Activity-Instance Modelling

A design lens to examine everyday activities at a granular level

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To Catalina, Ernesto, Carlos and the rest of the people whom I think of and long for today and always.

Para Catalina, Ernesto, Carlos y el resto de las personas a quienes pienso y añoro hoy y siempre.

Abstract

Everyday activities (EAs) can be broadly defined as the practices that people carry out as part of their daily lives. The focus of this doctoral investigation is the examination of EAs from a design viewpoint. Specifically, the primary objective of this investigation was to develop a new framework for examining EAs at a granular level, that is, focusing on individuals' views and experiences when performing these practices.

The above framework, eventually named Activity-Instance Modelling (AIM), was developed through a bricolage approach. In other words, the development of AIM involved the adaptation and integration of methods commonly used in design with methods from areas where systematic data analysis is prioritised. The areas from which methods were sourced to develop AIM were Multimodal Interactional Analysis (MIA) and Social Network Analysis (SNA).

The choice of these two areas (MIA and SNA) was based on the ontological and epistemological similarities they have with the design. Both MIA and design are concerned with the practical and symbolic interactions that people establish with artifacts. On the other hand, both in SNA and in design, visual representation techniques are used to develop a better understanding of interactions between different types of artifacts and actors.

The specific methods that served as building blocks to develop AIM were the interview (from design), multimodal transcript (from MIA) and network visualisation and degree centrality indicator (from SNA). The adaptation and integration of these methods was carried out throughout three empirical studies on EAs. Each of these studies served a specific purpose in the development of AIM.

The first study served to establish the analytical foundations of AIM. The second study was conducted to ensure that AIM would allow for effectively collecting and analysing primary data on EAs. The third study served a dual purpose. On the one hand, the third study served to incorporate a data visualisation component to AIM, thus more closely aligning it with designers' forms of inquiry. In addition, the third study served to confirm that AIM allowed for examining activities other than the one used to establish its foundations.

The three studies above were supplemented by a design exercise. It is pivotal to underscore that this exercise was not intended as a seminal contribution to design nor to showcase the utility of AIM as a design tool. Rather, the design exercise was conceived as a crucial step in the very process of developing AIM. Specifically, the design exercise was viewed as a diagnostic effort to identify aspects of AIM that might require further refinement before the framework could be used in real design scenarios.

Together, the three empirical studies on EAs and the design exercise resulted in a framework that allows to systematically examine the realisation or physical description of EAs following a qualitative-inductive approach.

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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 submitted for the award of any other degree or diploma of a university or other institution of higher education.

Miguel Montiel.

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Co-authored publications

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Chapter 1 Introduction

Everyday activities (EAs) can be broadly defined as practices consistently performed by a significant portion of a society's members. The concept of EAs is central to this investigation. However, it is pivotal to underscore that the objective pursued in this investigation was neither to deepen the understanding of any specific EAs nor demonstrate the utility for design purposes, of any particular theory concerned with EAs.

Instead, what this investigation pursued was innovation in the study of EAs within design. Specifically, this investigation was aimed at developing a novel framework for examining EAs at a granular level, thereby producing insights that can inform artifact design. This chapter explains the reasoning behind the definition of the above objective.

The chapter is organised into three sections. Section 1.1 elaborates on the concept of EAs, emphasising the advantages that these practices offer as a unit of analysis in design. Section 1.2 then reviews the strengths and limitations of existing design methods for examining EAs, highlighting the need for new tools that support the micro-scale or granular analysis of these practices.

Next, Section 1.3 presents the research question that guided this investigation and also outlines the methodology followed to address the research question. Finally, Section 1.4 details the structure of this thesis and provides an overview of the content of the subsequent chapters.

1.1 Everyday activities as units of analysis in design

The conceptualisation of EAs by designers frequently draws upon theoretical perspectives from sociology, psychology, and other areas within social science, as evidenced by Kuijer et al. (2013), Hielscher et al. (2007), and Kaptelinin and Nardi (2006). Within social science, there is an abundance of definitions and classifications of EAs. For example, Susie Scott (2013) defines EAs as practices that are *pervasive*, *mundane* and *routine*.

Scott's use of the term 'pervasive' to characterise EAs emphasises that these practices are consistently conducted by a significant portion of a society's members. A pervasive

practice is also inherently mundane since most people are accustomed to performing it on a regular basis. Over time, this continuous realisation leads people to perform EAs routinely, that is, with minimal conscious thought. For greater clarity on Scott's vision of EAs, consider the two activities discussed below.

In Western societies such as Aotearoa New Zealand, dog walking is an activity that aligns with Scott's characterisation of EAs as practices that are pervasive, mundane and routine. Recent studies show that 34% of New Zealanders own at least one dog (Companion Animals NZ, 2020). Many dog owners take their pets for a walk daily, and in some cases, more than once a day. Furthermore, many dog owners adhere to consistent times and routes for their daily walks. This repetition often leads to dog walking becoming almost automatic, requiring minimal conscious thought about the path to be taken.

In contrast, a surgery stands as an activity that does not align with Scott's characterisation of EAs. Surgeries are specialised tasks, performed exclusively by trained medical professionals, not by significant portions of a society's members. Moreover, for most people undergoing surgery is not a mundane event but rather an extraordinary occurrence.

Another key aspect of EAs is their dependency on artifacts. Without artifacts, the execution of many EAs would become challenging, if not outright impossible. For example, leaving a note for someone would not be feasible without an artifact that can be marked (e.g., paper) and one with which marks can be made (e.g. pencil). The pivotal role that artifacts play in EAs becomes even clearer when considering that numerous EAs are named after an artifact or a process inherently performed with an artifact (e.g. dishwashing).

The relevance of artifacts in EAs can be further understood through the lens of Lev Vygotsky's cultural-historical psychology (1980, 1982). Vygotsky posits that artifacts enable people not only to conduct activities but also to acquire and perpetuate knowledge. Leontiev (1978, 1981) extended this idea by emphasising that the characteristics (or design) of artifacts mirror the knowledge amassed by societies over time. Individuals embody and contribute to the continuation of this shared knowledge by putting artifacts to specific uses during activities (Miettinen, 2001). For example,

hunting arrows may incorporate a broad tip designed specifically for taking down large animals. By using this type of arrow for hunting a buffalo, an individual validates both the design choice to incorporate a broad tip into the arrow and the shared understanding that broad-headed arrows are effective for hunting large preys.

Based on the above ideas by Vygotsky and Leontiev, EAs can be considered as practices whose study can contribute to advancing the understanding of the *use* of artifacts. Drawing inspiration from Sarah Ahmed (2019), use can be defined as the harnessing of the functions (or capabilities) that artifacts have given their design. For example, a chair has (among others) the function of supporting the weight of the human body. This function is derived from specific aspects of the chairs' design, including their structure, shape and materials (Ashby & Johnson, 2010).

People can harness the functions of an artifact in a myriad of ways. Sitting on a chair to rest and standing on a chair to reach a high shelf are two distinct ways in which people can harness a chair's function of supporting the weight of the human body. People can also harness the function of chairs to support the human body for recreational purposes. An example of this use of chairs is the game musical chairs (also known as Trip to Jerusalem). In this game, participants walk around a row of chairs while music plays and compete to sit on one of the chairs when the music stops (Takata, 1997). Furthermore, sitting on a chair of a certain size, shape, and material can serve as a way for people to denote their rank within an office hierarchy (Crilly, 2010).

The myriad of uses that people give to artifacts can be better understood through the examination of EAs. For clarity, consider how examining dining or housekeeping practices can help uncover underlying motivations leading people to use chairs as seats or makeshift ladders. For some people, dinner primarily represents an opportunity to spend time with their family. On this basis, the use of a chair as a seat during dinner can be considered to stem from a social purpose. Conversely, people may stand on a chair to clean a high shelf as part of their preparation for entertaining guests. In this instance, the use of a chair as a makeshift ladder may be motivated by an interest in being a good host.

As the dinning and housekeeping examples illustrate, EAs are units of analysis that can inform design considerations beyond mere functionality. Examining EAs can help

designers uncover the underlying and often symbolic motivations driving the uses that people give to artifacts. This point aligns with the perspective of Kaptelinin and Nardi (2012a, 2006), who argue that human activities are motivated not only by fundamental needs for survival, such as eating and sleeping, but also by culturally and socially derived needs, such as being a gracious host.

Recognising that examination of EAs can provide insights into artifacts that go beyond mere functionality, this doctoral investigation was oriented toward the scrutiny of such practices.

1.2 A gap in designers' toolkit to examine everyday activities

The study of EAs in design is not new. Existing design handbooks, such as that by Martin (2012), include a variety of methods for examining EAs. Given their focus, these methods are categorised in this investigation as either *holistic* or *granular*. Holistic methods offer a macro-scale perspective on EAs by providing an understanding of how such practices are influenced by traditions, laws, public policies, social conventions, power dynamics, and other sociocultural factors. Granular methods, on the other hand, focus on understanding and dissecting individuals' experiences when performing EAs.

The *Activity Checklist* developed by Kaptelinin et al. (1999) is a prime example of a holistic method that offers a macro-scale perspective of EAs. This method consists of a list of themes specifically integrated to prompt designers to consider how specific sociocultural factors impact the unfolding of EAs. To illustrate the application of the Activity Checklist, consider how one of the sociocultural factors covered in this method, namely, the division of labour in a society, can influence people's approach to laundry.

In societies where household chores are traditionally the responsibility of one family member, the average laundry loads can be considerable in size as they include garments worn by several people. Conversely, in societies where household chores are more evenly distributed, different family members might wash their clothes separately, resulting in smaller laundry loads.

The division of labour within a society can extend beyond human participants to include artifacts themselves (Latour, 1992). Consider how in industrialised societies, the availability of washing machines can free people from certain labour-intensive steps of

the laundry process such as scrubbing and rinsing. This automated approach to laundry contrasts with that of non-industrialised societies where clothes are washed manually.

As the laundry example shows, holistic methods can offer valuable insights into how specific sociocultural factors influence the unfolding of EAs. However, holistic methods exhibit key limitations. Due to their sociocultural focus, holistic methods tend to highlight aspects of EAs that are general or common to the majority of members of a society. This emphasis on the collective experience, while valuable for a comprehensive understanding of EAs, can lead to the inadvertent omission of micro-scale aspects of EAs that are pivotal from a design viewpoint. The meanings that people assign to artifacts is one of these aspects.

Beyond their practical utility, artifacts have emotional significance, which may impact how people use them in EAs (Crilly, 2010; Mugge, 2007). For example, given its emotional significance, a garment inherited from a deceased relative can be worn only on special occasions and be washed and stored with special care. Furthermore, the emotional significance of an artifact can influence how people carry out EAs not directly related to the artifact. For instance, when wearing a garment with emotional significance, a person may exercise extra caution during dinner to avoid accidentally staining the garment with grease, sauce or other foodstuff.

The meanings attached to artifacts are deeply personal and can differ significantly from one individual to another. Thus, to truly capture these unique human-artifact relationships a granular lens that focuses on the individual views that people have of artifacts and EAs is essential.

Another aspect of EAs that may not be fully captured through holistic methods is the ingenuity that leads individuals to put artifacts to *queer uses*. Proposed by Ahmed (2019, p. 199), the term queer use refers to “how things can be used in ways other than for which they were intended or by those other than for whom they were intended”. For example, clothes pegs are primarily created to hold garments while they dry after washing them. However, people can use clothes pegs for a number of other purposes including keeping bags of food sealed, preventing cables from tangling, hanging photos on a string for decorative display, and so on.

As Ahmed goes on to explain, queer uses emerge from people's ingenuity. In the quote below, Ahmed highlights how the qualities of an artifact present a range of possibilities for action that individuals can harness in creative ways to meet goals that often extend beyond the purpose for which artifacts were originally intended.

> Even when we use something in ways that were not intended—a cup as a paperweight, for instance— we do so given the qualities of a thing. Perhaps when we use something in ways that were not intended, we are allowing those qualities to acquire freer expression. The keys that are used to unlock a door can be used as a toy, perhaps because they are shiny and silver, perhaps because they jangle (Ahmed, 2019, p. 26).

Furthermore, people's ingenuity may be a factor even when artifacts are used for the purposes for which they were originally created. In his seminal work *Our Own Devices: How Technology Remakes Society,* Edward Tenner (2009) discusses how people with different profiles (from soldiers to athletes) have developed shoe-tying techniques that suit their unique needs and contexts:

> Laces also represent group identity. In North America, Europe and Asia, school authorities occasionally ban colored laces for their association with gangs. Leaving laces threaded but with ends united has been and emblem of youth rebellion. Not wearing them at all with lace-up shoes has, like baggy trousers, been part of inner-city prison chic. (At the other extreme, Lord Baden-Powell established a "Scout's way" of tying laces that concealed both the knot and the end of the string). And even among conservatively dressed adult males there are notable differences in shoelace technique (Tenner, 2009, p. xiii).

Identifying and examining inventive artifact uses such as the ones Ahmed and Tenner describe requires a granular lens that delves into the unique and creative ways in which particular individuals leverage artifact functions when conducting EAs. This micro-level examination can help designers create solutions that directly address the needs and values of specific individuals or groups, which resonates with emerging design approaches such as *Designs for the pluriverse* proposed by Arturo Escobar (2018).

The spectrum of design tools for examining EAs at a granular level includes observation-based methods such as the *AEIOU framework* (Hanington & Martin, 2012; Wasson, 2007). Using this method involves describing the unfolding of EAs based on five key components: Activities (tasks people perform), Environments (spaces where these activities occur), Interactions (exchanges between people and their surroundings),

Objects (artifacts within the environment that play roles in the activities), and Users (the people being observed).

Granular methods such as the AEIOU framework, which are based on observation, can provide insights into what people do with artifacts in EAs. However, these methods do not consider people's thought processes, limiting the understanding that designers can gain into artifact use. For clarity, consider again the laundry example. Through observation, it is possible to recognise how some people wash their clothes in two or more separate batches. However, observation alone does not offer insights on the criteria that people follow to separate their clothes (by colour, fabric type, level of soiling, and so on) nor about people's motivations for washing specific groups of clothes separately.

To examine both what people do and think when performing EAs, designers can rely on granular methods such as the *Think-Aloud Protocol (TAP)* that combine observation with questioning. Using TAP involves asking people to verbalise what they observe, think, and feel while conducting EAs (Jaspers et al., 2004). In this way, designers can identify key decisions that people make on the fly when performing EAs and observe how such decisions influence the use people give to artifacts.

Despite the advantages they offer for examining what people do and think when conducting EAs, granular methods that combine observation with questioning also have limitations. Having been created for use in industrial design contexts where rapid decision-making is a priority, these methods often do not provide a systematic approach for data analysis, as highlighted by Sosa in the quote below. As a result, EAs analyses conducted with granular methods that combine observation and questioning tend to occur mostly in designers' heads and without thorough documentation.

> Designers carry out informal research practices and researchers carry out informal design practices. By the former we mean those primarily occupied in design activity who intuitively conduct a review of historical precedents or who unsystematically apply some measurements using a prototype or ad-hoc instruments such as surveys or interviews. Such informal research activities are in service of gaining insights for their design activity and are not carried out to claim a direct contribution to the knowledge base of the field except through their role in loosely informing the final design product (Sosa, 2021, p. 391).

The absence of a clearly defined data analysis process in granular methods that combine observation and questioning may lead to designers (particularly novice ones) not reporting in sufficient detail the process to derive findings from the data. Consequently, designers may struggle to effectively communicate and justify their design recommendations to their teammates (Kiernan et al., 2020; Krishnakumar et al., 2021). This communication barrier may adversely affect decision-making in organisations that depend on collective input to define product and service features (Drury et al., 2012; Moe et al., 2012). Without a clear understanding of how their peers produce design recommendations from research, designers are not well positioned to challenge or build upon those recommendations.

Recognising that granular methods combining observation with questioning often lack a systematic approach to data analysis, this investigation identifies a significant gap. These methods can lead to undocumented analyses and insufficient communication of design recommendations. Addressing this gap, the primary objective of set for this investigation was to develop a framework for the systematic and comprehensive examination of EAs at a granular level.

1.3 Addressing the gap in the designers' toolkit

The research question guiding this investigation was: How can design practice be informed by the comprehensive and systematic examination of artifact use in everyday activities?

The inclusion of the terms *comprehensive* and *systematic* in the research question was deliberate. As established in the previous section, the uses that people give to artifacts in EAs can reflect motivations that go beyond the practical. Thus, by referring in the research question to the "comprehensive" examination of artifact use, the present investigation was directed towards devising a framework to examine not only what people do with artifacts in EAs, but also the ideas that impact or shape such behaviours.

In turn, the term "systematic" was incorporated into the research question to set the present investigation towards devising a framework with two fundamental attributes. Firstly, the framework would be firmly grounded in well-established theoretical principles, providing a solid and reliable foundation for its application. Secondly, within

this framework, the processes of data collection and analysis would be transparent and reproducible. The above attributes align with Sander's (2012) characterisation of systematic research as that which is which is theory-based, explicit and transparent.

The research question also refers to "informing design practice". Harold G. Nelson and Erik Stolterman (2012) define design as the crafting of mediums that enable more desirable futures. In crafting these mediums, designers face several decisions, ranging from the selection of preliminary design concepts, to specifying the looks of finished products (Herrmann & Schmidt, 2008). Thus, by referring in the research question to "informing design practice", the intention was to steer this investigation towards creating a framework that supports decision-making regarding the design of artifacts.

1.3.1 A design-centric methodology

Central to the methodology devised to address the research question was the recognition put forth by scholars such as Nelson and Stolterman (2012) and Nigel Cross (2006) that design is a domain with its own pedagogical and research traditions. Accordingly, the methodology employed in this investigation was structured around abilities that Cross (2006) deems as distinctive of designers. In other words, the methodology was designed to ensure that key abilities highlighted by Cross as distinctive to designers were actively applied during the development of a new framework to examine EAs. The list of abilities that Cross considers distinctive of designers includes: the use of combinatorial thinking and the use of abductive thinking.

Leveraging combinatorial thinking

One of the design-related abilities shaping this investigation's methodology was the use of *combinatorial strategies*. As noted by Cross (2006) and Gero (1994), designers often generate innovative solutions by combining the functionality of existing designs. Consider how smartphones incorporate functionality previously found in a wide variety of design solutions, from wired phones and calculators to calendars, watches and credit cards.

Drawing inspiration from designers' use of combinatorial strategies, the decision was made to develop the framework using a *bricolage approach* (Kincheloe, 2011; Yee & Bremner, 2011). Specifically, the framework to examine EAs at a granular level would be developed by integrating methods commonly used in design with methods adapted

from research domains where the transparent and structured analysis of data is prioritised.

The decision to adopt a bricolage approach for developing the framework was inspired by the perspectives of scholars such as Sosa (2021), Yee (2017) and Kara (2015) whose work demonstrates how the integration of design methods with conventional research methods can lead to revolutionary research approaches:

> I argue here that the interstices between those who inform their normal design practice by/through formal research practices and those who inform their normal research practice by/through formal design practices can be better understood as nebulous pre-paradigmatic spaces that are neither here nor there…The revolutionary practices that emerge in these interstices escape binarism. Interstices provide shelter to emerging practices for those who choose not to adopt a scientific/social/humanities/artistic academic tradition to inform their design practice. They also provide fertile ground to those who choose not to dress up their design practice as research. Rather, these individuals and their emerging communities find intellectual excitement, unexplored opportunities for impact, and merit in the transformation of normal practices to explore revolutionary modes of integrating design and research (Sosa, 2021, p. 393).

The two areas from which methods were sourced to develop the framework were *Multimodal Interactional Analysis (MIA)* and *Social Network Analysis (SNA)*. Broadly speaking, MIA can be defined as a framework for systematically examining a broad range of communicative modes, spanning from spoken and body language to artifact-mediated communication (Norris, 2004, 2012). Due to its broad analytical scope, MIA was seen as a research domain whose methods would offer an ideal basis for developing a framework that considers what individuals do, think and say when conducting EAs.

Social Network Analysis (SNA) on the other hand, is a research domain concerned with visualising, describing, and examining interactions between sets of heterogenous elements (Tabassum et al., 2018; van Duijn & Vermunt, 2006). The analysis of interactions in SNA is based on a visual representation system made up of two types of graphic elements: *nodes* and *links*. Nodes are geometric figures (usually circles) that can represent people, companies, websites, or other entities. Links, on the other hand, are

lines drawn between two nodes to indicate the interaction between the entities that the nodes represent (Prell, 2012; J. Scott & Carrington, 2011).

The visual representation system used in SNA opens opportunities to systematically depict and analyse key aspects of EAs, hence the decision to source methods from SNA to create a new framework to analyse EAs. For example, nodes could be drawn to represent the artifacts that people use in different EAs. Next, links, could be drawn to indicate the artifacts that are used in the same activity. This visual mapping can help designers better understand how modifications made to one artifact could influence the use of other artifacts associated both with the same activity as the modified artifact and other activities.

Leveraging abductive thinking

The use of *abductive thinking* is a second ability that Cross highlights as distinctive of designers and that influenced the methodology used in this investigation to devise a novel framework for examining EAs. The term abductive thinking refers to taking intuitive leaps, often based on incomplete information, to arrive at innovative solutions or ideas (Cross, 1997; Kolko, 2010). As highlighted by Cross in the quote below, the use of abductive thinking in design is exemplified in how designers develop solutions progressively, that is, by formulating initial proposals that they iteratively refine to a satisfactory point.

> A central feature of design activity, then, is the reliance on generating fairly quickly a satisfactory solution, rather than on any prolonged analysis of the problem. In Simon's (1969) inelegant term, it is a process of satisficing rather than optimising; producing any one of what may well be a large range of satisfactory solutions rather than attempting to generate the one hypothetically-optimum solution (Cross, 2006, p. 7).

Drawing inspiration from designers' use of abductive thinking, two methodological decisions were made. First, the framework to examine EAs at a granular level would be developed progressively. That is, an initial or preliminary framework would be developed, which would then be expanded and refined in subsequent phases. Second, the preliminary framework and its subsequent refined and expanded versions would be formulated through the course of a series of empirical studies on EAs. This progressive and empirically-grounded approach to developing the framework mirrors the iterative

processes often used by design professionals to refine methods for artifact design, a practice underscored by Schønheyder and Nordby:

> …design practitioners at Halogen use and develop design methods through conscious and coordinated cycles by which design methods evolve from project to project. In a cycle, a design method is pragmatically adapted, developed and used to fit situational needs, design practitioners' skillsets and the organisation of design activities. The overall goal of a cycle is to select, adapt and use appropriate design methods together with [Human Factors] HF methods to improve the quality of the design process and project delivery, while maintaining a design practitioner's integrity (Schønheyder & Nordby, 2018, p. 10).

Besides aligning this investigation with approaches commonly used in design for method creation, the decision to develop the framework through a series of empirical studies on EAs was made for reasons of applicability and quality. Developing the framework through a series of empirical studies would ensure the framework's design directly addressed challenges that designers encounter when examining EAs in their professional practice. In addition, a multi-study approach would facilitate a progressive development of the framework, ensuring that the methods incorporated within it effectively integrated with each other.

1.4 How is this thesis organised?

This thesis covers a cross-discipline literature review on the concept of EAs, as well as the process followed to develop a framework for examining EAs at a granular level, that is, focusing on the experience of individuals when conducting EAs. This framework has been called Activity-Instance Modelling (AIM).

Broadly, this thesis is organised as follows: Chapter 2 is critical review of theories from a variety of research domains, including psychology, sociology, and philosophy that examine the concepts of *activity* and *the everyday*. Based on this review, a definition of EAs formulated from a design perspective is provided. Chapter 2 also delves into the strengths and limitations of existing design methods for examining EAs, highlighting the need for tools that allow for the granular analysis of EAs to be conducted in a comprehensive and systematic manner.

Chapter 3 presents the research question and discusses its implications for the development of the framework. This chapter also delineates the philosophical stance of this investigation, recognising design as a domain with its own research and pedagogical traditions. The chapter then details the methodology followed in this investigation, highlighting measures taken to ensure that the development of the AIM framework involved the application of abilities that distinguish designers from professionals and scholars from other areas. This chapter concludes by outlining the development of AIM as a process that included an empirical stage and a practice-based stage.

Chapters 4 and 5 detail the empirical stage in the development of AIM. This stage involved carrying out three studies, hereinafter referred to as Study 1, Study 2 and Study 3. Each of these studies was conceived to serve particular objectives in the development of AIM.

The objective set for Study 1 was to adapt a specific MIA method (i.e., the multimodal transcript) to establish the analytical foundations of AIM. Study 2 was conducted to supplement the analytical approach devised in Study 1 with a data collection component, thus enabling AIM to be applied comprehensively in a full research cycle, from initial data gathering to in-depth analysis. Study 3 was motivated by the recognition that designers' research processes often involve the translation of observational and speech data into sketches, diagrams, mood boards, and other visual representations. In line with this research approach, Study 3 focused on incorporating visual representation methods adapted from SNA into the AIM framework.

Chapter 6 details the practice-based stage in the development of AIM. This stage involved carrying out a design exercise based on an analysis of EAs conducted with AIM. It is pivotal to underscore that this exercise was neither conceived nor anticipated to offer a seminal contribution to the design discipline. Instead, the intention with this exercise was to identify areas of the AIM framework that may require further refinement before the framework could be used in real design contexts.

Chapters 7 presents the findings of this investigation, detailing how the methods adapted over the course of Studies 1, 2, and 3, integrate into in a cohesive framework or structured approach to examine EAs at a granular level.

Finally, Chapter 8 details the original contributions this investigation makes to the body of design knowledge. Chapter 8 also describes the potential limitations associated with the development of AIM, and also elaborates on why these limitations do not detract from the overall value of this investigation. This chapter concludes by outlining lines of future work to continue refining and expanding AIM after the PhD.

Chapter 2 Literature Review

Everyday activities (EAs) can be broadly defined as practices that people perform as part of their daily lives. Central to these practices is the use of artifacts. The uses that people assign to artifacts in EAs span from the practical (e.g., using a hammer to drive a nail) to the symbolic (e.g., wearing a sports team's t-shirt to show support and fan loyalty). Thus, examining EAs can deepen designers' understanding of the multifaceted roles artifacts play in people's everyday life.

This chapter consists of a literature review on the concept of EAs. The chapter is organised into four sections. Section 2.1 delves into definitions and classifications of EAs that, although created in areas other than design, have informed the creation of design solutions. To provide an even more comprehensive perspective of EAs, the concepts of *activity* and *the everyday* are respectively reviewed in Sections 2.2 and 2.3. Building on these reviews, Section 2.4 introduces a definition of EAs formulated from a design viewpoint and highlights the need for tools to comprehensively and systematically examine EAs at a granular level.

2.1 Definitions and classifications of everyday activities

The study of *everyday activities* (EAs) extends across multiple research domains, leading to a plethora of definitions and classifications of these practices. This section is a review of definitions and classifications of EAs that have either informed the creation of design solutions or hold the potential to do so. The definitions and classifications discussed herein predominantly frame EAs in three distinct manners: as practices requiring human skill deployment, as practices conducted within specific settings, and as socio-historical phenomena.

2.1.1 Everyday activities as practices that entail human skill deployment

One area where EAs are examined as practices involving the deployment of human abilities is Aging Studies. Researchers within this area delve into various aspects of the later stages of human life. One of the primary topics in Ageing Studies is understanding how proficiency in conducting everyday activities, typically referred to in Ageing Studies as *activities of daily living* (ADLs), changes as individuals age.

From the perspective of Ageing Studies, Katz (1983) defines ADLs as personal care tasks whose performance entails the deployment of physical and mental skills. An example is the task of taking a shower. Physically, this task requires coordination and balance to stand on a wet surface while scrubbing various parts of the body. Mentally, showering may involve the visual assessment of various contextual factors. For instance, observing the amount of steam rising from the water provides a visual cue of the water's temperature. Recognising such cues helps individuals avoid stepping into water that is too hot or too cold, ensuring a safer and potentially more enjoyable showering experience.

