global collaboration and other purposes; and the dialogue with our Notes administrator being peppered with continuing diagnostic and support requests for current teaching activities. In being able to deal directly with Daniel I was actually in something of a privileged position, which reflected a relationship of trust between us. For instance in one case I asked Daniel for a favour "BTW the Notes server is inaccessible again, could you pse check it out or should I log a job for it?" (TC 30/09 11:05 am). In formalising the work through a job request Daniel's support tasks would have had increased visibility within his unit, but may have resulted in slower service for me. In the immediately subsequent email (DI 30/09 11:28 am) Daniel reported that "the Domino service has been restarted" having noticed a student having trouble accessing the server, and "he should be ok now".

There is a noticeable gap in the evidence trail between Peter's (30/09/2004) request for an upgrade "asap", and its completion on 19/10/2004, a month prior to the preferred cutover date which I had initially advised (i.e. two weeks after completion of our collaboration). The diary note of 18/10/2004 indicates that we had been engaged in planning a testing and backout process of some form, but the details are not precise, and the plan on our part appears not to have been formally documented, but rather more loosely conceived. From memory Diana and I simply worked through the core functionality of the system using the web browser which represented the student access mode confirming that it worked. In addition we appear to have tested the Notes clients (viz. the discussion over differing javascript functionality across Notes and web versions) and probably confirmed that Designer was still functioning for developer use. The critical import of this was that we had managed to negotiate an acceptable mechanism for managing the risk of this externally imposed (and at the time unwelcome) change. Jarvenpaa & Leidner (1999) have noted the need for a "phlegmatic reaction to crises" as a means of retaining trust later in a GVTs life, and

such a response was evidenced here by the parties involved. Notably several of those involved in this incident were not members of the GVT but members of an extended and frequently invisible supporting cast, whose work is illuminated in the context of "breakdown" (Hettinga, 2002). Yet complementing this supporting cast was another set of contending actors who could almost be termed "negative stakeholders" (Alexander, 2005):

> "with viewpoints opposed to the successful completion of the product's development or its coming into service, or its successful operation"

While not necessarily malevolent in this instance, the "negative stakeholder" dimensions here reflected a not atypical clash of priorities in a broader institutional setting, which impacted our collaboration.

A notable feature of this incident is not only the active forms of TUM involved in this *adjustment* to the technology environment, but the presence of so many different technology components. These included links to technical guides for software upgrades; javascript validation for Notes web forms versus Notes client versions; the different Notes applications (the server product - Domino server, the client version of the Notes software, and the developer product – Designer); different Notes product versions and the need to re-establish consistency between versions across platforms; the differing classroom and graduate laboratory desktop images (which included a collection of pre-installed software applications); lecturer laptops; install CD's for student home and laboratory use; the IBM academic software licensing agreement; the active Domino service (which had to be restarted in one communication); the proposed 'Zenapp' for remote software distribution upon user initiation; web user accounts versus client accounts (for diagnostic differentiation); the Notes server address (online.aut.ac.nz); the Blackboard Course Utility database; LDAP (a security access protocol); email; telephone; and the Notes collaborative database. In contrast to the lament of Orlikowski and Iacono (2001) about the absence of the IT artefact in much IS research, this plethora of IT artefacts is pervasive in the evolution of this incident, and over the course of a one month period it was as though the gaping maw of the institution's technology infrastructure had opened to us as coordinators. This demanded significant technology awareness on the part of the coordinators, judgement about appropriate actions to be taken, and active engagement with other parties in a broad set of TUM activities extending well beyond concerns with the collaboration itself. The incident demonstrates the escalation effect of a technology infrastructure change occasioned through an external shock, imposing ripples of change across many

different contexts and roles. Here we see a change which invoked our many concurrent roles as: coordinators of this collaboration; Notes developers (of this and other applications); teachers of a graduate level course in which students were also Notes developers; monitors of technology service provision; trouble-shooters mediating with support parties on behalf of students; "corporate citizens" of the university bowing to wider student needs; "shepherds" of our projects which demanded active TUM activities and roles such as testers and instigators of risk management plans with our technical support colleagues. It goes without saying that this generated a considerable amount of unplanned work on our behalf, not solely for this collaboration but across other concurrent activities, and demonstrates how *time pressure* can rapidly build in such situations of "interaction breakdown" (Thomas et al., 2007).

The richness of the TUM activities involved in this incident supports the necessity of field studies for this form of investigation, as these emergent and interlinked chains of events would not be replicable in a laboratory study. This temporal form of episode analysis has advantages similar to those clamed by Thomas and colleagues (2007) for the use of the "critical incident technique (CIT) interview methodology", in that "it enables a focused and in-depth capture of intact job behaviour and its context". In fact this form of TUM analysis may surpass CIT, in that rather than the potentially secondary forms of data generated by interviews based upon perceptions 'after the fact', this analysis is strongly grounded in empirical data based on the communications between the actors and the technology artefacts and practices thereby revealed over time.

A20-6.9 Episode of Interest Profile: Episodic Change Episode 3

A20-6.9.1 Episode Characteristics – Episodic Change Episode 3

Episode Characteristics	
Duration:	21/02/2005 – 27/05/2005
Supporting data:	7 Diary Notes – 21/02/2005, 22/02/2005, 23/02/2005 (plus 8/03/2005), 24/02/2005, 24/02/2005b, 26/02/2005, 27/05/2005
No of sources	7
Word count	786
Actors:	Tony Clear, Arnold Pears, Steve MacDonell, John Hughes

Table A20-6.49: Episode Characteristics - Episodic Change Episode 3

A20-6.9.2 Narrative Summary - Episodic Change Episode 3

This episode consists primarily of a series of seven diary notes revolving around my visit to St Louis in February of 2005 some four months after completion of the collaboration. A final diary note chronicles a meeting in late May 2005 with my doctoral supervisor Professor John Hughes in Sydney to discuss a draft of chapter three of this thesis.

The first note briefly records the presentation at St Louis University on 21/02/2005, [after my first face to face meeting with Fred earlier that day], where we held a panel session at which I and three fellow panellists from St Louis University presented. I noted that two of the St. Louis students from the previous year's collaboration were present in the audience, and we had the chance to discuss during the session and talk further with them afterwards. I took specific note of quotes from one of the students (Adam De Woskin):

> "we learnt more b'cos things did not go smoothly"
> "if we did it again we would have a better idea how to function"
> "interesting to see educators perspective – just as confused as we were and equally challenged"

In an excerpt from the second note next day (22/02/2005) I recorded observations and selected feedback received from the SIGCSE doctoral consortium discussants, where I

felt I had done a very poor presentation trying to cram too much into the 10 minute allocated slot. Feedback from one discussant included comments such as: "why do global virtual teams? where do you want to contribute? Which community? Focus on that literature. Fill in other lit as needed. Too many fields you are drawing on. Too many incomparable paradigms of research so just pick one". Another discussant asked pertinently "Not so much: what's your question as what's your focus. What exactly will you study? Will you focus on mediation? Tools, technology appropriation? Roles activities, group process? All these are too much for one PhD". Then a further discussant observed "You speak of complexity, you need to simplify and specify. It seems to me you are trying to define a model of support roles. Ok do that then. Collect data to test validity (not just support) of the model. Then revise the model appropriately. Later work can look at roles & performance that aid/harm the group".

The third day (23/02/2005) recorded a meeting at the SIGCSE conference proper with Arnold, our first real debriefing after the collaboration. Arnold observed that he had suffered from a "sales problem" and that experiencing difficulties was part of the issue – a process issue, where the natural student tendency was to be goal directed. Arnold asked why New Zealand students had not posted photos of themselves? Talking of the final reports from students we drew an analogy to looking through "frosted glass mirrors". Arnold advised that he had been very busy and need to do a debrief after the event, as there was not enough time to dedicate to it and students "don't understand academic load in tracking what is going on" We needed to work on mechanisms to reduce the load and break down the model. For instance in the case of the Runestone project there was a continuing narrative and set of customs carried forward from prior students. Arnold recounted the experience of a particular student experienced in software development across four countries (including Sweden, India, US and another), who was very dissatisfied with the AUT collaboration:

> "b'cos we had all these problems in our work environment and found it frustrating and ineffective (couldn't get colleague to buy into his strategies)"

In the Runestone model there was a set of open team forms accessible across teams, a wiki matrix for online presentation times, editable by students on a first come first served basis but with an audit trail.

As an epilogue to this note, I had subsequently observed (08/03/2005) to my doctoral supervisor Professor Stephen MacDonell, the not wholly inconsistent pattern of this collaboration as:

> "Ground Hog Day with neophytes".

The following day (24/02/2005) Arnold and I met again, with the following notes being recorded. Arnold remarked that from 2 – 5 pm each day his students had been unable to log into the AUTonline system (our scheduled but not advised downtime as I was finally able to respond cf. section 6.7.6.1.3 above). Arnold outlined the technology environment established to support the Runestone project. The machine was setup in a DMZ (demilitarised zone) outside the firewall, and was managed and owned at departmental level with administrative privileges held by Arnold and a technical assistant. These roles for faculty and technical staff effectively shielded students from activities associated with install, configure, prepare, use. Arnold and I agreed that in computing education we needed to sell the idea that installing and configuring software was not "wasted time" and that students underestimated the effort involved in environment management, as an overhead yet in reality a valued activity. The note concluded by drawing the distinction between 'development' and 'production' environments.

Later that day (24/02/2005) Arnold and I met in the house bar of the conference hotel where we came to the following conclusions:

1) "task 2/2004 too limited to require true collaboration
2) icebreaker opt out option "self-managed team" proved counter productive
3) Runestone icebreaker requires students in pairs to post websites on each other (Arnold has requirements)
4) Personalities for collaboration
   5) Joint task
   6) Loose approach"

With respect to the latter comment regarding personalities I had further noted that the collaboration was very dependent upon personalities, and this year Diana would be absent, Kitty would be the local coordinator or Jim Buchan possibly? The note concluded with an addendum recording a discussion held earlier in one of the session breaks, in which we had agreed it would be best for Arnold to visit New Zealand to meet the collaborators and agree an approach. I had also advised that Fred would be on sabbatical next semester.

The following day (26/02/2005) which I recorded as the last day of the SIGCSE conference, I noted that I had briefly caught up with Arnold and handed over a proof read chapter of a thesis for one of his doctoral students. Arnold advised that he was hoping to make it to Australia before the next collaboration, but probably not. Next semester he would be on 80% parental leave and was not sure if he would be taking the course (but thought he probably would). We agreed the need to negotiate a common assessment for the course up front and a common icebreaker approach. Two actions were identified, first Arnold was to send details of his icebreaker task, and secondly I

was to discuss with Diana the concept of using the quiz [which we had instigated in semester one that year internally] as a global collaborative task.

The final note in this episode, records a discussion with Prof. John Hughes at UTS on a draft of chapter 3 of this thesis. The discussion canvassed the theoretical model to be applied, technology-use mediation and the data analysis approach and debates over grounded theory approaches, then considerations of suitable examiners. (From memory the data analysis at this stage was based upon a pilot analysis working with an alternative set of collaborative computing data related to a synchronous experiment, which had proven highly challenging in the AUT environment). The discussion moved on to the distinctions between educational and corporate environments, and the function of restrictive, "locked down" technology environments. John insightfully observed "configuration is not a democratic process". In discussing teleconferencing services John noted the availability of commercial services fully assisted and provided as an end to end service from multiple locations. A question was posed "do corporates have more stable environments or is this natural in ad-hoc collaborations?" The note concluded by agreeing that more data analysis would be useful, and the clustering process needed to be thought through.

A20-6.9.3 Appropriation Move Patterns - Episodic Change Episode 3

Figures (A20-6.50 – A20-6.52) below depict the patterns of 'appropriation move types' and 'subtypes' (DeSanctis & Poole, 1994), which characterise this episode, and demonstrate the manner in which the technology has been appropriated.

A20-6.9.3.1 Appropriation Move Patterns – Episodic Change Episode 3 - direct

This episode contained no *'direct'* appropriation moves as it did not involve a direct case of technology use, but rather a process of reviewing historical uses and planning for future technology use, through TUM moves in the episodic change mode.

A20-6.9.3.2 Appropriation Move Patterns – Episodic Change Episode 3 - Constraint

There are several moves categorised as *constraint,* where the 'structure is interpreted or reinterpreted'.

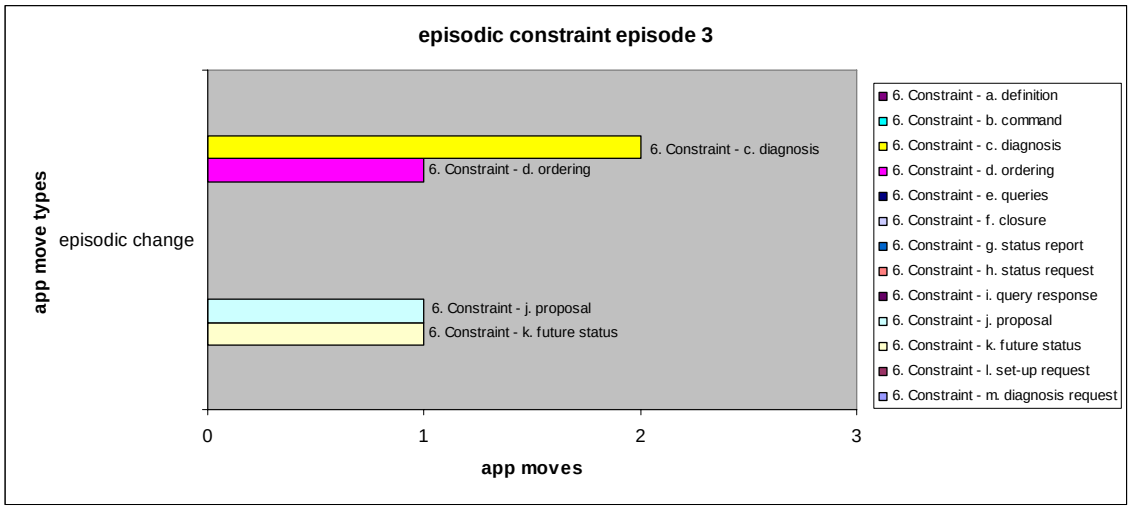


Figure A20-6.50: Episodic Change Episode 3 Appropriation Move Types - Constraint

The moves coded as 'c –diagnosis' (commenting on how the structure is working, either positive or negative) excerpted below, offer an example of a retrospective diagnosis, where the 'structure' in question was not so much a specific technology feature, but more the overall 'metastructure' of the global collaboration itself.

> Quote from Adam "we learnt more b'cos things did not go smoothly"
> "if we did it again we would have a much better idea how to function"
>
> "interesting to see educators perspective - just as confused as we were, and equally challenged" (TC 21/02/2005)

The student reflections here were heartening from my perspective. It was my first opportunity to meet with the St Louis students and gain a sense of their views on the exercise. The acknowledgement that they considered they had learned through challenge and partial failure was encouraging in this experimental domain. As we had reflected just prior to the St Louis panel (Clear & Kassabova, 2005), this learning "model of joint enquiry into the unknown…carries inherent risks as…failure in the planned activity may reflect success in the research, but the scope for tidy packaging of the whole learning process is reduced, with a corresponding rise in uncertainty and ambiguity". The suggestion that based on this experience, a repeat collaboration would be more effective was also coded against the TUM related move "j.proposal" (suggesting how the structure should be used), i.e. the whole metastructure of a collaboration (with its more specific technology structures embedded therein) would have been appropriated more effectively (even if the specifics of that process were somewhat vague).

A further excerpt coded as "c.diagnosis" came in the interchange with Arnold over the AUTOnline outages.

> Arnold 2-5 pm Arnold's students unable to log in to AUTonline

(our scheduled but not advised downtime) (TC 24/02/2005)

Arnold's 'negative comment' on the functioning of AUTOnline resulted in my ability to give a 'diagnostic' response about our operational policies for the overnight backup and maintenance of AUTonline. This backup window caused downtime in the middle of the day for our offshore colleagues, and was a situation about which we had not been advised. This issue has been previously discussed in section 6.7.6.1.3 above.

The diary note excerpt below shows the move coded as 'd–ordering' (specifying the order in which structures should be used), in which the 'learning task' and the 'icebreaker task' are highlighted as elements to be addressed prior to the next collaboration. In this discussion the concept of a "quiz" as a suitable task to be discussed with Diana was noted, as we had just introduced a quiz to the internal collaboration that semester.

Agreed need to negotiate common assessment for course up front and common icebreaker approach.

*** Arnold to send details of icebreaker task
*** me to discuss with Diana over quiz concept (TC 26/02/2005)

In contrast to the previous 'diagnosis' appropriation moves, this 'ordering' move places the overall collaboration and its embedded technology *metastructures* in a more positive light, with constructive approaches being proposed to improving aspects of its functioning. The move encapsulates a set of *TUM activities* in the *episodic change* mode.

In a similar vein is the TUM related move coded as "k.future status" (state what is proposed to be done with - or to establish - the structure),

Discussion earlier in one of session breaks
Arnold to visit NZ to meet collaborators and agree approach (TC 24/02/2005)

Here the appropriation move extends beyond the technology focus to the wider *metastructure* of the GVT, with a face-to-face meeting proposed to facilitate the next collaboration. The study by Shachaf (2008) lends support to this proposal: "dispersed and diverse GVTs that operate using mediated communication channels need to be able to master a wide repertoire of channels and to be able to use them effectively, *but they also need face-to-face meetings [emphasis added]*".

This particular coding of 'future status' is intriguing, has it extended the boundaries of the coding system beyond its original focus on the appropriation of an *AIT?* DeSanctis & Poole (1994) have defined appropriation thus,

> "We will call the immediate, visible actions that evidence deeper structuration processes *appropriations* of the technology. By examining appropriations we can uncover exactly how a given rule or resource within a GDSS for example, is brought into action".

So was this proposal for Arnold to visit and meet face to face an "immediate, visible action" of *appropriation*? I believe it could arguably be viewed as such, as a TUM related appropriation move with a future focus, indicating the shaping of the technology. But it poses a question concerning the limits of 'technology structures' versus 'social structures'– is a *metastructure* such as a *GVT* open to appropriation in the same manner as an IT artefact? Are there advantages in the identification of a 'metastructure' as a more stable pattern of activity, and a more invariant social form, around which differing AITs can be wrapped based upon differing TUM activities to shape their establishment and use?

Overdijk and van Diggelen (2006) reviewing different definitions of "appropriation", draw a distinction between: 1) the DeSanctis & Poole (1994) definition of appropriation based on what they term "constructive utilization" (Overdijk and van Diggelen, 2006); 2) the cited definition of Rogoff whereby 'appropriation' refers to an internalization process of "taking something that belongs to others and making it ones own", as for instance "cultural tools such as language, procedures, or 'technical tools' (e.g. a technology) that are attached to a particular practice" (Ibid.); 3) the definition of Carroll et al (2002) whereby "appropriation is a process in which a technology is explored, evaluated and adopted or rejected by users" (Ibid.).

While adhering to DeSanctis & Poole's (1994) notion of "appropriation" in this thesis, it is augmented by analysing the process of TUM and associated appropriation moves and introducing the further element of time. This remains broadly consistent with the "Social Shaping of Technology" (McKay & Gillespie, 1992) theoretical strand within which appropriation can be viewed. In McKay & Gillespie's (1992) terms Arnold could be viewed as a "designer" encoding the "technology" of a GVT (*here a combined technology and social structure*) with preferred forms of use, and thereby working as an "agent of ideology". The notion of "ideology" here is analogous to the DeSanctis & Poole (1994) notion of "spirit" with which a given AIT may be imbued by its designers. While our desired "spirit" for the GVT was both collaborative and transformative in nature, McKay & Gillespie (1992) have argued that "marketing" is a

key aspect of producing any technology, and a consumerist ideology is a key driver for much current social action. This view resonates with what I have termed the "discourse of enterprise" (Clear, 2002b) with its desire to extend reach to consumers in foreign markets as a driver of globalisation. This discourse however sat in opposition to the "discourse of community" (ibid.) which drove our collaboration, through the desire to both transform educational experiences, and develop culturally aware global citizens. On deeper observation however, both discourses no doubt were drivers for this work, as we ourselves as employees of Universities vying for international repute were captives in the globalization agenda. Thus we were working as agents of the same consumerist ideology to assist our students who would leave to work in global firms subject to the same global and ideological forces. But it appears that this consumerist model has increasingly shaped student attitudes in terms of their expectations and what they will "tolerate" in the delivery of a course.

The discussion appears to have moved a long distance from planning for Arnold to visit New Zealand, but it serves to highlight the broader social forces shaping the collaboration and informing the 'metastructure spirit' of the GVT as an extended structure for appropriation. The discussion also demonstrates how TUM (in this case before the event and in the context of the *episodic change* mode) inherently has a temporal dimension.

A20-6.9.3.3 Appropriation Move Patterns – Episodic Change Episode 3 - Judgement

This episode has two examples of a *judgement* move, where the actors express judgments about the structure.

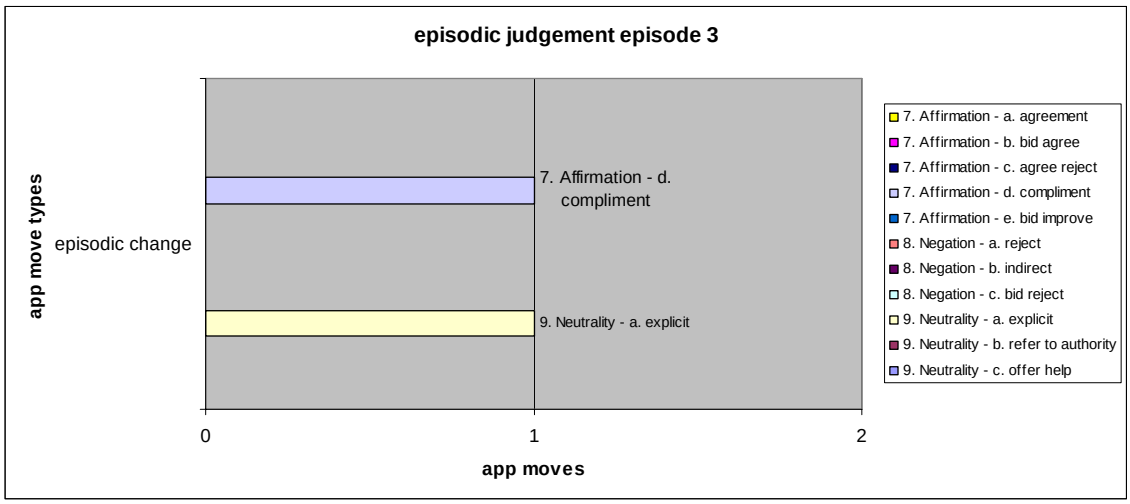


Figure A20-6.51: Episodic Change Episode 3 Appropriation Move Types - Judgement

The move coded as *'affirmation- d compliment'* relates to a student reflection at the St

Louis panel session:

> Quote from Adam "we learnt more b'cos things did not go smoothly"
> "if we did it again we would have a much better idea how to function" (TC 21/02/2005)

The structure referred to here is not so much a direct technology structure such as an '*AIT*,' but really the '*metastructure*' of the "*collaboration*". The student compliment acknowledges the value of failure in learning, and also reflects upon the benefit of that learning for a future collaboration. Perhaps this comment illustrates the limitations in working in ad-hoc student GVTs, with no prior histories of working together in GVTs or of working with the technology platforms involved. On a similar note Overdijk & van Diggelen (2006) have noted the significance of different levels of social organisation in face to face collaborative learning, where, "the history of a student group, or the experience of the individual student…may influence the way the technology is brought into action and affects the student's discourse". Nonetheless if valid learning can result from our global collaborations (as acknowledged here), which would equip students for future collaboration, then we have achieved some of our wider educational goals.

