

## Design Thinking Methods and Creative Technologies in Virtual Worlds

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### Abstract

Globalization and the virtualization of business has highlighted the challenges of managing a dispersed team and have encouraged further research into the benefits of face-to-face communications and how that might be simulated in a virtual world. It is anticipated that high profile research and development projects, such as Oculus Rift, and High Fidelity, could see a revived interest in virtual reality and virtual worlds and how these could augment design thinking for online collaboration. The research project was informed by a review of the literature with relevance to design thinking, the virtual, co-design, human centered design, and tacit knowledge sharing. This research project examined how virtual teams could use prototype tools and modes of design thinking by geographically dispersed groups within a shared virtual space. More specifically, it examined how teams of creative technologies students both apply and learn design thinking, by creating and using collaborative tools, designed in a virtual world, to be used in a virtual learning environment. The undergraduate students studying a design major in business will be asked to engage in a transdisciplinary dialogue with students from another school of creative technologies using the context of a virtual world. The research follows a constructivist approach to teaching the business students design collaboration to review the benefits of face-to-face collaboration, and how that might be simulated online in a virtual world using those tools and methods. The study demonstrates innovation in a number of ways through virtual collaboration between diverse students of business and creative technologies using design thinking methods and methodology. The paper will also present how business students understand design thinking and illustrate the barriers to innovation in a virtual simulation through iterative prototyping virtual tools that encourage co-design and human centered design. The paper concludes with some findings from the data collected during the research project, with some early commentary and discussion of those findings.

**Keywords:** Design thinking; Creative Technologies; Virtual Teams; Virtual Worlds; Face-to-face Simulation; Design Collaboration

### 1. Introduction

Design Thinking has become an important methodology with respect to companies and organizations who wish to be more innovative. Globalization and the virtualization of many aspects of business can be regarded as two megatrends that have highlighted the challenges of managing a dispersed team, and how the limitations of geographical separation can be overcome. Many regard face-to-face communications as the gold standard for teams wishing to design innovative products, services, processes and organizational structures (Dixon, 2000; Nonaka & Takeuchi, 1995; Von Krogh, Nonaka, I., & Ichijo, 2000). A literature review served as the rationale for the authors of this current research to begin exploring online tools and methods that might closely simulate face-to-face design thinking methods. It has encouraged the researchers to examine the actual benefits of face-to-face communications and how that might be simulated in a virtual world as one of many possible solutions to this problem.

It is anticipated that high profile research and development projects, such as Oculus Rift and High Fidelity, (currently still in alpha development), could see a revived interest in virtual reality and virtual worlds, and how these could augment design thinking for online collaboration. This research project will examine how virtual teams could prototype tools and modes of design thinking to be used by a geographically dispersed group within a shared virtual space. We have examined how teams of business students apply and learn design

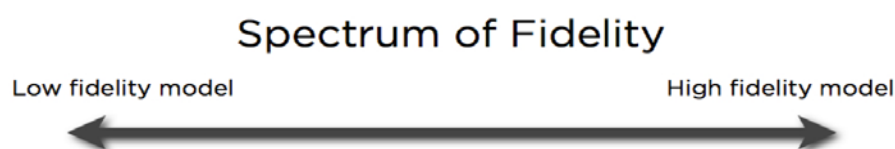
thinking, by creating and using collaborative tools, designed in a virtual world, to be used in a virtual learning environment. This paper will present the findings in this research project.