In Ageing Studies, ADLs are classified based on the skills required for executing them. Edemekong et al. (2022) distinguish between *basic ADLs*, which involve skills to "manage one's basic physical needs", and *instrumental ADLs*, which require "more complex thinking skills, including organizational skills." Further delineating this distinction, Edemekong et al. outline specific sub-categories for both basic and instrumental ADLs. The verbatim definitions of these sub-categories can be found in Tables 2.1 and 2.2.

Table 2.1

Sub-categories of basic ADLs as outlined by Edemekong et. al (2022).

Sub-category	Verbatim definition
Ambulating	The extent of an individual's ability to move from one position to another and walk independently.
Feeding	The ability of a person to feed oneself.
Dressing	The ability to select appropriate clothes and to put the clothes on.
Personal hygiene	The ability to bathe and groom oneself and to maintaining dental hygiene, nail and hair care.
Continence	The ability to control bladder and bowel function.
Toileting	The ability to get to and from the toilet, using it appropriately, and cleaning oneself.

Table 2.2

Sub-categories of instrumental ADLs as outlined by Edemekong et. al (2022).

Sub-category	Verbatim definition
Transportation and shopping	Ability to procure groceries, attend events and managing transportation, either via driving or by organizing other means of transport.
Managing finances	This includes the ability to pay bills and managing financial assets.
Shopping and meal preparation	Everything required to get a meal on the table. It also covers shopping for clothing and other items required for daily life.
House cleaning	Cleaning kitchens after eating, maintaining living areas reasonably clean and tidy, and keeping up with home maintenance.
Managing communication	The ability to manage telephone and mail.
Managing medications	Ability to obtain medications and taking them as directed.

Defining and categorising ADLs based on human abilities as is done in Ageing Studies can provide valuable information for creating design solutions. Drawing on Katz's (1983) perspective of ADLs, designers can assess what physical and mental skills are required to complete an activity and then create artifacts that align or augment those skills. For example, home gardening is a part of the day-to-day lives of many people in Aotearoa, New Zealand (Longhurst, 2006). Home gardening involves physical skills such as digging holes in the ground, and mental skills such as visually estimating the depth of these holes to ensure proper seed planting. Recognising and understanding the skills necessary for home gardening can help designers create solutions to make the activity easier, safer, more enjoyable, and so on. For instance, designers could create a garden trowel with an ergonomic handle to ease the digging process. Additionally, incorporating measurement marks into the trowel's blade could aid users in visually assessing the depth to which they are planting seeds.

By examining the skills required to navigate daily life, designers can also craft solutions that broaden accessibility, allowing a more diverse range of individuals to engage in ADLs with ease. Consider, for example, the everyday challenges faced by individuals with Parkinson's disease. Afflicted by hand tremors, these individuals often find it difficult to hold and maneuver artifacts with precision and stability, which limits their ability to

perform basic ADLs such as eating and drinking. In response to this situation, self-stabilising eating utensils have been developed (Nazrin et al., 2021; Vidya et al., 2017). Through servo motors and sensors, these utensils compensate for hand tremors, allowing people with Parkinson's to eat without receiving assistance from others.

While offering valuable insights for creating design solutions, the definitions and classifications of ADLs developed in the field of Ageing Studies also present certain limitations. By focusing on skills deployment, these definitions often overlook other facets of EAs, such as the meanings these practices carry. Take food consumption as an example. Beyond mere nourishment, food consumption can also be emotionally evocative. Consuming specific meals can elicit a range of emotions in individuals, from joy and disgust to a sense of nostalgia or comfort (Köster & Mojet, 2015). In addition, food consumption carries significant cultural and social weight. For instance, in Malay culture, foods such as eggs, flowers, sweet sticky rice and butter rice are considered to symbolise fertility and prosperity, and therefore it is customary to serve these foods at special occasions such as weddings (Muhammad et al., 2013).

Succinctly, ADLs are not solely functional; they combine practical aspects with emotional significance and are deeply rooted in cultural and social contexts. However, these later dimensions of ADLs (emotional and sociocultural significance) tend to be overlooked or not explicitly addressed in the definitions and classifications of ADLs formulated within the realm of Ageing Studies.

Another limitation of the definitions and classifications of ADLs formulated in the field of Ageing Studies is the lack of conceptual clarity. Notably, there is a discrepancy in how ADLs are framed across different definitions and classifications. While Katz (1983) frames ADLs as tasks that involve the deployment of skills, Edemekong et al. (2022) define certain ADLs as skills themselves. For example, Edemekong et al. define the instrumental ADL of transportation and shopping as the "ability to procure groceries and attend events" (2022, p. 4).

The ambiguity between the notions of ADLs and skills can pose challenges when determining the objective of a design solution. Is the intent to bolster a specific skill or improve the entire activity? If the focus is on enhancing a particular skill, how is this refinement expected to impact the overall execution of the activity?

2.1.2 Everyday activities as practices performed at specific settings

One area where EAs are examined as practices conducted within specific settings is Assistive Robotics. Various researchers in this area have formulated classifications of EAs considering the types of places where these practices take place. Drawing on Galasko et al. (1997), Aaron M. Dollar (2014) introduces a classification of EAs specifically crafted to guide robotic applications in both domestic and work settings.

Dollar distinguishes between *Domestic Activities of Daily Living (DADLs)* which are "regularly performed in human living environments", Extradomestic Activities of Daily Living (EDADLs) which are "performed primarily outside of home" and *Physical Self Maintenance (PSM)*. For each category, Dollar outlines specific sub-categories which are detailed in Table 2.3. However, Dollar does not provide detailed definitions for these sub-categories.

Table 2.3

Sub-categories of basic DADLs, EDADLS, and PSM as outlined by Dollar (2014).

Domestic Activities of Daily Living (DADLs)	Extradomestic Activities of Daily Living (EDADLs)	Physical Self-Maintenance (PSM)
Food preparation	Transportation/driving	Feeding/medicating
Housekeeping	Shopping	Toileting
Laundry	Employment-related tasks/tool use	Bathing
Telephone/computer/technology use	----	Dressing/grooming
Office tasks/writing	----	Ambulation/transfer
Hobbies/sports	----	---

Dollar's (2014) distinction between DADLs and EDADLs offers designers a foundation to better understand the social dimension of EAs. In domestic settings, for example, individuals often operate with a sense of privacy given that their actions are observed only by household members, if any. This sense of privacy may prompt individuals to behave more freely, indulging in personal quirks and preferences without much reservation.

In contrast, extradomestic settings place individuals under the watchful eyes of a broader audience. Faced with this public exposure, individuals might feel inclined or even pressured to align their actions with societal conventions and norms. For instance, an individual's use of cutlery might align more closely with etiquette rules when dining at a restaurant than when eating at home alone or with family members.

Despite their utility in illuminating the social dimensions of EAs, classifications such as Dollar's are not without limitations. A primary limitation is the fluidity of EAs. Notably, EAs are not rigidly bound to specific locations, unlike what the classification in Table 2.3 suggests. An activity commonly performed in domestic settings might occasionally take place in extradomestic settings (and vice-versa). For example, someone who typically exercises at the gym may sometimes choose to work out in a public park or even in their own living room or backyard. Situations such as the above allow for recognising that the boundaries between DADLs and EDADLs are fuzzy rather than fixed.

The distinction between EAs can be fuzzy even between those that typically take place in the same type of settings (domestic vs. extradomestic). In his seminal book *The Phenomenology of the Social World*, Alfred Schütz (1972) posits that the activities people conduct on a given day are not independent events but rather parts or facets of an overall experience. Schütz emphasises that while there are discernible boundaries that allow people to distinguish one activity from another, these boundaries are not rigid but rather fluid. In simpler terms, Schütz's perspective highlights the possibility for EAs to intersect or overlap.

To further elucidate the above point, consider the interrelation of two activities: wearing and washing clothes. The length of time that garments are worn influence their level of dirtiness and thus, the effort and time required to wash them. A shirt worn briefly for a casual outing might require less intensive washing than one worn during an outdoor activity lasting several hours. Furthermore, the activity of washing clothes can be paired with other household tasks. For example, a person may leave clothes soaking in soapy water while conducting other activities such as sweeping or dusting.

The above examples highlight the limitations of a rigid categorisation of EAs, making it clear that considering only the environments in which EAs take place can lead to an oversimplified understanding of these practices.

2.1.3 Everyday activities as socio-historical phenomena

Within the literature on EAs there are also theoretical perspectives that offer a lens for analysing how these practices evolve and are reshaped by historical context and social developments. A prominent example is Practice Theory (PT). This theoretical perspective, advocated by scholars such as Pierre Bourdieu, Anthony Giddens, Theodore Schatzki, and Andreas Reckwitz views *practices* as the central unit of analysis. Reckwitz defines practices as a block or pattern of interdependencies between various elements including "forms of bodily activities, forms of mental activities, things and their use, a background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge" (2002, p. 249). Elizabeth Shove and her colleagues illustrate the above conceptualisation of practices with skateboarding:

> Skateboarding consists of a complex amalgam of skateboards and street spaces along with the bodily competencies required to ride the board and to use the affordances of the street to turn tricks; the rules and norms that define the practice of skateboarding; its meaning to practitioners and outsiders including its partially oppositional character, and so on (Shove et al., 2012, p. 15).

Delving deeper into the concept of practice, Shove et al. suggest that practices can be understood both as enduring patterns and as individual instances of enactment. These two perspectives, rather than being mutually exclusive, are deeply interwoven. As Shove and her colleagues further explain, the patterned interdependency between the elements comprising a practice emerges through the continuous execution of the practice itself.

The above point can be better understood by considering the example of skateboarding again. Both the techniques for performing skate tricks and the standards by which skate tricks are judged have evolved over time, shaped by the cumulative attempts of countless skaters using their boards. With each trick performed, skaters not only express their individual interpretation of skateboarding but also introduce new approaches to said practice that, over time, may become trends or standards within the broader skate community.

> At the same time, practices exist as performances. It is through performance, through the immediacy of doing that the 'pattern' provided by the practice-as-an-entity-, is filled out and reproduced. It

> is only through successive moments of performance that the interdependencies between the elements which constitute the practice as an entity are sustained over time (Shove et al., 2012, p. 15).

The understanding of practice provided by Reckwitz and Shove allows for recognising the centrality of human-artifact interactions in both the immediate unfolding of EAs and their evolution over time. This understanding has informed several works in design literature. For instance, drawing on Reckwitz, Hielscher et al. (2007) conducted a study aimed at devising new grooming solutions that disrupt conventional haircare practices. The ultimate goal in this study was to encourage people to adopt environmentally friendly haircare routines. Likewise, drawing on both Reckwitz and Shove, Kuijer et al. (2013) crafted bathroom sets designed to redefine well-established bathing practices in an environmentally-conscious manner.

While Reckwitz and Shove's ideas have found applications in design, it is crucial to recognise their potential limitations as design roadmaps. Central to Reckwitz and Shove's articulation of practice is the historical change of human activities and the role human-artifact interactions play in such evolution. This retrospective lens stands in contrast with the forward-looking orientation of design. While also concerned with change, design operates on a broader spectrum. Design is not merely concerned with modifying what currently exists. Design is also about envisioning novel scenarios and crafting pathways to transition towards them (Nelson & Stolterman, 2012). In this sense, Reckwitz and Shove's perspectives provide an incomplete framework for informing or guiding design in all its depth and breadth.

Throughout this section, a number of definitions and classifications of EAs have been reviewed. Each of these definitions and classifications allow for examining key aspects of EAs. Specifically, the classification of EAs proposed by Edemekong et al. (2022) provides a basis for examining the human skills deployed in EAs. On the other hand, Dollar's (2014) classification allows for situating EAs within two main types of settings: domestic and extradomestic. In turn, Reckwitz (2002) and Shove et al. (2012) offer insights into the role human-artifact interactions play in the historical evolution of EAs.

Although providing valuable insights on EAs, the above definitions and classifications present certain shortcomings as design roadmaps. Both the classifications of Edemekong et al. and Dollar barely address the role of artifacts in EAs, even though

without artifacts most EAs could not be carried out. On the other hand, the historical perspective offered by Reckwitz and Shove contrasts with design's prospective orientation, aiming not just to modify the present but also envision and enable more desirable futures.

It is essential to stress that the above limitations do not undermine the value for design of the definitions and classifications of EAs proposed by Katz, Edemekong et al., Reckwitz and Shove. Rather, these limitations highlight the opportunity of supplementing these scholars's ideas with perspectives on EAs formulated from a design viewpoint. The subsequent sections have been prepared in response to this opportunity. Sections 2.2 and 2.3 delve, respectively, into the concepts of *activity* and *the everyday*. Drawing from these reviews, a design-centric definition of EAs is articulated in Section 2.4.

2.2 The concept of activity

An activity can be broadly described as a relationship between a subject (or actor) and an object (or purpose) (Kaptelinin & Nardi, 2006). Activity Theory (AT) is among the frameworks focusing on activities that has gained extensive traction in design areas such as Human-Computer Interaction (HCI). The roots of AT lie in the psychological work of Lev Vygotsky (1980) who argues that society and culture are not external influences on the mind, but forces actively engaged in the mind's very formation. Before delving into the framing that AT makes of activities, this section revisit some of Vygotsky's key ideas.

According to Vygotsky, culture shapes the mind by providing individuals with both *physical* and *symbolic tools*. While physical tools consist of tangible artifacts used to interact with the external world, symbolic tools encompass language, signs, and other systems of representation that mediate mental processes (Glick, 1997).

In Vygotsky's perspective, tools allow individuals to carry out activities and help them acquire knowledge and mental abilities. For instance, a person who initially cooked with a recipe book but then memorised the cooking steps might no longer need the book to prepare a meal.

Vygotsky introduced the terms *mediation* and *internalisation* to describe situations such as the above. While the former term refers to how tools enable people to perform

activities, the latter describes how individuals become capable of mentally executing tasks that previously depended on physical aids.

Vygotsky also posits that the mind is a product of life in society. He emphasises that higher psychological functions[1] progressively go from being *inter-psychological* to being *intra-psychological* (Kaptelinin & Nardi, 2012b). That is, higher functions start out as abilities whose deployment requires or involves multiple individuals, and gradually become abilities an individual can deploy without help from others. Take bike riding as an example. In the beginning, children learn to pedal and steer while their parents provide physical support and guidance. In other words, riding a bike is at first a distributed effort between the children and their parents. However, over time, the children develop greater mastery and confidence, allowing them to ride independently without external assistance.

Building upon Vygotsky's ideas on mediation, internalisation, and the inter-intra psychological transition of higher psychological functions, Alexei Leontiev (1978) and Yrjö Engeström (2015; 1999) have developed specific perspectives on the concept of activity. These perspectives are detailed in the following sections.

2.2.1 Leontiev's concept of activity

For Leontiev, an activity is a relationship between a subject (or actor) and an object (or purpose). In other words, an activity arises in as much as a subject, moved by a specific purpose, undertakes an effort in the world.

> …activity is a process of intertraffic between opposite poles, subject and object…The basic constituent feature of activity is that it has an object. In fact, the very concept of activity implies the concept of the object of activity (Leontiev, 2009, p. 396).

[1] Higher psychological functions contrast with natural functions, which are innate mental abilities (e.g., memory or perception) shared by all animals. While natural functions can develop through maturation, practice, or imitation, their structure remains fixed and consistent across similar species. In contrast, higher psychological functions are mental abilities that emerge through the re-structuring of natural functions within a sociocultural environment (Kaptelinin & Nardi, 2012b).

Drawing on Wertsch (1983), Kaptelinin and Nardi (2012b) identify a series of attributes that Leontiev adheres to activities. These attributes are: *object-orientedness*, *mediation*, *hierarchical structure*, *internalisation and externalisation* and *development*.

Object-orientedness

Core to Leontiev's AT is the notion that activities are directed towards specific *objects*. In AT, the term object is derived from the Russian word *predmet*, which describes an entity independent of an individual but intrinsically linked to the individual's purposes or interests. Thus, Leontiev's notion of object-orientedness implies that activities are aimed at purposes that hold significance to people (Kaptelinin & Nardi, 2006).

The purpose of an activity is driven by a *need*, that is, a condition that requires satisfaction or fulfilment. Leontiev (2009) does not delineate a taxonomy of human needs. However, Kaptelinin and Nardi (2012b, p. 38) posit that people have *basic* and *cultural* needs. Basic needs are physiological requirements such as food or sleep that are fundamental for human survival. Cultural needs, on the other hand, are requirements stemming from social conventions, customs and traditions.

As Leontiev goes on to explain, an activity always yields an *outcome*, that is, an observable or tangible effect. A canonical example used in AT to illustrate the relationship between need, object, activity and outcome is that of the primordial hunting[2] (Leontiev, 1981). The outcome of this activity consist of a secured prey. Procuring this prey fulfils the object or purpose of obtaining food. This purpose, in turn, stems from a basic need, namely, nourishing the body.

Mediation

Activities are grounded in the use of tools. Drawing from Vygotsky (1980), Leontiev (1981) distinguishes between *technical* and *psychological* tools. Technical tools consists of material artifacts that allow people to produce physical changes in the environment. For example, to bring down a prey, primordial hunters may use artifacts such as spears, bows, ropes, knives and so on. Psychological tools, on the other hand, consist of symbols that influence the behaviour of individuals. In the context of primordial hunting, a

[2] Primordial hunting refers to the tracking, capture and killing of animals to secure food.

rudimentary map with inscriptions might guide hunters to prey-rich areas within specific regions.

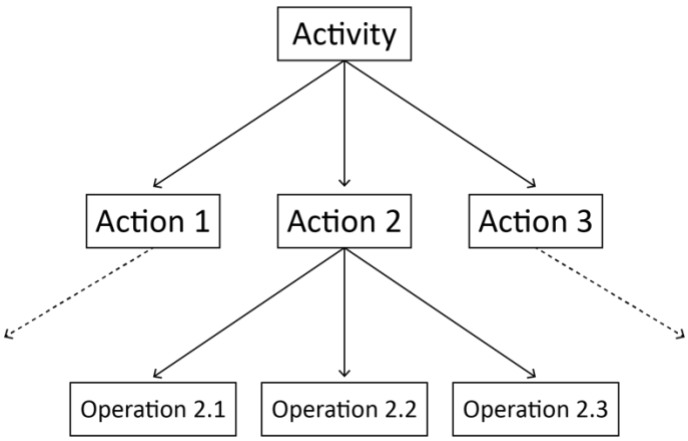
According to Leontiev, the characteristics (or design) of tools mirror the knowledge amassed by societies over time. Individuals embody and contribute to the continuation of this shared knowledge by putting tools to specific uses during activities (Miettinen, 2001). For example, hunting arrows may incorporate a broad tip designed specifically for taking down large animals. By using this type of arrow for hunting a buffalo, an individual validates both the design choice to incorporate a broad tip into the arrow and the shared understanding that broad-headed arrows are effective for hunting large preys.

Hierarchical Structure of activity

According to Leontiev activities can be analysed at three levels (Figure 2.1). The top level is the activity itself which, as previously established, is directed towards purposes of significance to individuals. The second level is made up of *actions*, which can be seen as steps that people deliberately undertake to achieve sub-goals or milestones in an activity. The third level encompasses *operations*, which can be described as the interactions people establish with tools when using them to complete an action (Kaptelinin & Nardi, 2012b).

Figure 2.1

Hierarchical structure of activities. Image adapted from Kaptelinin and Nardi (2012b).



To better understand the hierarchical structure of activities proposed by Leontiev, consider again the example of the primordial hunt. This activity entails at least two actions or steps, namely, scaring and ambushing an animal. The action of scaring an

animal may involve operations such as banging sticks, stomping the ground, or shouting to direct the animal's movement. Meanwhile, the action of ambushing an animal might involve operations such as activating a trap, throwing a rock at the animal, or shooting an arrow to take down the prey.

Operations can involve both routine and improvised interactions with artifacts. Those proficient in an operation can handle tools without having to consciously consider their use. However, in the face of unexpected circumstances, people can consciously adjust the handling of a tool while performing an operation.

Internalisation and Externalisation

Leontiev's perspective is that activities are distributed across *internal* and *external dimensions*. While the internal dimension comprises thoughts or mental representations, the external one involves body movements. In other words, for Leontiev activities are as mental as they are physical (Kaptelinin & Nardi, 2006). For instance, using a bow and arrow involves not only the physical act of drawing the bow and releasing the arrow, but also mental acts such as gauging the distance to the target, calculating the arrow's trajectory, and anticipating the prey's movement.

Leontiev further clarifies that the distribution of activities between the internal and external dimensions is dynamic. That is, aspects of an activity that are primarily mental at one point can shift to being predominantly physical at another (and vice-versa). Initially, a primary hunter could use a map to locate a specific hunting area. After numerous expeditions following the same route, the hunter may have memorised the route and therefore no longer need the map as a guide. However, this internalised knowledge could be externalised at certain times. For example, recognising the importance of the route, the hunter could create landmarks to guide others to the hunting area.

Development

Within Leontiev's AT, the term development highlights that activities are in constant flux and evolution (Leontiev, 1981). The development of an activity can be examined at both the individual and societal levels.

At the individual level, the notion of development is captured by gaining experience and knowledge about an activity influences the way a person approaches it. At first, a novice hunter may have difficulty finding and tracking prey. However, with more hunting expeditions and accumulated experience, the same individual could learn to recognise subtle signs of animal behaviour, and therefore track and capture preys more effectively than before.

At a social level, the notion of development is reflected in how activities change as a result of community life. By observing their peers employing a different camouflage strategy or a particular method of imitating animal calls, primordial hunters can further refine their animal tracking skills. This community learning serves a dual purpose: it fosters the emergence of innovative hunting techniques while also ensuring that these techniques are disseminated among the current generation of hunters.

To summarise, Leontiev posits that activities are efforts that individuals undertake to meet goals and satisfy needs. He further emphasises that activities are grounded in artifact use and that the use of artifacts allows individuals to acquire and apply knowledge both physically and mentally.

Leontiev's perspective, however, has not been without criticism. One contentious aspect within Leontiev's AT is his depiction of the individuals (or subjects) engaged in activities. Blunden (2010), for example, criticises Leontiev for overlooking the relationship between individuals and their social environment:

> A major problem in Leontiev's theory however is that it completely lacks a theory of identity… under modern conditions, it is not possible to talk of the activity of a group without problematizing membership of individuals in the group and how the individual perceives the actions of the group and their participation in it (Blunden, 2010, p. 214).

Acknowledging the limitations of Leontiev's perspective, Engeström endeavoured to articulate a broader view of activities, emphasising the connection between the subjects and their broader social context.

2.2.2 Engeström's concept of activity

In his seminal book *Learning by Expanding*, first published in 1987 and republished in 2015, Yrjö Engeström posits that activities are deeply rooted in social contexts:

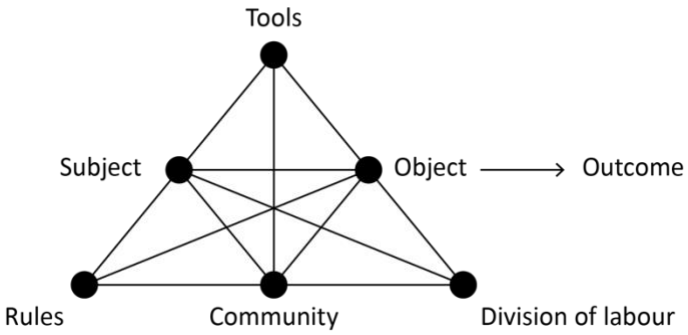
> Human activity is not only individual production. It is simultaneously and inseparably also social exchange and societal distribution. In other words, human activity always takes place within a community governed by a certain division of labour and by certain rules (Engeström, 2015, p. 114).

Engeström's perspective on the concept of activity is encapsulated in his widely recognised *Activity System Model*, often termed *Engeström's Triangle*. As Figure 2.2 illustrates, this model consist of a diagram that depicts activities as systems made up of three interacting elements: subject (or actor), object (or purpose), and community. The model also accounts for specific elements that mediate the interactions between the subject, object and community:

- The subject-object interaction is mediated by tools whose design reflects the knowledge accumulated by the community.
- The subject-community interaction is mediated by rules or social norms that guide the subject's behaviour implicitly and explicitly.
- The community-object interaction is mediated by division of labour where specialised tasks performed by different individuals contribute to both to the fulfilment of the object (or purpose) of an activity and to the production of an observable or tangible outcome.

Figure 2.2

Engeström's Activity System Model. Image adapted from Kaptelinin and Nardi (2012b).



To better grasp Engeström's model, consider again the primordial hunting example. The subject of this activity is the hunter or group of hunters who are actively engaged in the tracking and capture of a prey. The object, or purpose of the activity, is to secure food by capturing an animal. Meanwhile, the community encompasses the tribe or clan, of

which the hunters are part of. The interactions between each of these three elements are mediated as follows:

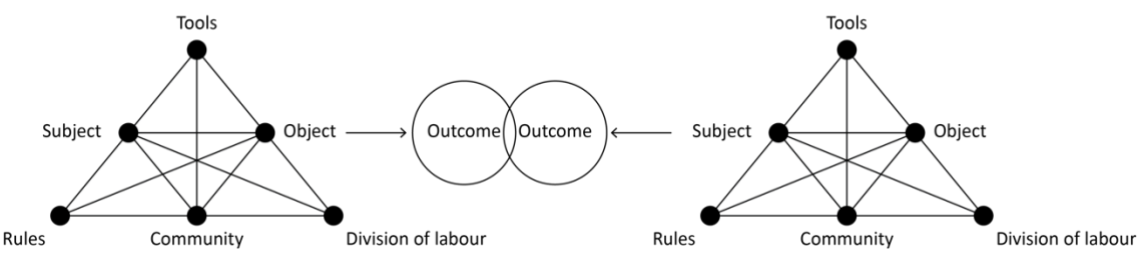
- The subject-object interaction is mediated by spears, bows, knives and other tools that allow hunters (subject) to capture their prey and thus provide their community with food (object).
- The subject-community interaction is mediated by the rules, rituals and traditions that dictate when, where, or how a hunt should commence.
- The community-object interaction is mediated by the assignment of specialised hunting tasks. For example, some hunters might be in charge of scaring the animal, while others ambush it at predetermined locations. This division of labour contributes to both producing an outcome (capturing prey) and fulfilling the activity's object (providing food for the community).

Echoing Leontiev's perspective, Engeström underscores that activities yield outcomes, that is, tangible results or effects. The notion of outcome is of particular importance in Engeström's AT as it highlights the interconnectivity of activity systems.

According to Engeström (2015), multiple activity systems can contribute to producing the same outcome or produce intrinsically related outcomes (Figure 2.3). For example, in a primordial setting, the outcomes of hunting and culinary activities are intrinsically related. Specifically, captured preys (outcome hunting activities) serve as ingredients to prepare meals (outcome of culinary activities). The interconnectivity of activity systems in Engeström's model mirrors the ideas of sociologist Schütz (1972) who posits that the activities of daily life are not isolated events but rather different facets of a broader lived experience.

Figure 2.3

Interconnected activity systems. Image adapted from Kaptelinin and Nardi (2012b).



Engeström also delves into the mismatches or contradictions that can arise within and between activity systems. He distinguishes between four types or levels of contradiction:

1. First-level contradictions are inconsistencies inherent to the elements of an activity system, namely, subject, object, community, tools, rules, and division of labour. For example, a novice hunter (subject) may experience nervousness or fear during a hunting trip. This emotional struggle can hinder the hunter's ability to effectively track or ambush preys during the trip.
2. Second-level contradictions are conflicts between different components of an activity system. A hunter (subject) might disagree with the established traditions (or social norms) about specific hunting areas. This personal belief could compel the hunter to venture into areas deemed off-limits by the community.
3. Third-level contradictions consist of challenges or discrepancies identified when comparing the current state of an activity system with its envisioned, more advanced purpose and outcome. For instance, a hunter might realise that the prey currently being pursued is not large enough to feed the entire community. Confronted with this insight, the hunter might decide to shift focus and track a larger prey, ensuring that the outcome of the hunt aligns with its primary objective: providing food for the community.
4. Fourth-level contradictions are clashes between different activity systems that jointly produce an outcome or whose outcomes are intrinsically linked. Consider two interconnected primordial activities: hunting and meat preservation. While the hunters goal is to catch preys to provide food for the community, meat preservers aim to extend the time that the hunted preys can be safely consumed. However, if meat preservers use ineffective techniques, the meat can spoil quickly, increasing the workload of the hunting group.