The move coded as *'neutrality – a explicit'* (expressing uncertainty or neutrality towards use of the structure) relates to the comment by Adam at the St Louis panel:

> "interesting to see educators perspective - just as confused as we were, and equally challenged" (TC 21/02/2005)

While the structure here is really the 'metastructure' of the "collaboration", this excerpt gives insight into the student perspective, where again we see the "mutual knowledge problem" Cramton (2001) in operation. Our conception of the learning process as one of joint enquiry was clearly not internalised here, with the students presumably assuming that the omniscient professors had the whole process under control, and attributing any confusion to themselves. Yet this opacity may have been as a result of a less conscious information sharing process due to the St Louis *IRB* strictures about research (cf. section 6.4.5 above). In recording this conversation even, I have been relatively circumspect, and in discussion with Fred at the time, we agreed that this information had been shared in an open forum and could therefore be communicated.

A20-6.9.3.4 Appropriation Move Patterns – Episodic Change Episode 3 - Relate

This episode shows examples of two moves categorised as *'relate'*, where the actors 'relate to other structures' and where 'the structure may be blended with another structure'.

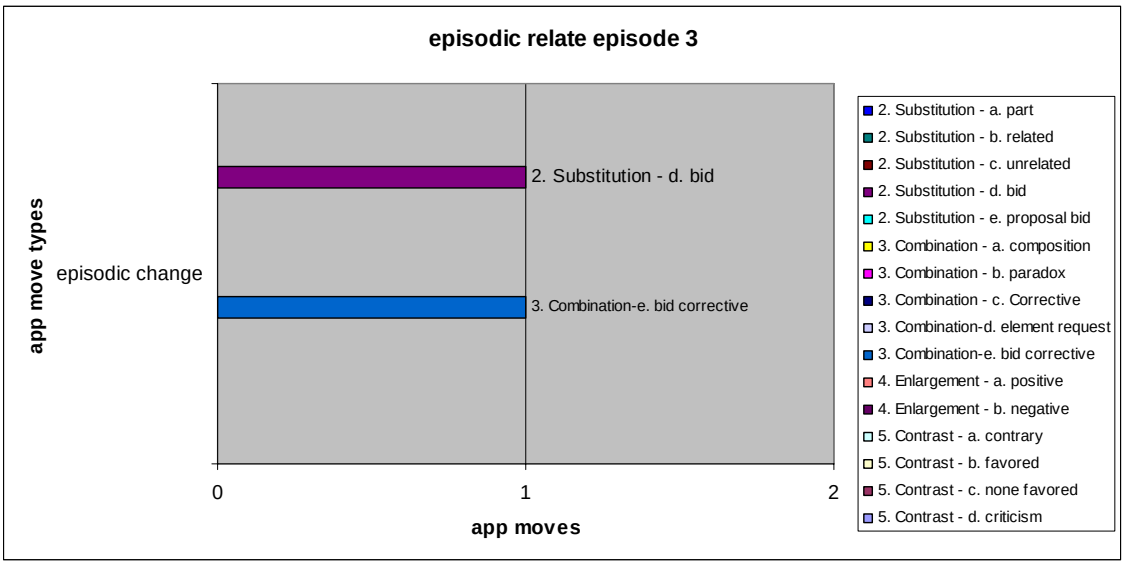


Figure A20-6.52: Episodic Change Episode 3 Appropriation Move Types - Relate

In the TUM related move coded as 'combination bid corrective' (propose use one structure as a corrective for a perceived deficiency in another), I made a note of an action on Arnold:

> *** Arnold to send details of icebreaker task (TC 26/02/2005)

We had agreed on the need to agree upfront on a "common icebreaker", being one key element in the collaboration, as a corrective action, since the present icebreaker design was not considered to be working effectively. Arnold's icebreaker task was designed to provide a more motivating introductory experience based upon a "task with higher interdependence" (Maznevski & Chudoba, 2000), as I had noted in an earlier diary note:

> Runestone icebreaker requires students in pairs to post websites on each other (Arnold has requirements) (TC24/02/2005)

In contrast the icebreaker in this collaboration had involved students firstly, creating websites to share information about themselves, and secondly, as a group jointly engaging in electing a leader or choosing to be a self managed team (cf. Appendix 11). This design had unfortunately enabled teams to work independently at an individual or LT level. Reviewed in terms of the three level "typology of interdependence" cited in Maznevski & Chudoba (2000), the icebreaker as a task appeared to function not at the desired "reciprocal" level where "work moves back and forth among people", but more at the "sequential" level where "work moves in a fixed sequence from one person…to the next", and at times even operated at the lowest "pooled" level, where "individuals complete work independently and aggregate it". This rather defeated the intended design of the icebreaker, which aimed to encourage "reciprocal interdependence

requiring frequent interaction among...members" (ibid.). In fact as figure A20-6.53 below indicates, only one GVT elected a leader, while the others took the initially perceived 'easier option' of being a self-managed team.

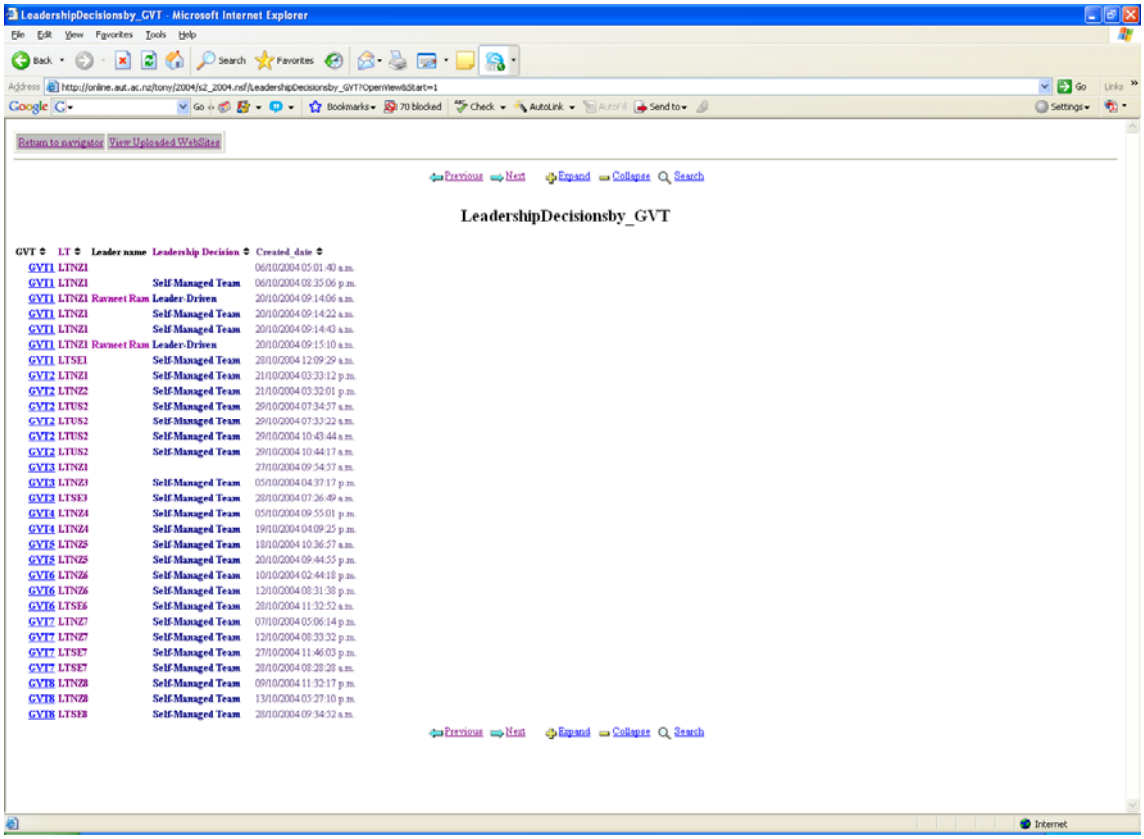


Figure A20-6.53. GVT Leadership Decisions

By enabling this choice, we had inadvertently designed an icebreaker task at variance with our desired 'collaborative spirit'. Section A20-6.6.6 above has reflected upon the challenges for students in GVT team leadership roles, so this ability to opt out may have been simply an easy way to avoid assuming responsibilities considered onerous. The differing student cultures may further explain observed behaviour. The Uppsala students on one hand were younger, new to university study, and may have deferred to their offshore counterparts. In contrast, the New Zealand students were quite ethnically and culturally diverse. A reluctance to assume a highly visible leadership role may have been due to the innate tensions between various cultural dimensions. For instance the "national culture' dimensions of Hofstede (1980): "collectivist versus individualistic cultures", "high versus low power distance" and "high versus low uncertainty avoidance" may have been influencing factors (cf. also Rutkowski et al., 2004, Leidner et al., 2006, Chang & Lim 2002). The excerpt below from one discussion thread lends support to such an argument, combined with a confidence/experience factor:

"I haven't got experience to be a team leader, so.....If anyone has such experience or wants to have a go, it would be great". (GVT9 Re: GVT leader or self-managed? 8/10/2004)

In the TUM related move coded as 'substitution bid' (propose use similar structure instead of the structure at hand and seek confirmation), I had noted an action on myself to check with Diana over the suitability of the 'quiz' we had adopted for this first time that semester for the internal collaboration:

*** me to discuss with Diana over quiz concept (TC 26/02/2005)

Again as with the cybericebreaker we had agreed to negotiate a common assessment for the course "upfront", and the main 'group decision making' collaborative task was a key element in this. Arnold and Fred had previously identified deficiencies in the website ranking task used in this collaboration (cf. section A20-6.7.2 & A20-6.7.4.1). While their diagnoses and recommendations differed, one key element was the required level of "task interdependence" (Maznevski & Chudoba, 2000) to engender meaningful collaborative work. The 'quiz creation' task therefore had been conceived of as a "reciprocal task" (ibid.) motivating (we hoped) through its inherent technology components and the level of collaborative interaction involved for students.

A20-6.9.4 Other Grounded Data -– Episodic Change Episode 3

Table A20-6.50a & A20-6.50b below provide counts for the data sources in this episode in which the above grounded theoretic 'open codes', 'concepts' and/or 'categories' have been found. The analysis will follow the tables in the same manner as the previous episodes.

Concepts	Codes	Count	Subtotals
Activity	configuration	1	
Activity	planning-meeting scheduling	1	
Activity	scripting	2	4
AIT	AIT	5	
AIT	AIT Spirit	1	6
Breakdown	Breakdown	3	3
Collaboration	collaboration	2	2
Control	authentication	1	
Control	authorization	2	
Control	Control	2	5
Culture	cultural issues	1	
Culture	Student culture	2	3
Data source	diary note	6	6
Environment	Environment	1	1
Freedom	freedom	2	2
GVT	GVT	2	2
LT	LT	1	1
Metastructure	Genre	3	
Metastructure	Metastructure	6	
Metastructure	Metastructure Spirit	5	
Metastructure	Runestone	3	17
Organizational unit	audiovisual unit - SLU	1	
Organizational unit	Inst för Informationsteknologi	1	
Organizational unit	IRB	1	
Organizational unit	Organizational unit	1	4
Research	data	1	
Research	PhD thesis	3	
Research	research design	6	
Research	Research Subject	1	11

Table A20-6.50a: Episodic Change Episode 3 – Concepts and Codes

Concepts	Codes	Count	Subtotals
Role	Coordinator	2	
Role	curriculum developer	1	
Role	Formal (teaching~research assistants)	1	
Role	GVT Leader	1	
Role	Innovator	1	
Role	monitor	1	
Role	Offshore Technical Coordinator	4	
Role	paper coordinator	1	
Role	parental	1	
Role	Purpose agents - teacher	5	
Role	Researcher	6	
Role	SLU GIM Student	1	
Role	Support and Maintenance Team representatives	1	
Role	Undergraduate Student	4	
Role	Uppsala IT student	3	35
Socio-emotional	context & technology-directed emotions	3	
Socio-emotional	motivation	2	
Socio-emotional	other-directed emotions	3	
Socio-emotional	performance-driven emotions	3	
Socio-emotional	Self-directed emotions	1	12
Task	Assessment	2	
Task	icebreaker	2	
Task	Learning task	5	9
TUM activity	Adjustment	2	
TUM activity	episodic change	4	
TUM activity	Reinforcement	1	7

Table A20-6.50b: Episodic Change Episode 3 – Concepts and Codes

As can be seen from the tables, the episode incorporates a multiplicity of *roles*, *metastructures* are a dominant concept, *research and*, *socio-emotional* dimensions are evident, as are *task*, *technology* and *TUM activity* spanning three modes. Considering that this whole episode took place largely in offline settings, the contents are remarkably diverse.

Again diverse, while addressing a seemingly limited set of issues, were the *Roles* evident in the episode associated with the teaching, research, coordination and technology support activities addressed.

In the *coordinator* role I planned for participation in the forthcoming *collaboration* that year, (working around such contingencies as Diana's absence); arranged to confirm with Diana in her the *paper coordinator* role, when I indicated that I would need to

confer with her about the viability of the 'quiz' as a *task* for the next *collaboration*; and built relationships with Arnold when I handed over a proof read thesis chapter from one of his students on the last day of the conference.

As *offshore technical coordinator* Arnold illuminated many aspects of his role in our conversations: from his "sales problem" with the *undergraduate Uppsala IT students* committing to the process of collaboration; their being unaware of the challenges for him in his *monitor role* in keeping track of things; their final reports written as though viewing their remote team members through "frosted glass mirrors"; the inability of *Uppsala IT* students to access AUTonline during the downtime window scheduled by our *support and maintenance team representatives*; Arnold's role in administering the *Runestone* server supported by his *teaching-research assistant*; to initially planning, then having to discard as impractical, a proposal for Arnold to have a face to face meeting in New Zealand prior to the next collaboration.

Further student roles were evident at the St Louis panel where the *SLU GIM students* were present in the audience. The *GVT leader* role was evident by its absence, in the discussion (previously noted in A20-6.9.3.4 above) about the negative impact of students selecting "the self managed team option".

The *teacher* role was pervasive as was the *researcher* role, in debriefing activities, in presentations, in the doctoral consortium and in future planning involving both roles. The role of *curriculum developer* was assigned to Fred for his aim of "injecting an international experience into a Global IM course (TC 21/02/2005)".

Within the concept of a *metastructure* appeared the *Runestone* project, as a comparative *collaboration* from which lessons could be learnt and practices transferred. Arnold for instance recommended firstly the adoption of the *Runestone icebreaker task* as an *AIT* feature. Secondly he advocated the use of a 'wiki' as an *AIT* under student *control*. In this shared *AIT*, *authorization* was given to openly access wiki forms across teams, with *authentication* being supported by an audit trail of changes. The wiki would help build an active *student culture* in the *collaboration*, informed by the collaborative *spirit* embedded in the wiki both as an *AIT* and as a *metastructure*, itself serving to support the *metastructure* of the *student GVTs*. The value of the *Runestone* project also lay in creating a "continuing narrative and customs from prior students" (TC 23/02/2005), thereby promulgating the *metastructure spirit* of the *Runestone* project and building a set of expectations within the *student culture* at Uppsala. With our collaboration occurring at the beginning of the Uppsala students' course of study, this effect was not able to be leveraged, although a 'continuing

narrative' was probably in effect at Auckland, where the students were more senior. A further note related to the *Runestone* technology platform, held under departmental *control* (of the Inst. för Informationsteknologi *organizational unit*) where *authorization* was managed by Arnold with the aid of a *teaching-research assistant* all within a "DMZ [demilitarized zone] outside the firewall" (TC 24/02/2005). This had the effect of giving the department *freedom* to operate its own *AIT* without corporate IT constraints, taking an *innovator* role in a 'development environment', while shielding students from the messiness of "install, configure, prepare and use" processes. For dynamic and experimental work such as this, such room to manoeuvre and perform one's own *configuration activity* in a "sandbox" technology environment is vital. As John Hughes dryly observed when I met with him three months later in Sydney

> "configuration is not a democratic process" (TC 27/05/2005)

In the same conversation - from memory triggered by my recent frustrating experience of collaboration using the 'Speak'nSee' desktop videoconferencing software in the collaborative computing course (Clear & Kassabova, 2008) - John and I reflected upon distinctions between organizational units, the educational versus the corporate *environment* with its "locked down" constrained technology platforms and applications. Were corporate *environments* inherently more stable, or was a fragile pattern of technology availability inherent in all ad-hoc collaborations? John noted that many corporates subscribed to managed *AITs* such as teleconferencing services to obviate such difficulties:

> teleconferencing services now fully assisted and provided as a full end to end easily accessible service from multiple locations (TC 27/05/2005)

The recurring broad theme in the above series of *metastructures* is that of an underlying *spirit* of *control*, offset by a counter theme of *freedom*.

Continuing with *metastructures*, the notion of a *genre* covers here a variety of coded items, each representing patterned forms based upon differing types and levels of technology: "presentation, diary note, doctoral consortium, GVTs, PhD, topic, model, conference, a proof read thesis chapter". The *metastructure spirit* of this doctoral thesis was queried at the St Louis *doctoral consortium*, with the focus, the base discipline for the literature, the scope and the informing research paradigms, all being aspects of the underlying *spirit* behind the work. In a similar vein the *metastructure* of Fred's 'Global Information Management Course' had an informing *spirit* of:

> Injecting an international experience (TC 21/02/2005)

Within the collaboration itself Arnold and I agreed that the *metastructures* of the

collaborative *task* and the *cybericebreaker*, while informed by a *metastructure spirit* of *collaboration,* had failed to achieve their goals:

> "task 2/2004 too limited to require true collaboration"
> "icebreaker opt out option "self-managed team" proved counter productive" (TC 24/02/2005)

As noted in section A20-6.9.3.4 above, these negative outcomes had resulted from our difficulties in designing *tasks* with the appropriate levels of "interdependence" (Maznevski & Chudoba, 2000), to realise the intended *spirit* of *collaboration* within each student *GVT*.

The notion of a *GVT* as a *metastructure*, led beyond students to consideration of the dynamics within the *GVT* of trial *coordinators,* with some changes in *LT* composition at the Auckland site being planned for the next *collaboration:*

- Personalities for collaboration
- Joint task
- Loose approach

> (v. dependent on personalities. Diana absent? Kitty local coorindator? Jim a possible?) (TC 24/02/2005b)

As is evident in the above excerpt, I was thinking aloud to myself about who would assume the role in Diana's absence, and the appropriate balance of personalities to coordinate from the Auckland site. This *LT* personality balance would in turn shape the group *culture* within the *GVT*.

The broad review of the *collaboration* conducted through several presentations, discussions and brief meetings in this episode, has highlighted several instances of *breakdown*. In the St Louis presentation (cf. Appendix 14 for the presentation flyer) Associate Professor of International Business Dr. John Zhao related his experiences as an educator, with the use of videoconferencing technology to link with Hong Kong students. The collaboration had suffered from technical failures resulting in negative student evaluations, and so John had ceased the initiative. We see in this experience support for the findings of Swigger et al., (2006), "many studies report that students experience a whole gamut of technical ups and downs, ranging from system failures to human failures and all the messiness in-between". Reflecting the student perspective on this was the feedback from a student in our audience who had participated in the 2004 collaboration:

> "interesting to see educators perspective - just as confused as we were, and equally challenged" (TC 21/02/2005)

Of course in our joint enquiry model of teaching, which carries some risks of student dissatisfaction, we do not see this as a problem since:

> "failure in the planned activity may reflect success in the research, but the scope for tidy packaging of the whole learning process is reduced, with a corresponding rise in uncertainty and ambiguity". (Clear & Kassabova, 2005)

The impact on Arnold was apparent in the excerpt below:

Arnold – sales problem

- experiencing difficulties part of the issue – process
- goal directed natural student tendency (TC 23/02/2005)

Thus the *breakdowns* inherent in this "process" driven model of learning, created some tensions for students *enculturated* into a "product" driven learning model, and a consequent problem for Arnold in "selling" the concept of the *collaboration*.

Another minor breakdown was evident in Arnold's question why the New Zealand students had not posted photos of themselves. This appeared to contrast with the Uppsala students who had produced more graphically embellished personal websites.