## 2. Literature Review

### 2.1 The Virtual

In the course of earlier research projects (Rive, 2008; Rive, Thomassen, A., Lyons, M., & Billinghamurst, M., 2008; Thomassen & Rive, 2010; Rive, 2012; Rive, 2016) it was noted that students and first time users in SL had found the interface difficult to learn and master. This is despite the fact that MORPGs (Massively Online Role Playing Games) have attracted millions of players worldwide, and participation in virtual worlds is becoming more and more common (Castronova, 2007). Preliminary interviews with the BCT (Bachelor of Creative Studies) students revealed that in 2016 first time users continued to struggle with the virtual world's GUI (graphic user interface) and expressed both frustration and confusion over the purpose of SL. The attitude towards the virtual world by some of the BCT students who were interviewed revealed that this negative approach could have been compounded by the commonly held belief that the 'virtual' is the antithesis of the 'real', and that virtual worlds were in some way not real, fake, and therefore, irrelevant. This could be summed up by a BCT student's comment about SL, asking 'what's the point?' However, a number of scholars and researchers have argued that the juxtaposition of the 'virtual' versus the 'real' is a false dichotomy, and that the virtual is best seen as the essence of the real and the opposite of the actual (Levy, P., 2009; Shields, J., 2003). Those who argue that even when subjects are interviewed about their experience in a virtual world, and they talk about 'RL' (real life) as opposed to SL, they also mention some liminal blurring and confusion between the two (Au, 2008; Boellstorff, 2008; Fornas, 2002; Guest, 2007; Heider, 2009; Loke, 2009; Meadows, 2008; Rive, 2012; Taylor, T.L., 2006).

The theory of presence is often discussed with reference to virtual worlds and virtual reality. One of the models developed by Lombard & Ditton (1997) was further simplified by Riva & Ijsselstein (2003) with their model of three modes of presence: social presence, physical presence, and co-presence, (being the intersection of the first two), (2003). This shared presence, in a virtual world, is often regarded as a subjective state, (Riva & Ijsselstein, 2003) and to borrow William Gibson's phrase from the cult novel, *Neuromancer*, (1984) is something like a 'consensual hallucination'. This state of presence can be analyzed and understood using another simple model, the spectrum of fidelity (Rive, 2009).



**Figure 1.** The Spectrum of Fidelity (2012)

The spectrum of fidelity (2012), presents a sliding scale that the 'informant', using qualitative cyber-ethnographic methods, can inform the researcher of the subject's sense of presence according to whether they claim to experience low or high fidelity of the virtual experience, in the virtual world, with respect to the simulation of actuality. This is typically a dynamic state and can vary under different social and temporal conditions. This can best be illustrated by the reaction of BCT students to the quality of the graphics and levels of engagement in SL.

### 2.2 Co-design in SL

There is little doubt that the demand for design innovation has forced traditional organizations to recognize the opportunities, and strategic importance of design and technologies. At the same time, they face pressures due to globalization and the virtualization of the office as employees become more geographically separated,

sometimes suffering from alienation and isolation. Design innovation enables these organizations to ensure their market positions and to achieve a leading edge in the market place. Due to this, it has become necessary to create innovative design concepts, development and management processes, as well as to tight integration of products and services (Aurich, Mannweiler, & Schweitzer, 2010), and to also find ways to overcome the tyranny of distance. Design can be understood as designers using co-design to explore solutions in an iterative process in which problems and solutions co-evolve (Cross, 2006). In management practice design thinking is being applied to achieve greater productivity, whether by way of higher-value products and services, better processes, more effective marketing, simpler structures, or better use of people's skills (Fleetwood, 2005). In recent years, some educators and practitioners have argued that "design thinking" can be useful in traditional management to frame problems and opportunities from a human-centered perspective, use visual methods to explore and generate ideas, and engage potential users and stakeholders in co-design (Brown, 2009).

Today's globalization and advancement in technologies has changed the working environment for designers. Designers face the challenge of creating world class work environments that support productivity, cut operating expenses, and most importantly facilitate innovation amongst an increasing mobile and interconnected workforce (Mau, B., 2004). Designers such as Brown (2009) have recognized that virtual worlds such as SL could be a way for virtual design teams, and managers to co-design despite being in separate cities, or time zones. To ensure quality standards and to create synergies between spatially distributed entities, virtual collaboration is a key aspect of connecting physical and virtual teams over large distances (Galambos et al., 2012). Mobile technology supported by ubiquitous high bandwidth Internet connections is reducing face-to-face human interaction. Technologies, such as groupware, videoconferencing, mobile phones, and the internet, all support the work of dispersed teams (Weimann, Pollock, Scott, & Brown, 2013). Selecting the appropriate kind of collaboration technology that best serves an organization depends on its purpose and desired result, which may change over time. 3D virtual worlds are becoming more frequently used tools due to their interactivity and real-time 3D objects, 2D visuals, audio, and text communications that assist collaboration (Koutsabasis, Vosinakis, Malisova, & Paparounas, 2013).