To summarise, Engeström postulates that activities are systems composed of seven core elements between which contradictions may arise. As indicated in Figure 2.2, the elements Engeström considers as constitutive of activities are: subject, object, tools, community, rules and division of labour.

Nevertheless, despite the emphasis he places on the relationship between subjects and their social environment, Engeström's perspective is not exempt from criticism. Specifically, Blunden (2010) accuses a lack of conceptual clarity in Engeström's model:

> To make a start with science we have to have a *concept* of what it is that we are investigating and the possibility of observing it. But here at the very least we have 7 entities, whose conception are posited as *preliminary* to the science of activity… Whether it is called a root model or a unit of analysis, Engeström's expanding triangle is an impressive *schema* of social life, a handy pocket manual of social analysis, but it is not the foundation of a science in the sense that Goethe, Hegel, Marx and Vygotsky envisaged. Engeström has given us an elegant schema of various components of social life, but he has not given us a concept of any of those components or of activity itself (Blunden, 2010, p. 232).

Considering the critiques put forth by Blunden, within the scope of this investigation, Engeström's model is not adopted as a definitive characterisation of activities. Instead, Engeström's model is considered a theoretical lens that supplements Leontiev's perspective, allowing for a more comprehensive framing of the concept of activity.

As established in Section 2.2.1, core to Leontiev's perspective of activity are the notions of object-orientedness and the hierarchical structure of activity:

- Object-orientedness: Leontiev (1981) posits that activities are directed at goals linked to human needs. While Leontiev does not provide a taxonomy of human needs, Kaptelinin and Nardi (2012, p. 38) distinguish between basic needs (requirements for human survival), and cultural needs (requirements stemming from social conventions).
- Hierarchical structure of activity: According to Leontiev (1981), an activity consists of a series of actions or steps that people undertake deliberately. Each action is implemented through human-artifact interactions, which he terms operations.

On the basis of the points above, activities can be conceived as multi-stage processes in which people use artifacts to meet both basic and culturally-defined objectives. However, this definition runs the risk of depicting activities as isolated phenomena, detached from their social context. Such a framing of activities would be problematic since even when acting alone, individuals are embedded within a social fabric with which they may identify with to varying degrees, as Blunden (2010) emphasises.

So how can activities be defined in a way that better captures the subject-community relationship? Engeström's model provides a pathway to address this question. Here, Engeström's model is not seen as a direct representation of activities. Instead, the model is considered to represent activities as phenomena embedded within a broader sociocultural milieu, encompassing social norms, community dynamics, and division of labour. Through this lens, activities can be framed as: socially-situated, multi-stage processes wherein people use artifacts to meet basic and culturally-defined goals.

The above understanding of activities is the one adopted in this investigation. It is crucial to note that this perspective is not intended to replace those of Leontiev and Engeström nor to provide a conclusive or universally applicable view of the concept of activity. Instead, the understanding of activities put forth in this investigation is a potential interpretation, formulated from a design point of view, of the ideas of Leontiev and Engeström.

2.3 The concept of the everyday

Leontiev and Engeström define activities broadly, without specifically delineating everyday activities (EAs) as units of analysis within design. Given this situation, the question arises: are EAs a specific category of human practices? If so, how do they differ from other types of practices? The use of the term *everyday* alongside *activities* suggests inherent characteristics specific to EAs. However, without further elaboration from Leontiev or Engeström, the distinctive features of EAs remain unclear. To address this gap, this section delves into a cross-disciplinary examination of the concept of *the everyday*.

The everyday is a concept widely addressed by scholars from various disciplines. For Susie Scott (2013), the everyday describes situations that are *pervasive*, *mundane*, and *routine*. A situation is considered pervasive when it consistently prevails among a majority of society's members across generations or throughout history. For example, smoking nargile (also known as a hookah, shisha, hubble-bubble, or water pipe) has been a common practice for most Turks for several centuries (Timur, 2006). Given this long-standing tradition, nargile smoking can be viewed as a pervasive practice in Turkish society.

A pervasive situation becomes mundane as it turns into a familiar experience, consistently seen or conducted by people throughout their lives (Bennett & Watson, 2003). As Timur (2006) continues to explain, in today's Turkey there are plenty of coffee houses offering nargile smoking in addition to other leisure alternatives such as board games. The prevalence of coffee houses offering nargile indicates that many Turks either engage in smoking nargile or observe others doing so on a regular basis. On this basis, smoking nargile can be considered a mundane activity in Turkish society.

A situation that is mundane typically involves routine behaviours. When individuals face similar situations time and again, their responses to these situations tend to become nearly automatic, requiring minimal conscious thought (Graybiel & Smith, 2014; Highmore, 2002). For someone who continually smokes nargile, holding the mouthpiece, bringing it to the mouth, and inhaling from it can become mechanised acts that require little or no attention.

Scott's (2013) perspective on the everyday is just one of the many lenses through which this concept is framed in social sciences. To gain a broader understanding of the everyday, a comprehensive search was conducted across various areas in the social sciences to identify theoretical perspectives specifically concerned with this concept. This search consisted of two steps. The first step involved a thesaurus query to identify word variants for the term *everyday*. Table 2.4 shows (in alphabetical order) the word variants the thesaurus query produced.

Table 2.4

Different terms to refer to the everyday.

Commonplace	Prosaic	Dull
Frequent	Usual	Familiar
Mundane	Conventional	Habitual
Normal	Customary	Quotidian
Ordinary	Daily	Routine

For the second step, keywords from Table 2.5 were used to identify theoretical and methodological approaches (within social science) related to the everyday. The emphasis was on frameworks where the everyday is seen as integral to social

interaction, social conventions, power dynamics, and other related phenomena. Table 2.2. shows (in alphabetical order) the theoretical approaches identified through this search.

Table 2.5

Theoretical approaches to the everyday that resulted from the search via keywords.

Actor-Network Theory	Multimodal Communication
Affordance Theory	Phenomenology
Cultural Studies	Post-structuralism
Cognitive and social psychology	Psychoanalysis
Critical Discourse Analysis	Symbolic interactionism
Ethnomethodology	Technological Mediation
Functional Structuralism	-------

The theoretical perspectives listed in Table 2.5 each offer different conceptualisations of the everyday. By contrasting these views, it became possible to organise the identified theoretical perspectives into three distinct groups:

- Theories that see the everyday as a prescribed experience.
- Theories that see the everyday as an experience mediated by artifacts.
- Theories that see the everyday as an emergent experience.

The following sections provide details of the theories that make up each of the three groups and comments on their conceptual similarities and differences.

2.3.1 The everyday as a prescribed experience

The theories in this group adhere to the ability of the everyday to shape people's behaviour. For psychoanalysts, the everyday is the arena of tensions between people's instincts (or basic appetites) and what society considers acceptable behaviour (Freud, 1914). For example, Elias (1978), analyses how anger and other socially sanctioned emotions turn into more accepted forms of expression (sports fandom) in everyday situations such as football matches.

A related view is that of social and cognitive psychology. In these two areas, the everyday is seen as a socialisation process, that is, an experience that teaches people

the written and unwritten codes of society (Argyle, 1983). For example, buying sweets in a store may involve the displaying of social skills such as greeting the shopkeeper and making small talk. According to social and cognitive psychology, these interaction skills are neither innate nor spontaneous, but rather the product of observing from an early age how others navigate similar situations.

Functional Structuralists go even further by arguing that the everyday does not teach but rather imposes certain behaviours on people (Durkheim, 1982; Levi-Strauss, 1966a, 2008). For example, etiquette rules delineate (among other behaviours) how to greet others, sit at the table, and handle cutlery at dinner (Haidar, 2013).

All the aforementioned theoretical perspectives ascribe a behaviour-shaping role to cultural norms. Giard (1998) delves deeper into this matter, outlining three primary ways in which cultural norms influence people's everyday behaviour:

- Dictating what artifacts to use in everyday situations.
- Delineating how to use artifacts in everyday situations.
- Specifying when to engage in everyday situations.

To further elucidate Giard's points, we can turn to George Orwell's essay *A Nice Cup of Tea* (Orwell, 1968). In this essay, Orwell outlines eleven "outstanding principles" (as he calls them) concerning the British tradition of tea-making. While Orwell acknowledges these principles as somewhat subjective, reflecting his personal tea preferences, they serve as a window into the influence of cultural norms on everyday routines. As Orwell highlights, his principles, cover aspects of tea-making which were widely known and debated among the British at the time the essay was written.

> … one should drink out of a good breakfast cup. That is, the cylindrical type of cup, not the flat, shallow type. The breakfast cup holds more, and with the other kind one's tea is always half cold before one has well started on it (Orwell, 1968).

In the excerpt above, Orwell emphasises the importance of using cups that keep the tea hot for longer periods of time. This perspective illuminates how a collective belief (that tea should be consumed hot) impacts on the type of artifacts deemed suitable for a given situation.

> …one should take the teapot to the kettle and not the other way about. The water should be actually boiling at the moment of impact, which means that one should keep it on the flame while one pours. Some people add that one should only use water that has been freshly brought to boil, but I have never noticed that it makes any difference (Orwell, 1968).

In the excerpt above, Orwell stresses the importance of ensuring the water is boiling when pouring it over the tea leaves. To this end, he advises to bring the teapot closer to the stove where the kettle is placed. This suggestion showcases how a shared idea (the water must be boiling when it touches the tea) guides the use of artifacts in everyday situations.

> For a pot holding a quart, if you are going to fill it nearly to the brim, six heaped teaspoons would be about right. In a time of rationing, this is not an idea that can be realized on every day of the week, but I maintain that one strong cup of tea is better than twenty weak ones (Orwell, 1968).

The excerpt above demonstrates how cultural norms dictate when to partake in everyday situations. Orwell refers to the ideal amount of tea leaves (six heaped teaspoons for a quart cup) but acknowledges the difficulty of adhering to this standard daily during "a time of rationing". The misalignment Orwell establishes between ideal tea preparation and the realities of rationing suggests that the frequency with which tea was consumed in Orwell's time was determined by convention, not practical decision.

To summarise, the theories of this group highlight that the everyday has a cultural dimension. Specifically, cultural norms and social standards influence the way people navigate their daily lives. Giard (1998) posits that cultural norms dictate three main aspects of human behaviour: when to engage in everyday situations, what artifacts to use in everyday situations, and how to use artifacts in everyday situations.

2.3.2 The everyday as a mediated experience

The theoretical perspectives in this group examine the influence of artifacts on everyday life. Gibson's theory of affordances states that artifacts offer possibilities of action that people can perceive and harness (Gibson, 1977; D. A. Norman, 1999). For instance, a set of steps provides the opportunity to reach a higher elevation.

However, as Gibson elaborates, these action possibilities (or affordances) are not inherent to the artifacts themselves; they emerge from the alignment between the perceivable features of artifacts and people's current intentions. Consequently, a set of steps can function as a means to access an elevated area at one moment, and as a seat for rest at another.

Within the framework of Technological Mediation (Verbeek, 2015), artifacts are perceived to influence not only people's actions but also their perceptions of everyday life. For instance, Verbeek (2008, 2010) delves into the transformative effect of smartphones on daily communication. He posits that smartphones, by enabling the sharing of emoticons, photos, and videos, have reshaped how individuals convey ideas and emotions to one another. Moreover, these devices have ushered in new norms of communication and social interaction. For example, many people expect a prompt response to a text message and consider it rude if the recipient leaves the message on "read" without replying.

The influence of artifacts on people's behaviours and perceptions of daily life is also a focal point in Cultural Studies, Post-structuralism, and Critical Discourse Analysis (CDA). Within Cultural Studies, researchers aim to discern the messages embedded within the texts and artifacts people use in daily life (Farmer, 2003; Moran, 2005). For example, Du Gay et al. (2013) posit that both Sony's inclusion of flamboyant young individuals in their 1980s Walkman advertisements and the Walkman's blue-tinted metal design were tactical choices aimed at presenting the device as technologically sophisticated.

Researchers in CDA and Post-structuralism focus on deconstructing the power dynamics inherent in everyday texts and artifacts (Foucault, 2020; Janks, 1997). According to Derrida (2001), texts and artifacts serve as mechanisms that powerful groups and entities use to render certain communities invisible. For example, band-Aids were manufactured for decades solely in a flesh-colour that matched fair skin tones (Oyesiku, 2021). Through Derrida's lens, such a colour choice neglects the presence and needs of dark-skinned individuals, further perpetuating racial biases.

The theories in this group allow for recognising that the everyday is a constantly evolving phenomenon and that artifacts play a role in this evolution. As Gibson (1977) posits, artifacts present distinct opportunities for action which individuals can capitalise on.

These actions might not always conform to cultural norms. In other words, artifacts can prompt individuals to question or challenge cultural standards. For example, the introduction of the microwave in the 1950s allowed for home cooking practices that diverged from culinary traditions prevailing in many Western and Eastern cultures up to that time (Chang & Krishna, 2021).

While artifacts can foster the evolution of the everyday, there is a flip side to consider. As Derrida (2001) points out, artifacts can reinforce existing ideas or lifestyles. Take, for instance, the automotive culture. Despite widespread awareness of the environmental repercussions of car travel, the very design and infrastructure of numerous cities impedes the adoption of alternative transportation methods. In other words, the urban layout of numerous cities inherently favours car-centric transportation, as observed by Ewing & Cervero (2017).

The role of artifacts in reinforcing cultural norms or the status quo may not always be immediately evident to people. Such a situation is evident in instances of *greenwashing*, where companies exaggerate the environmental benefits of their products, essentially promoting consumerism under the guise of sustainability (de Freitas Netto et al., 2020). For example, a water bottle marketed as eco-friendly and decorated with nature-inspired designs may give the impression of being environmentally-friendly. However, upon closer examination, it might become apparent that only a small portion of the bottle is made from recycled materials, with the majority being new plastic. This design misleads consumers into thinking they are purchasing a fully sustainable product when, in reality, the product's environmental benefits are marginal at best.

2.3.3 The everyday is emergent

The theoretical perspectives in this group see the everyday as emergent, i.e., arising from the interweaving of multiple factors rather than pre-determined or fixed. Within Phenomenology and Symbolic Interactionism, the everyday is considered to emerge from people's interpretations regarding the behaviour of others (Blumer, 1986; Schutz, 1967). Consider a pedestrian deciding when to cross the street. The speed of an approaching car might be interpreted by the pedestrian as a sign the driver does not intend to stop. Based on this interpretation, the pedestrian might wait for the car to pass. Similarly, a driver might slow down in anticipation that a pedestrian wearing

headphones might cross the street without noticing approaching vehicles (Schroeder & Rouphail, 2011; Sucha et al., 2017).

In Ethnomethodology the everyday is seen as an experience that individuals co-create through their actions. For ethnomethodologists, social conventions are not rules that individuals invariably adhere to, but behavioural guidelines from which people can deviate given their individual goals (Garfinkel, 1964, 1991). The example of queues can illustrate this point. People waiting in line are aware that their turn will come once those in front are served. However, this established order is not immune to disruptions. To move faster through the line and thus reduce waiting time, impatient people may negotiate, deceive, or even intimidate those in front of them.

In Multimodal Interactional Analysis (MIA), the everyday is seen as emerging from interpersonal interactions that are influenced or mediated by artifacts (Norris, 2004, 2012). Consider how the shape of a table can influence the dynamics of a conversation. At a round table, individuals can effortlessly see and hear anyone speaking, facilitating inclusive conversations where everyone can participate. Conversely, those seated at the ends of a rectangular table might struggle to hear one another. As a result, these individuals might converse exclusively with those seated nearby.

Actor-Network Theory (ANT) further expands the range of elements whose interactions give rise to the everyday. Core to ANT is the concept of *non-human actants*. A non-human actant is any tangible or intangible entity that makes a perceptible difference in a situation (Latour, 1992, 2007). The act of slicing an apple with a knife provides a useful example. The physical effort required to slice the apple varies depending on both the sharpness of the knife and the firmness of the apple. Likewise, the fineness of the slices can vary depending on the taste or preferences of the person who is slicing the apple. Therefore, through the lens of ANT, the knife, the apple, and the person's slicing preference would be considered non-human actants.

Recognising the influence of non-humans in everyday life is not to equate their role with that of humans. In other words, ANT does not argue nor advocate for a symmetry between humans and non-humans actants. As Latour (1992, 2007) goes on to explain, human actions entail intentionality. That is, people act motivated by specific purposes (as is also considered in AT). In contrast, the influence that non-humans exert upon the

everyday is contingent on both their physical attributes and the meanings people adhered to them. Consider a driver stopping when a traffic light switches to red. The traffic light does not physically prevent the driver from continuing to move forward. What the traffic light does is provide a visual stimulus that the driver recognises as a *stop signal*. However, the decision to adhere to the stop signal ultimately lies with the driver.

While differentiating the roles of human and non-human actants in shaping the everyday, ANT does not assign greater importance to either type of actant (Dürbeck et al., 2015; Khong, 2003). In other words, from an ANT's perspective, humans are not inherently more important than non-humans, and vice versa. Instead, ANT posits that an actant's importance is situation-dependent. Consider a person walking on a beach. In this situation a human actant (the walker) takes precedence over a non-human actant (shoes) because the act of walking on a beach is not subject to the presence or absence of footwear. In contrast, a person could not play football on the beach without having a ball or other kickable object. In other words, both a human (player) and a non-human actant (ball) are integral to the act of playing football.

Variations in importance also occur between actants of the same type. The players, the referee and the spectators are all human actants in a casual football match. However, not all of these actants are equally important. The match could take place without a referee and spectators, but not without players.

Disparities of importance such as the above can also be observed among the non-human actants of the football match. For example, the ball and the players' uniforms are not equally essential for the match to occur. While the absence of uniforms might complicate team differentiation, the match can still proceed. However, without a ball (or some other kickable object), the match simply cannot happen.

Even ideas can have differing levels of importance in specific situations. For example, a football player might be driven by individual ambition rather than team spirit. Such a mindset could lead the player to attempt scoring, even if a teammate is better positioned for the shot.

To summarise, the theories in this group recognise the interdependent roles of people, artifacts, and ideas in shaping the everyday. On the basis of these theories the everyday can be considered to arise from human actions that are influenced by cultural norms, personal views and the availability, design, and meaning of artifacts.

The theories in this group also allow for recognising that the level of influence that artifacts and ideas exert upon the everyday is not predetermined (Latour, 1992, 2007). In other words, there are no artifacts or ideas, within the everyday, that are inherently more influential than others. Instead, the level of influence of artifacts and ideas varies depending on the situation at hand.

2.4 Integrating the two concepts: activity and everyday

The concepts of activity and everyday were reviewed in the previous sections. On the basis of these reviews, this section will now frame EAs from a design perspective. It should be noted that the goal here is not to provide a conclusive or all-encompassing perspective of EAs. Instead, the goal is to provide a benchmark or sample on how to conceptualise EAs from a design point of view.

2.4.1 A design-centric conceptualisation of everyday activities

Drawing on Leontiev (1978, 1981) and Engeström (2015), activities were defined in Section 2.2 as socially-situated, multi-stage processes wherein people use artifacts to meet both basic and culturally-defined goals.

On the other hand, drawing on Scott (2013), the everyday was framed in Section 2.3 as situations that are pervasive, mundane, and routine. The term pervasive refers to situations consistently experienced by the majority of society's members across generations or throughout history. The term mundane denotes situations that individuals encounter regularly throughout their lives. Lastly, the term routine describes situations navigated by individuals with minimal conscious thought.

In addition, the discussion in Section 2.3 also enables a recognition of everyday situations as jointly shaped by cultural norms (Giard, 1998), personal views (Garfinkel, 1964, 1991), and artifacts (Gibson, 1977; Latour, 1992; Norris, 2004).

Building upon the above ideas, this doctoral investigation conceives EAs as pervasive, mundane, routine, and socially-situated processes wherein people use artifacts to meet both basic and culturally-defined objectives. A foundational tenet of this conception is that EAs encompass a cultural, individual, and physical dimension. In other words, the unfolding of EAs is influenced by the interplay between cultural norms, people's personal views, and the availability, design and current state of artifacts. To provide further clarity on its design-centric focus, the perspective of EAs put forth in this investigation will be dissected next.

Everyday activities are pervasive, mundane and routine

Framing EAs as pervasive, mundane and routine processes provides designers with a basis for distinguishing EAs from other types of human practices. For instance, getting dressed is both pervasive and mundane in Aotearoa New Zealand, as the majority of people (irrespective of their background or profession), engage in this activity daily. Likewise, getting dressed is routine because most people conduct this activity without requiring significant cognitive effort. While people might reflect on what clothes to wear, the act of putting on garments is done instinctively by most individuals.

It is pivotal to underscore that an activity does not have to be conducted daily to be considered an inherent part of everyday life. The example of grocery shopping can illustrate this point. Buying groceries is an activity often undertaken not daily but at variable intervals of time (weekly, biweekly, monthly, and so on.) Yet, grocery shopping remains a pervasive activity because it is widespread and integral to the daily life across various demographics. Buying groceries is also a mundane activity as it does not generate much excitement. On the contrary, for many people shopping for groceries entails a tedious task. Furthermore, grocery shopping is routine in the sense that many individuals develop habits such as frequenting the same stores or purchasing a specific set of items, which lends some predictability to the activity.

The above three attributes (pervasive, mundane, and routine) are not common across all human practices. For instance, performing a surgery is a specialised activity, limited to those with specific training, equipment and credentials. Therefore, unlike getting dressed or shopping for groceries, a surgical procedure is not considered within this investigation as an everyday activity.

Everyday activities are socially-situated

Framing EAs as socially-situated provides an avenue for designers to critically reflect and scrutinise the underlying social factors influencing how people engage in these practices (Engeström, 2015; Engeström et al., 1999). For example, division of labour is a social factor that can impact people's culinary and eating practices (Gupta et al., 2019). Those with demanding work schedules might lean towards quick meals or takeaways, while those with more flexible agendas might opt for home-cooked meals.

Another social factor that impacts EAs is the influence of community or peers (Bruss et al., 2005). For example, in families or groups of friends where there is a strong emphasis on fitness, people might be more inclined to choose salads, smoothies, or other health-centric meals. In contrast, families and groups of friends that prioritise tradition, comfort, or celebratory gatherings might be more inclined to eat hearty and rich dishes.

Everyday activities as processes wherein people use artifacts

The term *process* is used in multiple professional and academic fields and thus has a wide variety of meanings. For this investigation, the term process refers to a sequence of steps taken to achieve a particular outcome. The characterisation of EAs as process offers opportunities to reimagine these practices. Specifically, designers could either modify the sequence or the number of steps that comprise an activity.

Furthermore, framing EAs as processes allows for a granular analysis, enabling designers to closely examine how individuals use artifacts at specific moments in an activity. As previously established in Chapter 1, Section 1.2, the term *use* is understood here as the harnessing of the functions (or capabilities) that artifacts have due to their design. Without a graphite lead, a pencil would lack the function or capacity to leave a trace, rendering it useless for activities such as taking notes or sketching.

The above understanding of the term use provides designers with further opportunities to reimagine EAs. By modifying an artifact's functions, designers can improve the efficiency, comfort, or even enjoyment of completing specific stages of an activity.

Everyday activities are aimed at basic and culturally-defined objectives

Positioning EAs as directed towards both basic and culturally-defined objectives grounds the perspective on these practices put forth in this investigation in a key tenet of AT, namely, that all activities are purposeful (Kaptelinin & Nardi, 2012b; Leontiev, 2009).

Moreover, the reference to basic and culturally-defined objectives highlights the importance of recognising that while EAs are utilitarian, they also carry meanings that designers must acknowledge to craft culturally-sensitive solutions (Escobar, 2018). Consider an activity such as home cleaning. On a basic, utilitarian level, this activity serves the purpose of maintaining a tidy and hygienic living environment. However, on a culturally-defined level, home cleaning can hold deeper meanings related to a sense of order in life or care for the family. Thus, designing solutions for home cleaning goes beyond merely offering tools for tidiness. Creating cleaning utensils involves providing people with mechanisms to enact their distinctive ways of caring for their families and their living spaces.

Everyday activities have cultural, individual and physical dimensions

At the heart of the conception of EAs put forth in this investigation is the acknowledgment that these practices possess cultural, personal, and physical dimensions. The cultural dimension of EAs is given by the cultural norms that influence people's behaviour (Giard, 1998). Consider how etiquette rules establish not only suitable times of day to eat specific types of food, but also appropriate ways to use cutlery at each meal (Haidar, 2013; Xu et al., 2018).

EAs also possess an individual dimension rooted in people's personal perspectives and choices (Garfinkel, 1964, 1991). In other words, while cultural norms provide behavioural guidelines, the specific circumstances of people's life and their personal worldview can influence how they interpret and enact those guidelines in their daily life. Even with a clear awareness of etiquette rules regarding cutlery handling at dinner, an individual might choose to deviate from the norm based on comfort, laziness or convenience.

Lastly, EAs have a physical dimension, which implies these practices vary due to the availability, design, and condition of artifacts (Gibson, 1977; Norris, 2004; Verbeek, 2010). For instance, the weight and sharpness of a knife can impact its use at dinner.

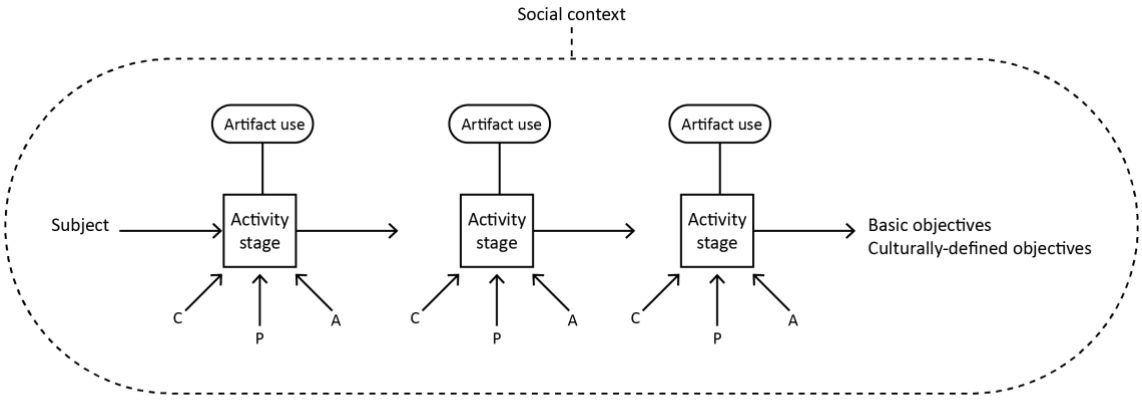
Slicing food with a lightweight, sharp knife might be effortless and precise, compared to the additional force and caution needed to slice food with a heavier, duller knife.

In regard to the physical dimension of EAs, a clarification is pertinent. Echoing Actor-Network Theory (ANT) (Khong, 2003; Latour, 1992, 2007), this investigation posits that no artifact is inherently more important or influential than others. Instead, the importance of artifacts is considered to be situation-dependent. For example, in a situation where a person needs to take notes during a meeting, a pen would be of utmost importance for allowing writing. Conversely, if someone is organising a stack of important documents that must be kept together for a presentation, a paper clip could become the more crucial artifact, as it serves to maintain the order and integrity of the documents.

To summarise, for the scope of this doctoral investigation, EAs are defined as pervasive, mundane, routine, and socially-situated processes wherein people use artifacts to meet both basic and culturally-defined objectives. This perspective on EAs is summarised in Figure 2.4. This figure sets the stage for the following section, which critically assesses the strengths and limitations of current design methods for examining EAs, ultimately identifying a need for new tools to examine these practices at a micro or granular scale.

Figure 2.4

The perspective of everyday activities adopted in this investigation.



C: Cultural norms.
P: Personal views.
A: Artifacts' design and current conditions.