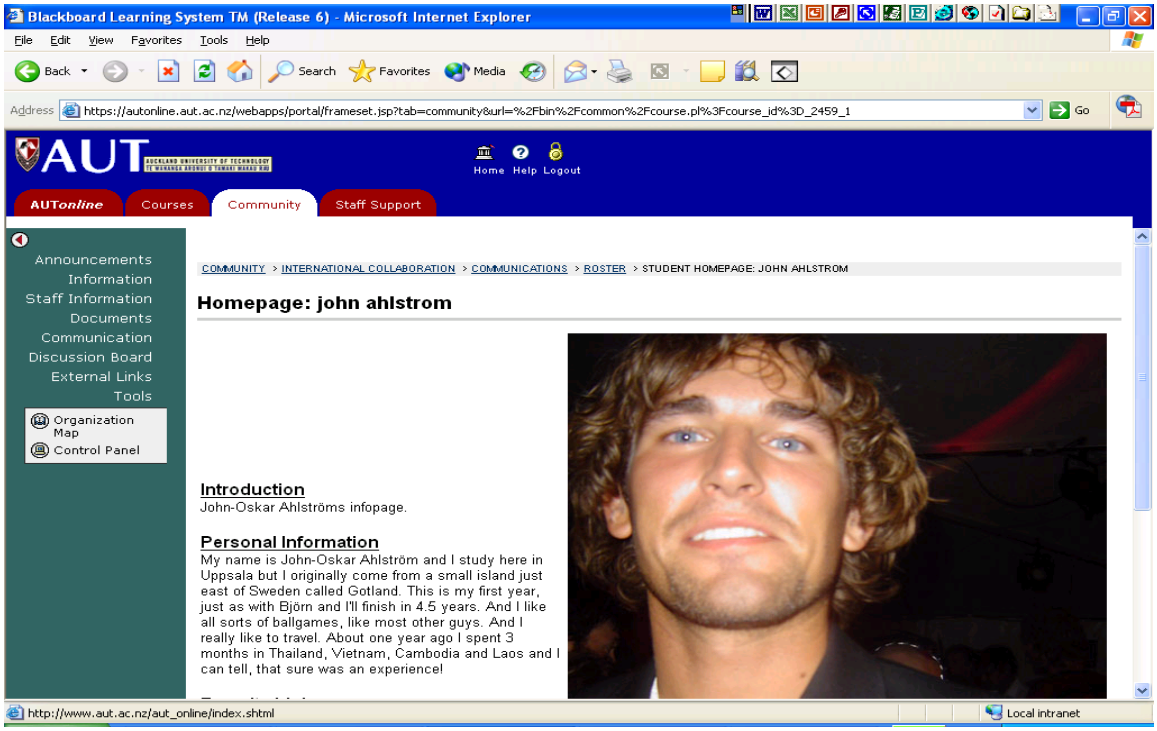


Figure 6.54. Uppsala Student Homepage

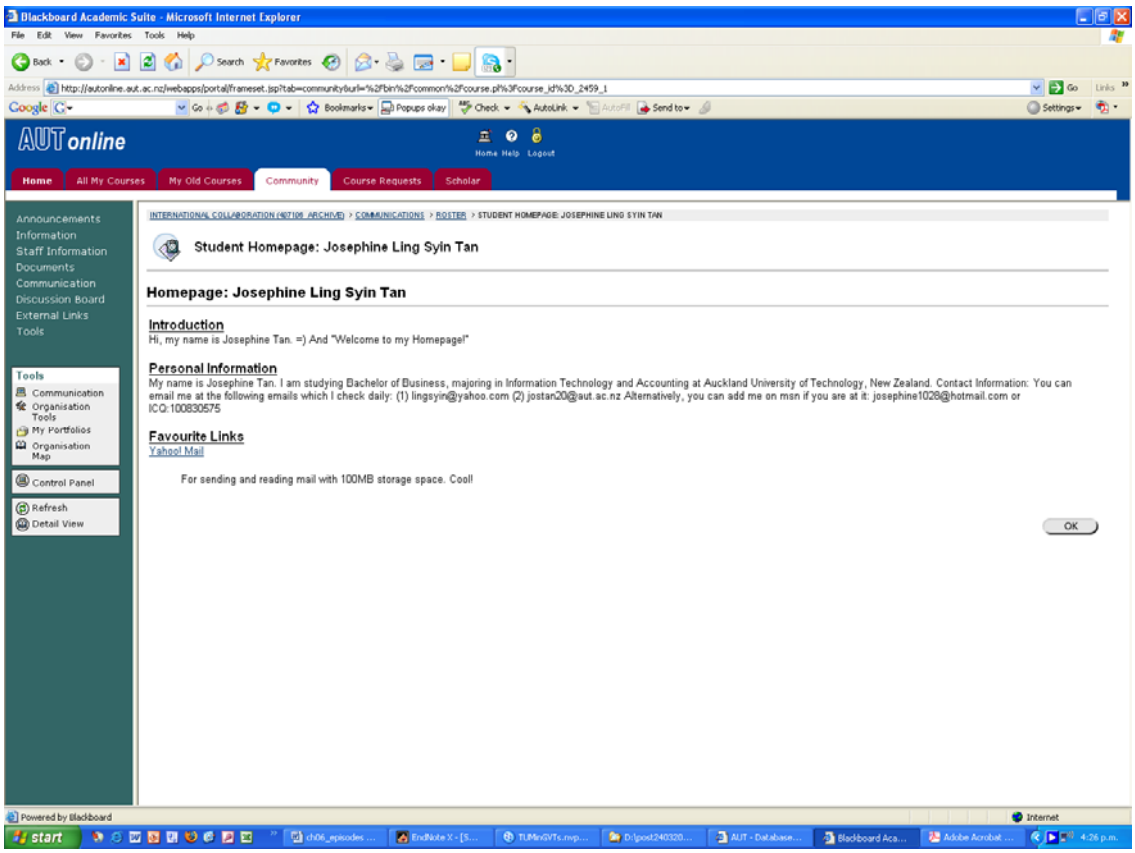


Figure 6.55 AUT University Student Homepage

Data is unavailable to explain the reasons for the difference, but some potential reasons come to mind. Cell-phone and digital cameras were not as ubiquitous in New Zealand in 2004 as they are now, so students may have simply lacked the technology. The Business students at Auckland may not have been so technically proficient and therefore perhaps were more reluctant to post photos and tweak html for presentation format. The "Youtube" (http://youtube.com/), "Myspace" (http://www.myspace.com/), "Blogging" (https://www.blogger.com/start), "Web 2.0" (Franklin & van Harmelen., 2007) and social computing phenomena, (which have reduced inhibitions about posting personal material on line), had not taken off at that time. For the *culturally* diverse Auckland students, there may have been some aspects of student *culture* in operation, relating to their willingness to post personal information in a group space open to relative strangers. In Hofstede's (1980) terminology perhaps this reluctance was evidence of a "high uncertainty avoidance" *cultural* dimension in operation. In subsequent discussion with Diana Kassabova (15/04/2008 personal conversation) she affirmed the plausibility of the latter cultural hypothesis, as she had observed that several of these mostly third year students had seemed to lack the exuberant confidence of younger students newer to the degree.

A contrasting *breakdown* reflecting a student experienced with global collaboration and

reported frustrations with his *GVT* teammates was recorded by Arnold:

> "one student experienced in s/w dev't across four countries – Se, India, US and ? v. dissatisfied b'cos we had all these problems in our work env't & found it frustrating and ineffective (couldn't get colleagues to buy into his strategies)" (TC 23/02/2005)

This was a particularly interesting report, as such directly applicable practitioner experience was unable to be brought to bear in the student GVT context. It was unclear to what extent LTs were operative in the Uppsala context, and whether they confounded the issue for the student in question. Perhaps this demonstrated graphically the challenges in building ad-hoc student GVT's, are they inherently doomed to repeat patterns observed over several collaborative cycles (a phenomenon referred to in figure 6.58 below). It begs the question, in what ways are such GVTs different from "artificial laboratory studies of groups that have neither a past nor a future" (Levine & Moreland, 1994). Do they simply approximate the "pallid laboratory creations of social psychologists" (ibid.)? Or did this inability to bring prior wisdom and experience to bear, simply reflect the daunting leadership challenges for students in GVTs, discussed in section 6.6.6 above?

The final *breakdown* incident related to the problems with accessing AUTonline:

> Arnold 2-5 pm Arnold's students unable to log in to AUTonline (our scheduled but not advised downtime) (TC 23/02/2005)

As noted above (cf. section 6.9.3.2) this was the first opportunity I had had to debrief with Arnold and explain the finally diagnosed cause of this puzzling system unavailability. While an operationally planned (although not advised) overnight outage for maintenance at the AUT site, it had been experienced as a daytime *breakdown* at the Uppsala site.

Research is a strong theme in this episode arising from several events and meetings with a focus on *research design*, the doctoral consortium and my presentation, the thesis discussions with John Hughes, the research panel presentation at St. Louis (where I met with some of the US students who had not been eligible to be *research subjects* during the collaboration) and the discussions with Arnold over the progression of the *collaboration* and plans for future work.

Socio-emotional interactions are notable in the episode. The St Louis Panel and resulting student feedback generated a set of excerpts with multiple *socio-emotional* dimensions, as identified in the work of Pekrun (2005) and of Järvenoja and Järvela (2005).

The following group of three excerpts were coded to *context and technology-directed emotions:*

> Quote from Adam "we learnt more b'cos things did not go smoothly"

The second comment was additionally coded to *performance-driven emotions:*

> "if we did it again we would have a much better idea how to function"

The third comment was additionally coded to *other-directed emotions:*

> "interesting to see educators perspective - just as confused as we were, and equally challenged" (TC21/02/2005)

Thus in this brief grouping we see vividly demonstrated the affective dimension of student learning, with the roles of *context and technology*, task *performance* and educators as *other* involved parties all contributing to the learning experience.

A further excerpt illustrating the "affective" dimension of student learning (cf. Denton & McKinney, 2004) was multiple coded to *context and technology-directed emotions, performance-driven emotions* and *other-directed emotions:*

> Arnold
> "one student experienced in s/w dev't across four countries – Se, India, US and ?
> v. dissatisfied b'cos we had all these problems in our work env't & found it frustrating and ineffective (couldn't get colleagues to buy into his strategies)" (TC 23/02/2005)

Here we see the triple impacts where the *context and technology*, and *other* team members conspired to frustrate the *performance* of this student, resulting in a loss of *motivation* and a negative learning experience. This was a rather disturbing report, indicating that the whole venture was open to serious challenge if a professionally capable student was unable to steer a GVT to a successful outcome. But the dynamics of the student involvement with the team were not clear from this brief comment. Did it demonstrate a deficiency in leadership skills (Kayworth & Leidner, 2002), or perhaps a lack of self-awareness? In hindsight would the student have learnt more from this experience of failure, "b'cos things did not go smoothly" as Adam had reflectively acknowledged above? I have reflected on this topic myself, with a self-aware student observing to me that "failure is a much better teacher than success" (Clear, 2007d). This of course raises the key issue of expectation, do any of today's students ***expect*** an experience of failure in order to learn from a course?

However the role of 'affect' in this episode was far from restricted to the students alone. Arnold reflecting on the collaboration experience expressed a set of *performance-driven* and *other-directed emotions*, related to his "sales problem" with student *motivation* and gaining commitment to overcome the innate difficulties in the collaboration, by 'goal oriented' as opposed to 'process oriented' students. *Context and technology-directed emotions* were also evident in the Runestone model contrast, which "shielded students" from some of the challenges of managing the technology environment, through Arnold and his TA administering the server within a "DMZ".

In a joint reflection over the complexities of client server based collaborations, Arnold made the following observations over building student *motivation* to deal with *technology* environment generated issues, which were a natural component of the work for those in the IT profession:

> need to sell idea that installing & configuring s/w is "not wasted time" underestimated environment mgt – overhead and valued activity (TC 24/02/2005)

Again reflecting *performance-driven* and *other-directed emotions,* Arnold also rued his students' lack of awareness, in this collaboration, of the challenges for a busy educator in keeping track of what was going on. He noted that the process needed a mechanism to reduce the load and break down the model to simple components.

For my own part, the episode included my own *performance-driven emotions* reflecting on the doctoral consortium, where I felt I had done a really bad job by trying to present too much material in the brief time slot allocated.

Both *self-directed* and *other-directed emotions* were evidenced in my notes regarding the potential personalities in the next collaboration with Diana's impending absence. My own reflections and the set of likely candidates were both encapsulated in that interaction.

Thus this inherently reflective episode contained a rich set of *socio-emotional aspects,* which were key elements in reflections upon what had worked and what did not work, and in the development of future plans.

While this episode focused largely on the *TUM activity* of *episodic change,* the episode also contained examples of the *TUM activities* of *adjustment* and *reinforcement*.

In the *adjustment* mode, Arnold's comments about "mechanisms to reduce the load" during the collaboration and the need to "break down the model" reflected a desire to *adjust* the process in mid stream, or in *episodic change mode* modify it for the next time. A more negative model of *adjustment* arose in the discussion about Arnold's students being unable to access AUTOnline between 2-5pm and therefore having to *adjust* their patterns of access.

In the *reinforcement* mode Arnold reported several practices which had helped reinforce students' activity during the collaboration. For instance his "sales problem" with students was an example of Arnold having difficulty with TUM in the *reinforcement mode*, as was his challenge with tracking what was going on, whereas the Runestone "continuing narrative and customs from prior students" illustrated an inbuilt model of *reinforcement*.

From a student perspective, an instance of difficulty with TUM in the *reinforcement*

mode, was portrayed when Arnold's experienced practitioner attempted to transfer the practices from his work environment to the student GVT, but "couldn't get colleagues to buy into his strategies".

In the *episodic change* mode, there are examples from different collaborations. The example cited below from the St Louis panel session, demonstrates a negative response based upon failure:

> John – videoconferencing H/K technical failure & negative evaluations so stopped" (TC 21/02/2005)

More positively the student feedback at the same panel indicated that "if we did it again we would have a much better idea how to function".

The dialogue about the Runestone server being departmentally administered at Uppsala, in a DMZ development environment, but with the downside (depending on one's perspective) that students were shielded from set up and configuration activities, presaged a desired change of practice. Both Uppsala and AUT sites desired a degree of change and greater autonomy, but the constraints of existing environments and resources tended to inhibit that. The earlier tension between *control* and *freedom* was again echoed here, indicating the challenges in bringing about *episodic change* that would generate "new social structures" (DeSanctis & Poole, 1994).

More positive evidence of *episodic change* can be found in the agreement I made with Arnold that we needed a 'common assessment approach', and would adopt Arnold's 'icebreaker' concept and discuss the use of a 'quiz' as the collaborative task. In support of this Arnold proposed to "visit NZ to meet collaborators and agree approach". This would represent a new practice both in advancing our GVT to a face-to-face experience, and in negotiating the collaboration with the whole team. At that time, Arnold had not met the other members, and had not visited New Zealand. While the logistics of travel prevented the intended visit, this more consultative, whole group style of working nonetheless represented an *episodic change* in the approach to coordinating the collaboration.

A20-6.9.4.1 Duality of structure - Episodic Change Episode 3

The dominant role of *metastructures* in this episode enables us to see the active interplay between action, structures and technology as closely intertwined elements. The process of *scripting* the next collaboration demonstrates the mutual shaping of technology and social structures (Orlikowski & Robey, 1991). Through conscious design of a common *assessment task* the 'institutional' structures of the courses and

their assessments, the *metastructures* of the course *assessments* and the *icebreaker* were tightly coupled with the *collaboration* process and the underpinning technology:

> Agreed need to negotiate common assessment for course up front and common icebreaker approach. (TC 23/02/2005)

Again through a conscious process of curriculum design, Fred had aimed to inject an "international experience into a global IM course". This decision had sparked the process of shaping the technology and social structures necessary to give it effect, but (as his students had remarked at the St Louis panel session), the implementation had been far from smooth. Yet the observed confusion on the part of both students and educators had the effect of generating acknowledged learning and a better sense of how to proceed "if we did it again". Thus an experiential effect was in operation, where, in the terms of DeSanctis & Poole (1994), "the group's internal system" in combination with other elements of the AST model, affords "opportunities and constraints in which appropriation occurs" with actions being shaped by the GVT's "knowledge and experience with structures". Ironically this 'experience effect' had its downside in the repeatedly observed novice GVT struggles in these collaborations, which I had termed "groundhog day with neophytes (TC 8/3/2005)".

The Runestone project countered this experiential effect for newcomers by building a "continuing narrative and customs from prior students". Thus the student grapevine, in combination with the technology artefacts, the course structures and the processes for structuring their use, served to mutually shape the experience. For the more junior Uppsala students in this collaboration (many of whom had recently arrived on campus), such a prior narrative was not present. As a Runestone example, the use of technology such as "open team forms accessible cross teams" and a "wiki matrix for online presentation times" encouraged a collaborative spirit, and a sense of mutual awareness and responsibility. The departmental level control of the technology environment enabled dynamic reconfiguration and adaptation within a "development environment" designed to suit the needs of the situation, rather than working within the strictures of a "locked down" corporate environment. As John Hughes had remarked "configuration is not a democratic process (TC 23/05/2005)", but such a constrained environment comes "pre-shaped" and lacking the required flexibility (or perhaps belief) to support the dynamic shaping processes and TUM activities of active *reinforcement* and *adjustment* demanded in a global virtual collaboration of this nature. Thus the social structures inherent in corporate IT "production" environments may act as constraints to certain forms of appropriation, requiring that a more open "sandbox" (Ambler 2002-2006) or

"development" environment be in place to afford opportunities for appropriation.

The discussion relating to the perceived deficiencies of the collaborative task and the icebreaker, as a result of their limited 'interdependence', demonstrates how these *metastructures*, played a role in mutually shaping the technology and the experience. When Arnold and I jointly redesigned these elements to enforce greater collaboration through a "reciprocal task" (Maznevski & Chudoba, 2000), a mutual shaping process was at work through a TUM activity of *episodic change.* The outcome of this mutual shaping would be a revised icebreaker (based on the Runestone model) and new collaborative task (the quiz).

Thus the episode amply demonstrates the "duality of technology" (Orlikowski & Robey, 1992) through these examples of the mutual shaping process by which actors, social structures and metastructures act in concert with technology to generate forms of appropriation and by *TUM activity* in the *episodic change* mode, plan to bring into effect "new social structures" (DeSanctis & Poole, 1994).

A20-6.9.4.2 Time and Space – Episodic Change Episode 3

The episode has several coded items related to the concepts of time and space as tabulated in table A20-6.51 below The dimension of *space* is ubiquitous in this episode with *location* coded in each data source. 'St Louis' as the setting for the bulk of the episode shows the primacy of *location*, as an opportunity for (in this episode) several interrelated *face to face* meetings.

Concepts	Codes	Count	Subtotals
Space	absence	1	
Space	face to face	6	
Space	international	2	
Space	Location	7	16
Time	day	1	
Time	experience	5	
Time	Synchronize	5	
Time	Time	5	
Time	Time separation	2	
Time Pressure	busyness	1	19

Table A20-6.51: Episodic Change Episode 3 – Coded 'Space' and 'Time'

John Zhao's presentation at the panel session covering his videoconferencing collaboration with 'Hong Kong', exemplifies the globalization of *location* and *space*. As an associate professor of *International* Business such an experience was a natural extension to his courses, as was Fred's motivation in introducing an *international* dimension to his Global Information Management course. Yet the failure of John's

initiative through technical failures demonstrated that global *space* was far from a conquered frontier.

The 'SIGCSE doctoral consortium' was another *location* or *space* [but also a "place" (Harrison & Dourish, 1996) being an established *face to face* academic genre imbued with social meaning] which helped not only in shaping this work, but in providing a rationale for visiting ST Louis, and an opportunity to gain financial support to do so. In this sense *space* can serve as a resource. Further references to *location* come with the question why 'NZ' students had not posted photos, and Arnold's student who had global software development experience in 'Sweden, India the US and one other country'. Both these references brought an extension to the notion of *space*, through the differing student cultures at each site as discussed in section 6.9.4 above, and again the notion of 'globalization' of *space* in *international* software development projects (cf. Treinen & Miller-Frost, 2006). A more abstract conception of *location* is inherent in the conversation about the Runestone server located "on a DMZ outside firewall". This military use of language suggests the server resided in a zone from which an occupying force had withdrawn. This of course enabled the *freedom* of operation required in a 'development' environment, but would be anathema to a corporate IT security unit. For instance Wool (2004) asserts that configuring a firewall to support a *demilitarized zone* is a "configuration error" that an external auditor would consider "represented violations of well-established industry practices and guidelines". A more detailed citation from Wool is given below:

> "Typical usage for a third interface is to attach a *demilitarized zone*—that is, a subnet dedicated to the corporation's externally visible servers. In such cases, free Internet access also gives internal users free access to the servers in the DMZ. Worse, it often allows the DMZ servers free access to the internal network, because the predefined "Any" network object is inherently zone-spanning. Therefore, allowing such access counted as an error". (Wool, 2004)

Thus the tension between *freedom* and *control* is highlighted here, the guardians of the corporate keys in the secure 'production' environment, versus the cowboys at the frontier in the experimental 'development' environment needing room to move. These inner tensions of course are microcosms of the modern university, with its Janus persona, facing externally as a dramaturgical locus of innovation and internally as a locus of control.

More prosaic forms of *location* can be seen in my notes. I met Arnold in the "hotel house bar" an ostensibly informal social *space*, and definitely a *space* for relaxation, in which we could engage *face to face* in the "the renewal and strengthening of interpersonal relationships" (Oshri et al., 2008). Yet this was definitely a collaborative working *space*, even if the conversation drifted only occasionally to the topic of the

project. Contrasting with this relaxed *space* was the more opportunistic form of meeting at the conference, in "one of the session breaks" where we discussed Arnold visiting "NZ to meet collaborators and agree approach" (TC24/02/2005). The role of *location* was significant here in planning for a future *face to face* (F2F) session. Two days later "on the last day of the SIGCSE conference" (a *day* for tidying up loose ends) this plan had become less definite:

> Arnold hoping to get to Australia before next collaboration, but probably not (TC 26/02/2005)

Arnold lived in Sweden, but his family lived in 'Australia', where he occasionally visited. The additional leg to 'NZ' for a *face to face* meeting was quite achievable.

Oshri et al., (2008) have argued that "thus far, solutions proposed to support collaborative work of globally distributed teams have been technical in nature paying little attention to the human and social aspects associated with such settings". In their work they "have observed that supporting interpersonal contacts between remote counterparts throughout the project lifecycle is rather challenging". Proposing a "lifecycle model of social ties" punctuated by "F2F" meetings, they advocate activities prior to the F2F event (in the introduction stage); during the F2F event (the build-up stage); and afterwards (the renewal stage) to sustain social ties throughout the lifecycle. Associated activities are presented in figure A20-6.56 below.

	Introduction	Build-Up	Renewal
Individual	▪ Increase awareness of communication styles ▪ Offer language courses ▪ Offer short visits of individuals to remote locations	▪ Create space for one-on-one interactions ▪ Provide sense of importance to each member ▪ Adjust communication styles	▪ Ensure real-time communication channels ▪ Ensure mixed audio and visual cues ▪ Offer short visits to remote locations ▪ Offer temporary co-location
Team	▪ Introduction of new team members ▪ Increase awareness of team composition ▪ Increase awareness of communication protocol ▪ Appoint contact person per remote team ▪ Set up mini-teams ▪ Offer virtual F2F meetings	▪ Conduct kick-off meeting ▪ Discuss differences between national and organizational cultures ▪ Offer space for multiple interactions between counterparts ▪ Offer team-building exercises ▪ Organize social events ▪ Discuss organizational structure	▪ Facilitate reflection sessions ▪ Facilitate round-the-table discussions ▪ Facilitate progress meetings ▪ Conduct virtual F2F meetings ▪ Offer F2F meetings
Organizational	▪ Distribute newsletters ▪ Create and offer shared cyberspace	▪ Support sharing of information from F2F meetings (for example, photos)	▪ Encourage direct communication channels
Tools	Phone, email, groupware tools, knowledge repositories, shared databases, teleconference, videoconference, online chat, intranet		

Figure A20-6.56. Individual team and organizational activities supporting social ties (ex. Oshri et al., 2008)

In this episode, mostly focusing on the Oshri et al., (2008) "build-up" stage during the F2F event(s), we see a more organic model than that proposed by Oshri et al., (2008) which implies more of a corporately managed project team and 'teams of teams' approach. In this collaboration the teacher-researcher teams had more control over structural options, whereas the student teams had less opportunity to choose.

During the 'build-up' stage Oshri et al., (2008) advocated at the 'individual level' "creating space for one-to-one interactions". Although Arnold and I had not designed it as such, the conference and associated activities provided an in-built context for such interactions. At the 'team level' "offer space for multiple interactions between counterparts (ibid.)", had been met in part. Arnold's flights had not coincided with the St Louis panel session so he had unfortunately been unable to participate. However I had the opportunity for multiple interactions with Fred, his colleagues and his students. I had lunch at the University and Fred took us (my partner Alison and me) out to dinner, so he did "organize social events (ibid.)". The conference also had 'organised social events' covered for my interactions with Arnold. At an 'organizational' level "support sharing of information from F2F meetings (for example photos) (ibid.)" had been initiated with the flyer for the St Louis panel (cf. Appendix 14). I have no doubt that we took photos, but cannot now find any. Maybe this shows the role of such actions primarily as an icebreaker at the outset, as suggested by Thorpe below:

> "The sharing of personal photos appears a very useful way for creating relationship linkages during the beginning stage of asynchronous online group" (Thorpe, 2008 p. 558)

For the doctoral consortium the proposal was posted to the private conference wiki, and names of participants to the public site. In both panel and consortium presentations powerpoint slides were exchanged. The conversations between Arnold and I did partially "discuss differences between national and organizational cultures (ibid.)". In effect we substituted "student" cultures for "national".