The design community is showing increasing interest in virtual worlds for collaborative design, and have begun to appreciate how they can facilitate collaborative activities in various design activities such as brainstorming, ideation, prototyping, communication and co-creation resulting in richer interaction and user engagement in the design process. With the rise in virtual collaboration in the business world, educators and researchers have also adopted virtual technologies in the education field. Educators have often emphasized that multi cultural immersion and intelligence have positive impact on the outcome of the project (Taras et al., 2013).

Despite the increasing interest in virtual reality and virtual worlds as an education or collaborative tools, design professionals and educators are still wary of these technologies. Only a few studies have investigated the effect of critical technological issues, such as the wrong tool selection, or limited internet access on performance as well as team, and team member satisfaction, in virtual work settings (Weimann et al., 2013). However, virtual reality presents a unique learning experience for students, and the effectiveness of highly immersive virtual reality has been well tested amongst K-12 students (Merchant, Cifuentes, Keeney-Kennicutt, & Davis, 2014).

### **3. Study Context and Method**

The research was conducted at Auckland University of Technology (AUT) across two schools, the Business School and Colab, a trans-disciplinary school that teaches creative technologies. The business students were third year undergraduate students studying with a major in design, and first year Colab students studying a Bachelor of Creative Technologies (BCT). The business students were doing an assignment for the paper "Design Collaboration" and were provided with theories and presentations on design thinking (Brown, 2009;

Kumar, 2012), and collaborative tools and design thinking methods in the virtual world, SL, (Second Life). The total number of students involved from both the disciplines was around 90.

Students were informed of some of the limitations, as well as the advantages of virtual worlds, and were asked to research and design prototypes using design thinking, and to create prototypes that would deliver tools and methods that would facilitate collaboration and co-design with the BCT students using human centered design in SL. They were further asked to test their prototypes and reflect on the effectiveness of their designs and how well their own team, and the BCT students collaborated using these tools and methods in the virtual world.

During the research it was emphasized to the business students that they should apply co-design and human centered design to their approach, including both physical ethnographic and cyber ethnographic observations, interviews, blogs and other possible quantitative approaches to data collection. The BCT students had been introduced to both critical thinking and reflective thinking but had little to no knowledge of design thinking theory, and methodologies. Students were encouraged to download the SL application and participate in the virtual world by observing, exploring and experiencing how people behave in SL.

The business students were asked to research and design prototypes using design thinking, and to create prototypes that would deliver tools and methods that would facilitate the BCT students to be able to collaborate, co-design and use human centered design in SL. They were further asked to test their prototypes and reflect on the effectiveness of their designs and how well their own team and the BCT students collaborated using these tools and methods in the virtual world.

#### **4. Findings and Discussion**

None of the students from either of the two groups had previously spent any time in SL, and some, with a gaming interest, regarded the virtual world as outdated and irrelevant. However, this lack of experience was seen as a research advantage by the authors as it encouraged the business students to approach their research environment and subjects with reduced prejudice, and were encouraged to apply design thinking, and human centered design, researching their design as ethnographers, and seeing themselves as 'a stranger in a strange land' (Heinlein, 1961). They were instructed not to assume that they understood the context of the situation, or the students that they were researching, but to allow the informants to describe their experiences. In the first interviews with some of the BCT students one of the business student teams found an overwhelmingly negative reaction to SL describing it with the following comments : 'crappy quality'; 'visually sucks'; 'old'; 'not visually appealing at all'; 'not enjoyable to collaborate on because it's too slow'; 'don't know how to use it'; 'prefer Facebook or face to face collaboration'; 'isn't quick and easy'; 'what's the point?'; 'need knowledge and skill to navigate and use the site'; 'it's not upgraded'; 'not helpful'; 'don't have a desire to use it' [sic]. Some of these responses would suggest they had a low fidelity experience. A number of the BCT students assumed that SL was a game, and responded 'I can't believe in my first class I was asked to download a game' and it is believed that this could have led to disappointment as they compared the SL graphics quality to that of current console games that are now approaching photo-realism and higher fidelity. A number of BCT interview subjects responded that their preferred way of communicating and collaborating in a group was in a face-to-face meeting.