Note. Figure 2.4 figure shows a subject embedded within a dotted ellipse that represents the social context. Within this context, the subject embarks on an activity whose realisation comprises various stages, each represented by a white square. The term "Artifact use" appears above each square, indicating that the subject utilises artifacts throughout all stages. Three arrows, originating respectively from the letters C, P and D converge at the bottom of each square. These arrows indicate that the various stages of EAs are jointly shaped by cultural norms (C), personal views (P), and the design and current condition of the artifacts the subject uses (D). The last element in Figure 2.4 is an arrow that extends from the third square (from left to right), pointing towards the label "Basic objectives and Culturally defined-objectives". This arrow indicates that upon the completion of all the stages of the activity, the subject achieves both types of objectives.

2.5 The study of everyday activities in design

The study of EAs is not new in design. Designers' interest in these practices becomes evident in the different applications of AT to reimagine aspects of people's daily lives. As underscored by Kaptelinin and Nardi (2012b), Leontiev's hierarchical structure of activity offers a framework that designers have used to reimagine the progression of EAs through design interventions (Collins et al., 2002; Crawford & Hasan, 2006). In turn, Engeström's model (2015) has served as a basis for both design and social innovation initiatives (A. D. Campbell, 2021; Gay & Hembrooke, 2004).

Designers' interest in EAs is further evidenced by existing design handbooks, such as that by Hanington and Martin (2012), which include a variety of methods for examining these practices. Given their focus, these methods are categorised in this investigation as either *holistic* or *granular*. Holistic methods offer a macro-scale perspective on EAs by providing an understanding of how such practices are influenced a number of

sociocultural factors. Granular methods, on the other hand, offer a pathway to delve into individuals' views and experiences when performing EAs.

The *Activity Checklist* (Kaptelinin et al., 1999) is a prime example of a holistic method. This tool consists of a list of themes specifically integrated to prompt designers to reflect on how sociocultural factors, such as cultural norms and the division of labour, impact the uses people give to artifacts in EAs. To illustrate the application of the Activity Checklist, consider how one of the sociocultural factors covered in this method (the division of labour in a society) can influence people's approach to the activity of laundry.

In societies where household chores are traditionally the responsibility of one family member, the average laundry loads can be considerable in size as they include garments worn by several people. Conversely, in societies where household chores are more evenly distributed, different family members might wash their clothes separately, resulting in smaller laundry loads.

As the example above shows, holistic methods can offer valuable insights into how specific sociocultural factors influence the unfolding of EAs. However, these methods exhibit key limitations. Due to their sociocultural focus, holistic methods tend to highlight aspects of EAs that are general or common to the majority of members of a society. This emphasis on the collective experience, while valuable for a comprehensive understanding of EAs, can lead to the inadvertent omission of micro-scale or granular aspects of EAs that are pivotal from a design viewpoint. The meanings people assign to artifacts is one of said aspects.

Beyond their practical utility, artifacts also hold emotional significance (Mugge, 2007), impacting how people engage with them in EAs. For example, given its emotional significance, a garment inherited from a deceased relative can be worn only on special occasions and be washed and stored with special care. Furthermore, the emotional significance of an artifact can influence how people carry out EAs not directly related to the artifact. For instance, when wearing a garment with emotional significance, a person may exercise extra caution during dinner to avoid accidentally staining the garment with grease, sauce or other foodstuff.

In addition, artifacts can fulfil aesthetic roles. That is, artifacts can provide people with sensory pleasure, or conversely, they might evoke discomfort (Crilly, 2010; D. Norman, 2007). For example, people may have a preference for clothing made of materials that feel pleasant to the touch, or clothing with colours or graphics that are visually stimulating. People might also choose clothes with a certain thickness, opting for lighter fabrics that offer a sense of freedom and comfort, or thicker fabrics that provide warmth and cosiness, especially in colder climates or seasons. Conversely, people may avoid materials that create undesirable noises when moving, such as the swishing sound of certain synthetics, to maintain a level of quietness and discretion in their attire.

Both the meanings attached to artifacts and aesthetic preferences are deeply personal and can differ significantly from one person to another. To truly capture these unique human-artifact relationships, a granular lens that focuses on individual sentiments and choices is essential.

The need for a granular lens becomes more evident when considering that in carrying out EAs, people can put artifacts to *queer uses*. Proposed by Ahmed (2019, p. 199), the term queer use refers to "how things can be used in ways other than for which they were intended or by those other than for whom they were intended". For example, clothes pegs are primarily created to hold garments while they dry after being washed. However, people can use clothes pegs for a number of other purposes including keeping bags of food sealed, preventing cables from tangling, hanging photos on a string for decorative display, and so on.

As Ahmed goes on to explain, queer uses stem from people's ingenuity. In the quote below, Ahmed highlights how the qualities of an artifact present a range of possibilities for action that individuals can harness in creative ways to meet goals that often extend beyond the purpose for which artifacts were originally intended.

> Even when we use something in ways that were not intended—a cup as a paperweight, for instance— we do so given the qualities of a thing. Perhaps when we use something in ways that were not intended, we are allowing those qualities to acquire freer expression. The keys that are used to unlock a door can be used as a toy, perhaps because they are shiny and silver, perhaps because they jangle (Ahmed, 2019, p. 26).

Furthermore, people's ingenuity may be a factor even when artifacts are used for the purposes for which they were originally created. In his seminal work *Our Own Devices: How Technology Remakes Society, Edward Tenner* (2009) discusses how people with different profiles (from soldiers to athletes) have developed shoe-tying techniques that suit their unique needs and contexts:

> Laces also represent group identity. In North America, Europe and Asia, school authorities occasionally ban colored laces for their association with gangs. Leaving laces threaded but with ends united has been and emblem of youth rebellion. Not wearing them at all with lace-up shoes has, like baggy trousers, been part of inner-city prison chic. (At the other extreme, Lord Baden-Powell established a "Scout's way" of tying laces that concealed both the knot and the end of the string). And even among conservatively dressed adult males there are notable differences in shoelace technique (Tenner, 2009, p. xiii).

Identifying and examining inventive artifact uses such as the ones Ahmed and Tenner describe requires a granular lens that delves into the unique and creative ways in which particular individuals leverage artifact functions when conducting EAs. This micro-level examination can help designers create solutions that directly address the needs and values of specific individuals and groups, which resonates with emerging design approaches such as *Designs for the pluriverse* proposed by Arturo Escobar (2018).

However, it is crucial to note that the granular lens does not overshadow or replace the holistic one. Instead, both lenses can work in tandem, providing a comprehensive understanding of EAs. While the holistic lens can help designers understand the sociocultural context in which EAs take place, the granular lens can offer designers deep insights into how individuals' approach to EAs is influenced by specific sociocultural factors.

2.5.1 The need for new tools to examine everyday activities at a granular level

The spectrum of tools with which designers can examine EAs at a granular level includes observation-based methods. The *AEIOU framework* is one such methods (Hanington & Martin, 2012; Wasson, 2007). Originally rooted in ethnographic studies, the AEIOU framework has been adopted by designers as a tool to gain insights from direct observations of EAs.

Using the AEIOU framework involves annotating or describing the unfolding of an activity based on five key components: Activities (tasks people perform), Environments (spaces where these activities occur), Interactions (exchanges between people and their surroundings), Objects (artifacts within the environment that play roles in the activities), and Users (the people being observed). After documenting these components, designers can analyse the interconnections between them. Doing so can help designers deepen their understanding of the physical dimension of EAs. For example, by examining interconnections between Environments and Activities, designers can identify how the layout of a room influences how Users move and interact with specific Objects.

The observation of EAs can be also be carried out in staged environments, that is, settings that replicate real-world conditions to varying degrees of fidelity (Cem Kaner, 2013). Illustrating the high-fidelity end of the spectrum, Keller et al. (2020) constructed a life-sized mock-up of a tram (or train compartment). This simulated environment was developed with the intent to evaluate the usability of public transport solutions during the early design stages.

On the other hand, illustrating a low-fidelity staged environment, Dai et al. (2018) conducted a study in which they presented participants with various hypothetical scenarios involving bus ticket verification during a trip. To enhance participants' immersion in these scenarios, Dai et al. provided them with physical props that were designed to emulate distinct elements of the bus riding experience.

Staged environments inherently decontextualise EAs, positioning participants in unfamiliar settings. However, this decontextualisation does not necessarily undermine the precision and validity of a study. On the contrary, this decontextualisation opens opportunities to gain a deeper understanding of EAs.

In their daily life, individuals often find themselves conducing EAs in diverse settings, some of which they might be experiencing for the first time (Anderson, 1995; Demetry, 2018). For example, on a given day, people might wash their hands at home in the morning, then do the same in a public bathroom at noon, and finally in the bathroom at a friend's house at dinner. Confronted with the unique characteristics of each of these settings, from differences in faucet designs to types of soap (liquid vs soap bars), individuals may modify their handwashing techniques to varying extents.

The adaptability of people to unfamiliar conditions is a topic of interest to designers as evidenced by Hielscher et al. (2007). These scholars used design probes with the explicit intention of disrupting participants' grooming routines, thereby encouraging them to discover alternative approaches to grooming.

However, the variability of settings in which EAs take place introduces a multitude of factors that can affect how individuals engage in these activities. This variability poses a challenge for designers trying to understand and leverage people's inherent adaptability to unfamiliar circumstances.

Staged environments provide a pathway to address the above challenge. By allowing for controlled testing, staged environments enable researchers to systematically explore how people adapt to specific contextual factors (Dai et al., 2018). In other words, staged environments make it easier to examine how people adapt to unfamiliar conditions, thus offering an understanding of EAs that naturalistic approaches to observing these practices may not easily provide.

While effective at examining people's actions, granular methods which are exclusively based on observation (e.g., AEIOU framework), provide limited access to people's thought processes. This limitation can adversely impact designers' understanding of the cultural and personal dimensions of EAs. By observing someone chopping vegetables, designers can discern specific details, such as how the person holds the knife or the thickness of the slices. Yet, observation alone might not reveal how the person's approach to chopping is influenced by traditions and conventions around food preparation or by their personal preferences and taste.

Designers interested in examining both people's actions and thought processes can turn to granular methods such as the *Think-Aloud Protocol (TAP)*. This method involves participants working through activities while verbalising what they are doing, thinking and feeling (Jaspers et al., 2004). By using TAP, designers can pinpoint decisions participants make on the fly and observe how such decisions influence the use participants give to artifacts in EAs.

However, the understanding that TAP provides of the interplay between people's thought processes and actions is limited. As Hanington and Martin emphasise (2012, p.

180), TAP emphasis is on “what is happening, as opposed to why”. In other words, while TAP provides access to people’s immediate thought processes, people’s deeper motivations for conducting EAs in particular ways may not be as easily discerned through TAP alone.

To delve deeper into the motivations guiding people’s approach to EAs, designers can ask participants to provide simulated walkthroughs of EAs. That is, participants can be asked to physically describe EAs rather than actually performing them in full.

While simulated walkthroughs do not capture EAs unfolding with the same level of detail as would be obtained through direct observation, they do offer advantages that offset this limitation. By involving physical description rather than the full execution of EAs, simulated walkthroughs provide participants the opportunity to distance themselves from the immediacy of the human-artifact inherent to EAs. This distancing opens a space for reflection that can help participants articulate their perspectives on EAs with greater clarity and depth (Clancey, 2002). The incorporation of activity simulation into design methods such as Scenario Testing and Scenario Description Swimlanes underscores the efficacy of this research strategy (Martin, 2012).

Despite integrating both observation and questioning, methods such as TAP, Scenario Testing, and Scenario Description Lanes exhibit limitations as tools for the granular examination of EAs. These methods were created primarily for use in industrial design contexts where rapid decision making often takes priority over systematic research. As a result, these methods often do not provide a systematic approach for data analysis, as highlighted by Sosa in the quote below. As a result, EAs analyses conducted with these methods tend to occur mostly in designers’ heads and without thorough documentation.

> Designers carry out informal research practices and researchers carry out informal design practices. By the former we mean those primarily occupied in design activity who intuitively conduct a review of historical precedents or who unsystematically apply some measurements using a prototype or ad-hoc instruments such as surveys or interviews. Such informal research activities are in service of gaining insights for their design activity and are not carried out to claim a direct contribution to the knowledge base of the field except through their role in loosely informing the final design product (Sosa, 2021, p. 391).

The absence of a clearly defined data analysis process in granular methods that combine observation and questioning may lead to designers (particularly novice ones) not reporting in sufficient detail the process to derive findings from the data. Consequently, designers may struggle to effectively communicate and justify their design recommendations to their teammates (Kiernan et al., 2020; Krishnakumar et al., 2021).

This communication barrier may adversely affect collaborative decision-making in organisations that depend on collective input to define product and service features (Drury et al., 2012; Moe et al., 2012). Without a clear understanding of how their peers produce design recommendations from research, designers are not well positioned to challenge or build upon those recommendations.

Recognising that granular methods combining observation with questioning often lack a systematic approach to data analysis, this investigation identifies a significant gap. These methods can lead to undocumented analyses and insufficient communication of design recommendations. Addressing this gap, the primary objective of set for this investigation was to develop a framework for the systematic and comprehensive examination of EAs at a granular level.

Summary

This chapter delved deep into the concept of everyday activities (EAs), reviewing definitions that, although they were formulated in areas other than design, have served as a basis for creating design solutions. Through this review, it became evident that these definitions, while valuable, do not offer a comprehensive roadmap for designers. In response to this, an examination of the concepts of *activity* and *the everyday* was undertaken, leading to a design-centric definition of EAs. Specifically, EAs were defined as: pervasive, mundane, routine, and socially-situated processes wherein people use artifacts to meet both basic and culturally-defined objectives.

The chapter also reviewed two main types of methods used in design to study EAs: holistic and granular methods. Holistic methods offer a macro-scale perspective on EAs by providing an understanding of how such practices are influenced by traditions, laws, public policies, social conventions, power dynamics, and other sociocultural factors.

Granular methods, on the other hand, focus on understanding and dissecting individuals' experiences when performing EAs.

Holistic methods such as the Activity Checklist (Kaptelinin et al., 1999), can help designers understand the sociocultural contexts in which EAs take place. However, holistic methods often overlook granular or micro-scale aspects of EAs that are relevant to design, such as the meanings people assign to artifacts and the role individual ingenuity plays in artifact use.

Granular methods such as the Think-Aloud Protocol which combine observation and questioning, can help designers better understand numerous micro-scale aspects of EAs. However existing granular methods often lack a structured approach for analysing and interpreting study participants' responses, limiting designers' ability to effectively communicate, challenge or build upon design recommendation derived from the examination of granular aspects EAs. Recognising this gap, the overall objective set for this investigation was: to develop a framework to systematically and comprehensively examine EAs at a granular level, placing particular emphasis of individuals' views and experiences when performing EAs.

Chapter 3 Methodology

In the preceding chapter, everyday activities (EAs) were defined as pervasive, mundane, routine, and socially-situated processes wherein people use artifacts to meet both basic and culturally-defined objectives. It was also highlighted that existing design methods to examine EAs at a granular level often do not provide a clearly structured path to data analysis, potentially limiting decision-making in organisations that depend on collective input to define product and service features (Drury et al., 2012; Moe et al., 2012). Without a clear understanding of how their peers produce design recommendations from research, designers are not well positioned to challenge or build upon those recommendations.

In response to the above gap, this doctoral investigation aimed to develop a framework for comprehensively and systematically examining EAs at a granular level. This chapter details the approach followed to address this objective. Section 3.1 delves into the implications and scope of the research question that guided the development of the proposed framework. Section 3.2 sets out the ontological and epistemological stance adopted to address the research question. Section 3.3 outlines the methodology employed to develop the framework, highlighting that this methodology specifically involved the integration of design methods with methods adapted from areas where systematic data analysis is a priority.

Next, Section 3.4 introduces the areas from which methods were sourced to develop the framework. The specific methods that served as the building blocks of the framework are reviewed in Section 3.5. Finally, Section 3.6 details the work programme undertaken to adapt and integrate the chosen methods, leading to the creation of a new framework to comprehensively and systematically examine EAs at a granular level.

3.1. The research question, its implications and scope

The literature review from Chapter 2 included a discussion of the strengths and limitations of methods currently used in design to examine everyday activities (EAs) at a granular level, i.e., focusing on the views and experiences of individuals when performing EAs.

Methods such as the Think-Aloud Protocol (TAP) combine observation with questioning (Hanington & Martin, 2019) which can help designers understand how cultural norms and personal views influence the unfolding of EAs. However, this type of methods often do not provide a clearly structured path to data analysis, potentially limiting decision-making in organisations that depend on collective input to define product and service features (Drury et al., 2012; Moe et al., 2012). Without a clear understanding of how their peers produce design recommendations from research, designers are not well positioned to challenge or build upon those recommendations.

Recognising the above gap, the overall objective set for this investigation was: to develop a framework (or structured research approach) to systematically and comprehensively examine EAs at a granular level. Guiding the course of this undertaking was the following research question:

- How can design practice be informed by the comprehensive and systematic examination of artifact use in everyday activities?

To further elucidate the implications of the research question, this section will methodically examine and analyse its constituent elements. This review includes a reiteration of how EAs and artifact use are understood in this doctoral investigation.

In Chapter 2, EAs were defined as pervasive, mundane, routine, and socially-situated processes wherein people use artifacts to meet both basic and culturally-defined objectives. In turn, artifact use is understood in this investigation as the harnessing of the functions (or capabilities) that artifacts have due to its design (Ahmed, 2019). Thus, by referring in the research question to the "examination of artifact use in everyday activities", the present investigation was directed towards devising a framework to study how people harness artifact functions in EAs to achieve both practical and culturally-defined goals.

The spectrum of uses that people give to artifacts in EAs spans from *designer-prescribed uses* to *queer uses* (Ahmed, 2019). Designer-prescribed uses are the primary purpose for which artifacts are created. On the other hand, queer uses stem from people's curiosity and ingenuity. Chapter 2 provided the example of a clothespin, designed primarily to

hold garments to a clothesline for drying, and also illustrated queer uses of the clothes peg, such as securing open food bags to maintain the freshness of the contents.

The myriad of queer uses that artifacts can have in EAs calls for an analytical approach that is flexible and therefore allows what people do with artifacts in EAs to be framed in multiple ways. Thus, the present investigation was directed towards devising a framework that would support the qualitative-interpretative examination of artifact use in EAs.

The research question also includes the term "comprehensive". While grounded in artifact use, EAs also have cultural and personal dimensions. In other words, the way people use artifacts in EAs is influenced by both cultural norms and individual's personal views (Certeau & Rendall, 1988; Garfinkel, 1964). For example, the choice of clothes people wear in their daily lives is influenced not only by current fashion trends and dress codes but also by people's personal preferences and taste. Thus, by referring in the research question to the "comprehensive" examination of artifact use, the present investigation was directed towards devising a framework to examine not only what people do with artifacts in EAs, but also the ideas that impact or shape such behaviours.

The term "systematic" is used in the research question in a similar sense to that used by Sanders (2012), who defines systematic[3] inquiries as those that are *theory-based*, *explicit*, and *transparent*. According to Sanders, a form of inquiry is theory-based when data collection and analysis are ontologically and epistemologically justifiable. In turn, a form of inquiry is explicit when the process to collect and analyse data is clear enough to be reproduced and contested. Lastly, a form of inquiry is transparent when it allows conclusions to be formulated in articulated ways. In other words, a form of inquiry is transparent when it is clear how and why certain conclusions are reached.

Drawing on Sander's perspective of "systematic", the inclusion of such a term in the research question set the present investigation on a course to develop a framework with

[3] For Sanders (2012), the term *systematic* refers to forms of inquiry that are theory-based, explicit, and transparent. This term differs from *systemic*, which in theories or models such as Engeström's Activity System Model (2015), refers to a research approach that considers the interrelated components that constitute a larger structure or entity, viewing them as elements in a complex web of interactions.

two fundamental attributes. Firstly, the framework would be firmly grounded in well-established theoretical principles, providing a solid and reliable foundation for its application. Secondly, within this framework, the processes of data collection and analysis would be transparent and reproducible.

The research question also refers to “informing design practice”. Nelson and Stolterman (2012) define design as the ability to imagine and bring to reality, mediums that trigger and enable changes in the current state of affairs. Conceiving and developing such mediums entails decision-making. During product development, designers face several decisions, ranging from selecting the preliminary proposals that will be further developed, to choosing materials and manufacturing processes for fabricating products (Herrmann & Schmidt, 2008). Thus, by referring in the research question to “informing design practice”, the intention was to steer this investigation towards creating a framework that supports decision-making in the design process.

To summarise, the research question posed the task of devising a framework that would support the qualitative-inductive assessment of artifacts use in EAs. This assessment should consider both what people do with artifacts in EAs and the ideas shaping these behaviours. In addition, the assessment conducted with the new framework should be grounded in well-established theoretical principles, prioritise transparency and reproducibility in its execution, and offer insights that inform the design of artifacts.

3.2. The philosophical stance adopted to develop the framework

The previous section outlined the primary objective of this investigation: to develop a framework for comprehensively and systematically examine EAs at a granular level. This section will now focus on the philosophical stance taken to address this objective.

Historically, there has been much debate about whether design falls into the domain of art, science, or straddles both (Munari, 2008; Simon, 1988). In recent decades, an emerging perspective posits design as a domain with pedagogical and research traditions different from those of science and art:

> In the same way that confusion often arises whether architecture is a midpoint between science and art, the nature of design, too, is often misrepresented. However, design is not a midpoint between applied arts and sciences. Design is a third culture with its own founding

> postulates and axioms, with its own approach to learning and inquiry (Nelson & Stolterman, 2012, p. 12).

Aligning with the perspective expressed by Nelson & Stolterman (2012), this investigation recognises design as a domain with its own pedagogical and research traditions. Accordingly, efforts were made during the planning phase to ensure that the investigation's empirical component was anchored in foundational design principles. In other words, deliberate efforts were made so that the very process of developing a framework for examining EAs would occur in a design-centric manner. Pivotal to these efforts were the insights from leading scholars who have extensively explored the unique attributes of design as a professional and scholarly practice.

In his seminal book *Designerly Ways of Knowing*, Nigel Cross (2006) discusses key abilities that distinguish designers from practitioners in other disciplines. The list of abilities that Cross addresses includes:

- Adopting solution-focused cognitive strategies.
- Employing abductive thinking.
- Solving ill-defined problems.
- Using non-verbal modelling media.

The abilities that Cross highlights served as a foundation to delineate the approach to meet the objective of this investigation: developing a framework for examining EAs at a granular level. Before detailing how Cross's highlighted abilities informed the development of the framework, it is imperative to delve deeper into the specifics of these abilities. Doing so will not only offer clarity on their relevance within the realm of design, but will also make the reasoning behind the planning of this investigation more transparent. Therefore, the remainder of this section delves on the abilities that Cross characterises as distinctive of designers.

3.2.1. Designers' distinctive abilities in the professional realm

From Cross's perspective, designers possess a unique set of problem-solving abilities. Among these abilities are the use of abductive thinking[4] and the adoption of solution-focused strategies. When approaching a problem, designers tend to formulate preliminary solutions (abductive thinking) that they subsequently refine to a satisfactory point (solution-focused strategy). Such an approach to problem-solving differs from that of scientists who tend to systematically consider variables (or relationships between them) until they find the rule or guiding principle of a problem.

> A central feature of design activity, then, is the reliance on generating fairly quickly a satisfactory solution, rather than on any prolonged analysis of the problem. In Simon's (1969) inelegant term, it is a process of satisficing rather than optimising; producing any one of what may well be a large range of satisfactory solutions rather than attempting to generate the one hypothetically-optimum solution (Cross, 2006, p. 7).

According to Cross, the reliance on abductive thinking and solution-focused strategies is directly tied to the type of problems designers typically encounter. As is widely accepted in the design literature, the problems designers face are ill-defined or wicked[5], implying that obtaining all information related to these problems is not feasible. When faced with wicked problems, the generation of preliminary solutions is essential, as it allows for the problem to be framed within manageable limits.

> It is also widely recognised that design problems are ill-defined, ill-structured, or wicked (Rittel and Webber, 1973). They are not the same as the 'puzzles' that scientists, mathematicians and other scholars set for themselves. They are not problems for which all the necessary information is, or ever can be, available to the problem-solver. They are therefore, not susceptible to exhaustive analysis, and there can never be a guarantee that 'correct' solutions can be found

[4] Abductive thinking in design refers to the process of making intuitive leaps, often based on incomplete information, to arrive at innovative solutions or ideas. It contrasts with deductive and inductive reasoning by emphasising creative conjecture and best-guess scenarios to bridge gaps in knowledge (Kolko, 2010).

[5] Wicked problems in design refer to complex issues that are ill-defined, ambiguous, and resistant to clear solutions. They often have multiple stakeholders with varying perspectives and lack a definitive correct answer. Addressing one aspect of a wicked problem may reveal or create other challenges, making solutions both temporary and adaptive (Buchanan, 1992).

> for them…It is only in terms of a conjectured solution that a problem can be contained within manageable bounds (Cross, 2006, p. 7).

As noted by Cross (2006) and Gero (1994), a strategy that designers often follow to generate solutions for wicked problems is to combine and adapt pre-existing designs (or parts of them). Take the personal computer (PC) as an example. Arguably, the design of the PC merges features of both typewriters (the keyboard) and TV sets (the screen). However, the creation of the PC entailed more than simply coupling or bringing together two pre-existing solutions. Not only did the keyboard and screen undergo significant modifications, but numerous electronic and structural components had to be developed so that the concept of a PC could come to fruition (Abbate, 1999).

Another strategy that designers use to generate solutions to wicked problems is to create visual representations, or "non-verbal modelling media", as Cross (2006) terms them. The role of visual representations in design is well-documented (Do, 1996; Do & Gross, 1996; Tang & Gero, 2001). One of the most influential views in this regard is that, when creating visual means, designers often find disparities between what they intend to depict and what the ensuing images suggest (Goldschmidt, 1991; Schon & Wiggins, 1992). According to Goel (1995), this ambiguity offers designers multiple avenues for reinterpreting information and therefore uncover unforeseen possibilities to address wicked problems.

In summary, Cross (2006) posits that designers are distinguished by their ability to employ strategies such as combining pre-existing designs and creating visual representations, to iteratively develop solutions for wicked problems. Yet, as explored in the following section, these abilities not only set designers apart in the professional realm. Often, the abilities that Cross highlights also distinguish designers within the academic arena.

3.2.2. Designers' distinctive abilities in the scholarly realm

The abilities highlighted by Cross (2006) can also be observed in designers' academic and scholarly endeavours. For example, the use of abductive thinking is evident in how designers engage in theory formulation. Scholars such as Markussen (2017) contend that theory building in design diverges significantly from traditional scientific disciplines, which commonly strive for optimal or definitive explanations. As Markussen elaborates,

pursuing a definitive theory in design is not feasible given the wicked problems that design is concerned with and the ever-changing circumstances in which designers operate. Thus, rather than aiming for definitive explanations, theory building in design aims for explanations that are fluid and open to extension, refinement, or even complete redefinition as new insights or challenges emerge.

> …design theories are not confined to descriptions, explanations or predictions of existing reality. Instead they should deliver creative 'propositions' (Zimmerman et al., 2010) or 'generative statements' (Gaver, 2012, p. 941) for investigating a potential future through the process of designing and making of artifacts. For the same reason they [design theories] take on a totally different form from scientific theories. They tend to be provisional, contingent and aspirational… (Markussen, 2017, p. 90).

Combinatorial strategies also play a critical role in design research. As highlighted by Sosa (2021) and Yee (2010, 2012, 2017) in the quotes below, many students pursuing their PhDs in design integrate traditional research methods with the design tools and visual representation techniques in which they are skilled. As these scholars further underscore, through such combination or bricolage[6] of methods, PhD students position themselves to unearth new problems and questions, as well as to examine ideas in comprehensive and innovative ways. Sosa's and Yee's perspectives echo that of Kara (2015), de Sousa Santos (2015, 2018), and Bhargava (2013), whose work shows how, by supporting alternative forms of knowledge, the unconventional use of research methods can foster methodological innovation and decolonial design practices in both industry and academia.