At a 'team' level, the episode also reflects "renewal" activity, where we did "facilitate reflection sessions (ibid.)" for parts of the team at each event. The St Louis Panel was a reflective occasion, as were the doctoral symposium and the debriefing sessions at SIGCSE with Arnold, not to mention the later meeting with John Hughes. But neither the doctoral consortium participants nor John Hughes were directly members of the GVT. In planning follow-up activity we made no specific arrangements at the individual level to "ensure real time communication channels" (ibid.). The tentative plans for Arnold to come to NZ via Australia did map to an individual level renewal

activity "offer short visits to remote locations (ibid.)", but again here the decisions were not corporately but rather individually driven. This then paints a picture of a rather more free-wheeling GVT than envisaged in the model proposed by Oshri et al., (2008). Perhaps this distinction echoes that discussed below with John Hughes between the academic and the corporate worlds.

The remaining *location* references now shifted to Australia and my meeting at 'UTS' in 'Sydney' to review my thesis with John Hughes. The *face to face* discussion here, triggered by reflections after the St Louis panel session, revolved around the complexities and the variety of actors and roles involved even in a local synchronous experiment, which we had conducted in our postgraduate collaborative computing course.

Tables A20-6.52a and A20-6.52b below, presented at the St Louis panel, depict this complexity:

Actor	**Role**	**Activity**	**Task**
Lecturer	Educator	Assessment	Design Assessment
	Facilitator	Supply Resources	Provide desk top equipment (webcam, headsets)
	Educator	Assessment	Provide trial assessment task at time of experiment
	Educator	Evaluation	Grade assessment
Technology Park Research Lab Developer	Developer	Develop, test, maintain, deploy desktop video-conferencing software Speak'nSee	
	Technical Support	Support Speak'nSee for collaborative experiment	
ITG	Technical Support	Support University wide Network and desktop Infrastructure	Arrange logical access, provide technical support, helpdesk and troubleshooting
School Resource Co-ordinator	Resource co-ordination	Resource management for rooms under school's control	Confirm suitable experimental machines
		Local Technical Support (Desktop admin)	Install non standard software, manage disk space

Table A20-6.52a: Actors and Roles Involved in Synchronous Experiment – Collaborative Computing Course 10/08/2004

Actor	Role	Activity	Task
Student	User	Conduct experiment	Arrange common session time and locations, Establish communication using Speak'N See, receive task, perform task, conduct evaluation, write report
Group –Local Composite	User	Conduct experiment	Arrange common session time and locations, Establish communication using Speak'N See, receive task, perform task
Speak'nSee	Application S/W	Provide desktop video-conferencing capability	Transmit, store and display messages
Java	Application environment	Provide libraries and supporting environment	Run java virtual machine
Computer	Server	Host server application	Run application instances and store and relay messages
	Client	Host client application	Run client application
Web Browser	Provide internet browser capability	Provide internet connection and plug-in application capability	Run application launcher, run application and connections
Webcam, headsets	input – output devices	Provide physical video and voice input and output	Receive and relay video and voice input
Internet	Connection mechanism	Provide standard network infrastructure	Relay data from source to destination
Time, event	Trigger	Cause task to be activated	Begin session Request task End experiment Commence evaluation Complete evaluation Write report

Table A20-6.52b: Actors and Roles Involved in Synchronous Experiment – Collaborative Computing Course 10/08/2004

The conversation with John over the complexities and frustrations inherent in this collaboration questioned the "differences in educational vs. other environments e.g. corporates v.[ery] locked down". John noted the availability of "teleconferencing services now fully assisted and provided as a full end to end easily accessible service from multiple locations" (TC 27/05/2005). Then the conversation moved to the question: "do corporates have more stable environments or is this natural in ad-hoc collaborations?"

As the earlier discussion over the Runestone server suggests, to support experimental and ad-hoc collaborations over multiple *locations*, a degree of project level control over the technology environment appeared a necessary, although not sufficient, condition for success. Client server applications introduced another level of complexity, but as Arnold had commented, educationally we "need to sell idea that installing & configuring s/w is "not wasted time" underestimated environment mgt – overhead and valued activity" (TC 24/02/2005)

In combining now both *space* and *time* dimensions of the collaboration, the apparently spatial concept of '*absence*' featured significantly in the episode. In the three cases below, each of which impacted the continued participation of the trial coordinators, a *time* and a *cultural* dimension were implicit:

> Next semester on 80% parental leave and not sure if taking course (but probably will) (TC 26/02/2005)
>
> (v. dependent on personalities. Diana absent? Kitty local coorindator? Jim a possible?)
>
> Fred on sabbatical next semester. (TC 24/02/2005)

The social dimension of the actors in the collaboration is evident in each of the above notes. In his *parental* role Arnold signalled his possible *absence* or partial *absence* for the following semester. Under the generous Swedish provisions for paid parental leave (cf. Pylkkänen & Smith, 2004. pp.6-7), Arnold would be taking time out to care for his young children.

> "The principal idea in the Swedish system is that parenthood is considered to be a shared responsibility between the mother and the father. Fathers are therefore particularly encouraged to take leave" (Ibid. p. 6).

The multiple dimensions of *time* implicated in this foreshadowed absence are fascinating. They are mapped against the 'five types' of time distinguished by Arrow, Poole et al., (2004), in table A20-6.53 below.

Time Type	Comment
Lifecycle	Parental leave occurs early in the 'lifecycle' of a child
Clock	The leave has a start and end date and time and a maximum duration of payment
Cyclical	The leave can be timed to coincide with a semester cycle
Event (predictable)	The leave period can be predicted and scheduled
Event (unpredictable)	It was not clear whether Arnold's remaining 20% of [clock] time would be available for the course and the forthcoming collaboration

Table A20-6.53: Parental Leave *Absence* and *Time* Classifications

The *time separation* of the planned *absences* of Diana on leave and Fred on 'sabbatical' for the next semester again had multiple time dimensions, although 'lifecycle' *time* would not have applied. It appeared that Diana's leave, remaining to be confirmed, was less of a 'predictable event' than Fred's. The academic notion of a 'sabbatical' further matched to 'cyclical' time, as it operated within the unfolding 'clock' *time* and semester 'cycles' of an academic career.

So in these brief few sentences we see deeply culturally rooted patterns of *time* leading to the probable *absences* of all the key coordinators in the next collaboration. This in turn would change the developing GVT dynamics as noted by Oshri et al., (2008), where "globally distributed teams needed to 'renorm' from time to time, mainly because newcomers joined and changed the dynamics of interpersonal ties within dispersed teams".

Diverting attention from future events were the items coded as *experience*. By reaching into the past they helped to situate the present. In the case of the *Runestone* project it served as a comparator: as a model to carry forward despite *time separation* a 'continuing narrative and customs" for new students; as an example of approaches to managing the technology infrastructure (cf. DMZ discussions above); and as a template for a revised icebreaker. The St Louis panel represented a sharing of *experiences*, some negative but with the positive acknowledgement that learning had been gained. The *experience* of Arnold's practitioner-student who could not get his team to co-operate, demonstrated that *experience* in successful collaboration did not mean it could be readily replicated across settings, and difficulties in managing to *synchronize* work globally are non trivial. John Zhao's challenges in managing to *synchronize* with his Hong Kong counterparts provided a further example, as did the AUTonline outages in which the Auckland overnight backup window was out of *synchronization* with the Uppsala prime time of day.

More constructive attempts to *synchronize* activities were prevalent. The discussion about Arnold visiting NZ, while finally discarded as a plan, was at least a constructive attempt to *synchronize* the work of the GVT. The sharing of information and plans regarding absences and alternative arrangements provided a good example of *TUM activity* in the *episodic change* mode, where the team worked to *synchronize* activities for the next cycle. By the end of the conference however, Arnold and I had agreed a plan to successfully *synchronize* the icebreaker and the collaborative task across sites.

The final time related concept in the episode was *time pressure*, which as noted below generated conscious *scripting* activity to relieve the impact of *busyness* for the coordinators involved:

> Arnold v. busy and needed to do a debrief after the event
> Not enough time and students don't understand academic load in tracking what is going on
>
> Mechanisms to reduce load
> - break down model (23/02/2005)

The *pressure* for an educator of coordinating a complex and imperfect collaboration with goal oriented students can be challenging. As Arnold observed, he had needed to debrief with his students over what had worked and what had not worked, and the pressures it had placed on him. In a sense this episode echoed Adam's comments at the St Louis Panel:

> "interesting to see educators perspective - just as confused as we were, and equally challenged" (TC 21/02/2005)

Arnold and I worked to revise the components of the collaboration, which we hoped would obviate some of the issues we had encountered. Whether we achieved fully the goal of breaking down the model to simplify it and reduce the load remained open to question. Nonetheless we had a working plan in mind for the next collaboration, and parted company feeling positive.

A20-6.9.4.3 Reflexivity of the actors – Episodic Change Episode 3

By its very nature, this episode encapsulates a highly reflexive mode of action, as Arnold and I as trial coordinators debriefed one another on the exercise, sharing our experiences and insights together with plans for future collaborations. From a research perspective this represented the "reflect" stage of an action research cycle (cf. Carr & Kemmis, 1983, Clear & Daniels, 2000, Clear 2004a). At a meta-level, and running side by side with the trial review, sits the series of reflections on TUM itself and this thesis. This more abstract level of reflexive thought raises the degree of reflexivity from the specific context to a broader conceptual and theoretical level. Thus as an episode it provides a particular example of a reflexive stance on the part of the actors, who are not merely reflecting upon themselves in their situation, but actively taking those insights to shape both future collaborations, their tasks and technology components. In addition the aim was potentially through this thesis to enable others to analyse and shape their own situations, through more effective TUM activities.

On the bleaker side however, the interaction I had with Steve MacDonell over the repeating and far from optimal patterns of student behaviour which I had observed in these annual collaborations (8/3/2005), suggests we have no ready panacea for effective GVTs based upon "ad-hoc" (Mennecker & Hoffer, 1992) student groups. I gave a presentation to the Doctor of Computing class at UNITEC shortly afterward, titled "*The functioning of global virtual teams: the role of collaborative computing technologies and technology-use mediation in supporting their work" (08/04/2005).* As can be seen in figure A20-6.57 below, excerpted from that talk, the phenomenon could be termed the "groundhog day" of ad-hoc student GVTs.

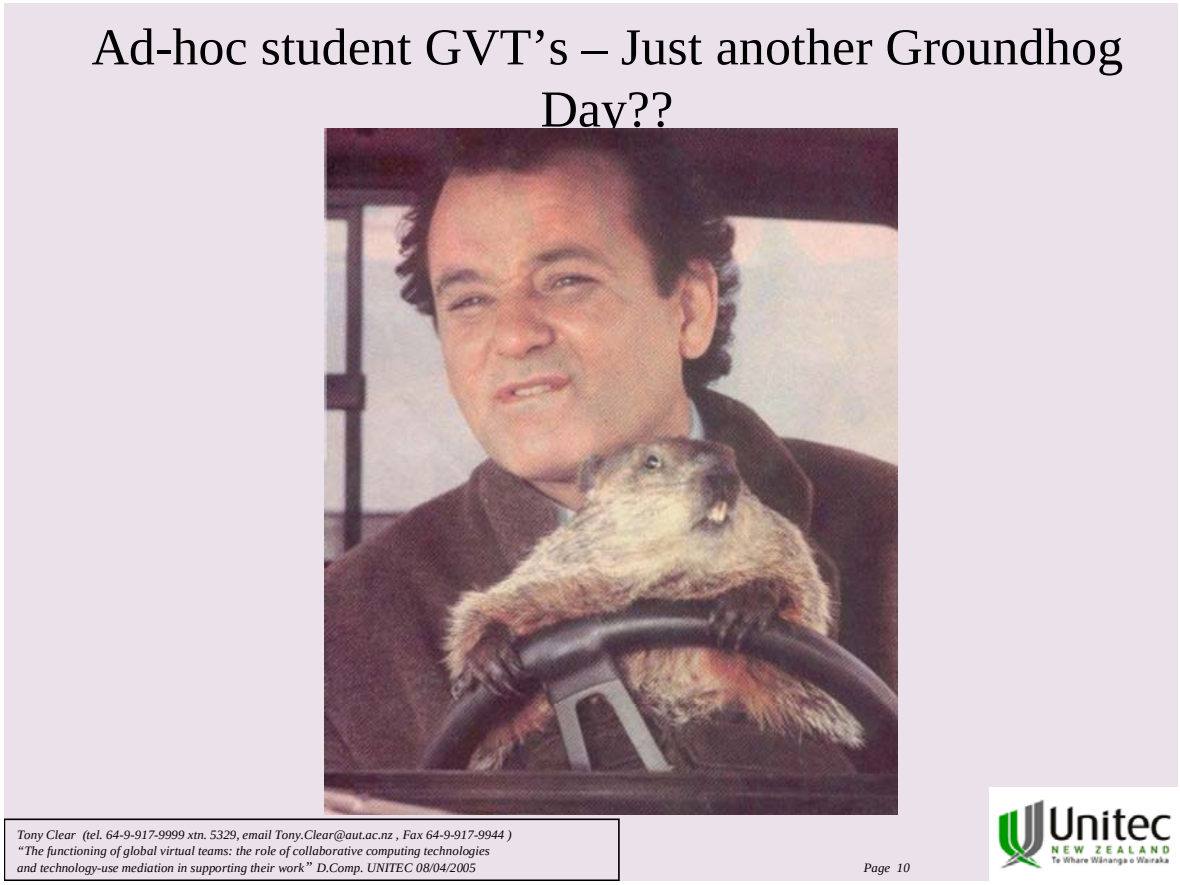


Figure A20-6.57: The *Groundhog Day* of ad-hoc student GVTs

(image downloaded from http://campuschapel.org/blog/uploaded_images/Big_Bill_In_Groundhog-731047.gif 25/03/2008)

While this depiction of ad-hoc student groups may be somewhat facetious, it does reflect the reality that such GVTs indeed face serious challenges, and do so each time. As Hollingshead and colleagues have noted (2005 p. 50):

> "researchers from the functional perspective have examined…effective performance of ad-hoc groups working together on one task at one point in time...research needs to investigate groups embedded in larger social systems and how effective and ineffective groups adjust in response to changes in their environment".

Ironically at the outset of this study, I had not fully internalised the fact that we as researchers, educators and coordinators of this programme of global collaborations did constitute such a group "embedded in larger social systems", and adjusting "in response to changes in our environment" (ibid.). As a real group with a history and an expectation of working together in future, not simply an 'ad-hoc group' we had a continued albeit varying membership. At times, in the terminology of Mennecke & Hoffer (1992), "composed of members with limited history as a group" we approximated a group "undergoing development", and at other times "with significant

group history" came closer to an "established group" (ibid.). The group although in some respects established, was also subject to continuing changes in surrounding structures – technologies/tools, metastructures (e.g. semester length reductions), courses and students. The cycling in and out of team members over time and the role of other members in guaranteeing continuity to the venture, suggest that Mennecke & Hoffer's distinction is applicable in part. The composition of the GVT of coordinators as partly new and partly established, suggests either that the group was continually "undergoing development" or that only parts of the group were doing so. The implications of addition of team members to an "established group" are not entirely clear, if we solely apply the Mennecke & Hoffer (1992) three types of group (*ad-hoc, undergoing development, established*) distinction.

In the context of this GVT, the diary notes of 24/02/2005 and 26/02/2005 illustrated the volatility of team membership, with Diana to be absent for the semester, Fred on sabbatical, and Arnold on 80% parental leave. Thus two of last year's three directly involved coordinators would no longer be in the frame for this year's collaboration. This hybrid, fluid and composite nature of our global virtual team may have represented a point of difference from other more traditional team structures, or was it simply natural for a team to have periodic influxes of new members who have to acclimate to the context? Sim & Holt, (1998) for instance discuss the process of inducting new members in face to face software teams. The literature appears sparse in this area of group membership transitions. Levine & Moreland (1994, 2004) have proposed models of group socialization, which apply to co-located groups, collaborative groups and to individual role transitions within the group, but what differences there may be for GVTs is an open question. The issue has been touched upon recently in the globally distributed team context by Oshri et al., (2008) who had,

> "…observed that our globally distributed teams had to "re-norm" from time to time, mainly because newcomers joined and changed the dynamics of interpersonal ties within dispersed teams".

For GVTs then, this topic of revolving membership composition over time and membership transitions as new members join and depart from teams, opens a whole new area for research. No doubt this presents a difficult area of enquiry, given the desirability of context rich longitudinal field studies of real GVTs to investigate such emergent phenomena Levine & Moreland (1994) have likewise criticised psychological research on small groups with their focus on artificial laboratory studies of groups that have neither a past nor a future, noting that "Most natural groups are

very different from the pallid laboratory creations of social psychologists…researchers must develop more dynamic theories that can account for temporal changes in the relations between groups and their members".

Acknowledging then the dynamism of GVTs, a further point of difference in the structure and composition of a GVT may be germane, (particularly when considering the extended teams of technology-use mediators called upon at times to support the GVTs work). In the review by Lee-Kelley & Sankey (2008) "An initial observation was the multitude of traditional teams within the larger global virtual team. This local-global structure and composition might present challenges that are unique and different from either a fully co-located team or a distinctly virtual team". Certainly the differing levels and patterns of local support at each site (e.g. *teaching assistants, support and maintenance team representatives*) have been apparent in this collaboration, as have the *local teams* of students operating, in some cases, against the *GVT spirit*.

A20-6.9.5 Visual Mapping – Episodic Change Episode 3

The diagram in figure A20-6.61 below and accompanying table A20-6.54 represent, as in prior episodes, a visual summary, or 'map' of the episode, focusing on the *metastructure* of the 'icebreaker', which embodied a combined set of technology, institutional and cultural properties that enabled it to serve a mediating role in shaping technology use.

> [As a comment, given the inability to report on the activities of the St Louis students, the real meaning of the combined radar chart in figure 6.61 is open to question, but nonetheless it has been included here for reasons of consistency in presentation].

The components of the icebreaker included students profiling themselves via a homepage (cf. figures A20-6.54 & A20-6.55 above) and then based upon that information and discussion within the GVT membership choosing a GVT leader. To augment the visual mapping, figures A20-6.58 and A20-6.59 below depict the supporting discussion threads and the Navigator (Lotus Notes "menu") for the Collaborative database.

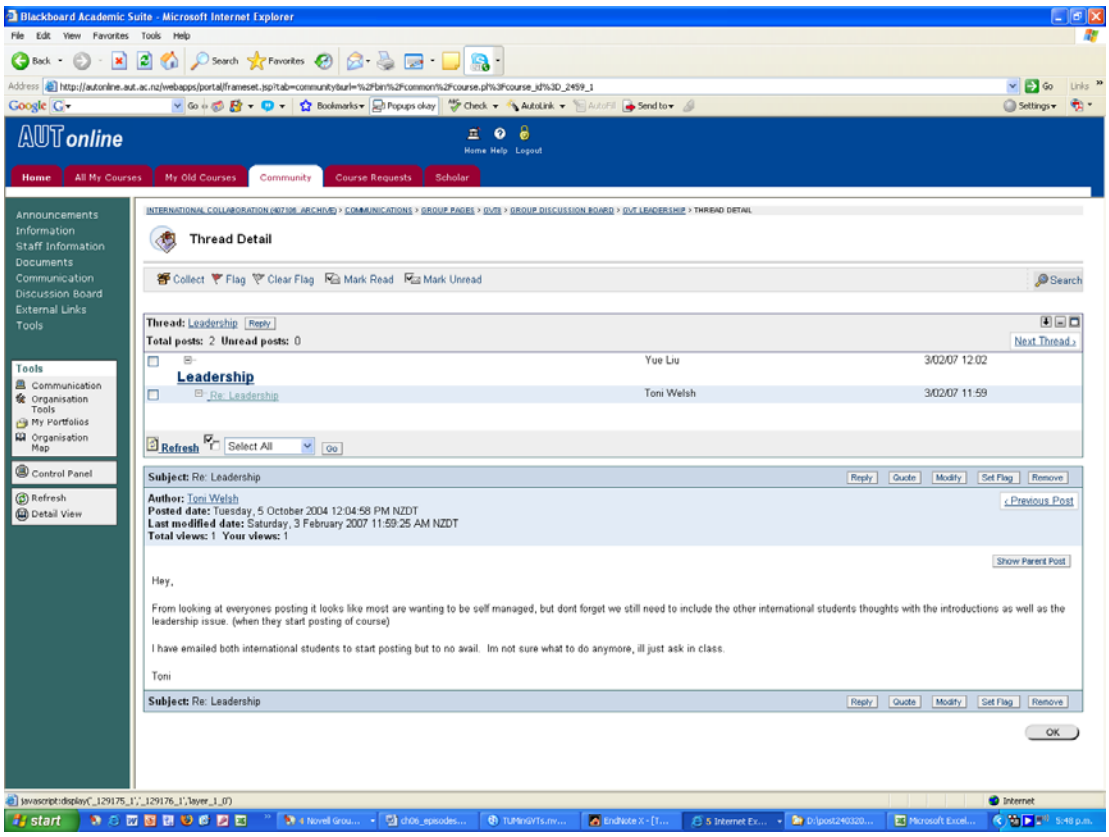


Figure A20.58: GVTLeadership Discussion Threads

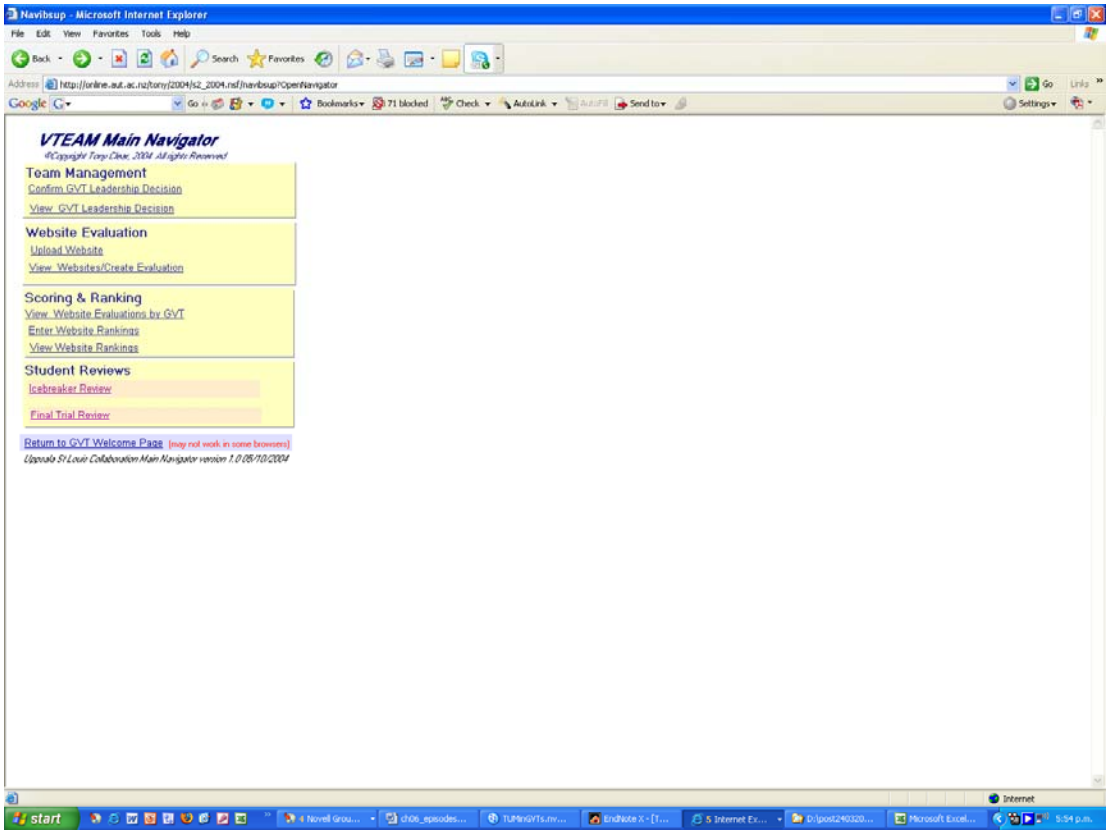


Figure A20-6.59: Notes Collaborative Database Navigator (Menu)

Figure A20-6.60 below further depicts the online form in the Collaborative Database by which students confirmed their GVT leadership decision.