However, other BCT students were positive about their experience in SL and commented that once they got over the 'weird' aspects of the virtual world they found it exciting, and creative. One BCT student commented in their blog that "I found it an opportunity to explore digital identities and new experiences". In their early encounters in SL they found it exciting to meet new people, and could appreciate how the real-time 3D modeling tools could promote collaboration.

This research project enjoyed a mixed reality environment, meaning that the business students could physically visit the BCT students in their actual design studio, as well as collaborate and communicate in the virtual SL environment. This gave them insights into the advantages and limitations of collaboration in a virtual world compared to a face-to-face experience.

The business teams developed a number of concepts that they wanted to prototype with the BCT students to test design collaboration. The virtual world afforded innovative design thinking methods and concepts that would not be contemplated due to both the feasibility and viability of the prototypes. For example, one concept was a virtual treasure hunt for dispersed teams, with design thinking clues, matched with virtual rewards, that were envisaged to assist in learning both co-design methods and the difficulties of the SL GUI. Using design thinking, in the SL context, the various business teams collaborated to come up with a number of innovative concept prototypes (Kumar, 2012) and collaborative tool prototypes that they envisaged and discussed amongst the teams. While some of these prototypes could have easily applied to a shared physical presence, there were some that provided isolated teams with co-design and human centered design methods despite the team's geographic separation, and some prototypes that went beyond the capability of the physical context using real-time 3D objects, including metadata, interactivity, and cost effectiveness that could only be achieved in the virtual world, or with computer aided co-presence. The virtual environment and architectural context can communicate cultural expectations and suggest a response, for example a virtual conference seating arrangement and stage would provoke a different response in SL than a virtual nightclub with mood lighting, speaker stacks and particles (Rive, 2012).

Prototyping plays an important role in design thinking, co-design, and human centered design. According to Highsmith (2004) due to the increasing pressures of time and cost of design, designers should look to information and communication technologies to provide rapid prototype designs using 'bits and bytes' as opposed to 'atoms', or physical artefacts. SL is particularly good at collaboratively and rapidly prototyping 3D objects in real-time that can be created, and viewed, by remote design teams, at the same time, in a virtual environment, while sharing co-presence. One of the business students remarked that rather than using sketching as a traditional design tool in SL, that it was easier to create a 3D prototype.

In a workshop that intended to use co-design, in order to create a prototype of a virtual classroom to teach creative technologies to the BCT students, the researchers prototyped the commonly used Postit™ note method in SL. They used a free web based, sketch and whiteboard application, to trial collaborative design ideation sessions. While the prototype was intended to enable the design thinking method that suggests, one idea, one sketch, per virtual Postit™ note (Brown, 2009). It was also thought that a collaborative sketch application, whereby more than one avatar, or remote team member, could work on a sketch together, was also thought to be useful. However, while the researchers were able to demonstrate a proof of concept by projecting the SL experience in a physical classroom to the BCT students, the prototype demonstrated limitations because the SL viewers, on the student's computers, only showed local interaction for each student, and did not allow effective screen sharing in SL.