> As these [PhD Design] students learn the normal uses of research methods, they creatively and resourcefully integrate and complement these with the design methods that they have advanced mastery on. This way, they use methods that can be characterized somewhere between designerly-research and researcherly-design methods to

[6] *Bricolage* is a term coined by Claude Lévi-Strauss (1966b) to refer to a sort of *do-it-yourself* approach by which individuals repurpose whatever materials are at hand to solve a problem. In the research context, Denzin and Lincoln (2011) use the term bricolage to refer to the piecing together of different methods, theories, and epistemological perspectives in order to comprehensively address the multifaceted nature of social phenomena.

> reveal new problems and questions, and to examine ideas, knowledge, and meanings (Sosa, 2021, p. 397).

> It is generally acknowledged in design theory and thinking literature that visual representation of complex information in different forms is a central feature of design activity. It is not surprising then, that my own PhD and many others that I have read or examined are either very visual in their representation or use of visual strategies in their processes. This strategy uses skills suited to the designers' cognitive styles, it also enables design researchers to leverage their more developed visual communication skills in support of their written argument (Yee, 2017, p. 160).

The combination or bricolage of methods entails more than simply using several methods together. As Yee elucidates in the quote below, adopting a bricolage approach entails two key competencies. First, researchers must be well-versed in diverse epistemologies. Second, researchers need the ability to discern alignments and reconcile tensions between these epistemologies. Simply put, the use of the bricolage approach entails reimagining multiple methods into a cohesive and innovative whole.

> It [the bricolage approach] goes beyond what some might describe as a mixed method. Kincheloe (2011) describes it as multi-perspectival research methods using tools from different disciplines that enable the researcher to compare and contrast multiple points of view. A key difference in using this multi-perspectival and interdisciplinary approach in research is that the researcher must be knowledgeable in differing epistemologies and social theoretical assumptions in order to confidently, select, adapt and apply the methods in an appropriate and defendable manner (Yee, 2017, p. 161).

To summarise, the abilities that Cross (2006) identifies as distinctive to designers are not solely applied in professional settings. Many designers also rely on these abilities when undertaking scholarly and research endeavours. On this basis, it is plausible to consider these abilities as intrinsic to how designers think and act. This understanding shaped this investigation's methodology which is described in the upcoming section.

3.3. A designerly methodology to develop the framework

The overarching objective of this investigation was to develop a framework for comprehensively and systematically examining EAs at a granular level. Subscribing to the view that design is a domain with its own pedagogical and research traditions, a methodology was devised that would ensure the development of the framework was

anchored in foundational design principles. This section delves into the specifics of said methodology, elucidating the design-centred approach adopted for developing the proposed framework for examining EAs.

3.3.1. Anchoring the development of the framework to foundational design principles

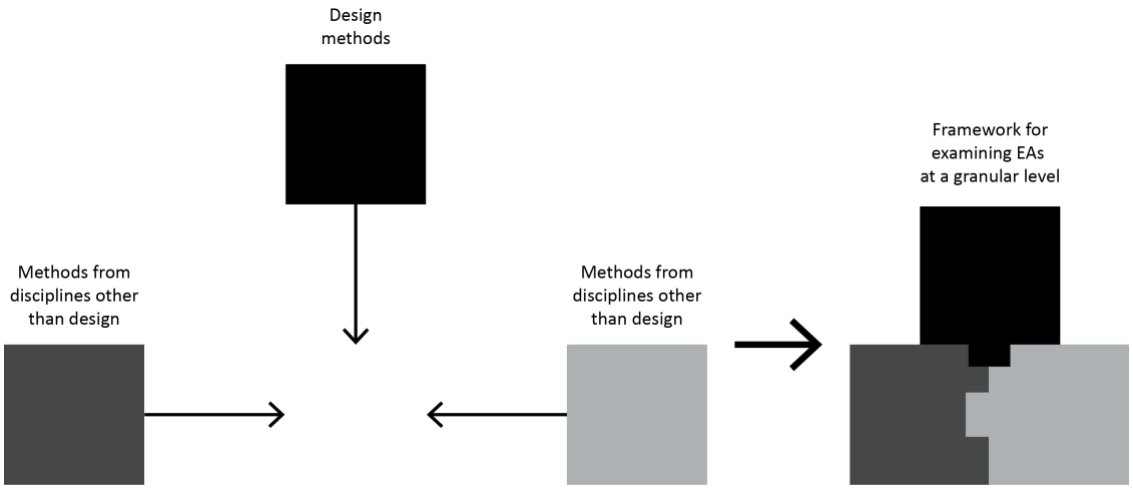
The methodology employed in this investigation was structured around abilities that Cross (2006) deems as distinctive of designers. In other words, the methodology was crafted to ensure that these abilities were actively applied during the development of the framework.

The design-related abilities shaping this methodology were: the use of abductive thinking, the use of combinatorial strategies, and the use of visual representations. These abilities not only allowed for the development of the framework to be aligned with underlying design principles, but also brought a number of other distinct advantages as detailed below.

Drawing inspiration from how designers combine existing designs to generate new solutions, the decision was made to develop the framework using a bricolage approach (Kincheloe, 2011; Yee & Bremner, 2011). Specifically, the framework would be developed by integrating methods commonly used in design with methods adapted from other disciplines (Figure 3.1).

Figure 3.1

A bricolage approach to develop a framework for examining EAs from a design viewpoint.



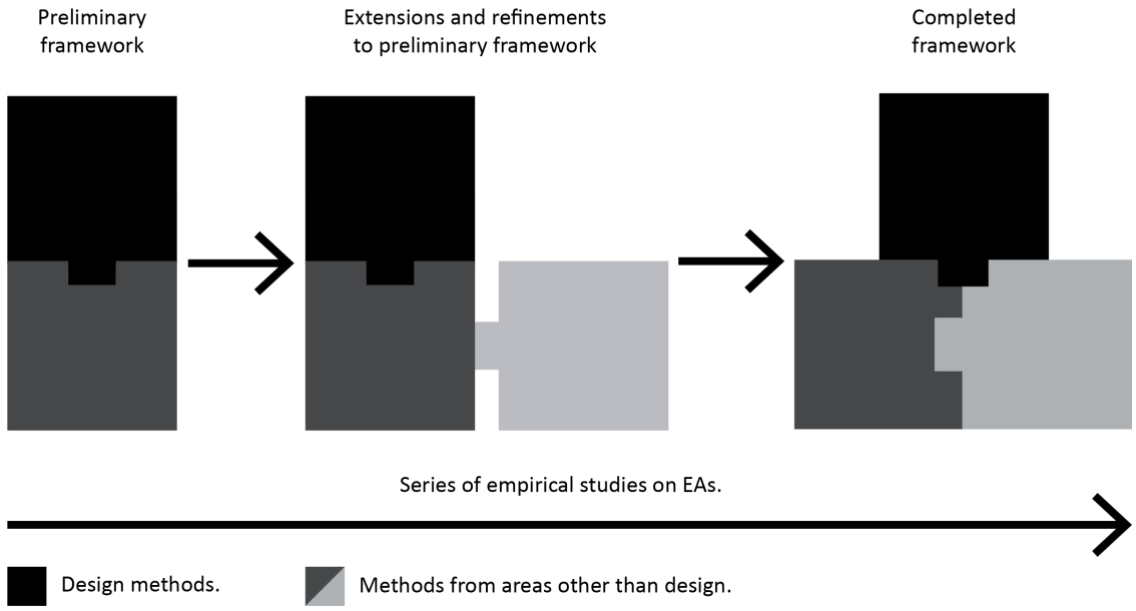
The decision to adopt a bricolage approach was based on a key recognition made in Chapter 2, Section 2.4. Several design methods for examining EAs at a granular level combine observation with questioning, which can help understand how cultural norms and personal views impact the use of artifacts in EAs(Hanington & Martin, 2019). However, these methods often do not provide a clearly structured path to data analysis, particularly when it comes to interpreting the comments and responses of study participants.

A combinatorial approach was seen as a pathway to address the above shortcoming. By employing a combinatorial approach, design methods that combine observation with questioning could be integrated with data analysis methods from disciplines that prioritise conceptual clarity and structured data analysis. This bricolage of methods was anticipated to yield a framework well-suited for both effective data collection and systematic data analysis.

After deciding that the framework would be developed by adapting and integrating methods from various areas, the next step was to outline the approach for performing said bricolage of methods. As highlighted by Cross (2006), designers often address ill-defined problems by generating preliminary solutions that they subsequently refine to a satisfactory point. Drawing inspiration from this approach to creating solutions, two methodological decisions were made. First, the framework would be developed progressively. That is, an initial or preliminary framework would be developed, which would then be expanded and refined in subsequent phases. Second, the development of the framework would be grounded in real-world application. In other words, the preliminary framework and its subsequent refined and expanded versions would be formulated through the course of a series of empirical studies on EAs (Figure 3.2).

Figure 3.2

Progressive approach to build a framework for examining EAs from a design viewpoint.



The decision to develop the framework progressively over several studies was due to several reasons:

- Developing the framework through the course of empirical studies would ensure the framework's design directly addressed challenges that designers encounter when examining EAs in their professional practice.
- Conducting multiple studies would allow the methods comprising the framework to be addressed individually or in subgroups rather than all at once. This detailed approach was expected to illuminate the strengths and limitations of the methods, thus paving the way for effectively adapting them to the proposed framework for examining EAs.
- Conducting multiple studies would enable iterative refinement of the methods. As the adapted methods were applied across different studies, their practicality and effectiveness in examining EAs could be gauged. Based on these evaluations, further refinements could be made, ensuring the methods were progressively shaped to fit as integral components of a framework aimed at examining EAs from a design viewpoint.
- A multi-study approach would facilitate a progressive build of the proposed framework, ensuring that the various methods comprising it effectively

integrated with each other. This approach was anticipated to culminate in the development of a cohesive framework, wherein each subsequent stage of analysis builds upon and advances the insights developed from the previous stages.

- Conducting multiple studies to develop the framework would offer flexibility, allowing for adjustments to the work programme after the conclusion of each study. This adaptability was especially critical as the framework's development spanned 2020 and 2021, a period marked by the Covid-19 pandemic. Given the continuous fluctuations in alert levels and public health restrictions in Aotearoa New Zealand, a flexible work programme was considered key to ensuring that this doctoral investigation could be concluded in a timely manner.

3.3.2. Ensuring the applicability of the framework

Besides decisions aimed at anchoring the development of the framework in foundational design principles, this methodology also incorporated decisions aimed at ensuring the applicability of the proposed framework. In other words, decisions were deliberately made to ensure the framework' suitability for examining a wide range of EAs and providing useful information for designing artifacts. The following paragraphs will elaborate on these additional decisions.

To ensure that the framework was suitable for examining a wide range of EAs, the decision was made to focus the studies used for its development on what this investigation designates as *model activities*. That is, activities that clearly exemplify inherent attributes of EAs and offer practical advantages to design researchers.

It is pivotal to highlight that the notion of model activities does not imply representativeness. In other words, the argument here is not that there are activities whose examination provides insights directly applicable to all EAs. Instead, the notion of model activities implies that there are activities that reflect more clearly than others the attributes that make EAs a distinctive type of human practices. Simply put, model activities facilitate the examination of attributes that, although common to all EAs, may not be equally observable in all these practices.

The decision to base the development of the framework on the examination of model activities reflects how geneticists study model organisms[7] specifically for the advantages they offer for understanding biological phenomena common across several species (Leonelli & Ankeny, 2013; Levy & Currie, 2015). Take for example the case of the fruit fly. Given its high reproductive rate and short lifespan (compared to other species), the fruit fly has allowed geneticists to gain a foundational understanding of how genes are passed on from parents to siblings across multiple generations. This understanding has served geneticists as a starting point to examine the mechanisms of genetic transmission in a wide variety of species, including humans (Shih et al., 2015).

Drawing inspiration from geneticists' approach, it was anticipated that examining model activities would yield a framework capable of accommodating the distinct manners and degrees of clarity in which EAs' intrinsic attributes are expressed across a wide range of EAs.

The selection of model activities for this investigation was informed by the following criteria:

1. A model activity is clearly guided by cultural norms. According to Giard (1998), cultural norms delimit three primary aspects of EAs: suitable times for their realisation, appropriate artifacts for their realisation, and suitable ways to use artifacts in EAs. For example, eating is an activity clearly guided by cultural norms. Etiquette rules establish not only the times of day to eat certain types of food, but also the appropriate ways to use cutlery at each meal (Haidar, 2013; Xu et al., 2018). In contrast, there are activities such as reading a book, in which the role of cultural norms is less clear. While book and author recommendations abound in the media, little is said about proper ways to hold a book or turn its pages.

[7] In the context of biology and genetics, *model organisms* are non-human species that undergo rigorous examination to elucidate a wide range of biological processes. The goal when studying model organisms is to generate insights applicable to other organisms, especially those considered biologically more complex than the one that serves as the model (Leonelli & Ankeny, 2013; Levy & Currie, 2015).

2. A model activity varies widely due to individuals' personal views and choices. To make a situation match their individual concerns and expectations, people may deviate from what cultural norms establish (Certeau & Rendall, 1988; Garfinkel, 1964). Take the activity of getting dressed as an example. In many societies, there are dress codes and fashion trends that influence the clothes people wear in their daily lives (Rubinstein, 2019). However, in order to communicate their personal values and opinions, some individuals may deliberately wear clothing that differs from what dress codes and fashion trends establish. In contrast, there are activities such as brushing teeth in which it is more difficult to recognise how people deviate from social conventions to express their individual views or interests.
3. A model activity clearly varies due to the design, availability and current conditions of artifacts. For instance, consider the activity of exercising. People's exercising routines can significantly vary depending on the apparatus and equipment available at the gym. In contrast, an activity such as watching TV may not vary much beyond the actual content that people are watching.
4. A model activity involves a wide range of artifacts, potentially facilitating the examination of a broad spectrum of artifact uses. For instance, housekeeping is an activity that involves a diverse set of artifacts such as brooms, dustpans, buckets, mops, spray bottles, sponges, cloths, paper towels, trashcans, and vacuum cleaners, to name a few. Therefore, housekeeping may offer a more varied landscape of artifacts uses compared to an activity such as jogging, which mainly revolves around sportswear and accessories such as fitness trackers.
5. A model activity poses minimal ethical issues because its examination does not require collecting confidential or private data nor putting participants in potentially vulnerable situations. For example, walking a dog is an activity conducted in public spaces, eliminating the need to intrude into people's private settings. In contrast, examining activities such as bathing or sleeping require observing or inquiring into intimate moments of people's daily lives.
6. A model activity is highly relatable. In other words, it is an activity that people with diverse profiles are keen to demonstrate and openly discuss. For example, exercising is an activity that people across various age groups and

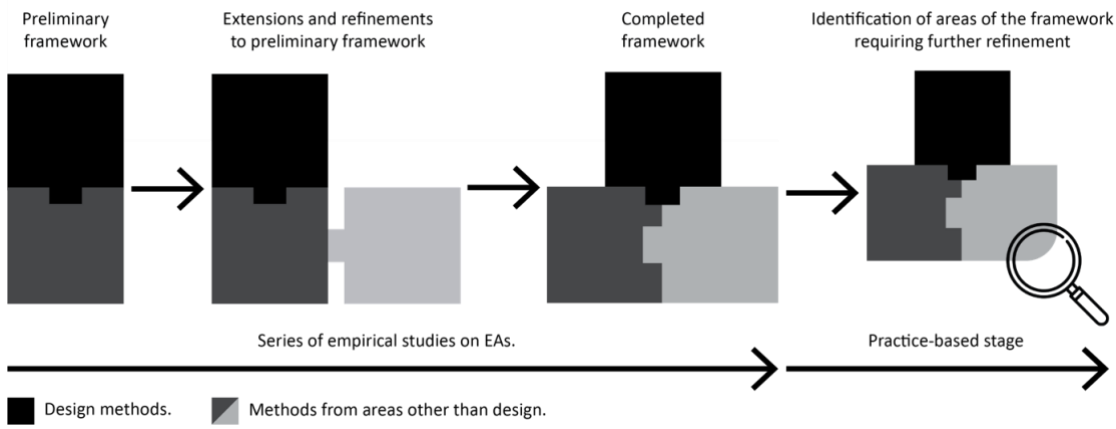
cultural backgrounds frequently demonstrate and discuss in forums such as blogs, TV shows, magazines, gym classes, and social media platforms such as Instagram. Activities such as beard trimming present a different case. Beard trimming is also a widely discussed topic on various forums. However, this activity is mainly undertaken by a specific demographic, namely, adults with abundant facial hair.

7. A model activity does not require multiple hours to complete, allowing for a streamlined approach to data collection and analysis. For instance, making a sandwich is an activity that can be completed in a matter of minutes, reducing the amount of time and resources required for studying it. On the other hand, activities such as watching TV can extend over several hours, potentially making the data collection and analysis more resource and time-consuming.

Integral to the planning of this investigation was ensuring that framework to be developed offered insights that would inform the design of artifacts. Accordingly, the decision was made that the development of the framework would also include a practice-based stage (Figure 3.3). This stage would involve carrying out a design exercise based on insights generated with the proposed framework.

Figure 3.3

Inclusion of a practice-based step in the framework's development.



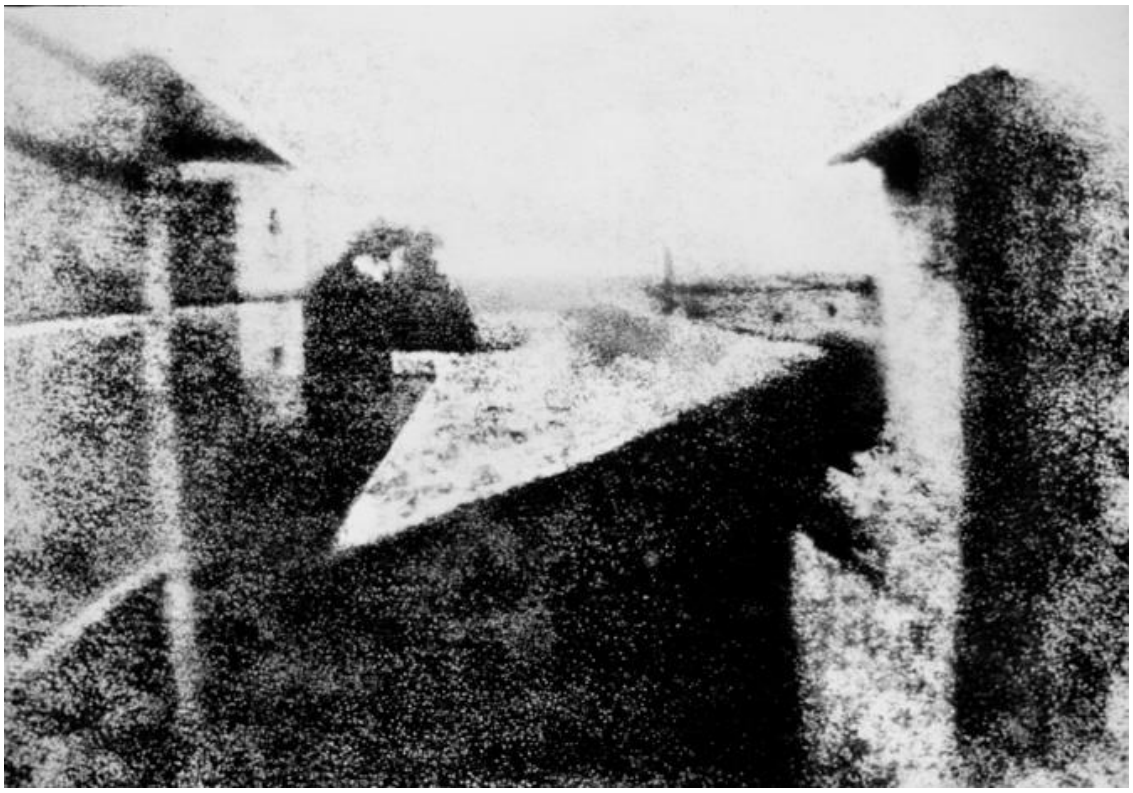
It is pivotal to note that this design exercise was neither conceived nor anticipated to offer a seminal contribution to the design discipline. Instead, the exercise was intended to serve a diagnostic purpose. It was anticipated that conducting this exercise would

allow for the identification of aspects of the proposed framework that potentially required further refinement before the framework could be applied effectively in real-world design contexts.

Drawing a parallel, the design exercise can be likened to Joseph Nicéphore Niépce capturing the first photograph in 1826 using his heliographic process (Clarke, 1997). In both instances (the design exercise and Niépce's experiment) the primary objective was not to produce an exemplary outcome. Rather, the central aim was to lay a foundation for future innovations, be it in design or in photography.

Figure 3.4

The earliest saved photographic image by Joseph Nicéphore Niépce (Clarke, 1997).



To recap, this section consisted of an account of the methodology defined to address the overarching objective of this doctoral investigation: to develop a framework for comprehensively and systematically examine EAs at a granular level. The five key decisions incorporated in this methodology were:

- The framework would be developed by adapting and integrating methods commonly used in design with methods from areas that prioritise systematic data analysis.

- The development of the framework would be progressive. That is, a preliminary framework would be developed, which would then be incrementally expanded and refined.
- The development of the framework would be grounded in real-world application. Specifically, the preliminary framework and its subsequent refined and expanded versions would be formulated through the course of a series of empirical studies on EAs.
- The series of empirical studies used to develop the framework would centre on model activities. That is, activities that clearly exemplify inherent attributes of EAs and that offer practical advantages to design researchers.
- The development of the framework would include a practice-based stage aimed at identifying aspects of the proposed framework that could require further refinement before the framework could be applied effectively in real-world design contexts.

The ensuing sections of this chapter will further elaborate on the methodological choices above. In Section 3.4, the areas from which methods were sourced for the development of the framework are identified. This is followed by Section 3.5 where the specific methods that served as building blocks of the framework are presented. Finally, the work programme to develop the framework is delineated in detail in Section 3.6.

3.4. Areas that provided building blocks for the framework

As established earlier, the overarching objective of this investigation was to develop a framework for examining EAs at a granular level. The methodology selected to address this objective involved integrating design methods with methods adapted from areas that prioritise conceptual clarity and systematicity. This section introduces two such areas: Multimodal Interactional Analysis (MIA) and Social Network Analysis (SNA).

The decision to leverage MIA and SNA methods to build the framework was due to the ontological and epistemological alignments between these areas and design. To provide greater clarity on this decision, this section offers a review of the foundations of MIA and SNA, their ontological and epistemological alignments with design, and the potential these alignments offer for examining EAs from a design viewpoint.

3.4.1. Multimodal Interactional Analysis

Multimodal Interactional Analysis (MIA) is a methodological framework for explaining the complexity of interpersonal encounters. MIA is primarily concerned with the overlaps and trade-offs between the various channels or *communicative modes* through which people exchange information (Norris, 2012).

Communicative modes are semiotic systems based on regularities and rules (Norris, 2004). For example, in MIA written language is considered a communicative mode because it can be described in terms of grammar and syntax rules, sets of word meanings, principles for verb conjugation, and so on.

MIA, however, is not limited to communicative modes where rules are explicit and known a priori. MIA practitioners have pinpointed regularities, and thus framed as communicative modes, other aspects of human interaction such as body language, proxemics (how close individuals position to each other or relevant artifacts), gaze, and music.

In MIA, all human interactions are considered to involve the exchange of information through various communicative modes (Norris, 2004). During a conversation, spoken language is just one of the communicative modes through which people may exchange information. Besides talking to each other, interlocutors may also be aware, (to a varying extent) of each other's way of standing, facial expressions, or hand movements.

In addition, surrounding artifacts may enable interlocutors to exchange information through communicative modes. For example, smartphones provide access to photos and videos which interlocutors can show to each other and discuss. Likewise, interlocutors can use pen and paper to create sketches or write notes to each other. Furthermore, artifacts can themselves be communicative modes. Artifacts such as clothing, jewellery, or sunglasses, can serve interlocutors to convey several aspects of their personalities.

In MIA, artifacts are considered to enable communicative modes in *embodied* and *disembodied* manners. (Norris, 2004). Embodied communication occurs when expressing or receiving information requires coming into physical contact with artifacts. Reading a book is an example of embodied communication because accessing the text

requires coming into physical contact with the book. Conversely, communicative modes are enabled in a disembodied manner when information exchange does not require coming into physical contact with artifacts. A billboard readable from the distance is an example of a disembodied exchange of information through the written and visual modes of communication.

The analysis of communicative modes in MIA is based on video. MIA researchers capture interpersonal encounters on video and subsequently analyse both the actions and speech acts[8] of the people in the videos (Norris, 2012).

The analysis of actions often involves creating written descriptions of what people do within specific intervals in the videos. These descriptions may also include inventories of the artifacts that appear on camera and comments about other people who appear in the video but who do not directly participate in the interpersonal encounter being examined (Ramey et al., 2016).

On the other hand, the analysis of speech acts in MIA usually involves the use Discourse Analysis (DA) and/or Thematic Analysis (TA) techniques. While DA allows for assessing the meaning and effects that particular speech acts have on an interaction, TA allows for identifying and making sense of patterns in the way people talk to each other (Braun et al., 2018; Phillips & Hardy, 2002; Terry et al., 2017).

As is widely recognised in specialised literature, the meaning of actions and speech acts are culture specific. For example, maintaining eye contact can be interpreted as a signal of attention and respect in some cultures, and as a confrontational act in others (Elhadji, 2017). Therefore, to effectively interpret actions and speech acts, MIA researchers must develop an understanding of the cultural background of the people they investigate.

[8] In Multimodal Interactional Analysis (MIA), as well as in other related fields of study such as pragmatics and linguistics, the term *speech acts* refers to instances of spoken language. The analysis of speech acts in MIA is concerned not just the words spoken, but also with the underlying intention or effect of these words within the context of an interpersonal encounter. Speech acts are typically divided into locutionary (the actual content of a utterance), illocutionary (the speaker's purpose or intent behind the utterance), and perlocutionary acts (the impact a utterance has on the listener) (Searle et al., 1980).

This understanding is typically developed through a combination of methods, including reviewing literature on cultural practices (Onwuegbuzie & Frels, 2016), conducting ethnographic fieldwork (Dicks et al., 2011), engaging with cultural informants (Johnson, 1990), and sometimes learning from the participants themselves about their cultural norms and values (Kress, 2011). By integrating such cultural insights into their analysis, MIA researchers can provide a more accurate and culturally sensitive interpretation of people's actions and speech acts.

Similarities between Multimodal Interactional Analysis and Design

Both MIA and design focus on artifacts and how people relate to them. In design, artifacts are often viewed as enablers of actions and thoughts (Krippendorff, 2006; Martín Juez, 2002). Meanwhile, MIA considers artifacts as mediums that aid human communication.

MIA and design are also similar in that in both areas are concerned not only with what people do but also with what people say. While design delves into how people interact with and speak about artifacts, MIA explores what people do and say to communicate their emotions, beliefs, and concerns (Martin, 2012; Norris, 2004).

One way in which MIA can contribute to advance design research on EAs is through the distinction between the embodied and disembodied ways in which artifacts enable human communication. The differentiation between embodied and disembodied communication highlights that not every human-artifact interaction involves physical contact. Therefore, observation alone does not allow for a comprehensive examination of artifact use in EAs.

Furthermore, the methods and techniques employed in MIA to analyse speech acts can be used in design to pinpoint instances of disembodied artifact use. At a family dinner, a comment such as "I almost choked on the chicken when the podcast host said that" hints at the disembodied use of artifacts such as speakers, a modem, an Internet connection, voice-activated virtual assistants, wireless headphones, or even remote-controlled smart home systems.

3.4.2. Social Network Analysis

Social Network Analysis (SNA) is a research domain concerned with visualising, describing, and examining interconnections or interactions between sets of elements (Tabassum et al., 2018; van Duijn & Vermunt, 2006). SNA encompasses methods and tools from several disciplines, including sociology, anthropology, statistics, mathematics, and information sciences (Prell, 2012; J. Scott & Carrington, 2011). These methods articulate around a representation system based on *nodes* and *links*.