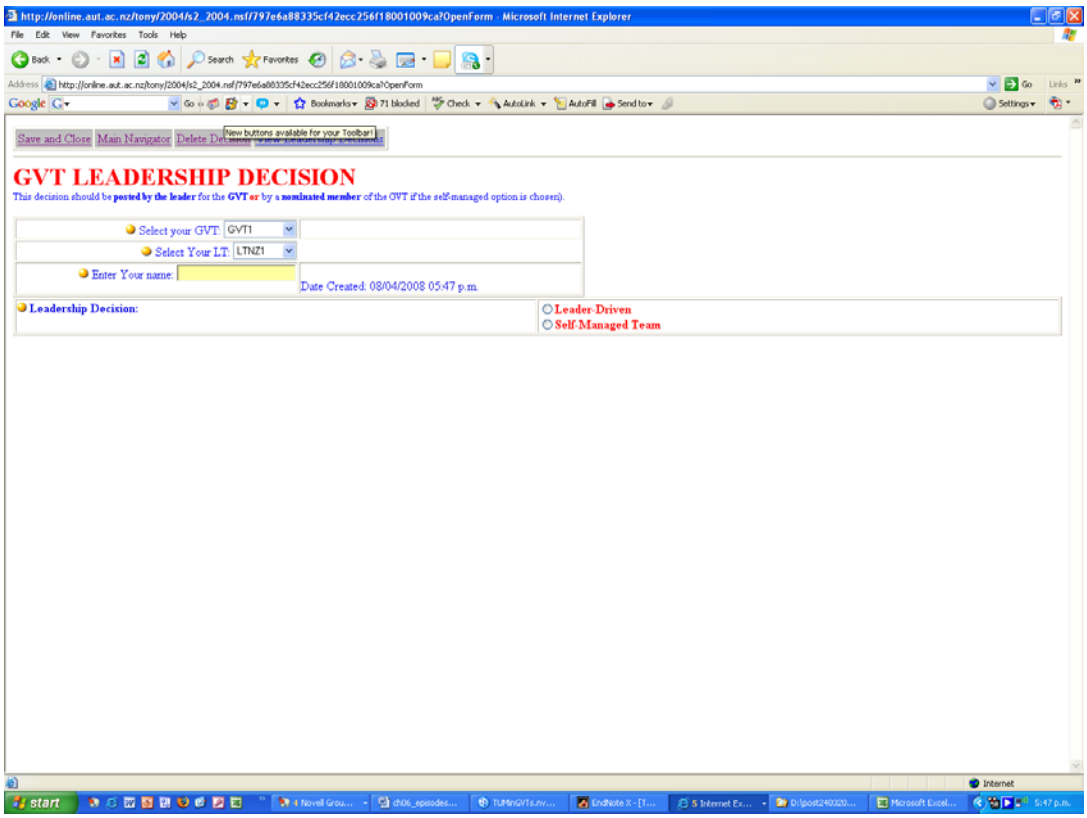


Figure A20-6.60 Notes Collaborative Database GVT Leadership Decision Form

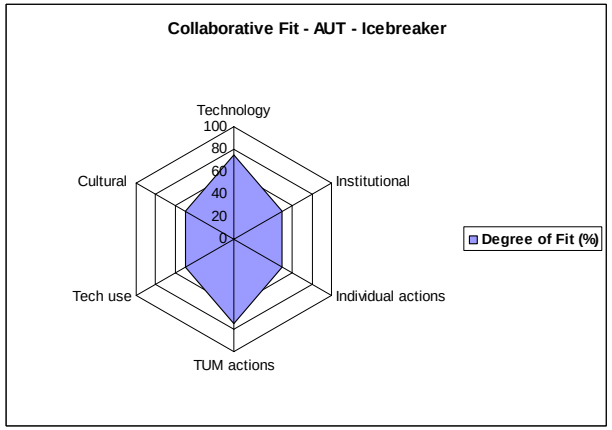
The second *metastructure* depicted in this section is that of the *Runestone Project* as portrayed within the episode, in comparison with the AUT collaboration. Figure A20-6.62 and accompanying table A20-6.55 below map the comparisons. As can be seen the Runestone model achieved a better fit across both Swedish and US sites, for a combination of reasons, which are subtle and not wholly replicable, although some lessons can be drawn and adaptations made to the AUT model for collaboration.

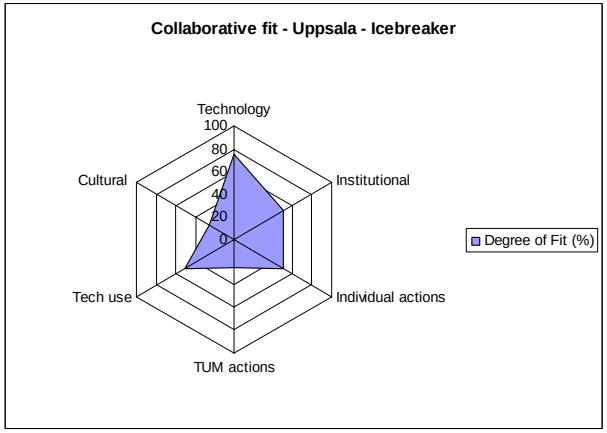
The radar charts in figure A20-6.61 below depict the operation of the *metastructure* represented by the *icebreaker* at each site. Each element is briefly tabulated in table A20-6.54 below.

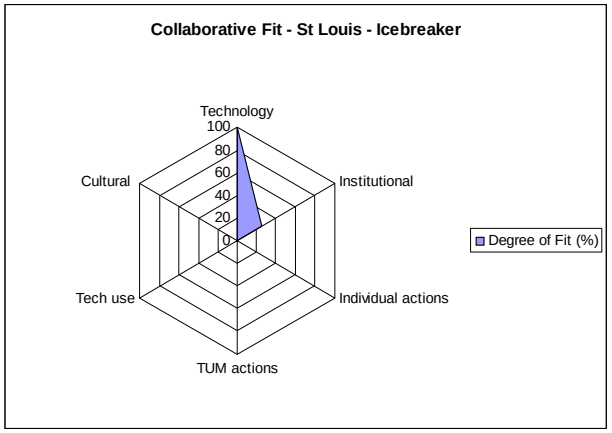
AUT	
Technology -	AUTonline student homepage feature, AUTonline group discussion board feature, GVT leadership discussion thread, email? Lotus Notes collaborative database forms confirm GVT Leadership decision, view GVT leadership decision [homepages feature does not support posting details for someone else
Institutional –	AUTonline institutional elearning platform, delays and holiday break
Individual actions –	Students choose "self managed team" option, students post mostly text to homepages and no personal photos, some students attempt to arrange online chat sessions – seemingly unsuccessfully
TUM -	Icebreaker uses AUTonline homepage feature for first time, discussion threads used for first time, icebreaker based on suggestions from Mats (Nov 2003), I made some thread postings to reinforce student actions
Tech use –	some homepages not created, discussion threads used, Students choose "self managed team" option, students post mostly text to homepages and no personal photos, some students attempt to arrange online chat sessions MSN and ICQ suggested in one posting – seemingly unsuccessfully
Cultural -	Students reluctant to assume GVT leader role, defer to others so take default option of self managed team, work diligently but with distress at lack of response
St Louis	
Technology -	AUTonline student homepage feature, AUTonline group discussion board feature, GVT leadership discussion thread, Lotus Notes collaborative database forms confirm GVT Leadership decision, view GVT leadership decision
Institutional –	No IRB approval, teaching approval only
Individual actions –	Unable to report
TUM -	Unable to report
Tech use –	Unable to report
Cultural -	Unable to report
Uppsala	
Technology -	AUTonline student homepage feature, AUTonline group discussion board feature, GVT leadership discussion thread, Lotus Notes collaborative database forms confirm GVT Leadership decision, view GVT leadership decision
Institutional –	Partly consistent with Runestone icebreaker (but not post websites on one another), new students so no collective expectations, delays & different holiday break
Individual actions –	Students choose "self managed team" option, students post text personal photos and links to homepages, activity levels appear low, 3 SE LTs post leader decisions
TUM -	Arnold struggling to keep track, students lose momentum
Tech use –	Students choose "self managed team" option, students post text, personal photos and links to homepages, activity levels appear low, 3 SE LTs post leader decisions, few students post evaluations
Cultural –	Frustrations with delays and process, inability to meet goals, lack of initial response when AUT students on holiday

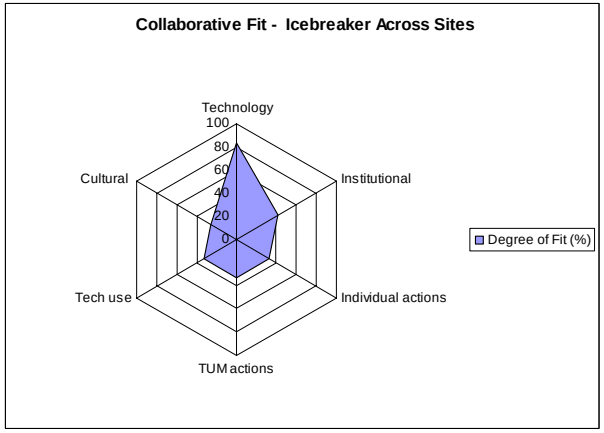
Table A20-6.54: Episodic Change Episode 3 – Metastructure of *Icebreaker*

Figure A20-6.61: Radar Charts – Episodic Change Episode 3 – Metastructure of *Icebreaker*









Degree of Fit Scale (%)

100% - full collaborative fit (CF)

75% - moderate CF

50% - partial CF

25% - limited CF

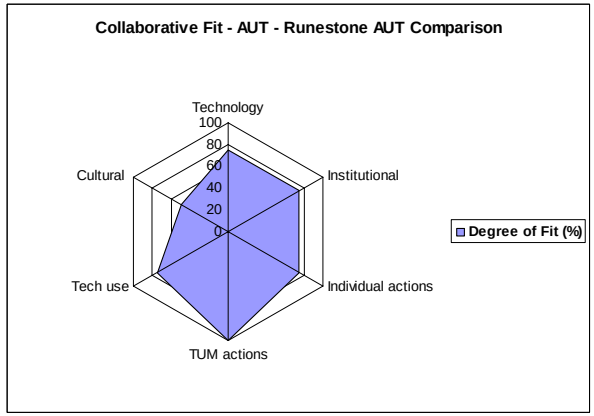
0% - no CF

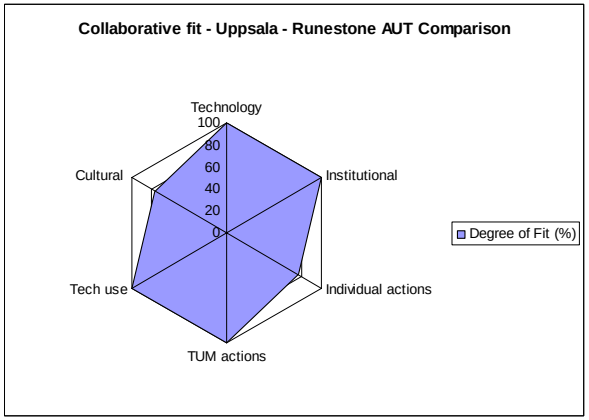
The radar charts in figure A20-6.62 below depict the operation of the *metastructure* represented by the *Runestone Project* as a comparison with the AUT Collaboration. The US partner represented here was Grand Valley State University. Each element is briefly tabulated in table 6.55 below.

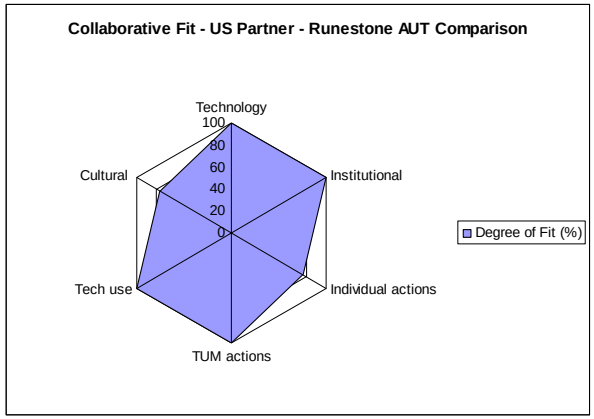
AUT	
Technology -	AUTonline features, Notes collaborative database, email? Icebreaker students posted individual homepages, team leader selection, website ranking & evaluation forms
Institutional –	Jointly conducted exercise with distinct course and separate local assessments, voluntary participation for ethics reasons, holiday break mid collaboration
Individual actions –	Students often work within LT alone and GVT connections variable
TUM -	reinforce communications, advise of status of others, remind of deadlines regularly, explain in class, lecturers demo via datashow and provide class time for activities
Tech use –	Use features provided, but not much use of sync features – even if proposed
Cultural -	Students persevere, reluctant to take GVT leadership role, reluctant to post personal information online
US Partner	
Technology -	Icebreaker whereby students post websites on each other in pairs, wiki editable forms open cross teams, first come first served editable matrix for booking online presentation times, server hosted at Uppsala on a DMZ outside firewall, CVS for development? mostly student driven, third party software and email for async & sync communications
Institutional –	jointly delivered course with remote Uppsala partner
Individual actions –	Students work in teams with remote counterparts, supported by routines, infrastructure and goals, some teams better than others
TUM -	Server admin at Dept'l level by Arnold & TA, students shielded from infrastructure, time zone diff about 8 hours therefore sync mtgs possible am/pm, highly interdependent task, weekly team briefings
Tech use –	Uppsala server & wiki features, CVS for development? mostly student driven, third party software and email for async & sync communications
Cultural -	Continuing narrative and customs from prior students? goal directed competitive students, senior students 4th year?
Uppsala	
Technology -	Icebreaker whereby students post websites on each other in pairs, wiki editable forms open cross teams, first come first served editable matrix for booking online presentation times, server on a DMZ outside firewall, CVS for development? mostly student driven, third party software and email for async & sync communications
Institutional –	Non interference by corporate IT, jointly delivered course with remote US partner
Individual actions –	Students work in teams with remote counterparts, supported by routines, infrastructure and goals, some teams better than others
TUM -	Server admin at Dept'l level by Arnold & TA, students shielded from infrastructure, time zone diff about 8 hours therefore sync mtgs possible am/pm, highly interdependent task, weekly team briefings
Tech use –	Uppsala server & wiki features, CVs for development? mostly student driven, third party software and email for async & sync communications
Cultural –	Continuing narrative and customs from prior students, goal directed students, senior students 4th year?

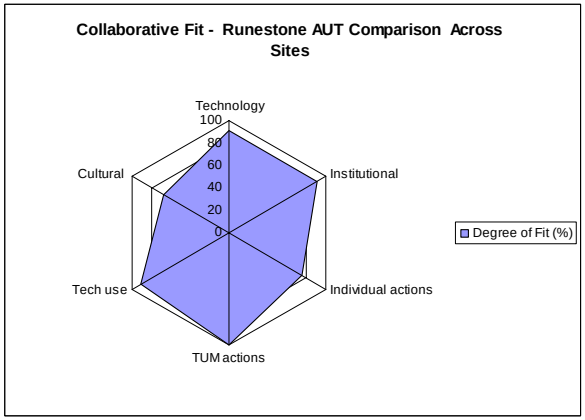
Table A20-6.55 Episodic Change Episode 3 – Metastructure of *Runestone Project as a comparison with AUT collaboration*

Figure A20-6.62: Radar Charts – Episodic Change Episode 3 – Metastructure of *Runestone Project as a comparison with AUT collaboration*









Degree of Fit Scale (%)

100% - full collaborative fit (CF)

75% - moderate CF

50% - partial CF

25% - limited CF

0% - no CF

A20-6.9.6 Temporal Bracketing – Episodic Change Episode 3

This episode, with its seven data sources, depicting a set of events with both a reflective and future planning focus, inherently links with activities both past and future. The temporal window could be considerably extended to explore in either direction, but without a precise focus could tend to drift. The selected 'TUM activity in focus' relates to one of the final actions agreed with Arnold, namely redesigning the metastructure of the collaborative task, and the introduction of a new task namely a 'quiz' to the collaboration.

Extended Episode Characteristics	
Duration:	20/10/2004 – 7/11/2005
Supporting data:	1 email message Arnold Pears 20/10/2004 1 email message Fred Niederman 22/10/2004 1 email message Tony Clear 23/10/2004 6 diary notes Tony Clear (11/04/2005, 13/04/2005, 3/06/2005, 7/06/2005, 1/7/2005, 9/9/2005) 1 MS Word file (Semester 1 2005 instructions – Diana Kassabova 10/05/2005) 1 MS Word file (Semester 1 2005 Groupware assessment – Diana Kassabova 3/06/2005) 1 Lotus Notes Collaborative database - S1 2005 'View' of uploaded quiz files (3/06/2005 – 7/06/2005) 18 Lotus Notes Collaborative database - S1 2005 final student evaluations (2/06/2005 – 10/06/2005) 1 MS Word file (Semester 2 2005 instructions – Kitty Ko 12/09/2005 1 MS Word file (Semester 2 2005 Groupware assessment – Kitty Ko 12/09/2005) 1 Lotus Notes Collaborative database - S2 2005 'View' of uploaded quiz files (26/10/2005 – 3/11/2005) 26 Lotus Notes Collaborative database – S2 2005 final student evaluations (26/10/2005 – 7/11/2005) 9 AUTOnline s2 2005 Group Discussion Forums - GVT Leadership (13/09/2005 – 23/10/2005) 9 AUTonline S2 2005 Group Discussion Forums - Phase 2: Create a Quiz (30/9/2005 -04/11/2005
No of sources	77 – focal lens of TUM activity related to "redesign of collaborative task"
Actors:	Tony Clear, Kitty Ko, Diana Kassabova, Fred Niederman, Arnold Pears, AUT students S1 2005, Uppsala and AUT students s2 2005

Table A20-6.56 Extended Episode Characteristics – Episodic Change Episode 3

Table A20-6.56 above incorporates the additional source items which enable this extended temporal bracket to explore the TUM activity related to the 'quiz' implementation.

A20-6.9.6.1 Narrative Summary – Extended Episodic Change Episode 3

The additional source items above help frame the TUM activity surrounding the

episodic change which resulted in adoption of the 'quiz collaborative task' within both the internal and external collaborations for 2005. This section summarises these sources, with relatively detailed illustrations of their specific content where deemed warranted. Fuller analysis follows after this largely descriptive summary section.

The episode originates with Arnold's critical reflections on the 2004 collaborative task design, in an email sent towards the end of the 2004 collaboration:

> I think that despite my attempts to motivate people here they feel that the exercise has little scope for collaborative activity
>
> Finally the structure of the exercises, from a Swedish perspective, is far to prescriptive and does not leave any scope for collaboration and negotiation within the teams,...I think that we need to seriously discuss the form of the exercises that we aske students to do, and have a clearer idea of how those exercises promote collaborative activity before next year's course. (AP 20/10/2004)

Fred also commented on the design of the 2004 'web site ranking' collaborative task, but in a rather different vein, suggesting a more staged and structured design.

> From a research perspective, I understand the idea of rating the websites, but we might want to split this assignment into some smaller bits -- identify the websites and argue why yours are the best. Everyone look at at least 10 websites from other groups, indicate why you thought these might be the most interesting, and rank them from 1-10; perhaps we could have a small prize for the websites voted most helpful. Do something with the content of the websites, either a paper or discussion. Students here tend to be motivated by a little competition (too much and they get too intense about the game and forget about the purpose), this might be a little bit cultural; but some discussion about things to create more student participation might be worthwhile. At least with our students, they seem to always want to know what is required and what is optional -- and usually they only want to do what is required. (FN 22/10/2004)

While the approaches of the two coordinators may have differed, nonetheless the message was similar – the collaborative task needed redesign to improve both its collaborative dimensions and its motivational value for students. My response to Fred also touched on the relationship between assessment task design and student culture and motivation.

> The issue of student culture is also highly relevant for us, we have similar student motivations to deal with here in NZ, whereas Arnold has different issues, b'cos his students expect to be given more autonomy and challenge. The assessment is definitely a motivator for our students and we have tried to design this activity so that it enables local autonomy over assessment designs in each institution. (TC 23/10/2004)

Following this set of email exchanges, the next chronological data items in this extended bracket consist of a diary note some 6 months later, relating to the incorporation of the 'quiz' as a task in the semester 1 2005 internal collaboration. In a meeting planning the internal collaboration, Diana, Kitty and I took note of Arnold's feedback from the S2 -2004 collaboration and the SIGCSE conference, to redesign the icebreaker task, require the selection of a leader by removing the option for a "self-managed team", and introduce a new common task, namely a 'quiz' as excerpted

below:

17) Quiz:
Topic related to course
-internationalisation & glob.
- technology
- Group decision making
- global virtual teams
s/w? [freeware examples?]
interactive quiz
quality of interactive quiz) assessment?
interactivity)
(TC 11/04/2005)

This meeting adjourned and the three of us reconvened two days later to continue the collaborative trial planning. We discussed the marking schedule for production of the quiz, with a suggestion of "bonus marks for the best quiz". The task was agreed as "GVT to create quiz". The discussion then moved to the technology platform with the 'quiz' feature of AUTOnline being discussed as a potential candidate. But here quiz creation was possible only with "instructor privileges". One option was to create an "organization" (an AUTonline course like structure) with "all students as instructors", but was not considered viable as we would be too dependent upon the Learning Technology unit's support. Our conclusion on the issue was:

AUT quiz creation s/w –
No too problematic to
Get support for (flag it)

- suggest open source quiz creation s/w (13/04/2005)

I noted that "evidence of individual contribution to the quiz" was to be provided in the "groupware assessment marking schedule produced". The discussion then moved to discuss the role of the Lotus Notes Database in support of the collaboration. We agreed to retain the "confirm leadership" task, but with "no self-managed option", and "enter name of leader" would be required. The "website evaluation section" would be removed. Students would collaborate in AUTOnline (file exchange, group, chat, email etc.). Options for uploading quizzes and the required Notes development were canvassed in the following excerpt:

4) upload quiz (html files)
Via AUTOnline (group space clumsy & digital drop box messy)
** Upload to Notes
-form
-views (TC 13/04/2005)

The note continued to discuss timings of the collaboration and stages, my forthcoming absence in Peru, the consent forms to be given to students, and then more about the quiz:

> Quiz – idea of technical activity as a motivator
> - may be re-used in presentations
>
> [Also useful for Swedish students who wanted technical/software task]
>
> Quiz – 8 -12 questions as target
> Approx 10 on average (TC 13/04/2005)

The note concluded with the coding for group names (alphabetical for LTs and numeric for GVTs ("to aid recyclability"), some reflections about delays in the IT support chain and an observation that the "local teams work Ok in general". The final task allocation was for me to produce the "consent forms" and Diana the "instructions".