The researchers then found that the BCT students quickly lost interest in this simulation of this common co-design method. It was noted that there is an educational challenge to maintain focus in SL, perhaps that was because it was perceived as a game, and the students found it was more fun to experiment with their own creativity, and suggests further research. The lack of focus also seemed to be related to the fact that the workshop was not a formal class, and that the BCT students experienced a co-presence in a mixed virtual and actual physical environment in a design studio. In the workshop it was possible for the subjects to look at the researcher's projected image of their SL viewer, shown in the classroom, and then physically move to another student's computer to compare, and converse about what they were trying to do, which generated lots of enthusiasm and noise. While this lack of focus hindered the design collaboration and testing of the prototype,

it should be noted that the excitement and creativity of the students were both at a high level, and could be a good sign of how design collaboration could be encouraged in SL. Some of their own prototypes were interesting, and encouraged excited collaboration. While the sketch prototype was designed as a 2D drawing tool, the students quickly iterated on that design and prototyped immersive 3D spheres and mapped 2D 360 degree photos, including one from a NASA control room, and a picture taken by one of the students of the classroom. These simple prototypes were found to be quite compelling as avatars were able to walk inside the spheres and experience an immersive experience that could be shared by remote teams. This also suggested that the new virtual world, High Fidelity, being developed by Philip Rosedale, the founder of Second Life, that enables immersive 3D head mounted displays, such as Oculus Rift, could be a welcome feature of new virtual worlds. This suggests future research into virtual design collaboration when this technology becomes available and is more user friendly after the alpha development phase.

Further, with respect to rapid prototyping in SL it was also noted by the researchers that because the students had a limited attention span, and when faced with lots of opportunities for self-expression, in order to engage stakeholders in co-design a prototype in a virtual co-design space should apply the Lean Startup method, or what Reis has called a 'minimum value product', or MVP (Reis, 2011). The prototype has to be able to be useable, although the proof of concept was also useful to prompt discussion in this particular case. As this first prototype did not demonstrate its capability as a MVP to the BCT students they did not engage in the design 'conversation' and the co-design flow was lost.

A later prototype tested by one researcher controlling two avatars, on two different computers, showed that it was possible to use a free web based whiteboard sketching tool that could facilitate both single sketch ideas, and collaborative sketches with the added bonus of real-time text, and the posting of web images, and uploads from local computers. This was all made possible with SL's 'web on a prim' technology that enables web browsing on 3D objects in SL, for example a web page on a cube. The authors of this paper had designed a collaborative sketch prototype in SL that combined the interactivity and speed of Postit™ notes, with 3D objects, text, and images. They are aware that this may go against the recommendation of Brown, and others from IDEO, who recommended that in a Postit™ note ideation and brainstorming session that there should only be one image, or idea per note (2009). It could be that because of the increased complexity of this multimedia approach that it might defeat the purpose of generating large quantities of ideas in a short, unfiltered, collaborative session. However, this collaborative prototype tool could be useful for later iterations of a design prototype in a focused discussion around a specific prototype. Future trials of this prototype could suggest certain refinements, and expose other opportunities and limitations of this approach.

One of the other advantages of prototyping in SL is both the interactivity using LSL, the Linden Scripting Language, and multi-sensory inputs. Core to the creative technologies workshop discussed earlier was a multi sensory experience that included shared music, sound effects, and visuals experienced in SL. The platform has the ability to share real-time playback of these media. A number of prototypes of DJ music playback systems were trialed by the students and researchers during the workshop including web based applications such as: Sound Cloud; YouTube music videos; the web version of Spotify; and You.DJ app that also showed an interactive simulation of two turntables that could be cross faded and effected as a shared multimedia experience in SL for those not physically present in the same place.

## 5. Conclusions

This initial research project highlighted a number of opportunities to explore early prototypes for design collaboration and design thinking in a virtual space and ways to explore new creative technologies for design students and professional teams in upcoming virtual technologies. There were some promising examples of how SL, and future virtual worlds, can augment and even possibly replace, some of the physical methods of design thinking.

The ability to share, interact, and collaborate, and thereby, co-design within a virtual world could provide solutions to the application of design thinking in education and professional praxis. The current technology is still limited in the way that it can simulate physical face-to-face design thinking methods, however, it is expected that the next generation of virtual worlds and virtual reality will improve these simulations. Further research into this area will provide data into what are the limitations and rewards of design thinking in virtual worlds and virtual reality.

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