Nodes are geometric figures that can represent people, companies, websites, or other entities capable of producing, disseminating, and receiving information. A link is a line drawn between two nodes to indicate that those specific nodes exchange information with each other. Links can have an arrow at one end, indicating a one-way exchange of information, or be without arrows, indicating a bilateral flow of information. Drawing nodes and links results in arrays of interactions known in SNA as *networks* (Caldarelli & Catanzaro, 2012).

There are several statistical methods used in SNA to examine the *structure*, *level of clustering*, and *centrality* in networks. In SNA, the term structure refers to the arrangement of nodes and links within a network. Analysing the structure of a network allows for estimating the communication efficiency, i.e., the speed at which information disseminates within the network. A widely used approach to examining the structure of a network is to count the number of links between the two farthest nodes. This approach is commonly referred to as measuring the diameter of a network. For deeper insights on network structure examination techniques, refer to Prell (2012).

In SNA, the term clustering level refers to the probability that two nodes, both linked to a third node, are also directly connected to one another. To draw an analogy, the clustering level indicates how likely it is that two friends of a specific person (or node) are also friends with each other. Analysing the clustering level of a network can help understand the network's resilience and the strength of the relationships between its members. A widely used approach to examine clustering level consists of determining how many groups of three interconnected nodes (closed triangles) exist compared to all potential triangular connections in a network (Cherven, 2015). For further details on how to examine clustering in social networks, refer to Scott and Carrington (2011).

Within the context of SNA, the term centrality refers to the ability of a node, given its position within a network, to receive or disseminate information. Two common methods to examine centrality in a network are *the degree centrality* and *betweenness centrality indicators* (Cherven, 2015). The degree centrality indicator ranks the nodes in a network according to their number of direct connections or adjacent links. Nodes with a greater number of links are considered more central than those with fewer connections.

Betweenness centrality, on the other hand, involves identifying the most direct routes between every pair of nodes in a network. Then, the frequency with which each node appears on these routes is determined. This measure highlights the nodes' role in facilitating information flow across the entire network (Derrible, 2012; Everett & Borgatti, 1999; Maharani et al., 2014). For more details on centrality indicators see Sharma and Surolia (2013)or Zhang and Luo (2017).

Similarities between Social Network Analysis and Design

Both design and SNA utilise visual tools to develop a better understanding of complex phenomena. In design, sketches, visual maps, 2D and 3D models, flowcharts and other types of visual representations are used to understand user requirements, define product features, among other purposes (Goel, 1995; Oxman, 2017; Van der Lugt, 2002, 2005). Meanwhile, SNA employs nodes and links to visually represent and systematically analyse interactions among people, artifacts, companies, and so on.

The visualisation and analysis methods used in SNA can help examine different aspects of EAs. Nodes could be drawn to represent the artifacts that people use in different EAs. Links, on the other hand, could be drawn to indicate the artifacts that are used in the same activity. Once this network is modelled, its diameter could be measured to better understand how changes made to one artifact could impact the use of other artifacts involved in the same or other activities.

3.5. The building blocks of the framework

In the previous section, Multimodal Interactional Analysis (MIA) and Social Network Analysis (SNA), were introduced as two areas that present ontological and epistemological similarities with design. With this foundation established, the focus will

now shift to detailing the specific design, MIA and SNA methods that served in this investigation as building blocks for developing a novel framework to examine EAs at a granular level.

3.5.1. Building blocks from design

The interview was the design method that served as the building block of the proposed framework for examining EAs. The interview is a data collection method whose conception and use have changed over time. The interview was originally viewed as data collection method conducted unilaterally by the researchers. In the original interview model, researchers designed and posed questions to respondents following a script or protocol. The respondents, for their part, limited themselves to listening to the questions and responding. Any comments or queries raised by respondents were considered as requests for clarity, not as data on the subject being examined (Gubrium & Holstein, 2012).

While the unilateral interview model is still used in multiple research domains, several researchers have recently advocated for a view of the interview as a two-way method. In his seminal book *Learning from Strangers* (1994), Robert Weiss emphasises that interviewing consists of obtaining, as objectively as possible, respondents' opinions on a topic. As Weiss goes on to explain, respondents' can provide more detailed information if they are given the opportunity to elaborate on their ideas beyond what a question asks or frames. In other words, Weiss argues that giving respondents some level of control over how an interview flows can improve the richness and depth of the collected data.

The choice of the interview as a building block of the framework was due to several reasons. The interview involves direct interaction with participants, making it possible to gather first-hand accounts of their opinions, attitudes, and personal perceptions on a wide variety of topics (Martin, 2012). Such deep understanding is critical for designers to create products that cater to the end-users specific contexts and requirements.

In addition, the interview is a data collection method that enables the supplementation of questioning with observation (Hanington & Martin, 2019). During an interview, participants can be posed with questions while they complete tasks defined a priori by researchers (Kuijer et al., 2013). Combining observation with questioning can be

particularly valuable for designers. This approach not only provides insights into what people do with the artifacts in EAs, but also about the reasons and motivations guiding people's actions.

The interview also opens up opportunities for methodological innovation. As Kara points out, interviews can be "creatively enhanced" (2015, p. 83). That is, researchers can explore inventive or unorthodox ways to make it easier for participants to elucidate and communicate their opinions, memories, concerns, feelings, and so on. These explorations may involve combining the interview with other data collection methods. An example would be an interview where the questions are aimed at better understanding the content of diaries that the participants filled out a priori.

Interviews allow for data to be collected both online and in-person without compromising the quality or validity of the data (Shapka et al., 2016). This versatility becomes particularly handy in contexts such as the Covid-19 pandemic, where in-person interaction with study participants might be neither safe nor feasible. Furthermore, both online and in-person interviews can be video recorded, enabling a thorough analysis of the data. For example, to analyse intricate details of participants' actions or statements, researchers can play specific segments of an interview video multiple times.

3.5.2. Building blocks from Multimodal Interactional Analysis

The multimodal transcript was the MIA method that served as a budling block to create the proposed framework for examining EAs. The multimodal transcript is a method used in MIA to systematically examine a broad range of communicative modes, spanning from spoken and body language to artifact-mediated communication (Norris, 2004, 2012). Due to its comprehensive analytical reach, the multimodal transcript was viewed as an ideal foundation for devising a framework that comprehensively examines artifact use in EAs.

The type of data used in MIA to examine communicative modes is video. Thus, to prepare a multimodal transcription it is necessary to have defined and videorecorded a priori the interpersonal encounters that will be analysed (Norris, 2004).

Roughly, the process to create a multimodal transcript consists of five steps. The first step is to revisit the video of an interpersonal encounter and capture still images of the

actions that people perform. In MIA, the term *actions* refers to processes bracketed (at least partially) by social codes (Norris, 2004, 2012). For clarity, consider the interpersonal encounter shown in Figure 3.5, which consists of two individuals talking in a park. The moment in which the individual on the right approaches the individual on the left can be seen as the action that marks the beginning of the interpersonal encounter (1). The next action may be a ritualised greeting that involves physical contact between the two individuals (2). Next, the individuals can strike up a conversation (3). Once they finish talking the two individuals may say goodbye and be on their way (4).

Figure 3.5

An encounter at a park deconstructed into actions.

The second step when creating a multimodal transcript is to supplement the still images extracted from the videos with written transcriptions of what the people in the videos said when performing each action. To systematically create these written transcriptions researchers can refer to transcription strategies such as those proposed by Jefferson (Sacks, 1974) and Tannen (2005).

The third step in preparing a multimodal transcript is to employ Discourse Analysis (DA) techniques to examine how people in the videos use spoken language (Phillips & Hardy, 2002). There are three main approaches (not mutually exclusive) used MIA to examine the use of spoken language:

- The first approach consists of assessing how particular utterances (or speech acts) impact on other communicative modes and vice-versa (Norris, 2004). In the context of two people sitting at a cafe talking, utterances such as “How have you

been, my dear?" or "Come on girl, tell me about your new job" will most likely result in an alternation of speaking turns. That is, the person who asked the question will become the listener and the person to whom the questioning was directed will start speaking. In addition, the question can produce changes in other communicative modes such as proxemics (distance between people). For example, the person who answers the question about the new job might get closer to the person who asked the question.

- The second approach followed in MIA to examine the use of spoken language consists of assessing what people's utterances mean, imply, or denote in the context an interpersonal encounter. Following this analytical approach involves identifying the words that people use to talk to each other and reflecting on what those word choices imply (Halliday & Matthiessen, 2014). For example, in the utterance "How have you been, my dear?" the words "my dear" suggest an attempt by the speaker to express affection towards the listener.
- The third approach followed in MIA to examine the use of spoken language is to conduct a Thematic Analysis (TA) to identify and make sense of similarities and differences in the way people speak to each other (Braun et al., 2018; Terry et al., 2017). For example, the utterances "How have you been, my dear?" and "Come on, girl, tell me about your new job" are similar in that they both contain words that suggest personal closeness between the interlocutors.

The fourth step in creating a multimodal transcript is to examine the communicative modes (other than spoken language) that people use in each of the actions identified in previous steps. The examination of these complementary communicative modes involves a constant shift between analysis and description. For example, examining the body language of two interlocutors would require analysing and providing a written account of details such as the position of their hands and legs, the tilt of their heads, and the direction in which their bodies point (Figure 3.6).

Figure 3.6

Hand position, leg position and gaze direction during a conversation.

The fifth step when creating a multimodal transcript is to compare the analysis of spoken language with the analysis of other communicative modes. This comparison may involve taking what the people in the video say as a basis for explaining or contextualising specific details shown in the images portraying the actions. For example, the expression “I have been very happy since we met,” together with the physical proximity and hand positions of the individuals in Figure 3.7, suggest that a romantic relationship exists between them.

Figure 3.7

Physical proximity and hand position suggesting a romantic relationship between two people.

Accounting for the analysis of the different communicative modes studied in MIA is beyond the scope of the present investigation and, therefore, such matter is not discussed in more detail. What is important to highlight here is that in a multimodal transcript spoken language serves as the basis to interpret people's behaviour during video-recorded interpersonal encounters. Researchers interested in learning more about the different communicative modes examined in MIA can consult manuals such as that of Norris (2012).

The analytical process followed in a multimodal transcription typically results in a physical or digital document composed of a series of still images showing the actions that people undertake in a video-recorded interpersonal encounter. A multimodal transcript can also include written transcriptions of what the people in the videos said when undertaking each action. Likewise, a multimodal transcript can include annotations made by researchers of the way people in the videos use spoken language and other communicative modes.

Figure 3.8 shows a multimodal transcription developed following the analytical approach developed by Norris (2004). The transcript, taken from Wilmes and Siry (2021),

was created from a video showing two elementary students completing science tasks in a classroom. The transcript consists of information organised in four columns. The first column shows the timelapse of the video from which each of the actions included in the transcript was sourced. The second column consists of brief descriptions of what each action consists of. The third column shows still images, captured from the video, showing the actions described in the second column. The fourth column consists of written transcriptions of what the students said when undertaking each action.

Figure 3.8

Example of the multimodal transcript approached developed by Norris.

Time	Embodied engagement	Video Offprints	Utterences
19:22	• Marie (left) places plastic on the metal pan using both hands • Calia (right) places left hand on pan, right holds a pipette • They work together to place plastic over metal pan		Marie: So….. Calia: Ahhhh, so you will put the water here… Marie: yeees
19:28	• Calia pulls the plastic wrap off of the pan • Calia looks around the room • Calia flattens the plastic		Calia: Then we have to take this off. Umm…
19:32	• Calia picks up the pan and turns to face Whitney (offscreen right)		Calia: no that is too deep.

3.5.3. Building blocks from Social Network Analysis

The SNA methods that served as building blocks to create the framework were the network visualisation method and degree centrality indicator. Within the SNA, these methods are respectively used to represent interactions between heterogeneous elements and compare the number of interactions in which each element participates (Cherven, 2015).

The choice of the network visualisation method and the degree centrality indicator as building blocks of the framework was due to their flexible application. Both methods can be applied using specialised software or by hand-drawing simple geometric figures. Such flexible application aligns with designers' inclination to visually represent information using both hand-made sketches and digital models (Goel, 1995; Tang & Gero, 2001). Thus, the integration into the proposed framework for examining EAs of methods that support both manual and software-based visual representation was seen as a strategic decision to ensure the framework would be closely aligned to how designers' conduct their analysis work.

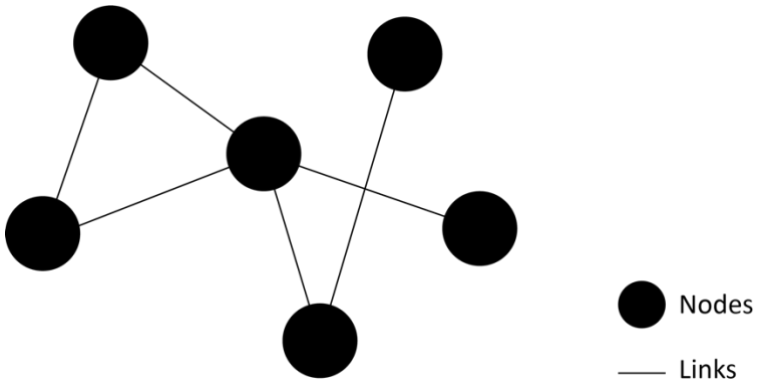
Network visualisation

The network visualisation method is used within SNA to represent interactions between various element types. Thus, to effectively apply this method, it is essential to have previously documented a specific set of interactions. The process for collecting data in SNA is beyond the scope of the present investigation and is therefore not discussed here. However, researchers interested in this topic can refer to Längler et al., (2019) who discuss the use of mixed methods to collect data in SNA.

The visual representation method is based on two graphic elements, namely, *nodes* and *links* (Caldarelli & Catanzaro, 2012). Nodes are geometric figures (usually circles) that can represent people, companies, websites, or other entities capable of producing, disseminating, and receiving information (Prell, 2012). Links, on the other hand, are lines drawn between two nodes to indicate relations or interactions that exist between those nodes. Drawing nodes and links results in structures known in SNA as networks or graphs (Figure 3.9).

Figure 3.9

Nodes and links comprised in a network.



The modelling of a network begins by creating a *node table* and a *link table* (Cherven, 2015). The node table lists the elements whose interactions or relations will be depicted in a network. This table can also include specific attributes for each element. For example, when creating a network depicting friendship relations among students in a class, the node table might consist of the names of each student, complemented by attributes such as their age, hobbies, cultural background, or academic achievements.

The link table specifies the relations or interactions that exist between the nodes. This table comprises at least three columns. The initial column specifies the *source* or node from which each link originates. The subsequent column identifies the *target* or node to which each link leads to. The third column specifies the type of relation or interaction each link depicts. For instance, consider the friendship between two students, Manaia and Kaia. In the link table, Manaia might be listed in the source column, and Kaia in the target column. The third column could further detail the nature of their relationship, indicating if they share a newly formed friendship or if they are best friends.

The last step in the network visualisation method involves rendering the network. This can be accomplished by hand-drawing links and nodes by referring to the corresponding tables. Alternatively, the node and link tables can be imported into specialised network-analysis software such as Gephi, Cytoscape, or AllegroGraph. While a detailed exploration of software options for visualising and analysing networks is outside the scope of this investigation, it is important to recognise that each available software has its own strengths and limitations. The best choice often hinges on individual research needs and preferences. For those researchers seeking guidance on selecting a network analysis software, the comparison by Pavlopoulos et al. (2017) provides a useful reference.

Degree centrality indicator

In the context of SNA, the term *centrality* refers to the ability of a node, given its position within a network, to receive or disseminate information. The degree centrality indicator enables the estimation of this ability by ranking the nodes according to their number of direct connections or adjacent links. Nodes with a greater number of links are considered more central than those with fewer connections. The calculation of degree

centrality can be done either manually, or by means of network analysis software such as Gephi, Cytoscape, or AllegroGraph.

3.6. The work programme to develop the framework

The previous section specified the methods chosen in this doctoral investigation to develop a novel framework for examining EAs at a granular level. The specific methods that serve as building block to develop this framework were: the interview, multimodal transcript, network visualisation, and degree centrality indicator. With these methods identified, this section will delve on the work programme followed to adapt and integrate them into a novel framework for examining EAs.

Given the three-year duration of the scholarships underpinning this investigation[9], the decision was made that the development of the framework would involve a total of three empirical studies on EAs. This number of studies was determined to maximise research progress within the available timeframe. Thus, each of the three studies, hereinafter referred to as Study 1, Study 2 and Study 3, was conceived to serve particular objectives. The following sections detail the conception and objectives of each study.

3.6.1. Study 1 – Setting the foundation of the framework

The objective set for Study 1 was to develop a preliminary understanding of how to adapt the multimodal transcript to examine EAs from a design viewpoint. The choice to prioritise this method was strategic. MIA researchers employ the multimodal transcript to examine a broad range of communicative phenomena, spanning from spoken and body language to artifact-mediated communication (Norris, 2004, 2012). Given its analytical reach, it was considered that first adapting the multimodal transcript would establish a solid foundation for crafting a framework to examine EAs comprehensively. That is, considering what people do, think and say when conducting EAs.

In line with the above objective, the decision was made to ground Study 1 in the analysis of secondary data on EAs. Using secondary data would eliminate the need for new data collection, allowing for a deep dive into the analytical process inherent to the

[9] Colab PhD MPhil Fees Scholarship and the Conacyt Scholarship.

multimodal transcript. This immersive approach was anticipated to streamline the adaption of the method for examining EAs.

The secondary data to be analysed in Study 1 would be User-Generated Videos (UGVs) showing individuals demonstrating an activity whose selection would be informed by the criteria outlined in Section 3.3.

The decision for working with UGVs in Study 1 was due to three reasons:

- UGVs provide easy access to a rich and ever-expanding source of secondary data. Online video-sharing platforms such as YouTube and Vimeo host a growing number of UGVs where individuals from several age ranges and cultural backgrounds demonstrate different aspects of their daily lives including EAs.
- Second, people in UGVs tend to comment on their actions as they perform them. Therefore, UGVs can provide information not only about the ways in which people use artifacts in EAs, but also about the motivations and ideas that drive these behaviours (Pink, 2016).
- Third, UGVs enable designers to immerse themselves in and become familiar with problem domain, which can increase the effectiveness of later work with participants (Gizem Hediye & Fatma, 2019). Therefore, analysing UGVs was viewed as an opportunity to gain experience using the multimodal transcript for examining EAs and to lay the groundwork for planning effective interviews in subsequent studies.

The sample size envisioned for Study 1 was between 3 and 6 UGVs. This sample size, although small, was considered appropriate because Study 1 was not aimed at deepening the understanding of the examined activity nor identifying patterns in how people perform it. The aim instead was to use real-world data to lay the foundation for a novel framework to examine EAs at a granular level.

3.6.2. Study 2 – Refining the preliminary framework

Study 2 was planned as a direct extension of Study 1. The UGVs analysis of the latter study was anticipated to result in a preliminary framework, inspired in the multimodal transcript, but tailored specifically to examining EAs at a granular level.

While UGVs are a rich and ever-expanding source of secondary data, certain details of EAs may not be fully captured in these videos. The editing process behind UGVs can often involve the removal or truncation of scenes, potentially diminishing the level of detail these videos provide on EAs. Thus, there was a concern that essential adaptations to the multimodal transcript could be missed in Study 1 due to the restricted insights UGVs offer on EAs.

Moreover, it was considered that adapting the multimodal transcript based solely on UGVs would raise the risk of crafting a framework mainly suited for secondary data analysis. Such a framework would be of limited use for designers. This is because creating contextually-relevant design solutions requires considering insights such as people's motivations, preferences, and values, which are most likely to be gained through primary data analysis.

In the light of the above considerations, the goal set for Study 2 was to further develop the framework devised in the prior study, making it suitable for collecting and analysing primary data on EAs. To achieve this goal, Study 2 was structured around three pivotal tasks:

- Developing an interviewing strategy specifically tailored to source primary data on EAs.
- Piloting the interviewing strategy to verify its adequacy for gathering detailed data on EAs.
- Refining the framework devised in Study 1, making it suitable to analyse the data collected through the pilot interviews.

For reasons of methodological continuity and efficiency, the decision was made that the pilot interviews in Study 2 would focus on the same activity that was examined in Study 1. Doing so would allow a direct comparison of the experience of analysing a secondary data set and a primary data set with a framework crafted by adapting the multimodal transcript. Such a comparison was anticipated to facilitate the identification of opportunities to further refine or expand such a framework.

Regarding participant selection and the sample size in Study 2, the following determinations were made:

- Participant selection in Study 2 would adhere to a purposive sampling approach (S. Campbell et al., 2020; Etikan et al., 2016). That is, participants would be selected based on their extensive experience and consequent ability to provide detailed information about the activity under examination. This in-depth perspective was regarded as crucial for enhancing the practical value of Study 2. It was anticipated that interviewing expert participants could reveal aspects of the activity that might not have been initially considered during the interview planning process. Recognition of these aspects would help to plan more effective interviews in future studies and better understand the potential of the interview as a method to collect data on EAs.
- The sample size envisioned for Study 2 was between 3 and 6 participants. This sample size, although small, was considered appropriate because Study 2 was not aimed at deepening the understanding of the examined activity nor identifying trends in how people conduct it. Instead, the aim was to leverage data on a strategically selected activity to ensure that the framework being developed was suitable for analysing primary data on EAs.

In addition to meeting methodological objectives, Study 2 was devised to serve an administrative purpose. Specifically, Study 2 was planned to produce a sample analysis that could be presented as evidence in the ethics application for AUT's Ethics Committee (AUTEC). By demonstrating that the use of the proposed framework does not pose ethical challenges, the intention was to expedite AUTEC's approval and thus advance the investigation to the next stage.

3.6.3. Study 3 – Enhancing and extending the framework

Study 3 was planned as a direct extension of Study 2. The latter study was anticipated to result in a preliminary framework for collecting and analysing primary data on EAs. This framework would be fundamentally anchored in the multimodal transcript, which is a MIA method that combines observation and spoken language analysis.

However, as Cross (2006) highlights, designers' analyses often involve the translation of observational and speech data into visual representations such as sketches, mood boards, flowcharts, and storyboards. To more closely align the newly devised framework with designers' forms of inquiry, Study 3 was structured around two pivotal tasks:

- The adaptation of two specific SNA methods for data visualisation and analysis, namely, network visualisation method and degree centrality indicator.
- Conducting a new series of interviews whose analysis would involve the combined use of the newly adapted SNA methods with the methods adapted in earlier studies.

The decision was made that Study 3 would focus on a different activity than that examined in Studies 1 and 2. This decision aimed to ensure that the resulting framework would be effective in analysing a broad spectrum of EAs. For clarity, consider the following analogy. A design team developing a new photographic lens would not be able to confirm the overall usefulness of the lens without testing it in multiple locations. Conducting tests in a single location would leave doubts as to whether the lens works overall or only under specific conditions.

Regarding participant selection and the sample size in Study 3, the following determinations were made:

- Participant selection in Study 3 would also follow a purposive sampling approach (S. Campbell et al., 2020; Etikan et al., 2016). That is, participants would be selected based on their extensive experience, allowing them to offer comprehensive insights into the activity under examination. This depth of perspective was seen as pivotal in elevating the practical significance of Study 3. Interviewing expert participants was anticipated to yield a data set whose richness and depth would open up multiple possibilities for applying SNA methods for creating visual representations of EAs.
- The sample size envisioned for Study 3 was between 3 and 6 participants. This sample size was deemed appropriate given the study's specific objectives. Specifically, the study was not aimed at deepening the understanding of the examined activity nor identifying trends in how people conduct it. Instead, the aim was to leverage data on a strategically selected activity to further develop a framework for examining EAs from a design viewpoint.

3.6.4. A practice-based step in the development of the framework

Study 3 was anticipated to be the inaugural application of a framework tailored specifically to analyse primary data on EAs. However, as widely acknowledged in the specialised literature, the scope of design extends beyond mere analysis or explanation. Design also involves envisioning and shaping possible futures through the crafting of artifacts (Nelson & Stolterman, 2012).

In line with the above perspective, the decision was made to include a design exercise in the process to develop the framework. It is essential to emphasise that this exercise was not intended as a seminal contribution to design. Rather, the design exercise was conceived as a crucial step in the very process of developing the framework. Specifically, the design exercise was seen as a diagnostic effort, aimed at identifying aspects of the newly devised framework that could require further refinement before the framework could be used in real design scenarios.

The first step in planning this exercise was to determine its structure. It was decided that the exercise would consist of creating a *design brief* from the EAs analysis of Study 3. While there is no consensus in the design literature regarding the precise definition of a design brief (Hocking, 2014; Sosa, 2019), for the purposes of this investigation the term design brief refers to a document that guides the formulation of preliminary design concepts or primary generators[10].

The decision to focus the design exercise on the generation of initial design concepts was based on two considerations. First, concept generation is critical to the overall design process. As widely noted in the design literature, decisions made at early design stages can significantly impact both the type of solutions created and their socio-environmental implications (Bragança et al., 2014; Schneider-Marin, 2023). Second, concept generation constitutes a defining aspect of a designers' professional identity, as emphasised by Cross:

[10] In design, a *primary generator* refers to a core idea that serves as a starting point for the design process (Darke, 1979).

> Before a proposal can be tested, it has to originate somehow. The generation of design proposals is therefore the fundamental activity of designers, and that for which they become famous or infamous (Cross, 2006, p. 16).

The second step in outlining the design exercise consisted of determining who would elaborate the design brief. Ultimately, it was decided that I would prepare the brief myself. This decision was made for strategic reasons. Crafting a design brief is an intricate endeavour that requires the strategic use of the information available about the problem to be solved. This point is effectively captured by Hocking (2014, p. 14) who emphasises that "design problems cannot be comprehensively formulated at the outset because certain components of the problem only emerge through the actual process of generating solutions.

Furthermore, creating design briefs involves not only gathering the available information, but also discerning what specific bits of information are used to frame or define the problem to be addressed. As widely acknowledged in the specialised literature, incorporating too much information in a design brief can paradoxically narrow the scope of design exploration, stifling creativity and thus the emergence of innovative solutions (Hocking, 2014; Kocienda, 2018; Sosa Medina, 2019).

In light of the above challenges, my dual role as the creator of the framework and author of the brief was considered advantageous. As the creator of the framework, I would possess a deep understanding of its underlying ontology. Therefore, it was considered that I would be uniquely positioned to discern which insights obtained through the framework's application would be most valuable and effective in delimiting a design task. In addition, engaging in this discernment process was expected to serve as a critical reflective exercise, enabling me to confront and reassess my presuppositions about the framework's utility and relevance in design.

The view of my dual role as framework creator and brief author as advantageous resonates with the perspective of several scholars who underscore that design thrives thanks to the knowledge and personal experiences that designers bring to the table. For example, the work of Zhang and Wakkary (2014) shows how interaction designers often draw on their personal experiences from childhood and adulthood to outline the characteristics of digital services. Likewise, in his seminal work *You make it and you try*

it out: Seeds of design discipline futures, Peter Lloyd (2019) stresses that design methods are intended at guiding and challenging designers' intuitions and preconceptions, not to make of design a process free of subjectivities.

> In practice using a design method leaves the individual or group to make subjective judgements about objective data. A method guides and challenges designers to consider things outside of their intuition and preconceptions; they were never meant to enslave the designer in a mechanical process where their judgment has no value (Lloyd, 2019, p. 170).

Summary

This chapter detailed the methodology employed in this investigation to develop a framework for examining EAs at a granular level, that is, focusing on the views and experiences of individuals when performing EAs. Central to this methodology was the adaptation and combination of methods commonly used in design with methods from the areas of Multimodal Interactional Analysis (MIA) and Social Network Analysis (SNA).

The methods that served as the building blocks of the proposed framework were: the interview (design), multimodal transcript (MIA), network visualisation (SNA) and the degree centrality indicator (SNA). These methods would be adapted and integrated over the course of three empirical studies on EAs, hereinafter referred to as Study 1, Study 2 and Study 3.

The methodology outlined to develop the framework also included a design exercise. This exercise would involve the preparation of a design brief from the EAs analysis of Study 3. It is pivotal to underscore that the brief was neither conceived nor anticipated to offer a seminal contribution to the design discipline. Instead the aim in preparing the brief would be to identify aspects of the newly devised framework that may require further development before the framework could be used in real-world design scenarios.