The next data item was the set of instructions for carrying out the quiz, produced by Diana, an excerpt of which is given below:

> "Phase 2. Group decision making related to a common task
>
> ***Time frame:*** Between Monday, the 16th of May and Sunday, the 5th of June (weeks 10, 11 and 12)
>
> ***Aim:*** This phase involves collaboration among the Local Teams (LT) within each of the Global Virtual Teams (GVT). Each GVT are required to design, create and upload an interactive quiz in the online Collaborative DB **VTEAM**. The quiz will include 8 to 12 questions related to themes such as:
>
> - Internationalisation and globalisation of GDSS
> - Technology supporting group work
> - Global virtual teams
> - Any other topic related to GDSS
>
> An example for software that can be used for producing an interactive quiz is available for free at
>
> http://www.tac-soft.com/Download/mcdownload.html
> **VTEAM** is available in AUTonline:
>
> COURSES > INTELLIGENT BUSINESS SYSTEMS S1 2005 > WEBSITES"
> (Semester 1 2005 collaborative trial instructions excerpt 10/5/2005 Diana Kassabova)

Accompanying the instructions to students were the assessment instructions for the task, with "Option 1" as excerpted below, being that for students who had elected to participate in the collaboration:

> ***Option 1.***
>
> Take part in the Collaborative trial that consists of two phases: 1) icebreaking (involves choosing a group leader) and 2) group collaboration for the creation of an interactive quiz.
>
> The quiz will include 8 to 12 questions related to themes such as:
> - Internationalisation and globalisation of GDSS
> - Technology supporting group work
> - Global virtual teams
> - Any other topic related to GDSS
>
> You will need to participate in the trial in a consistent and meaningful manner (for more detail refer to ***Instructions for the trial).***
>
> **Required:**
> - Identify **four key issues** that you have experienced during the trial and that are related to the **process of collaboration.** Write up an **individual reflective report of 800 words**.
> - **APA Reference** to relevant readings is required. References are not included in the word count.
> - Collect and submit **at least four pieces of evidence** related to these issues.
> - Submit evidence for **collaborative contribution** to quiz creation.
>
> **Note:** In order to be assessed for this part of the assignment your GVT must have submitted a complete quiz in the online DB.
>
> (Semester 1 2005 groupware assessment excerpt 3/6/2005 Diana Kassabova)

At this stage in the collaboration I had recorded two further diary notes. In the first of these notes Kitty reflected positively on the outcomes of the trial:

> Discussion briefly with Kitty
> -students are happier this time
> - task easier to follow
> - same time zone a big difference. (TC 3/6/2005)

In the second diary note Diana shared her similarly positive view:

> Discussion with Diana in photocopy room. Internal collaboration drawing to a close, final evaluations being entered in class
> This time all GVT's had successfully completed their tasks
> - quizzes for each available
> - no complaints – first time ever.
> Students mentioned desirability of international collaboration. Diana discussed problems with last international trial – minor disaster
> They were quite surprised. (TC 7/6/2005)

In support of Diana's comments the Lotus Notes 'view' of the collaborative database in figure 6.63 below shows a strong improvement in student performance. As the data shows all four GVTs had produced and posted a working quiz to the Notes database. Thus a 100% completion rate had been achieved for the four GVTs involved in the semester 1 2005 internal collaboration. This successful outcome strongly contrasts with that achieved for the prior semester 2 2004 international collaboration, as shown in table A20-6.36 above.

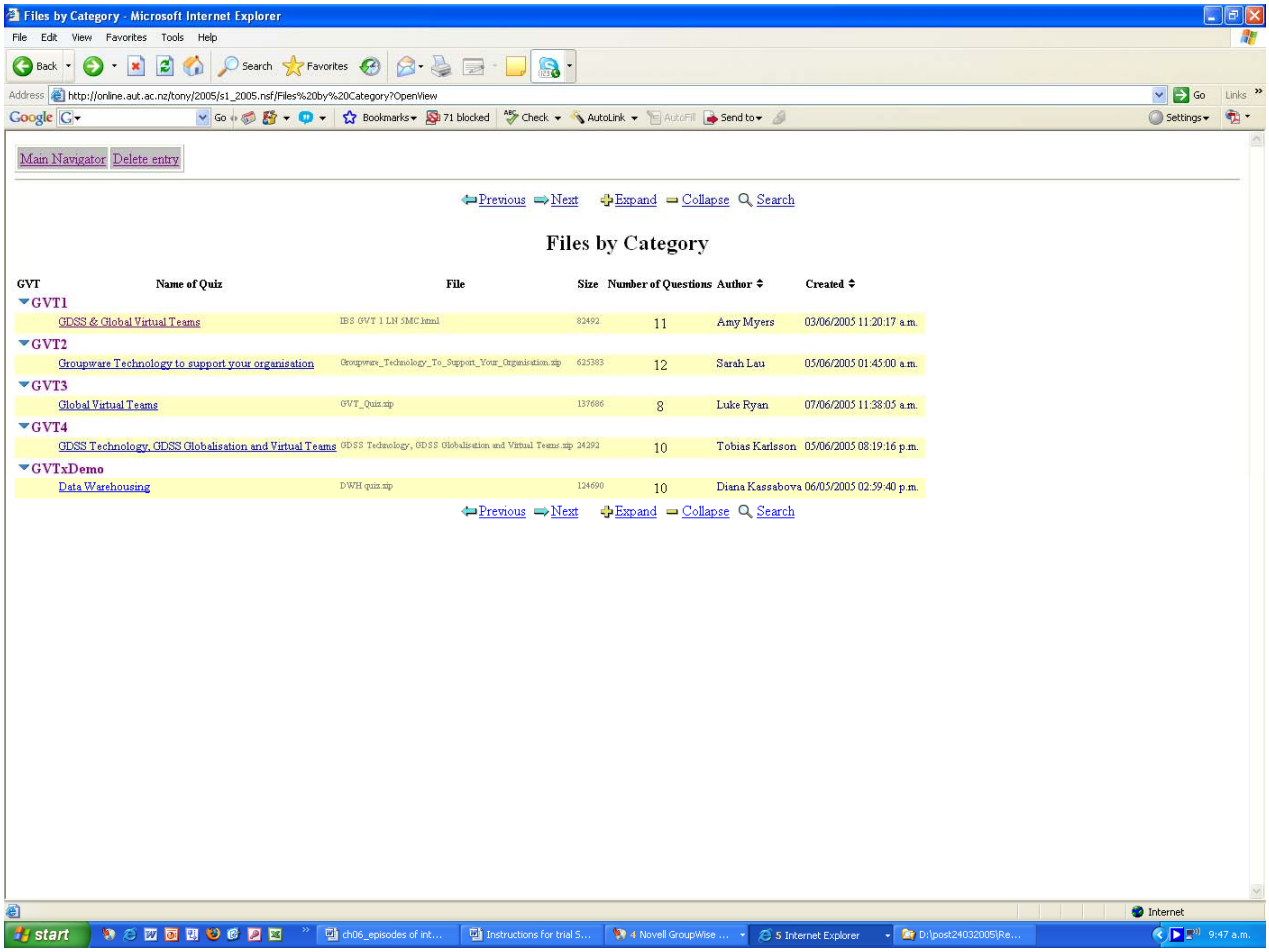


Figure A20-6.63: Semester 1 2005 AUT Internal Collaboration - Quiz Completions

As a *reinforcement* activity, the 'GVTxdemo' entry provided an exemplar guiding students in how to post their quizzes to the system.

Further supporting this performance data on student achievement were the student evaluations, which recorded student perceptions of the collaboration. An example of a student evaluation form is depicted in figure A20-6.64 below.

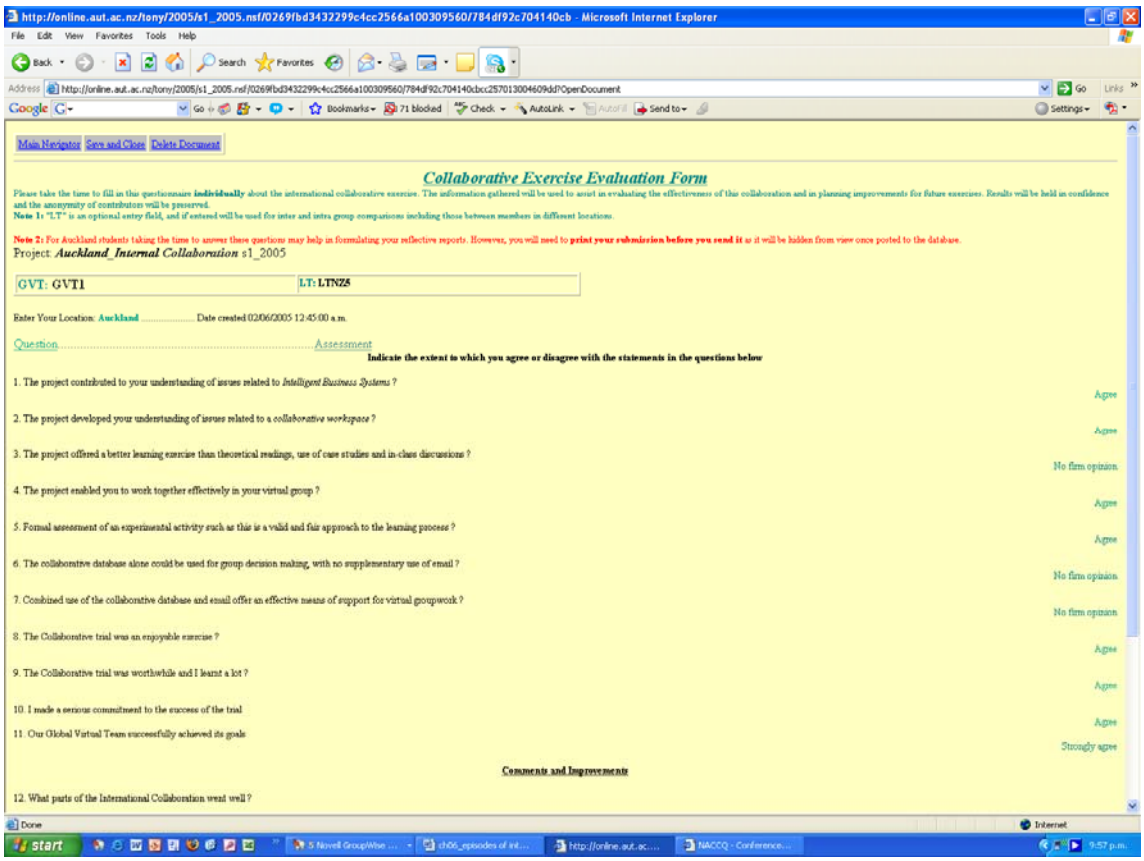


Figure A20-6.64: Semester 1 2005 AUT Internal Collaboration – Sample Final Student Evaluation Form

Two relevant questions from the evaluation address 1) the effectiveness of the virtual group and 2) the success of the GVT in achievement of its goals. The questions and the responses from the example above are excerpted below for ease of readability.

> "4. The project enabled you to work together effectively in your virtual group?
>
> Agree
>
> 11. Our Global Virtual Team successfully achieved its goals
>
> Strongly agree"

A brief summary of responses to these questions from all 18 respondents is depicted below in figure A20-6.65.

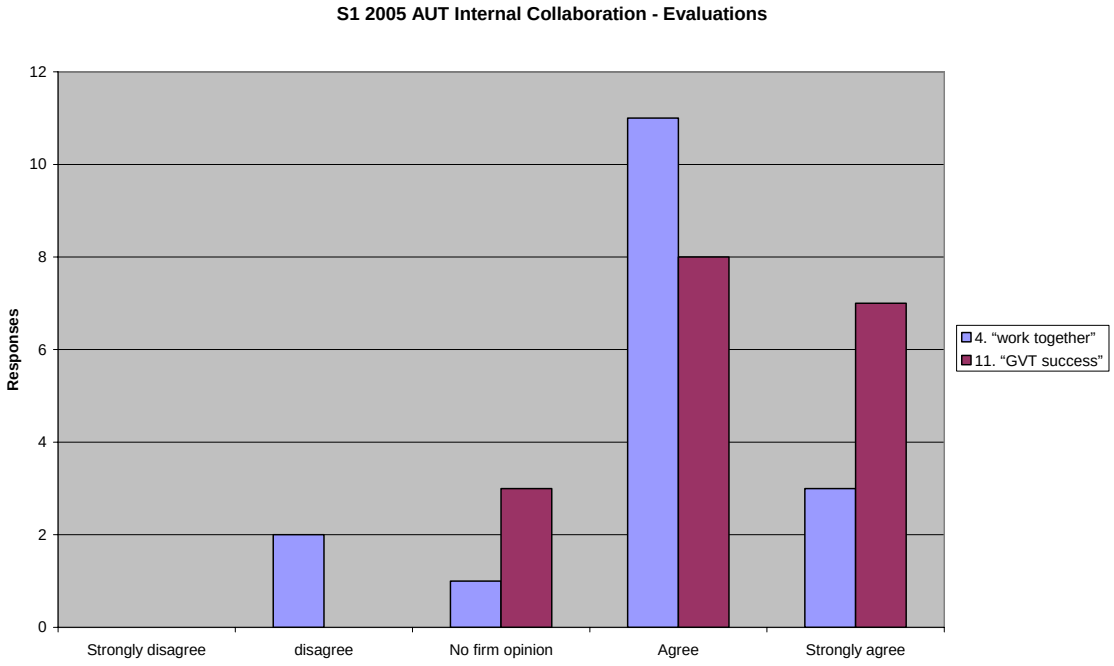


Figure A20-6.65: Semester 1 2005 AUT Internal Collaboration –Student Evaluations of GVT Success

As can be seen, the student evaluations were generally positive. An overview of the full set of evaluations is depicted below in the Lotus Notes 'view' of figure A20-6.66, which does highlight one GVT (GVT3) that was less satisfied with the outcome.

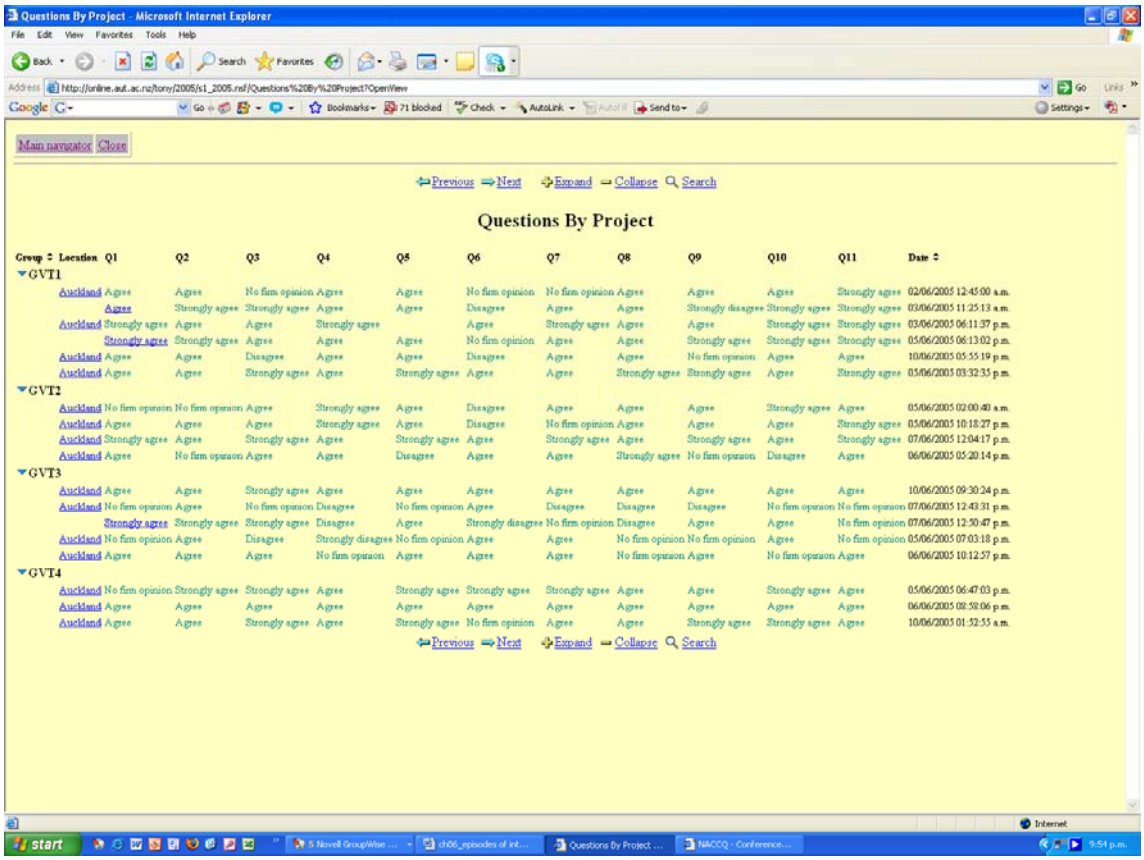


Figure A20-6.66: Semester 1 2005 AUT Internal Collaboration – Final Student Evaluations View

While not intending to conduct an in depth analysis of student responses here, a brief probe into GVT3 responses proved illuminating. Selected student responses from this less effective group suggested the GVT faced some issues with leadership, group cohesion and time management in performing their task. The full and relatively balanced response to the open ended questions from student A is given below to help portray the GVT experience. More selective excerpts from other students follow to complement student A's response. Some aspects relating to the 'collaborative task' were apparent in these excerpts, but they occurred in the wider context of GVT actions.

Student A response:

> "What went well:
> The initial ice breaking stages went well with good, fast progress being made. Also, the quality of the qusetions included in our quiz was very good, covering a broad area of virtual teams, giving a good overview of the topic.
>
> 13. What are the ***three***main improvements you would suggest to improve the effectiveness of the Collaboration?
>
> First change:
> Set dates/deadlines to post on your progress or just to keep contact with the rest of the group so tasks are kept fresh on the minds of group members.
> Second change:
> Have mandatory weekly chat sessions so the group can communicate in real time.
> Third change:
> Place a greater emphasis on the need to continue communicating even when tasks have been set, so members are not just going away, doing their part and then posting it, but engaging in frequent communcation in order ro gain feedbaack and an overall gauge on where the project currently stands.
>
> 14. What did you gain from the International Collaboration that was of most value ?
> The thing of most value was suprisingly not the actual information that was being exchanged, but more the process of how the whole virtual team worked. What i found out was later emphasised through theory that was studied; i learnt how the team should/shouldn't operate before researching the topic and this was just through the experience of being in a team. I found my self agreeing and relating our processes to theory when reading articles about virtual teams".

Student B response:

> "What went well:
> Election of the group leader. This went well because only few persons took part in the evaluation process what made the decision easy.
> First change:
> Measure contributions of each team member.
> Second change:
> Evaluate contributions of each team member.
> Third change:
> Reduce the size of the virtual teams.
>
> 14. What did you gain from the International Collaboration that was of most value ?
> - For effective virtual collaboration even more than for face-to-face collaboration incentives become very important to ensure contribution. can never replace face-to-face communication due to invisible processes when communicating!"

Student C response:

> "First change:
> better communication of tasks required
> Second change:
> more emphasis on due dates
> Third change:
> more intel on the quiz making programme"

"First change:
Have more of a focus on group processes when working on line, by this i mean that the structure of the activity should involve the whole group".

Student D response:

"What went well:
All in all, it was quite a traumatic experience. But for consolation, I learned a lot about virtual teams.

First change:
A referee - middle person would do keep things in perspective.
Second change:
Someone should check on progress.
Third change:
Leader's performance should be assessed (at least two-weekly) for the purposes of this class exercise.
14. What did you gain from the International Collaboration that was of most value ?
communication is very important and someone must keep the leader accountable"

The next data source is a diary note recording initial planning thoughts for the semester 2 2005 international collaboration, during which Diana would be absent in Europe and Mattias Wiggberg would take the primary role in coordinating things from the Uppsala end. As can be seen in the excerpt below a variety of TUM activities were involved. From the perspective of the 'collaborative task' the question of "motivation" for Swedish students as opposed to the motivations of AUT students (primarily grades?) was raised.

S2/2005 Collaboration. Diana to observe from afar while in Europe/Germany. Robert to teach evening class first half of course…
***Dates tbd
***email Mattias details to Kitty & Mats & Arnold's for AUTOnline set up
Diana's students a/c
"dianakstudent" – login name
"Diana" - password
URL - evaluation
- quizzes
Motivation for Se Student quiz completion?
AUT – Grades?

(TC 1/7/2005)

The following data source is directly related to the 'collaborative task', being the subset of student instructions relating to the group decision making task. This section is excerpted in full from the instructions for the collaboration:

Phase 2. Group decision making related to a common task

Time frame: Between Monday, the 10th of October and Sunday, the 30th of October.
Aim: This phase involves collaboration among the Local Teams (LT) within each Global Virtual Team (GVT). Each GVT are required to design, create and upload an interactive quiz in the online Collaborative DB **VTEAM**. The quiz will include 10 to 12 questions related to themes such as:

- Internationalisation and globalisation of GDSS
- Technology supporting group work
- Global virtual teams
- Any other topic related to GDSS

Some examples of software that can be used for producing an interactive quiz are available for free at
http://www.tac-soft.com/Download/mcdownload.html
http://www.articulate.com/home.html

VTEAM is available through AUTonline:
INTERNATIONAL COLLABORATION 2005 > EXTERNAL LINKS

(Semester 2 2005 collaborative trial instructions excerpt 12/9/2005 Kitty Ko)

Complementing the student instructions was the groupware assessment for the AUT students. Initially we planned to use exactly the same assessment as the previous semester in the internal collaboration, which is reiterated below for ease of reading:

> ***Option 1.***
> Take part in the Collaborative trial that consists of two phases: 1) icebreaking (involves choosing a group leader) and 2) group collaboration for the creation of an interactive quiz.
>
> The quiz will include 8 to 12 questions related to themes such as:
> - Internationalisation and globalisation of GDSS
> - Technology supporting group work
> - Global virtual teams
> - Any other topic related to GDSS
>
> You will need to participate in the trial in a consistent and meaningful manner (for more detail refer to ***Instructions for the trial).***
>
> **Required:**
> - Identify **four key issues** that you have experienced during the trial and that are related to the **process of collaboration.** Write up an **individual reflective report of 800 words**.
> - **APA Reference** to relevant readings is required. References are not included in the word count.
> - Collect and submit **at least four pieces of evidence** related to these issues.
> - Submit evidence for **collaborative contribution** to quiz creation.
>
> **Note:** In order to be assessed for this part of the assignment your GVT must have submitted a complete quiz in the online DB.

(Semester 1 2005 groupware assessment excerpt 3/6/2005 Diana Kassabova)

On further deliberation Kitty and I realised there was a potential issue for the AUT students should their Swedish colleagues not participate actively in the collaboration. I recorded this concern in the diary note below:

> Assignment to remove stipulation that "GVT must have submitted a complete quiz". Can be enforced in solely B Bus. IBS context, more difficult when dependent upon SE students. Current evidence requirements still Ok even if LT quiz only achieved. (TC 9/9/2005)

As a result of this concern, while otherwise retaining the instructions intact, we removed the requirement in the final box below:

> **Note:** In order to be assessed for this part of the assignment your GVT must have submitted a complete quiz in the online DB.

(Note: box not included in Semester 2 2005 groupware assessment 12/09/2005 Kitty Ko)

This adjustment would enable AUT students to meet the requirements of their assessment (in the event of a GVT failure) by still having process and issue related evidence and by at least producing a quiz at the LT level as a product of the work. With this assessment design, in the event of failure, there should have been more scope to meet the reflective outcomes of the assessment.

The next set of source items was the collection of group forums set up in AUTOnline,

and the many postings made to them. These are portrayed in table 6.57 below.

GVT	Forums	Threads	Posts	Participants
1	GVT Leadership	1	9	5
	Phase 2: Create a quiz	7	30	7
2	GVT Leadership	3	17	7
	Phase 2: Create a quiz	9	28	7
3	GVT Leadership	3	8	7
	Phase 2: Create a quiz	8	25	7
4	GVT Leadership	1	8	5
	Phase 2: Create a quiz	5	17	6
5	GVT Leadership	1	16	9
	Phase 2: Create a quiz	7	29	10
6	GVT Leadership	2	11	7
	Phase 2: Create a quiz	6	32	7
7	GVT Leadership	2	5	4
	Phase 2: Create a quiz	10	26	9
8	GVT Leadership	1	21	5
	Phase 2: Create a quiz	10	42	7
9	GVT Leadership	2	13	7
	Phase 2: Create a quiz	4	20	6

Table A20-6.57 AUTOnline Discussion Forums S2 2005 - Descriptive Statistics

As tabulated in table A20-6.57 above, the collaboration was supported by discussion forums for each phase (in this case the leadership choice and quiz creation task). These appear to have been actively used, and contributed significantly to the conduct of the exercise, with several student originated threads and postings made within the instructor created forums for each GVT. The *GVT Leadership Discussion Forum* was ostensibly a component of the icebreaker task and therefore outside this bracket's focus on the 'quiz creation task'. Yet, when reviewing the threads and postings relating to quiz creation, the significant role of the GVT leader became apparent. Thus the postings within both the forums (*GVT Leadership* and *Phase 2: Create a quiz*) have been included in this bracket. A detailed summary of the content of these discussion forums is given in Appendix 15.

In brief, each GVT managed to appoint a leader through a variety of self-directed processes including various forms of voting, volunteering and by default merely selecting the initiator of the process. Teams seem to have collaborated actively to complete their task, with patterns typically involving: interactions over selection of the topic for the quiz; discussions about the process for producing the quiz; in some cases

downloading and testing the third party quiz software; sharing of questions and answers; collation of a final question and answer set, incorporating the questions into the third party application and allocation of a team member to post the final quiz to the Notes database.

As with the internal collaboration, as the data shows in figure A20-6.67 below, all nine GVTs had produced and posted at least one working quiz to the Notes database. In fact two GVTs had posted more than one quiz. GVT2 had posted a zipped version and a more readily viewable html version of the same quiz, plus an alternate quiz of a more "jokey" nature. It appeared that this GVT may have functioned as two separate LTs.

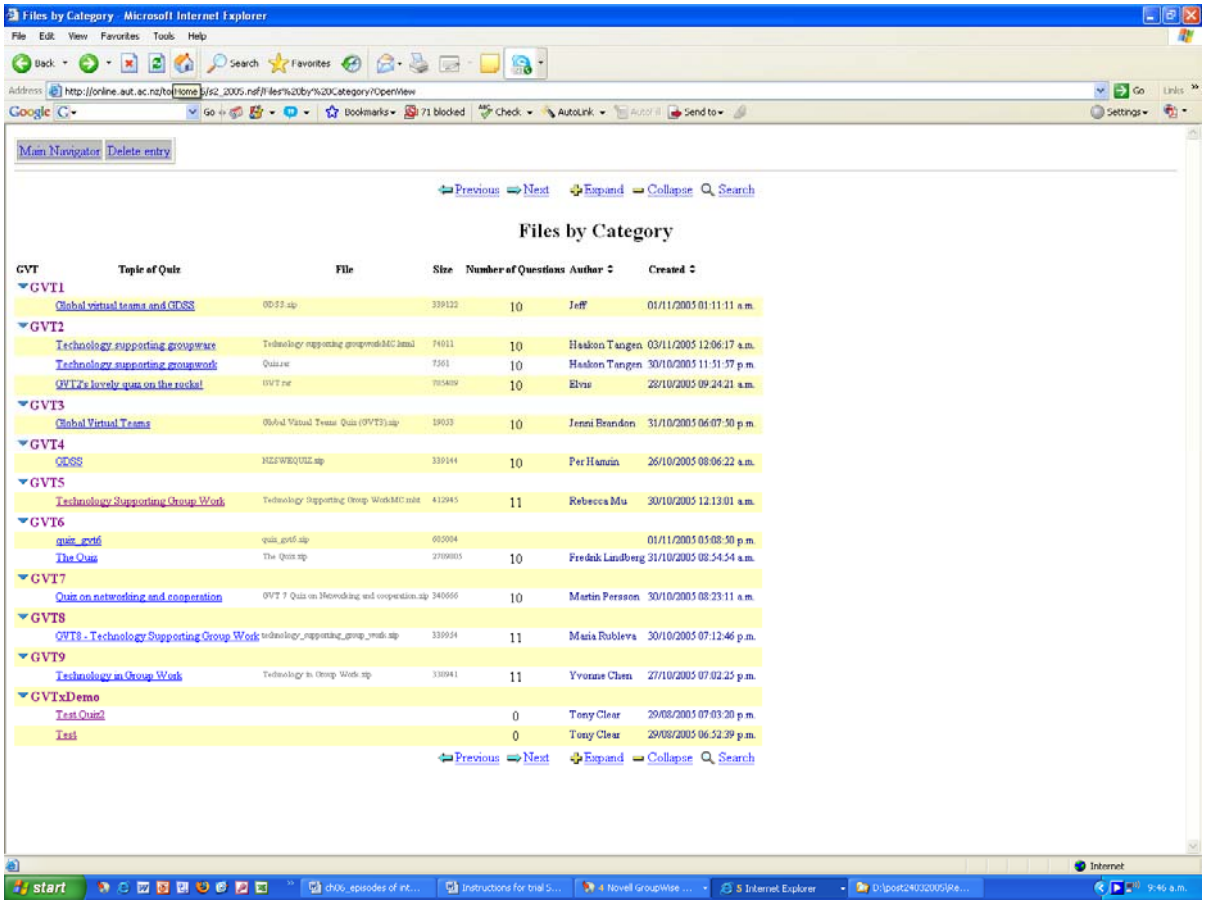


Figure A20-6.67: Semester 2 2005 AUT - Uppsala International Collaboration - Quiz Completions View

The initial dialogue over selection of a group leader indicates a degree of confusion over the scope of the GVT leader role:

> All in favour of Jonas for group leader reply with a yessir.
> And all in favour of Haakon as the NZ leader reply with a didelidoo.
> (GVT2 GVT Leadership Forum 16/09/2005)

These two separate quizzes are depicted in figures A20-6.68 and A20-6.69 below

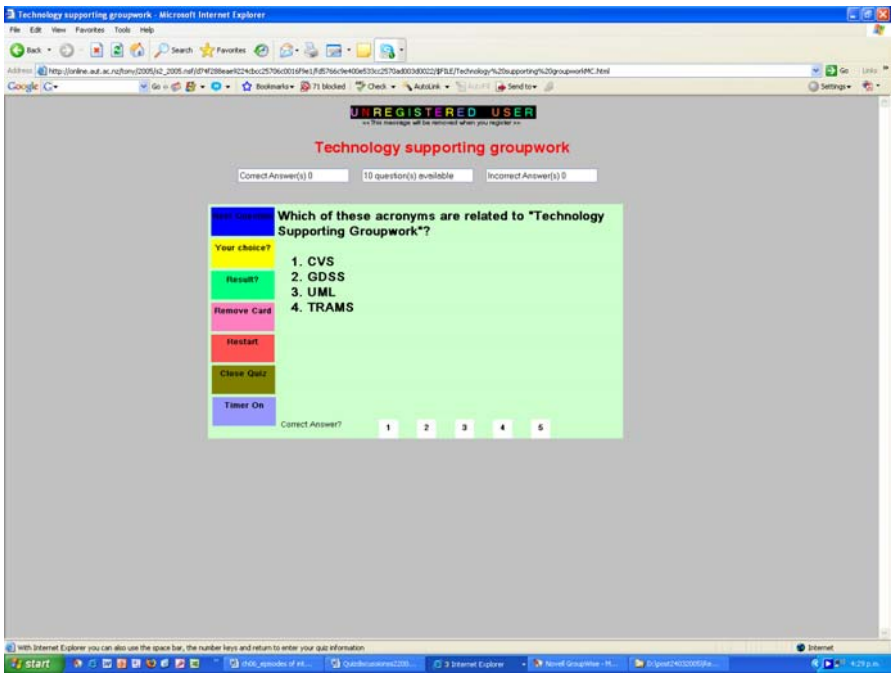


Figure A20-6.68: Semester 2 2005 - GVT2 Online Viewable Quiz (html version)

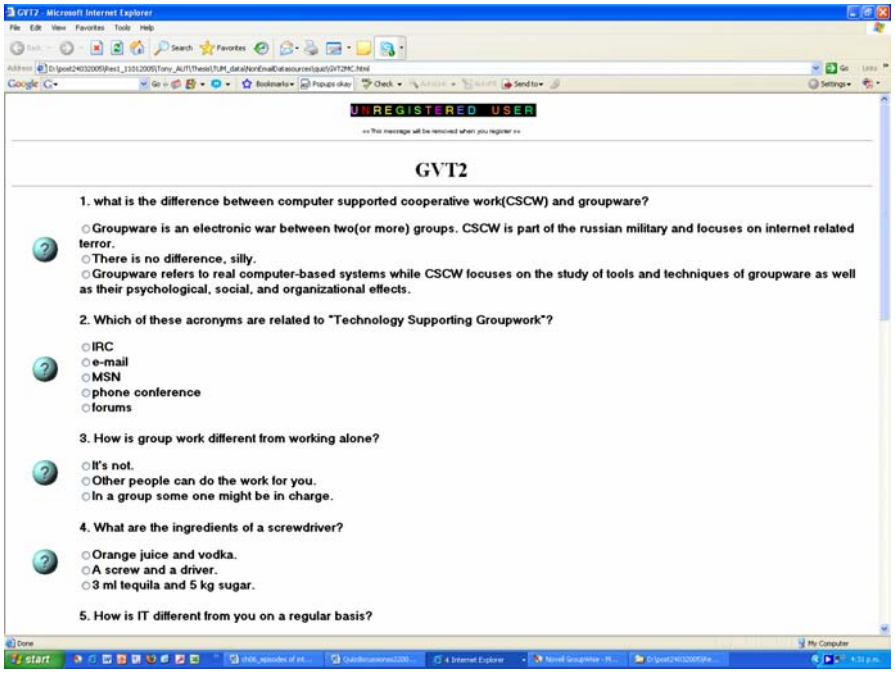


Figure A20-6.69: Semester 2 2005 - GVT2 Alternate Quiz Run Locally (.rar version)

The first of these quizzes had been posted by Haakon on behalf of either the full GVT or just his AUT team members, whereas the second had been posted under the pseudonym “Elvis”, so its origin was unclear. The Swedish references in figure A20-6.70 below do indicate that the quiz had been developed by one or more of the Swedish members of the GVT. In addition to generating some confusion “Elvis” demonstrated a lack of loyalty to his home GVT (GVT2) with the answer to question 8 in figure A20-6.64 below, where GVT4 was considered the best group? To what extent this was

evidence of a broader lack of commitment to the task, or simply Elvis 'having fun' was hard to discern. This initial evidence suggested that GVT2 was operating as two separate LTs.

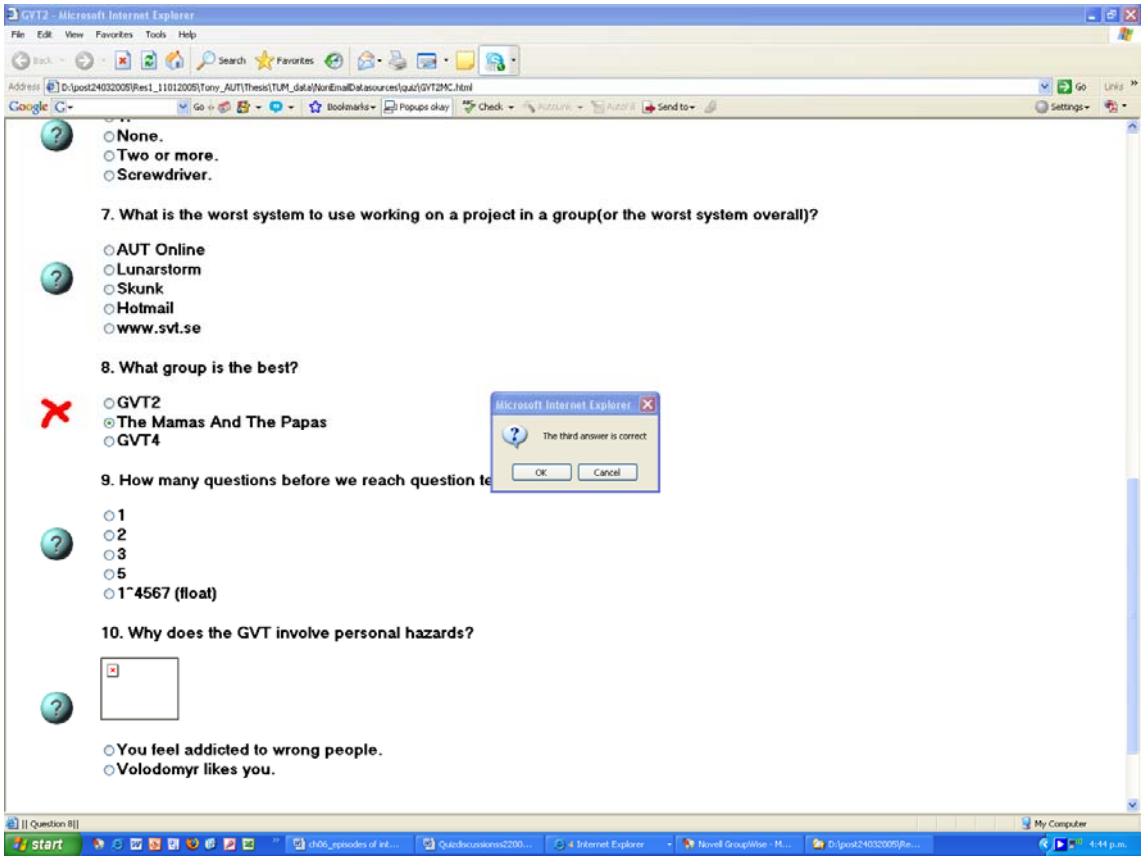


Figure A20-6.70: Semester 2 2005 - GVT2 Alternate Quiz – Q.8 What group is the best?

However there was considerable counter evidence within the discussion threads that the team was functioning overall as an effective GVT. The commented excerpts below amply demonstrate the effective functioning of the team, and thereby the second quiz posting stands out as a puzzling event, reflecting either confusion on the part of some team members, or a joke on the part of one or more of the Swedish team members:

> *Discussion on topic and reading assignment*
> Well, I suggest we all post one question each in this thread, and then decide who will complete the quiz making the "program", or "interactive quiz".
> But first we have to choose a subject for the quiz.
> I suggest, as Rachel did, the subject "Technology Supporting Groupwork".
> So, questions anyone? (24/10/2005)
>
> *Discussions (multiple student created threads 9 – including 'please read" under create a quiz forum contributing qu's – 6 x SE 2 x AUT members*
> Odd Haakon, I give you the assignment to hand in the completed quiz.
> Ok?
> Sweet! (24/10/2005)
>
> Great!
> Somebody who can create and upload the quiz when it's finished?
> I'm coming up with a question soon.. (out of ideas) (28/10/2005)

I have uploaded the quiz now. It is just in a word document since I didn't know what else to use. I can still edit it, anyone know of a tool that I can use??? (31/10/2005) [Haakon]
Quiz uploaded to site html 3/11 & .rar files 30/10 plus another quiz posting (Elvis?) 28/10

The other duplicate posting GVT (GVT6) had posted two separate quizzes, but in this case for quite a different reason, as the dialogue below illustrates.

the_quiz.rar (5.317 Mb)
Ok, here it is...
added some pics to :D
Tell me what you think and if I should change something before uploading it.
/Cheers! (29/10)

It looks very nice. I tried to upload it to VTEAM, but I can't get it to work. I've tried both Safari and Firefox. I don't get any error message, the file just doesn't get saved. Who else will try?
Erik (31/10)

quiz_gvt6.zip (590.824 Kb)
I tried making a smaller file (the one attached to this post), but that didn't seem to help.(31/10)

Hey Erik,
The file has been uploaded when u posted it. It works fine(1/11)

Well actually, it never worked when I tried to upload it to the VTEAM navigator. But it did work for Fredrik when he tried a few hours later.
It might have been a temporary problem, or maybe the VTEAM thing just didn't like my web browser.
Erik(1/11)

As the above dialogue confirms, this team had eventually posted the quiz which, as intended, had been generated by the combined GVT's efforts.

Thus it appears that a 100% completion rate had been achieved for the nine GVTs participating in the semester 2 2005 internal collaboration. This successful outcome strongly contrasts with that achieved for the prior semester 2 2004 international collaboration, as shown in table A20-6.36 above.

Again in support of this performance data on student achievement were the student evaluations, which recorded student perceptions of the collaboration. An example of a student evaluation form is depicted in figure A20-6.71 below.

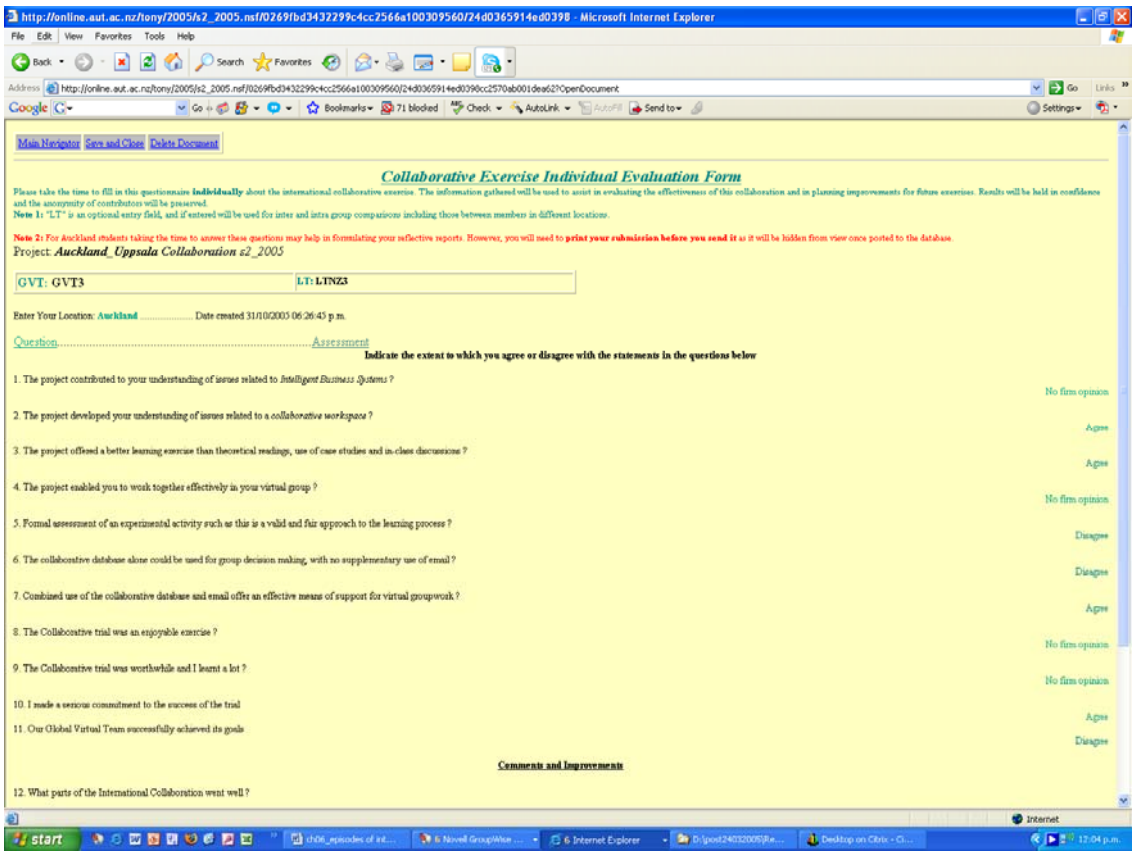


Figure A20-6.71: Semester 2 2005 AUT - Uppsala International Collaboration - Sample Final Student Evaluation Form

As with the semester 1 2005 internal collaboration, two questions from the evaluation again addressed 1) the effectiveness of the virtual group and 2) the success of the GVT in achievement of its goals. The questions and the responses from the example above are excerpted below for ease of readability.

"4. The project enabled you to work together effectively in your virtual group?

No firm opinion

11. Our Global Virtual Team successfully achieved its goals

Disagree"

A brief summary of responses to these two questions from all 26 respondents is depicted below in figure A20-6.72.