The next chapter details the first two empirical studies used to develop the proposed framework. The first study laid the groundwork for the framework by adapting the multimodal transcript, making it suitable to examine EAs. The second study built on this groundwork, aiming to both broaden and fine-tune the preliminary framework established by the initial study.

Chapter 4 Foundations of the framework: Studies 1 and 2

The preceding chapter detailed the methodology devised to address the overall objective of this investigation: to develop a framework to comprehensively and systematically examine everyday activities (EAs) at a granular level. Integral to this methodology was the decision that the framework would be developed over a series of three empirical studies on EAs.

This chapter details the first two studies conducted to develop the framework. The chapter is organised as follows: Section 4.1 introduces and justifies the choice of the activity examined in Studies 1 and 2. Section 4.2 then details Study 1. This first study involved developing a preliminary framework based on adaptations made to a method known in the area of Multimodal Interaction Analysis (MIA) as multimodal transcript. Section 4.3 details Study 2, which focused on refining and expanding the preliminary framework devised in Study 1, ensuring that it allowed primary data on EAs to be collected and analysed effectively.

4.1 The activity examined in Studies 1 and 2

This chapter delves into the first two studies carried out in this investigation to develop a framework to comprehensively and systematically examine everyday activities (EAs) at a granular level. These two studies, hereinafter referred to as Study 1 and Study 2, were complementary.

Study 1 focused on adapting a data analysis method from MIA, with the intent of making it suitable for examining EAs. The MIA method adapted in Study 1 was the multimodal transcript. On the other hand, Study 2 was aimed at devising and piloting an interview strategy to obtain primary data on EAs. These data were then used to evaluate the efficacy of the analytical approach devised in Study 1, in examining primary data on EAs.

Together, Studies 1 and 2 were anticipated to result in a preliminary framework for collecting and examining primary data on EAs. Given the inherent complementarity of Studies 1 and 2, the decision was made that both studies would focus on the same activity. The selection of this activity was carried out in two main steps, as detailed below.

4.1.1 General search for an activity

To ensure that the framework developed in this investigation would be suitable for examining a wide range of EAs, the decision was made to focus the studies for the framework's development on what this investigation designates as *model activities*. That is, activities that clearly exemplify inherent aspects of EAs and offer practical advantages to researchers.

The work by Chilvers et al. (2010) was instrumental in selecting a model activity for Studies 1 and 2. Drawing from time-use diaries, Chilvers et al. identified that older people in Western societies predominantly engage in seven activities: sleeping/resting, performing domestic tasks, watching television, listening to music/radio or using computers, eating/drinking, and socialising (Figure 4.1).

Figure 4.1

Activities identified by Chilvers et al. (2010) as predominant in Western societies.

Although Chilvers et al. focus primarily on older adults, their findings hold relevance for broader demographics. Firstly, activities such as sleeping/resting and eating/drinking are pivotal for survival and therefore are common across people from all range ages. Furthermore, activities prevalent among the elderly might reflect daily routines formed over many years, suggesting that such activities could be common among various age groups. For example, in Western societies such as Aotearoa New Zealand, listening to music or watching TV are activities common among people across a wide range of ages, from children to seniors.

Given the potential relevance of the activities highlighted by Chilvers et al. across various demographics, the decision was made to use these activities as a basis for selecting a model activity for Studies 1 and 2.

The activities highlighted by Chilvers et al. were evaluated using the criteria detailed in Chapter 3, Section 3.3.2. This approach allowed for systematically narrowing their list of seven activities until identifying a suitable model activity for Studies 1 and 2. The criteria used for selecting a model activity were:

1. A model activity is clearly influenced by cultural norms.
2. A model activity varies widely due to individuals' personal views and choices.
3. A model activity clearly varies due to the design, availability and current conditions of artifacts.
4. A model activity facilitates the examination of a broad spectrum of artifact uses.
5. A model activity poses minimal ethical issues because its examination does not require collecting confidential or private data nor putting participants in potentially vulnerable situations.
6. A model activity is highly relatable. In other words, it is an activity that people with diverse profiles are keen to demonstrate and openly discuss.
7. A model activity does not require multiple hours to complete, allowing for a streamlined approach to data collection and analysis.

Arguably, all the activities highlighted by Chilvers et al. are shaped by cultural norms and the personal choices and preferences of individuals (criterions 1 and 2). Take for example the activity of sleeping/resting. While social norms may establish appropriate times for going to bed, the decision of what time to engage in this activity depends largely on the preferences and circumstances of individuals. Similarly, the variety of TV shows that people watch or the music they listen to is influenced by both cultural trends and personal choices. For instance, an individual may find some artists' lyrics offensive and therefore, despite the artists' worldwide recognition, choose to avoid listening to their music.

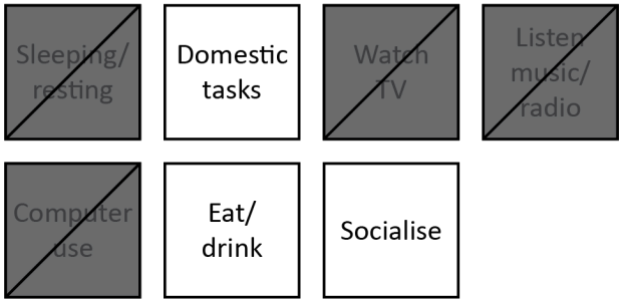
Likewise, all the activities highlighted by Chilvers et al. are influenced by the design, availability, and current conditions of artifacts (criterion 3). Consider how people's sleep quality can vary depending on whether they sleep on an ergonomically designed mattress or on the floor inside a sleeping bag. Likewise, the time that people can listen

to music or speak to someone using a smartphone is contingent upon the phone's battery level and the availability of both a charger and an electrical outlet.

However, not all the activities highlighted by Chilvers et al. equally fulfil criterion 4 (involving a wide range of artifacts). Domestic tasks such as house cleaning often involve the use of a diverse set of utensils and supplies, ranging from brooms and mops to detergents and cleaning liquids. Similarly, food preparation and consumption involve the use of a wide array of kitchen utensils and appliances such as cutting boards, pots, plates, cluttery, and so on. In contrast, activities such as sleeping/resting, watching TV, listening to music/radio and using computers, predominantly revolve around a primary electronic device and a few pieces of furniture. Consequently, the decision was made to exclude these latter activities from the selection pool (Figure 4.2).

Figure 4.2

First discard of candidate activities for Studies 1 and 2.



Criterion 5, which emphasises that model activities should pose minimal ethical challenges to researchers, played a pivotal role in selecting between the three remaining activity options: domestic tasks, eating/drinking and socialising. Domestic tasks and eating/drinking can be conducted either in solitude or in the company of others, offering researchers flexibility in choosing the contexts in which to examine these activities. In contrast, socialising inherently involves interpersonal encounters during which people may share private information, creating potential ethical dilemmas for researchers. Given these considerations, socialising was deemed less appropriate for serving as a model activity and was therefore excluded from the pool of activity options.

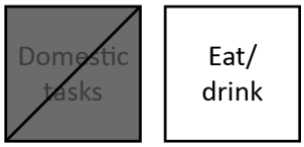
Figure 4.3

Second discard of candidate activities for Studies 1 and 2.

Criterion 6 establishes that model activities are highly relatable, meaning that people with diverse profiles are keen to demonstrate and openly discuss them. To gauge the relatability of the two remaining activity options (domestic tasks and eating/drinking), a search was conducted on Amazon books using the terms *Eating* and *Housekeeping*. The search showed over 60,000 books dedicated to *Eating*, compared to only 10,000 on *Housekeeping*. Such disparity in the number of results suggests that experiences related to eating and drinking are a topic that resonates with a broader audience than experiences related to housework. With these insights in mind, eating/drinking was favoured over domestic tasks (Figure 4.4).

Figure 4.4

Third discard of candidate activities for Studies 1 and 2.

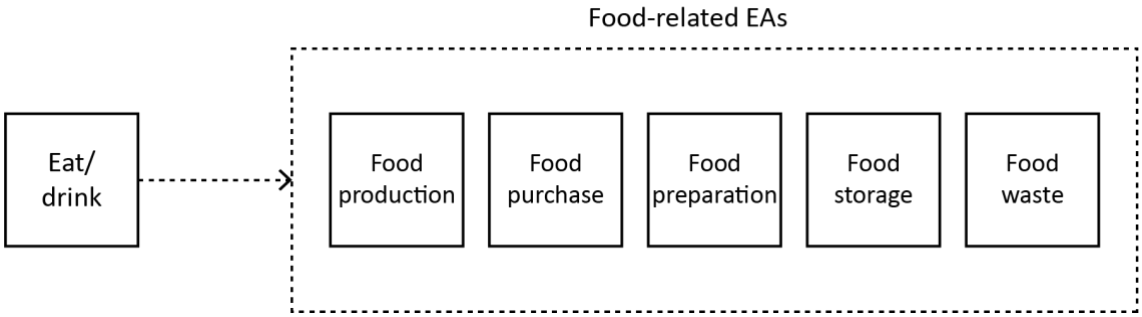


4.1.2 Narrowed search for an activity

The selection of the eating/drinking activity was preceded by a more granular search for a model activity (Figure 4.5). This subsequent search was driven by the recognition that everyday practices that revolve around food encompass more than the simple act of consumption. These practices also encompass the production, purchasing, preparation, storage and disposal of food and beverages.

Figure 4.5

Narrowed search for an activity to examine in Studies 1 and 2.



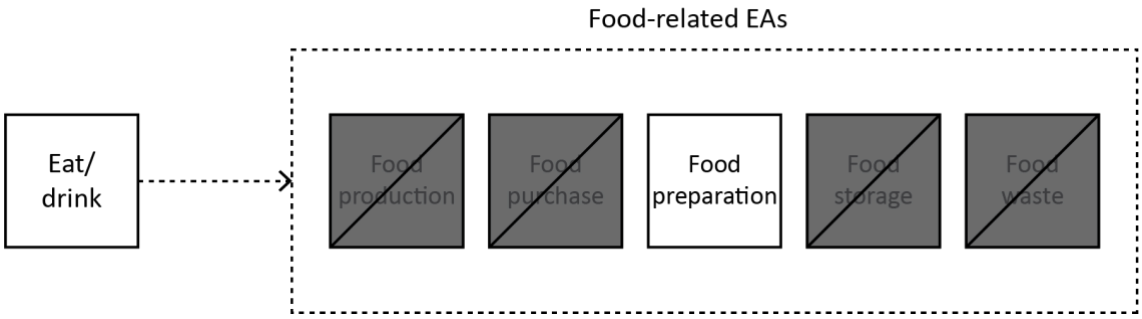
To decide which type of food-related practices to focus on, a new search was conducted on Amazon books using the terms *Food production*, *Food purchasing*, *Food preparation*, *Food storage* and *Food waste*. This search yielded the following results:

- 50,000 on Food production
- 20,000 on Food purchasing
- 60,000 on Food preparation
- 8,000 on Food storage
- 10,000 on Food waste

The search results above suggest that experiences related to food preparation are a topic that resonates with a broader audience than experiences related to other food-related practices. Accordingly, it was decided that Studies 1 and 2 would focus on food preparation (Figure 4.6).

Figure 4.6

Fourth discard of candidate activities for in Studies 1 and 2.



However, the spectrum of activities related to food preparation is vast, spanning from sautéing vegetables to marinating chicken, boiling pasta, roasting lamb, making a salad,

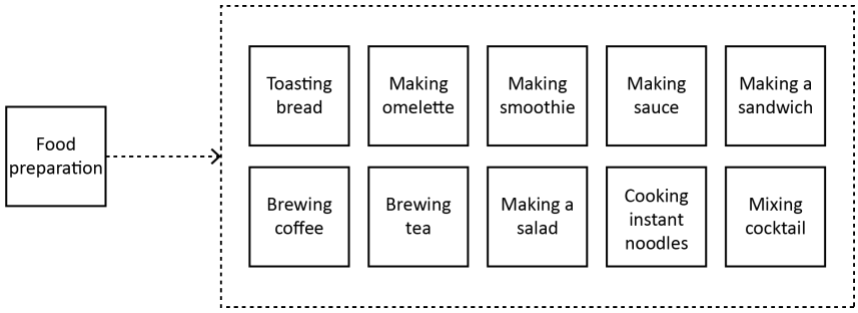
slow-cooking a stew, steaming rice, broiling fish, braising beef, baking a cake, and so on. To narrow down the list of activity options, I applied Criterion 7, which emphasises that a model activity should be completed within a few minutes.

I created a list of food preparation activities that can be completed within a few minutes and that are integral to my daily life. The aim in following such an approach was creating conditions conducive to effective data collection. I considered that my personal familiarity with the activity under examination would facilitate building rapport with the people participating in my investigation, encouraging them to be more open and share their views in depth (Novotny et al., 2021; Prior, 2018).

The food preparation activities that I included in the list were: toasting bread, frying an omelette, making a smoothie, making a sauce, making a sandwich, brewing coffee, brewing tea, making a salad, cooking instant noodles, and mixing a cocktail (Figure 4.7).

Figure 4.7

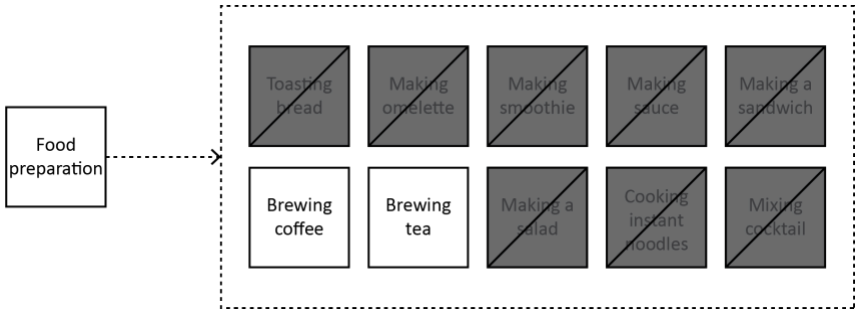
Food preparation activities originally considered for in Studies 1 and 2.



Among the ten food preparation activities I considered, making coffee and tea stood out as particularly suitable options to serve as model activities in Studies 1 and 2 (Figure 4.8). Notably, some people make coffee and tea daily, and in some cases, multiple times a day. This frequent occurrence can lead to higher proficiency, allowing individuals to be in an optimal position to discuss or demonstrate these activities in detail. In contrast, activities such as making an omelette or a smoothie might be conducted less often. While expertise can also be gained in these more sporadic activities, it was considered that study participants might find it easier to elucidate and articulate their vision and approach towards activities they engage in more regularly.

Figure 4.8

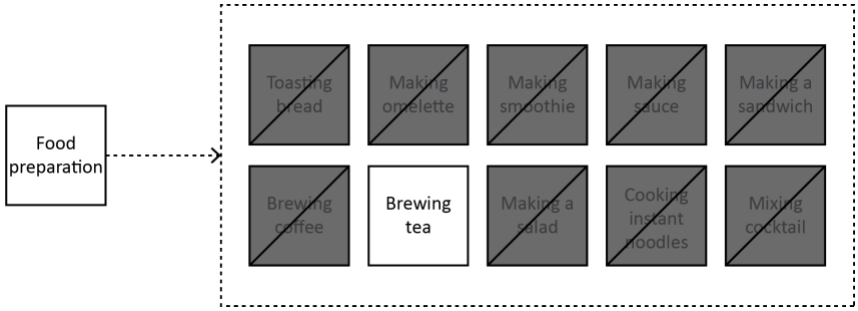
Fifth discard of candidate activities for in Studies 1 and 2.



Ultimately, tea-making was chosen as a model activity for Studies 1 and 2 (Figure 4.9). This decision was rooted in the activity's high relatability (criterion 6). While prevalent among specific demographics within Aotearoa New Zealand, coffee is not a staple across all cultures and age groups and might even be avoided by individuals with specific dietary restrictions. In contrast, tea, with its myriad of varieties catering to different tastes and preferences, is a beverage made and consumed by individuals spanning a wide range of ages, lifestyles and cultural background.

Figure 4.9

Final discard of candidate activities for in Studies 1 and 2.



In addition, tea-making is an activity that is clearly influenced by cultural norms (criterion 1). Tea is a common beverage in various cultures, most of which have developed particular customs on how to make and drink tea (Lv & Shen, 2012). For example, Chinese tea culture is primarily concerned with tea purity, so the Chinese tend to drink tea without additional ingredients. Conversely, in British tea culture, ingredients such as milk, sugar, fruit, flowers, or even spices are commonly added to the tea (Jiang, 2011).

Tea-making is also an activity that clearly varies due to people's personal views and choices (criterion 2). People may prepare and drink tea for a variety of reasons, ranging from relaxation and better sleep to immune system strengthening (Thample, 2017).

Depending on their specific motivations, individuals may choose different types of tea, or employ varied brewing techniques, showcasing the role individual agency plays in EAs.

Tea-making also offers advantages in terms of artifact diversity (criterion 3). The type of artifacts that people use to make tea often vary from culture to another. For example, while the traditional British tea set includes artifacts such as teabags, teapots and spoons, the Chinese one includes artifacts such as bowls (to drink tea), tea baskets (to sift tea) and bamboo clips (to stir tea) (N. Wang, 2011).

Furthermore, tea-making clearly varies due to the availability, design, and current conditions of artifacts (criterion 4). For example, if a teapot is available, the tea-making process might involve adding tea leaves or a teabag to the teapot, pour boiling water into the teapot, and then let the tea steep. Without a teapot, making tea would require adding the tea leaves (or teabag) and the boiling water straight into a cup (or some other container).

Lastly, tea-making is an activity that offers ethical advantages for a data collection because examining this practice does not require collecting sensitive information, nor does it require interacting with people in intimate situations or settings (criterion 5).

4.2 Study 1 – Setting the analytical foundation of the framework

The objective set for Study 1 was to develop a preliminary framework for examining EAs at a granular level by making adaptations to the MIA method known as the multimodal transcript. To further emphasise this objective, in the remainder of this chapter I use a first-person narrative style to describe Study 1.

As I established in Chapter 3, Section 3.6.1, the decision to initiate the development of the framework by adapting the multimodal transcript was strategic. MIA researchers employ the multimodal transcript to examine a broad range of communicative phenomena, spanning from spoken and body language to artifact-mediated communication (Norris, 2004, 2012). Given its analytical versatility, I considered that first adapting the multimodal transcript would lay a solid foundation for developing a framework to examine EAs comprehensively. That is, considering what people do, think and say when conducting EAs.

In Study 1 I examined secondary data on tea-making. Doing so removed the necessity for gathering new data and instead allowed me to deep dive into the analytical process inherent to the multimodal transcript. The secondary data I examined in Study 1 consisted of user-generated videos (UGVs) I retrieved from online video sharing platforms. These videos show individuals making a cup of tea. The choice of UGVs as secondary data in Study 1 was due to several reasons:

- First, UGVs allow designers to immerse themselves in and become familiar with a problem domain, which can increase the effectiveness of later work with users (Gizem Hediye & Fatma, 2019).
- Second, people in UGVs tend to comment on their actions as they perform them. Therefore, UGVs can provide information not only about the ways in which people perform EAs, but also about the motivations that drive people to do so in particular ways (Pink, 2016).
- Third, UGVs are public, easily accessed, and enable data collection during public health crises like the Covid-19 pandemic.

4.2.1 Retrieval of user-generated videos

User-generated videos (UGVs) are available on video-sharing platforms such as YouTube and Vimeo. These platforms allow searching for videos using key words. The process I followed to identify keywords was to consult a thesaurus to identify word variants for *tea-making*. Table 4.1 shows the results of this query.

Table 4.1

Results of the thesaurus consultation carried out in Study 1.

Variants for the term 'tea-making'			
Get some tea	Make a cup of tea	Brew tea	Boil the billy
Make some tea	Brew a cup of tea	Brew a pot of tea	Brew tea up
Have some tea	Have tea	Make a pot of tea	Get a cup of tea
Get a mug of tea	Have a cup of tea	Have a mug of tea	Make a mug of tea
Prepare some tea	Put the kettle on	Take tea	----

The terms in Table 4.1 are the keywords I used to retrieve UGVs for Study 1. Filters on the video-sharing platforms allowed me to sort search results by relevance, that is,

based on the similarity between the searched keywords and UGVs titles and descriptions.

The keyword search returned different types of UGVs. While some UGVs showed methods for brewing tea, others give an account of industrial processes for growing and commercialising tea. The UGVs that the search returned also varied in terms of location. While some UGVs were filmed in domestic settings, others showed methods and techniques used by street vendors or baristas (people who serve tea in restaurants or tea bars).

The UGVs returned from the keyword search also varied technically. While the audio in some videos was clear, in others it was difficult to understand what the people in the videos were saying. In addition, the UGVs varied in terms of language. Although the keywords I used in the search were in English, not all the search results were in such a language. The camera angle and framing also differed across the UGVs. While some videos offered detailed views of individuals interacting with tea utensils and supplies, in others people's actions were partially hidden behind furniture or artifacts that people were not actively using.

Considering the differences in content, language and technical execution of the UGVs, not all of them were suitable to serve as secondary data in Study 1. In such situations, Gizem and Fatma (2019) recommend defining criteria to select UGVs for a study. The criteria I defined to select the UGVs for Study 1 were:

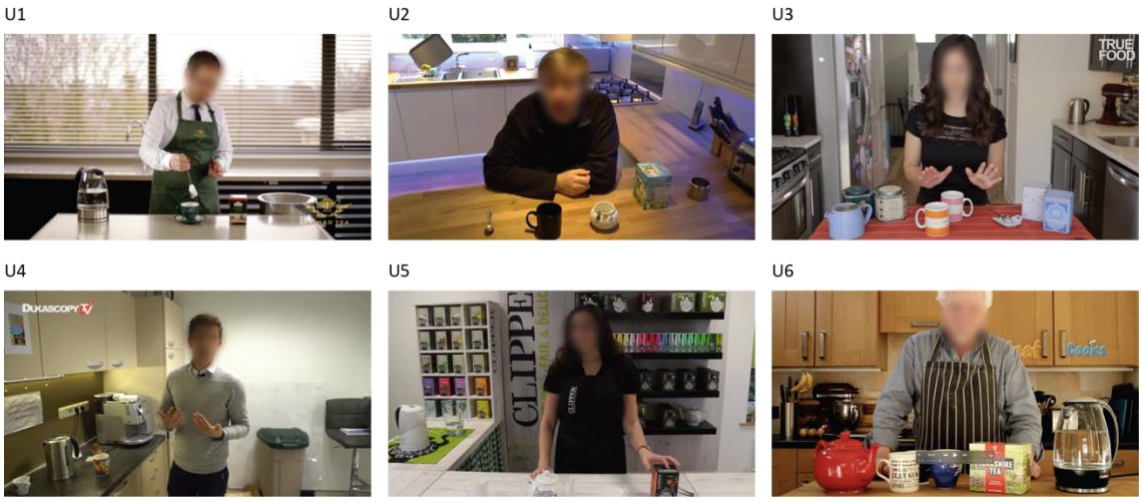
1. The UGVs had to be created with instructional purposes, that is, to share feasible ways to make tea in everyday environments.
2. The UGVs had to show the making of a cup of tea from start to finish.
3. The framing, lighting and resolution of the UGVs had to allow observing what people do with tea utensils and supplies.
4. The audio of the UGVs had to allow distinguishing what people say.
5. People in the videos had to speak in English and provide real time explanations of what they do.

I examined a total of six UGVs, which I refer to henceforth as U1, U2, U3, U4, U5, and U6 (Ahmad Tea, 2015; ClipperTeas, 2011; Dukascopy TV (EN), 2017; KeefCooks, 2018;

Rickvanman - Variety Channel, 2015; True Food TV, 2017). A sample size of six, although small, was considered appropriate because Study 1 was not aimed at deepening designers' understanding of how people make tea. The aim instead was to use real-world data to lay the foundation for developing a framework to examine EAs at a granular level. Figure 4.10 provides a screenshot of each of the videos I analysed.

Figure 4.10

Screenshots of analysed user-generated videos (UGVs).



4.2.2 Analysis of user-generated videos

I downloaded and analysed each of the six UGVs independently. The analysis of the UGVs was carried out through an adapted version of the method known in MIA as multimodal transcript.

To illustrate the analytical process of Study 1, below I delve into the details of the analysis of U1. This UGV shows the process of making a cup of tea with a teabag. My choice to illustrate the analytical process with U1 is rooted in ethical considerations. Since U1 was produced by a tea brand, this video does not expose the living environment of any individual.

Activity deconstruction

The analyses performed within MIA using the multimodal transcript typically begin with the deconstruction of a videotaped interpersonal encounter into *actions*. In MIA, the term actions refers to moments within an interpersonal encounter bracketed, at least partially, by social codes such as greetings (Norris, 2004, 2012). However, the present

investigation does not focus on interpersonal encounters but on the use of artifacts in EAs. Therefore, I deviated from the notion of actions held in MIA, and instead considered actions as the steps people deliberately undertake when conducting an activity.

To facilitate the deconstruction of the tea preparation processes shown in the UGVs, I established a distinction between *transformation* and *transfer actions*. Transformation actions are aimed primarily at physically modifying artifacts or supplies[11]. Figure 4.11 shows the person in U1 boiling water in a kettle. Boiling water can be considered a transformation action because the person's primary goal is to modify the temperature of a liquid.

Figure 4.11

Transformation action. Person in U1 boiling water in a kettle (U1. 00:56).

On the other hand, transfer actions are aimed primarily at relocating or repositioning artifacts or supplies. Figure 4.12 shows the person in U1 pouring water from a kettle. Such an act can be considered a transfer action because the person's primary goal is to make a portion of water flow from the inside of the kettle to the inside of the cup.

[11] In the context of this investigation, *supplies* refer to food, fire, energy, or any other organic or inorganic item or substance that people use when conducting everyday activities.

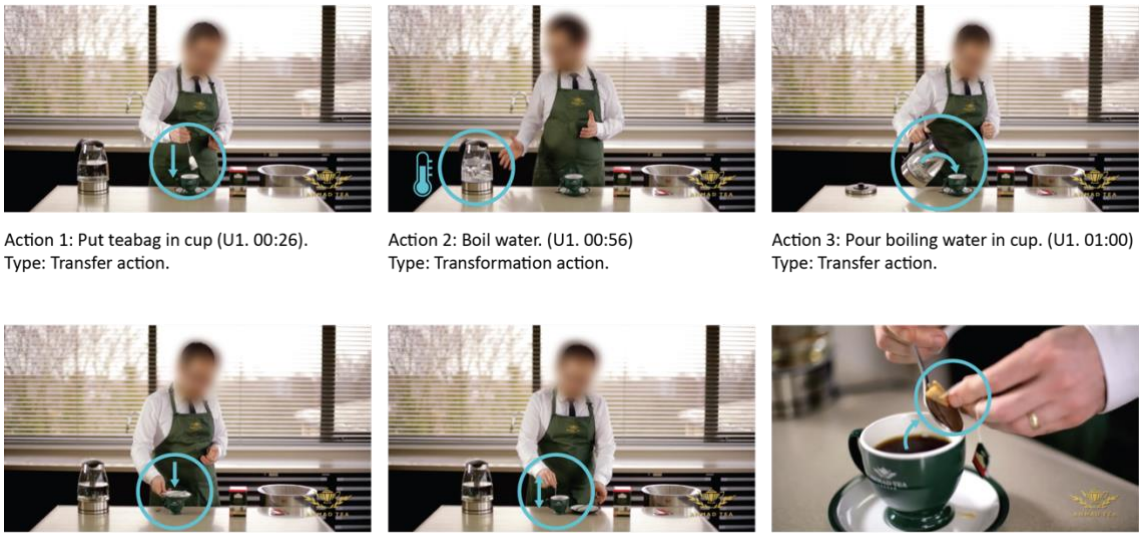
Figure 4.12

Transfer action. Person U1 pouring boiling water from a kettle (U1. 01:00).