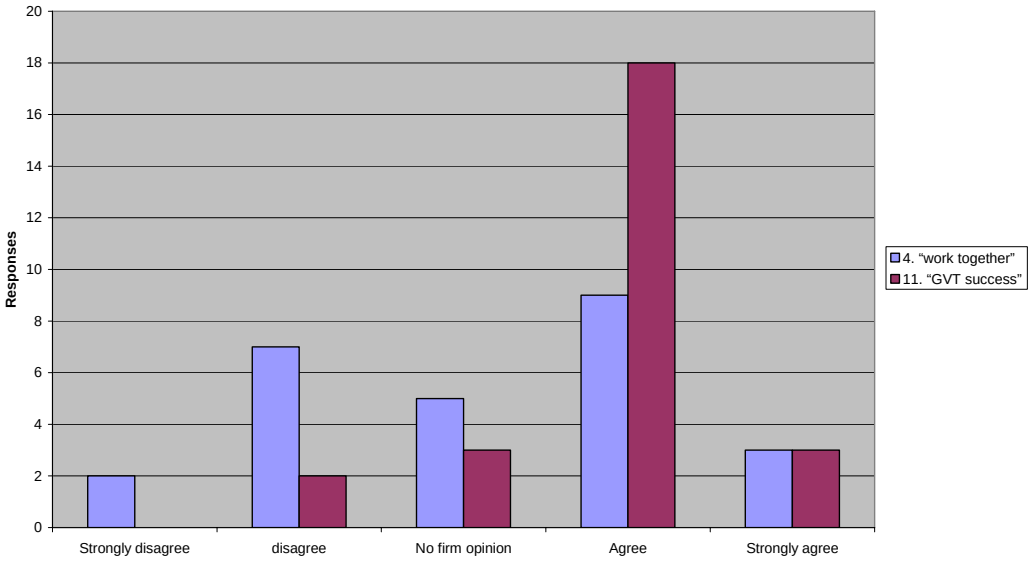


Figure A20-6.72: Semester 2 2005 AUT Uppsala International Collaboration –Student Evaluations of GVT Success

As can be seen, the student evaluations of overall success were reasonably positive, but less so for question 4 "The project enabled you to work together effectively in your virtual group", than in the prior internal trial depicted in figure A20-6.72 above. An overview of the full set of evaluations is depicted below in the Lotus Notes 'view' of figure A20-6.73, which does highlight a pattern of fewer Swedish evaluations and of the Swedish respondents being less satisfied with the group work and to a lesser extent with the outcome. Further analysis is given in the breakdown over page.

Figure A20-6.73: Semester 2 2005 AUT - Uppsala International Collaboration - Final Student Evaluations View

A breakdown of the student evaluations is provided through the Swedish – Auckland student comparison in figures A20-6.74 and A20-6.75 below.

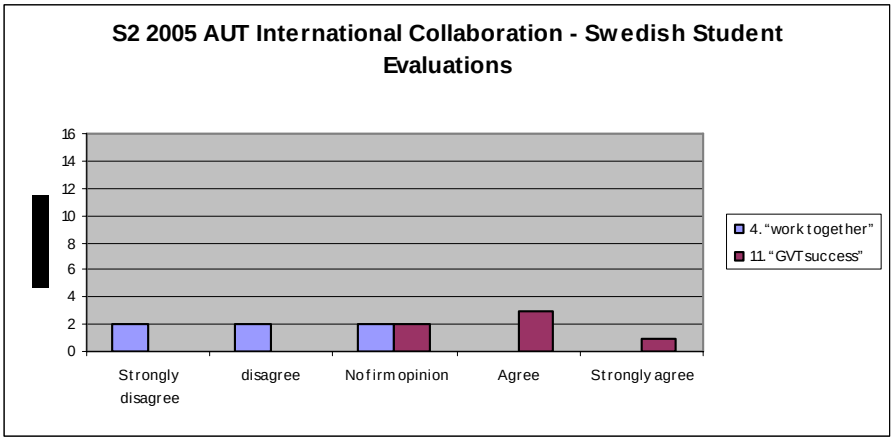


Figure A20-6.74: Sem. 2 2005 International Collaboration – Swedish Student Evaluations of GVT Success

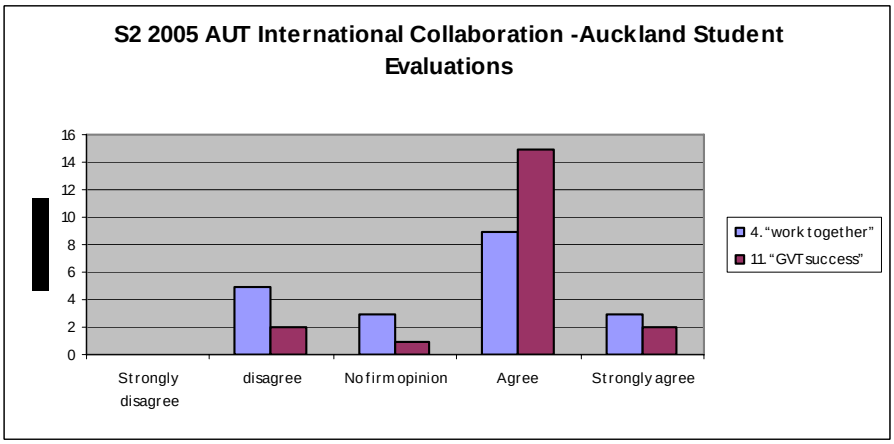


Figure A20-6.75: Sem. 2 2005 International Collaboration – Auckland Student Evaluations of GVT Success

The patterns indicate a higher perception of both effective groupwork and overall success on the part of Auckland participants, and the few Swedish respondents show a much clearer difference in their views on the effectiveness of groupwork. Nonetheless both groups seemed largely in agreement with the proposition that"Our Global Virtual Team successfully achieved its goals".

Excerpts from student responses (over page) have been selected to help explain some of the patterns of response in figures A20-6.74 and A20-6.75 above, and to give further insight into the dynamics that were in operation for some GVTs.

Student A response

4. The project enabled you to work together effectively in your virtual group ?

disagree

11. Our Global Virtual Team successfully achieved its goals

Strongly agree

Third change:
More challanging task, now as is a person can put this together by himself in a night. No real teamwork is necissary but if there was a more challenging task the leader would be the hub but not the engine, instead of like now, both. (Final Trial Review Online Evaluation GVT4 Uppsala student 26/10/2005)

Student B response

4. The project enabled you to work together effectively in your virtual group ?

Agree

11. Our Global Virtual Team successfully achieved its goals

Agree

First change: The quiz exercise should be on a topic that is a little more interesting, allowing members to be readily involved in the discussion.
Third change: The icebreaker stage, quiz, and leadership decision did not require much collaboration. It was only a matter of one member suggesting an obvious idea, and everyone agreeing, because there was not much to disagree about. (Final Trial Review Online Evaluation GVT2 Auckland student 28/10/2005)

Student C response

4. The project enabled you to work together effectively in your virtual group ?

Strongly Disagree

11. Our Global Virtual Team successfully achieved its goals

No firm opinion

What went well: We made up 10 questions
Second change: An interesting task.

14. What did you gain from the International Collaboration that was of most value ?People can't read instructions. (Final Trial Review Online Evaluation GVT2 Uppsala student 3/11/2005)

Student D response

4. The project enabled you to work together effectively in your virtual group ?

Disagree

11. Our Global Virtual Team successfully achieved its goals

No firm opinion

What went well: All the tasks we're easy to complete.
Second change: An interesting task.
Second change: A bigger task for the group decision part to give the project more weight. (Final Trial Review Online Evaluation GVT1 Uppsala student 4/11/2005)

Student E response

4. The project enabled you to work together effectively in your virtual group ?

No firm opinion

11. Our Global Virtual Team successfully achieved its goals

Disagree

What went well: We got off to a good start, a large majority of the group seeming enthusiastic about the exercise. We also managed to get the quiz completed to a reasonable standard.
First change: Make it a graded assessment (ie a percentage of the IBS grade) - this would encourage students to participate more.
Second change:Make the requirements of the quiz more clear. (Final Trial Review Online Evaluation GVT3 Auckland student 31/10/2005)

These responses present a varied set, with mixed views, especially concerning the success of the GVT. The *task* is a focus for many responses, with the quiz being described as too limited to encourage collaboration, not interesting enough, requiring clearer instructions and reasonably motivating. Strategies to improve *motivation* were suggested, with coercive approaches based on grades and increased weighting being

proposed.

The evolution of the set of events summarized in this section, demonstrates the diverse range of *TUM activities* in *episodic change* mode that accompanied the introduction of a new 'quiz creation task'. The unfolding of the consequent changes, adaptations and their outcomes has been described over the two collaborations subsequent to devising this revised task. A profile which attempts to portray the developments in this temporal bracket in a more succinct fashion is now given in Figure A20-6.76 below.

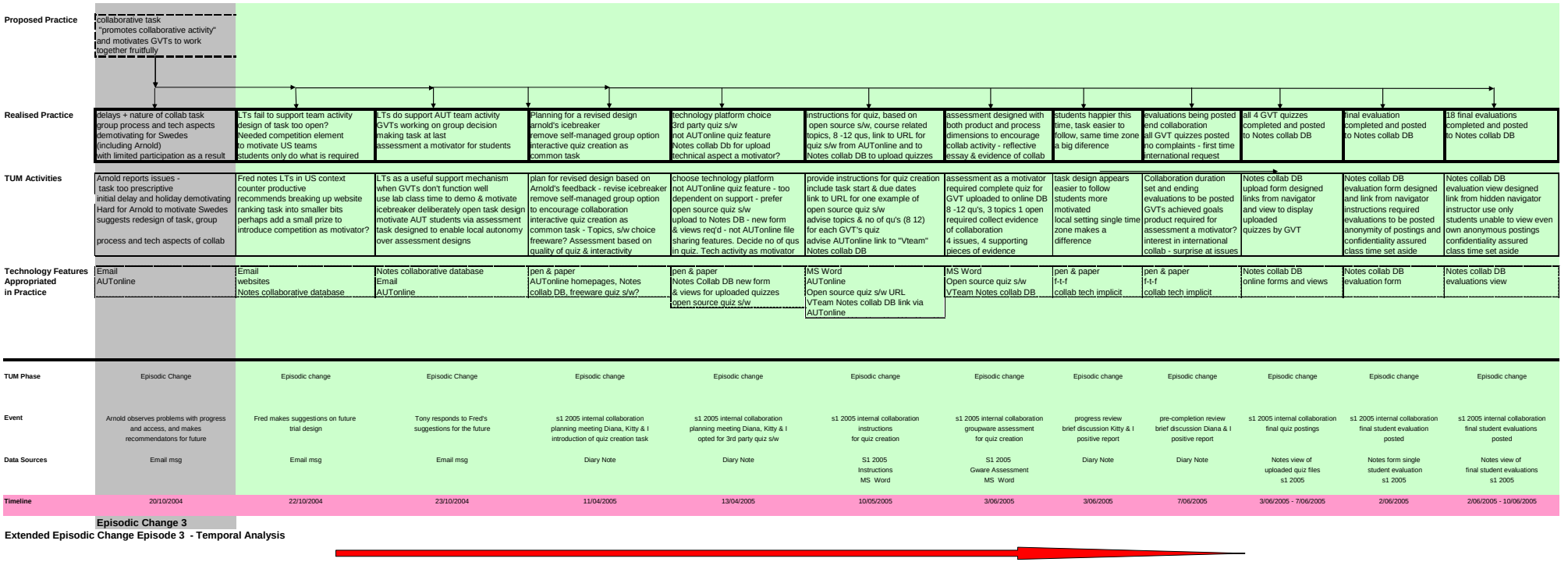


Figure A20-6.76: Temporal Bracket: Extended Episodic Change Episode 3 – S1 2005 Internal Collaboration Evolution Over Time

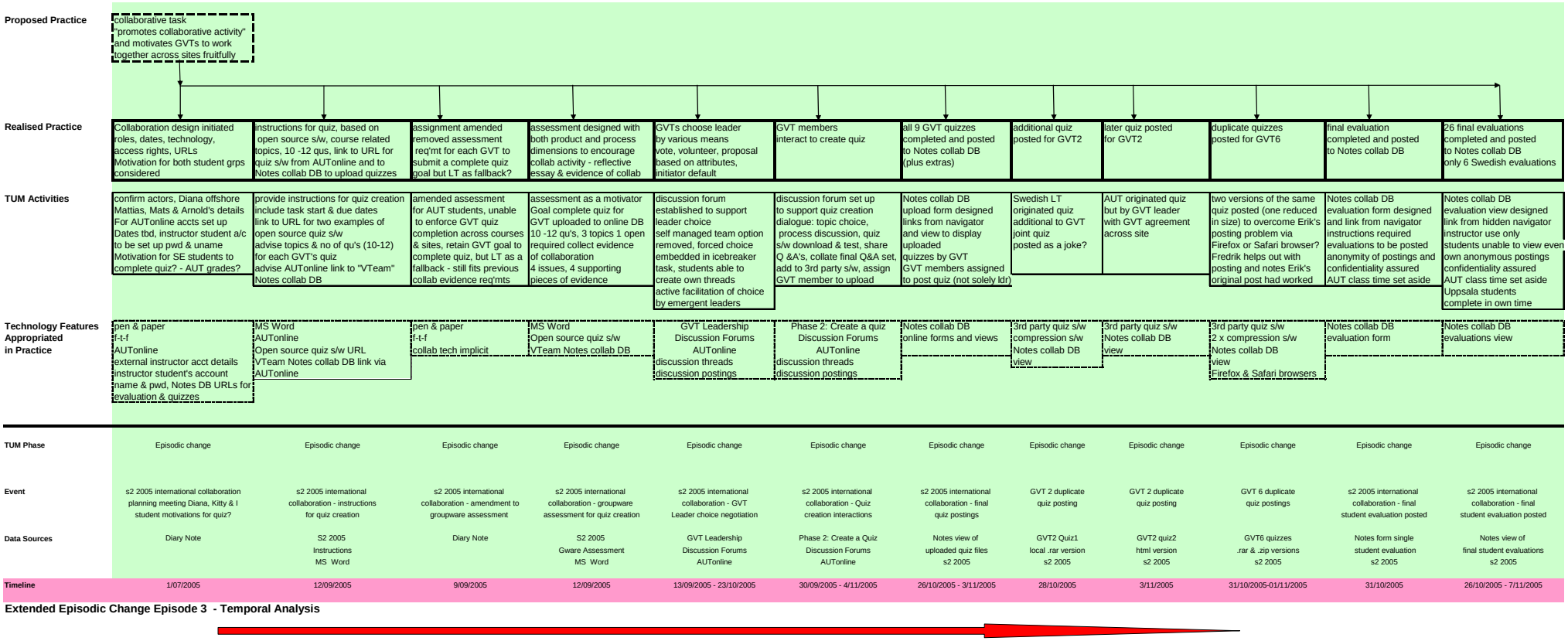


Figure A20-6.77: Temporal Bracket: Extended Episodic Change Episode 3 – S2 2005 International Collaboration Evolution Over Time

A20-6.9.6.2 Conclusion – Extended Episodic Change Episode 3

The evolution of the two collaborations and the adaptations of the collaborative "quiz creation' task depicted in figures A20-6.76 and A20-6.77 above, illustrates the complex and subtle nature of TUM in two separate field settings, where the local and the global have interacted. After initial success with the task redesign for the internal collaboration, the global collaboration added further dimensions which served to detract from the success of the process. Nonetheless the two collaborations present a far more positive picture than that of the 2004 international collaboration (cf. section A20-6.6.6 above), so the focus on collaborative task design and motivation has clearly had an impact. The collaborative task however, as but one phase element of the collaboration, cannot be fully separated from the preceding icebreaker phase which has served to build some sense of overall team, and provide a leadership structure, however fragile, within the GVTs.

Reviewed in terms of the three level "typology of interdependence" cited in Maznevski & Chudoba (2000), the '*quiz creation task*' appeared to function for some international GVTs partially at the desired "reciprocal" level where "work moves back and forth among people", but also at the "sequential" level where "work moves in a fixed sequence from one person…to the next". This may have been an inevitable outcome of the twelve hour time zone differences and the primacy of asynchronous communication media, where steps would naturally alternate between team members at remote sites. Comments from some teams as identified from their discussion threads, and evaluation forms, suggested that activity could bypass members of the group:

> Third change:
> The icebreaker stage, quiz, and leadership decision did not require much collaboration. It was only a matter of one member suggesting an obvious idea, and everyone agreeing, because there was not much to disagree about. (28/10/2005 GVT1 member evaluation excerpt)

Denning & Yaholkovsky (2008) have distinguished between levels of "working together", on a four level continuum from: 1) information sharing; to 2) coordination; to 3) cooperation; to 4) true collaboration, which they define as "working together synergistically". They criticize the design of most collaborative technologies arguing that, "most 'collaboration tools' do not guarantee that their users will collaborate on anything. Only a few tools qualify as collaboration technologies". The few examples the authors propose are actually collaborative processes such as "cooperative enquiry" and "at best are partially automated" (ibid.).

The suggested value of synchronous meetings in supporting collaborative activity by the GVT was noted in an AUT internal (s1 2005) student evaluation, excerpted below,

with a counter commentary from an international (s2 2005) GVT:

> Second change:
> Have mandatory weekly chat sessions so the group can communicate in real time (06/06/2005 GVT3 member evaluation excerpt).
>
> This project is indeed integrated with a course, but the project itself is quite abstract regarding the "connection " to the course. Hence, a lot of participants i Sweden do not take this seriously and are not very active in this project.
> Yes, I will remind our swedish GVT members, but I doubt all of them will participate in a live chat session. (20/10/2005 GVT8 member evaluation excerpt).)

In the above comment perhaps we see the barriers posed by both student motivation, and the inability of dispersed GVT members to work synchronously. For the internal trial, neither barrier was present. The students could work together both electronically and face-to-face, where (as Kitty had noted) "the same time zone made a big difference" (TC 3/06/2005). It is unclear to what extent the AUT GVTs in the internal collaboration of semester one 2005 did work face-to-face, but with some class time being dedicated to the collaboration, a degree of face to face collaboration may be assumed. In addition, for AUT students in the internal collaboration, the assessment was closely linked both to the course and the collaboration outcomes, which appears to have proved a motivating factor. In the International collaboration this link was not so clear for Swedish students, and since the reliance on completion of the GVT task had been removed from the AUT students' assessment, was now less pressing for AUT students. As the excerpts below indicate there were evident issues with non participation by some GVT members.

> First change:
> compulsary posting amounts to ensure memebers are contributing (5/11/2005 GVT1 member evaluation excerpt)
>
> First change:
> Make it a graded assessment (ie a percentage of the IBS grade) - this would encourage students to participate more. (31/10/2005 GVT3 member evaluation excerpt)
>
> Second change:
> Provides bonus to student who contribute more. This would help student to talk more and contribute more. (30/10/2005 GVT4 member evaluation excerpt)
>
> First change:
> Change the project's task to something more interesting than creating a quiz, if possible (31/10/2005 GVT6 Swedish member evaluation excerpt).

Designing tasks that would motivate both groups of students has been an ongoing quest in this work. For instance for the 2004 collaboration we had made the following observations:

> *"Given the notable motivational issues observed for the Swedish students we agreed a revised collaboration design to better suit the needs of each student cohort…In the second phase of the exercise the group decision task has also been modified, with the website topics for ranking now*

addressing collaborative technologies and thus being directly of relevance to each of the participating student cohorts, regardless of the different courses they are studying". (Clear & Kassabova, 2005)

In the 'quiz creation task' redesign we had again aimed to conceive a task that would motivate both cohorts of students. Denton & McKinney (2004) have identified the importance of "affective factors" in motivating student achievement, with two intrinsically motivating factors being the "*interest*" and the "*value*" of the learning activity. Juggling these two factors across two culturally diverse student cohorts, has proven challenging. For instance AUT students had found "*value*" in "summatively assessed work" (Clear & Kassabova, 2005), whereas Swedish students found "*interest*" in technically challenging work. The 'quiz' had a technical dimension which we had hoped would satisfy the Swedish students, and the assessment had a 20% weighting for the AUT students, a relatively high value and consistent with earlier recommendations for grade contribution by Jarvenpaa & Leidner (1998). As can be seen from the above quoted student evaluations, we had not been entirely successful with either student cohort. Removing the stipulation that GVTs "must have submitted a complete quiz in the online DB" from the AUT assessment for the international collaboration, impacted AUT student perceptions, and comments suggest that AUT students believed a greater degree of coercion would have been helpful.

However, such comments also reflect a simplistic response to the challenges of collaboration, to which 'command and control' solutions do not provide a ready answer. In their longitudinal study of six virtual project teams in a corporate environment, Furst and colleagues (2004) encountered very similar issues to those encountered in this collaboration with student GVTs, which suggests the situation of our student GVT's was not wholly artificial. In the stages of virtual project team development proposed by Furst et al., (2004) they highlighted (in their "norming midpoint transition") such challenges as: "difficulty in developing norms around modes of communication, speed and frequency of responding and commitment to use special software". In the "Performing Phase II" they cited "vulnerability to competing pressure from local assignments, frustrations over free-riding or non-committed teammates and communication discontinuities due to asynchronous communication". They also observed that in situations where "self managed virtual teams are created without a formal leader…the emergence of an informal or social leader is an agonizingly slow process" (ibid.).

By contrast, while many of the above challenges were experienced in these

collaborations (for which evidence has been provided earlier, also cf. the summary in appendix 15), many of these challenges had been successfully surmounted. Having removed the 'self-managed team option" the teams generally chose their leaders without much trouble. They then proceeded about their tasks relatively productively, which reflected in the generally positive outcome for both collaborations, from both a task performance and a student evaluation point of view. For instance the few selected excerpts below demonstrate some positive but balanced student perceptions of the more challenging international collaboration:

> What went well:
> The tasks were completed even though not everyone particiapted (31/10/2005 GVT5 member evaluation excerpt).
>
> 14. What did you gain from the International Collaboration that was of most value ?
> I considered the experience a great opportunity to interact with students from both another educational institution and a completely different country and culture. I also learned to appreciate the distance between us - time delays were a large factor in completing the exercise in a timely manner. Time management is key, moreso than with any other non-virtual group assignment (31/10/2005 GVT3 member evaluation excerpt).
>
> 14. What did you gain from the International Collaboration that was of most value ?
> I know better about virtual team. I learned that culture, communication, time area and other related issues may influence the operation of virtual team project. I learnt that virtual team can do better than the real team in some conditions as well. International collaboration is a really valuable and interesting experience (1/11/2005 GVT3 member evaluation excerpt).
>
> What went well:
> The team worked and interacted with one another quite well and no problems occurred. We were able to delegate tasks and complete them on time even with the constraints such as other commitments, not all members of the team making their share of contribution, etc. (28/10/2005 GVT9 member evaluation excerpt).

One of the most positive student evaluations came from the internal collaboration, with the following statements:

> What went well:
> The initial ice breaking stages went well with good, fast progress being made. Also, the quality of the qusetions included in our quiz was very good, covering a broad area of virtual teams, giving a good overview of the topic.
>
> 4. What did you gain from the International Collaboration that was of most value ?
> The thing of most value was suprisingly not the actual information that was being exchanged, but more the process of how the whole virtual team worked. What i found out was later emphasised through theory that was studied; i learnt how the team should/shouldn't operate before researching the topic and this was just through the experience of being in a team. I found my self agreeing and relating our processes to theory when reading articles about virtual teams (6/06/2005 GVT3 member evaluation excerpt).

In summary, the results of redesign of the collaborative task have been somewhat mixed although positive, and other interrelated factors have no doubt contributed to these outcomes. Yet the progress towards a more successful collaborative process (as a result of these *TUM activities* of *episodic change)* has been marked over this period which covered both the 2005 internal and international collaboration cycles.