Figure 4.13. shows both the transformation and transfer actions I identified in U1. The first action the person in U1 performs is to put a teabag in a cup. Then, the person boils water in a kettle. Once the water boils, the person pours it in a cup containing a teabag. Next, the person covers the cup with a saucer to preserve the heat and lets the tea brew for 3 minutes. Then, the person dunks the teabag repeatedly to help the tea mix better. The next action consists of squeezing the teabag. This action involves using the spoon to press the teabag against the inside wall of the cup. Finally, the person removes the teabag from the cup.

Figure 4.13

Actions from the tea-making process shown in U1.



Action 1: Put teabag in cup (U1. 00:26).
Type: Transfer action.

Action 2: Boil water. (U1. 00:56)
Type: Transformation action.

Action 3: Pour boiling water in cup. (U1. 01:00)
Type: Transfer action.

Action 4: Let tea brew. (U1. 01:23)
Type: Transformation action.

Action 5: Dunk teabag. (U1. 01:52)
Type: Transformation action.

Action 6: Remove teabag from cup. (U1. 02:11)
Type: Transfer action.

Examining use

After deconstructing the tea-making processes shown in the UGVs into actions, I examined the artifacts and supplies that people use in each action. This examination took inspiration from the distinction established in MIA between embodied and disembodied communication (Norris, 2004, 2012). Embodied communication occurs when sending or receiving information requires coming into physical contact with artifacts (e.g., writing with a pen and paper). On the other hand, disembodied communication occurs when the sending or receiving of information does not require physical contact with an artifact (e.g., reading a sign from a distance).

Given that this investigation is concerned with artifact use in EAs, not interpersonal communication, I did not delve into how the artifacts people use in the UGVs, enable the exchange of information. Instead, I considered the embodied and disembodied ways in which the individuals in the UGVs interact with artifacts and supplies while making tea.

To examine embodied uses, I revisited the video segments showing each action and created descriptions of what people did with artifacts and supplies. Figure 4.14 shows details of the third action from U1 (pouring boiling water in a cup). The way I described this action was: the person turns off the kettle, grabs it by the handle and lifts it off the base. Next, the person brings the kettle closer to the cup. Then, the person tilts the kettle to pour water over the teabag sitting inside the cup.

Figure 4.14

Details of the embodied use of the kettle in action 3 (Pour boiling water in cup) in video U1.

(1) - (U1. 00:58). (2) - (U1. 00:59). (3) - (U1. 01:01).

Since disembodied uses do not involve physical contact with artifacts and supplies, they may not be apparent and instead manifest only in spoken language. Thus, I transcribed the explanations that the people in the UGVs provided on each action. To facilitate the later analysis of the transcripts, I removed fillers (“err”, “hmm”, and similar sounds),

repetitions (reiteration of ideas), stutters, and hesitations. I also replaced non-standard language forms such as “gonna”, “ain’t”, and “cause” with their more formal equivalents.

I then examined the explanations people in the UGVs provided on each action. The snippet below is the explanation of action 3 in U1 (pouring boiling water into a cup). In this snippet, the person points out that the water goes “straight onto the teabag”. This comment suggests that the person is using the teabag as a target or reference point to pour water. In this snippet, the person also explains that turning off the kettle as soon as the water starts boiling prevents the water from losing oxygen. This comment suggests that the person is harnessing the transparency of the kettle’s body to monitor the state of the water.

> *So, as the kettle is now coming up to a rolling boil, we will just turn it off so again, it [water] does not over boil and lose all the oxygen, and pour that [water] straight onto the teabag (U1. 00:54).*

4.2.3 Results of the analysis

The analysis of embodied and disembodied interactions in the UGVs allowed me to identify five levels of human-artifact interaction that can take place when people use artifacts in EAs. These interaction levels are *articulatory*, *kinetic*, *sensory*, *regulatory*, and *symbolic*. The following sections provide details on each of these interaction levels.

Articulatory interaction

Interactions at the articulatory level involve physical contact with artifacts or supplies. Figure 4.15 is a close-up of the sixth action in U1 (remove teabag from the cup). In such an action, the person comes into physical contact with the spoon and cup. Specifically, the person holds the spoon in the right hand and rests the left thumb on the cup’s rim. These articulatory interactions, which I circle in Figure 4.6, allow the person to use the convex part of the spoon and the cup’s inner wall to squeeze the teabag.

Figure 4.15

Person in U1 pressing the kettle's power button to boil water (U1. 02:09).

Kinetic interaction

These interactions involve either moving an artifact or supply or coordinating body motion with that of an artifact or supply. Figure 4.16 shows a kinetic interaction associated with the use of the teabag wrapper. This figure shows the person in U1 removing the top edge of a teabag wrapper. To this end, the person moves one hand away from the other (each holding a part of the wrapper). This kinetic interaction is evident in the change in the distance between the person's hands, which I emphasise with arrows.

Figure 4.16

Person in U1 pressing the kettle's power button to boil water (U1. 00:17).

Sensory interaction

These interactions are associated with the visual, auditory, olfactory, tactile, and gustatory stimuli that artifacts and supplies provide to people. In the snippet below, the person from U1 explains that the colour change in the water as a result of direct contact with the tea leaves makes some people think that the infusion is ready to drink and, therefore, they remove the teabag from the cup.

> *…This is where people often go wrong with the teabag. They would stand and dunk the teabag and, as soon as the colour looks about right, they would think it's ready to drink. Well, teabag tea is the same as any tea; it needs time for the full flavour to come out. For teabags, you must give it a minimum of 3 minutes to brew properly (U1. 01:05).*

Regulatory interaction

Regulatory interactions involve trade-offs between the agency of people and the functions (or capabilities) of artifacts and supplies. In action 2 (boiling water), the person in U1 determines when the boiling process begins by turning on the kettle. However, there are aspects of the boiling process that person does not fully control. In the snippet below, the person from U1 points out that for the tea to brew properly, the water "should reach a hundred degrees Celsius". The time it takes for the water to reach that temperature is given not by the person's preferences, but by the function of the kettle to produce heat and that of the water to absorb it.

> *Next, we need to take freshly boiled water. If the water is already boiled, it would have lost a lot of oxygen and that means the tea won't brew properly and the resulting infusion will be flat and dull. So, you must always use freshly drawn water and allow the water to come fully to the boil. It [the water] should reach a hundred degrees Celsius for the tea to brew properly (U1. 00:28).*

Symbolic interaction

These interactions occur when people characterise artifacts or supplies. That is, when people designate artifacts or supplies as interesting, expensive, indispensable, and so on (Halliday & Matthiessen, 2014). In the snippet above, the person in U1 interacts symbolically with the water by commenting on the characteristics that it must have to be used to make tea. According to the person in U1, the water to make tea must be "freshly draw" and "not have lost a lot of oxygen". The snippet also accounts for a symbolic interaction with tea as a beverage. Such an interaction occurs when the person describes tea made with low-oxygen water as "flat and dull."

The overlap of the different levels of interaction

The articulatory, kinetic, sensory, regulatory, and symbolic levels of interaction are not independent but can overlap. In other words, when using an artifact people can simultaneously interact with it on several of levels. For clarity, consider again action 3 in U1. As Figure 4.17 shows, such an action consists of pouring boiling water in a cup. Doing

so, involves for the person in U1 to hold the kettle by the handle. This articulatory interaction is marked in Figure 4.8 with the letter A.

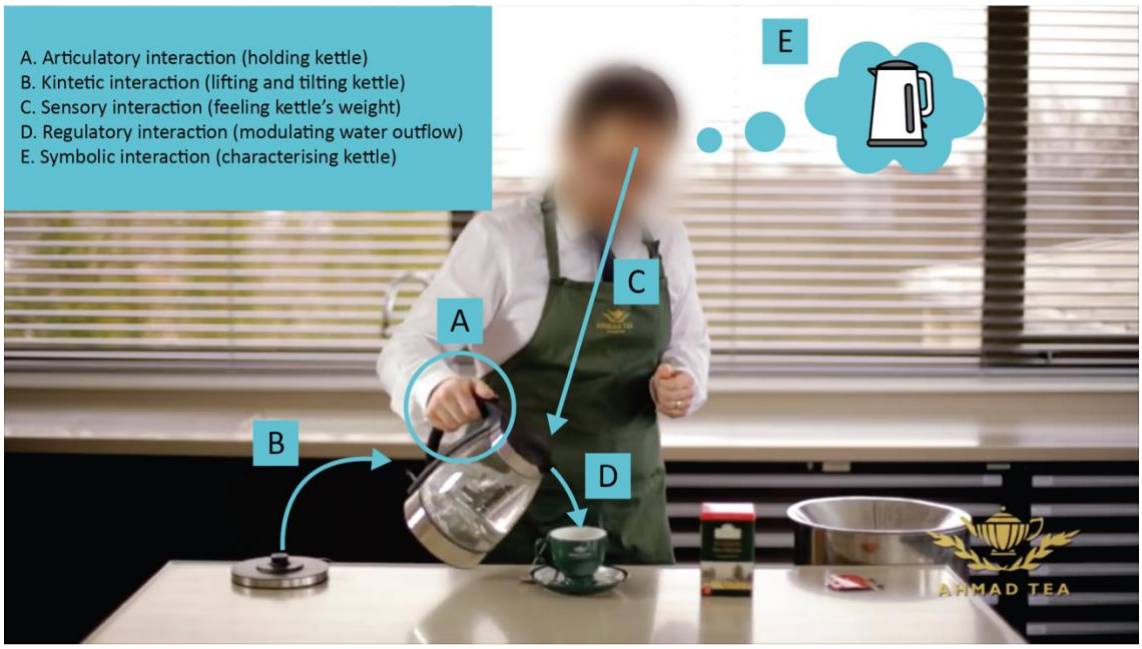
Action 3 also involves tilting the kettle so that the water flows into the cup. This kinetic interaction is marked in Figure 4.8 with the letter B. Arguably, when pouring water, the person in U1 may be somewhat aware of sensory stimuli such as the weight of the kettle or the transparency of its body. I mark this sensory interaction with the letter C.

There are aspects of action 3 that are co-regulated by the person and the kettle. For example, the speed at which the water leaves the kettle varies depends on the angle at which the person tilts the kettle and the size of the spout of the kettle (letter D).

The symbolic interaction with the kettle (letter E) can vary depending on how the interactions at the other levels unfold. Consider how the person may characterise the kettle differently depending on how easy it is to hold and lift or the precision with which water can be poured from it.

Figure 4.17

Simultaneous interaction at articulatory, kinetic, sensory, regulatory and symbolic levels.



4.2.4 Reflections from Study 1

In Study 1, I adapted a method known in MIA as the multimodal transcript to examine secondary data on EAs. Such an adaptation resulted in a preliminary framework to

examine EAs at a granular level. Integral to this preliminary framework is the distinction between transformation and transfer actions. While the former type of actions is primarily aimed at physically modifying artifacts or supplies, the latter type is primarily aimed at repositioning artifacts or supplies.

By typifying actions based on people's primary intentions, the preliminary framework offers a structured approach to understanding the unfolding of EAs. Differentiating between transformation and transfer actions allows pinpointing pivotal moments or milestones within an activity. For example, in the context of tea-making, the completion of the steeping process is a milestone that marks the transition to subsequent actions, such as adding sugar to the tea or serving the prepared tea.

While the distinction between transformation and transfer actions can be useful to understand the unfolding of EAs, it is crucial to acknowledge that transformations and transfers are intrinsically intertwined. Even if the primary aim of an action is to transform an artifact, such a transformation may produce transfers as side effects (and vice-versa). For example, pouring boiling water from a kettle into a cup can be considered a transfer action because the primary aim is to make a portion of water to flow from one place to another. The side effects of such an action include changes in the physical state of the water, namely, the water exiting the kettle undergoes a heat loss upon contact with the cooler surface of the cup. Situations such as the above do not make the distinction between transformations and transfers irrelevant, but they do call for exploring ways, other than the typification of actions, of applying these concepts to deconstruct EAs.

The preliminary framework also offers a structured path to examine artifact use in EAs. Once an activity has been deconstructed into actions, the second step in the framework consists of revisiting the video segments showing each action and creating written descriptions of what people do with artifacts and supplies in each action. These descriptions allow for identifying uses that involve coming into physical contact with artifacts (e.g., tilting a kettle to pour hot water).

The examination of artifact use in the preliminary framework involves transcribing and analysing the explanations that the people provide on each action. The emphasis of this analysis is on identifying fragments in people's explanations where they refer to artifacts with which they do not come into physical contact but that in some way affect the

ongoing action. For example, a comment such as “pour the water straight onto the teabag” suggests that the speaker is using the teabag as a target or reference point to pour water.

4.3 Study 2 – Enhancing the preliminary framework

The preliminary framework developed in Study 1 provides a structured path to examine secondary data on EAs. However, informing the creation of contextually-relevant design solutions often requires a deep understanding of insights (e.g., people’s motivations and preferences) which are most likely to be gained through primary data analysis.

In the light of the above considerations, the goal set for Study 2 was to further develop the preliminary framework, making it suitable for collecting and analysing primary data on EAs. To achieve this goal, Study 2 was structured around three pivotal tasks:

- Devising an interviewing strategy specifically tailored to source primary data on EAs.
- Piloting this interviewing strategy to verify its adequacy for gathering detailed data on EAs.
- Utilising the data collected to assess and enhance the preliminary framework devised in Study 1.

The decision to incorporate an interview strategy into the framework was due to several reasons. First, interviews as a data collection method serve a dual purpose. They allow the interviewer to gather information through questioning, and at the same time, they provide an opportunity to observe various non-verbal cues and behaviours of the interviewee (Hanington & Martin, 2019). Such an approach can facilitate the understanding of how cultural norms and personal views shape the use of artifacts in EAs.

Second, interviews allow for data to be collected both online and in-person without compromising the quality or validity of the data (Shapka et al., 2016). Third, interviews can be video recorded. Such a possibility makes interviews a data collection method compatible with the framework devised in Study 1, which was tailored to examine video data.

Furthermore, the interview is a method that opens up opportunities for methodological innovation. As Kara highlights, interviews can be "creatively enhanced" (2015, p. 83). That is, researchers can explore inventive or unorthodox ways to make it easier for participants to elucidate and communicate their opinions, memories, concerns, feelings, and so on. The innovation opportunities the interview offers can be particularly useful in research initiatives intended at devising new research approaches.

In addition to aiming at methodological objectives, Study was devised to produce a sample analysis that could be presented as evidence in the ethics application for AUT's Ethics Committee (AUTEC). By demonstrating that the use of the newly devised framework did not pose ethical challenges, the intention was to expedite AUTEC's approval and thus advance the investigation to the next stage.

4.3.1 Devising and piloting an interview strategy

For reasons of methodological continuity and efficiency, I chose to focus the pilot interviews in Study 2 on the same activity that I examined in Study 1. This decision allowed for a direct comparison of the experience in analysing a secondary data set (Study 1) and a primary data set (Study 2) using the newly devised framework. I anticipated that such a comparison would help me identify opportunities for further refining or expanding the framework.

Participant recruitment and sample size

The approach I followed to recruit participants for Study 2 was purposive (S. Campbell et al., 2020). That is, I recruited people based on their ability to provide detailed information on tea-making. This in-depth perspective was regarded as crucial for enhancing the practical value of Study 2. I anticipated that interviewing expert participants could reveal aspects of tea-making that might not have been initially considered during the interview planning process. Identifying these aspects would contribute to a better understanding of the potential of interviews as a method for collecting primary data on EAs.

To find candidates for the study, I circulated an invitation through social media. I included my contact information in the invitation so that people who were interested in participating in the study could get in touch with me. The selection criteria I used to select participants from those who responded to the invitation involved their fondness

for homemade infusions and their reasons for drinking them. In other words, I looked for people who liked to make infusions at home and who drink them for specific purposes, e.g., relaxing, sleeping better, strengthening the immune system, and so on.

I recruited a total of six participants. A sample size of six, although small, was considered appropriate because Study 2 was not aimed at deepening designers' understanding of how people make tea. The aim instead was to use real-world data to further develop a framework to examine EAs at a granular level.

The format and structure of the interviews

Study 2 took place during a lockdown period imposed by the New Zealand government in response to the Covid-19 pandemic. During this period, direct contact with participants was not allowed. Consequently, I made the decision to conduct the interviews online. Thus, the interviews consisted of video calls made through video telephony services such as Skype, Zoom, and Google Meet. Participants were given the freedom to join the interviews using the device of their choice. The interviews lasted between 40 and 60 minutes and were video recorded for subsequent analysis.

In addition to ensuring the safety of both participants and me as the researcher, the online format allowed participants to join the interview from home, potentially providing a more comfortable setting for elucidating and explaining why they make tea in particular ways.

Another reason why I found the online format advantageous is that I considered that observing participants in their daily environments could help to understand how contextual factors, such as the availability of certain artifacts or supplies, might impact on their tea-making practices.

The interviews were divided into two parts. In the first part, I asked the participants to show me the space where they normally make tea. In all cases, this space was in the kitchen. During this part of the interview, I also I inquired about the participants' tea-making preferences. Topics covered in the first part of the interview included:

1. Do you have preferences for certain types of tea?
2. How do you usually drink your tea? Why?
3. In your view, what are the characteristics of a good cup of tea?

4. Why are these characteristics important to you?
5. How do you ensure that your tea infusion acquires these characteristics?
6. What ingredients and utensils do you normally use to make tea?

In the second part of the interview, participants showed me how they normally make a cup of tea at home. As they proceeded with their demonstration, I asked participants about the reasons why they use artifacts and other supplies in particular ways. I video recorded the interviews using the record feature available from the video telephony services I employed.

The decision to structure the interviews in two parts was a purposeful choice intended to ensure effective data collection. The initial part of the interview was aimed at encouraging participants to reflect on the tea-making approach they would subsequently demonstrate. This reflective stage of the interview was deemed necessary due to the established understanding, presented in Chapter 2 (Section 2.4), that EAs are routine practices. Thus, without an opportunity for introspection, there was a potential risk that participants might struggle articulating their motivations for making tea in particular ways during the subsequent demonstration.

Data log

At the end of each interview, I downloaded the recording of the video call. I labelled and saved each interview as a separate file in an external hard drive. The file labels consisted of the word *Volunteer* followed by consecutive numbers (Volunteer 1, Volunteer 2, and so on).

I then transcribed the interviews into text files using Otter transcription software. To facilitate their reading and subsequent analysis, I did not include fillers (“err”, “hmm”), repetitions (reiterating questions), stutters and stammers. I also replaced non-standard language forms, such as “gonna”, “ain’t”, and “cause” with their more formal equivalents.

4.3.2 Analysis of pilot interviews

Given that Study 2 served as a consultation to obtain approval from AUT’s Ethics Committee, I am not authorised to include images or quotes from the pilot interviews. Thus, I have chosen to illustrate the analysis of the interviews by including both

paraphrased excerpts from the interviews and diagrams depicting the actions performed by the interview participants.

Broadly speaking, the analysis of the interviews involved three steps. First, I deconstructed participants' tea-making processes into actions. Next, I created written descriptions of what participants did with artifacts and supplies in each action. I supplemented these descriptions with transcribed snippets of the verbal explanations that participants gave about each action. Finally, I conducted a Thematic Analysis (Braun et al., 2018) of the interviews to examine the underlying ideas that guide participants' approach to tea-making. The following sections below provide further details of the steps I followed to analyse the interviews.

Activity deconstruction

The analysis began by revisiting the videos of the interviews to deconstruct participants' tea-making processes into actions, i.e., steps deliberately undertaken to complete an activity. The intention in doing so was to set the ground for examining, in later steps, the artifacts and supplies that the participants use at key moments in their tea-making process.

Integral to the approach I followed to deconstruct activities in Study 2 are the concepts of transformation[12] and transfer[13]. However, in the analysis of Study 2, I considered transformation and transfer not as the primary goals of two different types of actions (as I did in Study 1). Instead, I considered transformations and transfers as events whose occurrence can delineate the beginning and end of actions. To illustrate this point, below I review two of the actions that I identified in the interviews on tea-making.

Figure 4.18 is a diagram of an action that consists of emptying the residual water from a kettle. Such an action can be delimited from two transfer events. The transfer that marks the beginning of the action occurs when the kettle is lifted from its base. In turn, the transfer which marks the end of the action takes place when all the residual water has fallen into the sink.

[12] In the context of this investigation, the term transformation refers to the physical modification of artifacts or supplies.

[13] In turn, the term transfer refers to the relocation or repositioning of artifacts or supplies.

Figure 4.18

Transfers marking the beginning and end of the action of emptying residual water from kettle.

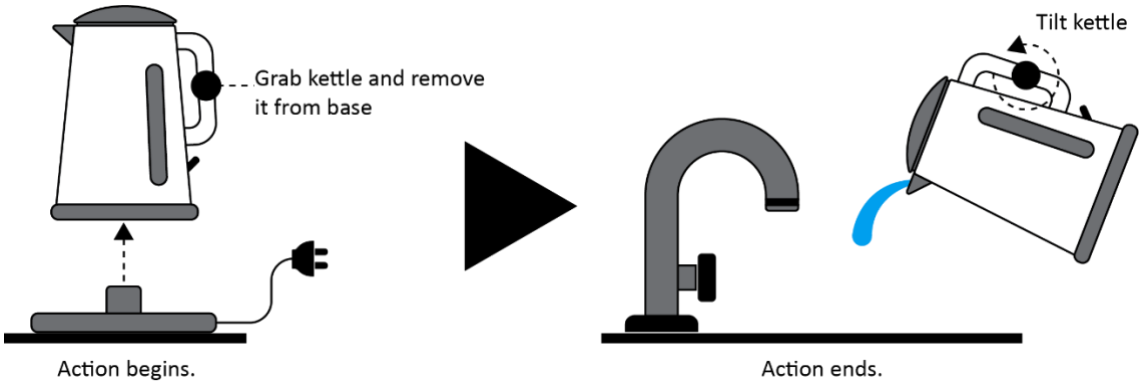
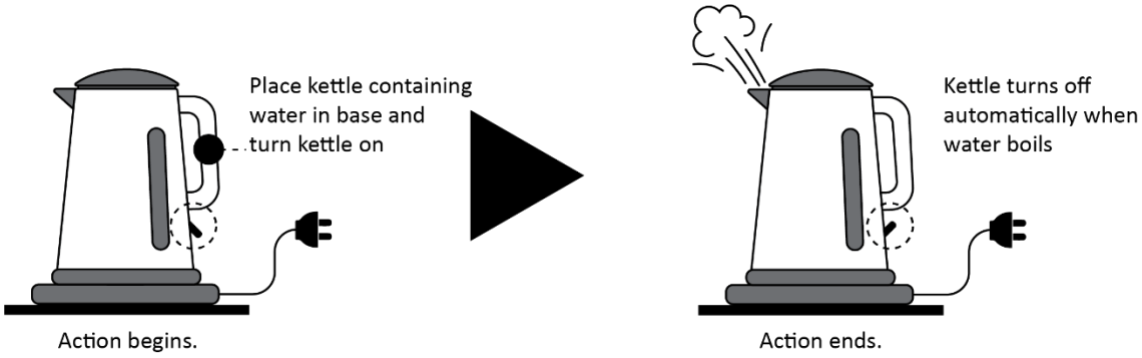


Figure 4.19 is a diagram of the action of boiling water. Such an action can be delimited from a transfer and a transformation. The transfer that marks the beginning of the action occurs when the kettle's power switch is pressed. The transformation marking the end of the action takes place when the kettle automatically turns off after the water starts to boil.

Figure 4.19

Transfers and transformations marking the beginning and end of the action of boiling water.



Examining use

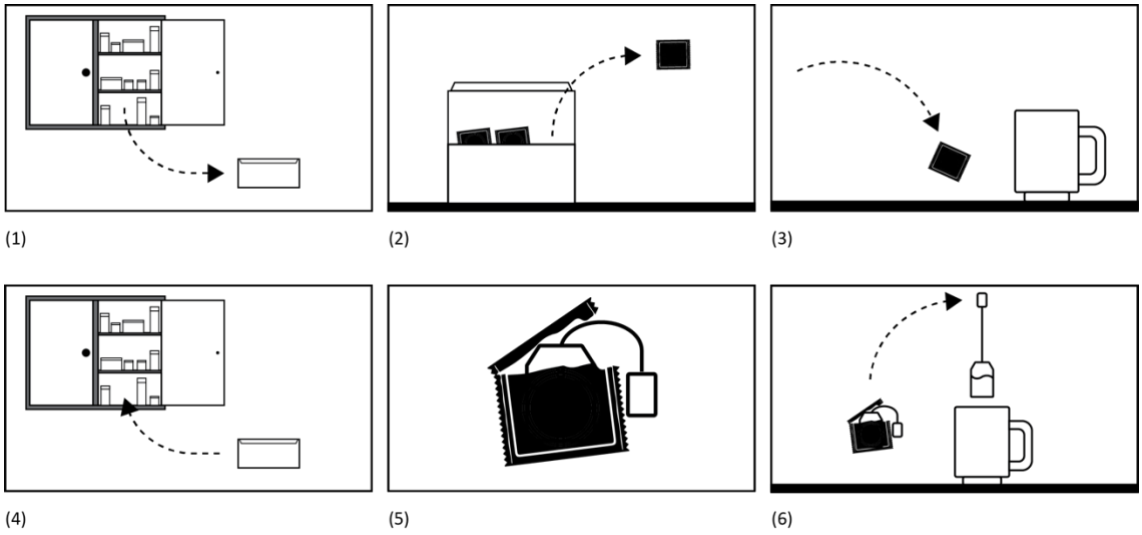
The next step in the analysis was to examine how participants use artifacts and supplies in each action. This involved revisiting the segments of the videos showing each action and creating written description of what participants did with artifacts and supplies.

Figure 4.20 shows details of the action of putting a teabag in a cup. The way I described this action was: the participant opens one of the high cupboards in the kitchen and pulls out a package containing liquorice teabags (1). The participant then places the package on the kitchen countertop and takes out a teabag (2). The participant throws the teabag

and it lands near a cup resting on the kitchen counter (3). The participant then closes the package containing the teabags, places it back on the high shelf, and closes the cupboard (4). Then, the participant takes the tea bag out of its individual wrapper (5) and, holding it by the cord, places it inside the cup (6).

Figure 4.20

Details of the fourth action performed by a participant (putting teabag in cup).



Thematic analysis of online interviews

To better understand participants' motivations to make tea in particular ways, I conducted a Thematic Analysis (TA) of the interviews. As noted in Chapter 3 (Section 3.5.2), the TA is a method to identify and make sense of similarities and differences in the way people explain or describe events.

The TA of the pilot sessions was inductive, which means that it was based on my interpretation of what the participants said. I began the TA by coding the transcripts of the interviews. This involved formulating pithy descriptions of the content of the snippets comprising the interview transcripts.

In coding the transcripts, I considered both the explicit and implicit meanings of what participants said about artifacts, supplies and their use. That is, I considered both what participants said openly and the potential implications of their word choices (Halliday & Matthiessen, 2014). For example, one participant reported adjusting the steeping time for the tea at the suggestion of a friend. I coded such a comment as *Housemates' influence*. Another participant reported turning off the kettle shortly before the water

boils in order to save energy. I coded such a comment as *Diminishing energy consumption*.

The next step in the TA was to define initial themes. To this end, I retrieved all the coded snippets and grouped together those marked with codes that seemed to be related. For clarity, below I include a review of two snippets.

One of the participants commented that consuming pennyroyal tea helps strengthen the immune system. I coded this snippet as *Health booster*. Another participant commented that fruit teas generate a feeling of relaxation and comfort. I coded this snippet as *Tranquilising effects*. Given that the two codes above refer to the impact that tea has on the body, I grouped the codes in a preliminary theme called *Benefits of tea*. To avoid researcher bias, both the coding of the interview transcripts and the grouping of the codes were shared with my PhD supervisors for review (Denzin, 2017).

The grouping of codes resulted in the definition of nine themes. I considered these themes as types of ideas guiding participants' approach to tea-making. The nine themes the TA yielded are:

1. *Benefits of tea*. Snippets where the participants refer to the physiological and physical effects that hot infusions produce.
2. *Living with others*. Snippets where the participants explain how living with a partner, friends or family members impacts on their tea-making method.
3. *Good manners*. Snippets where the participants explain how the presence of guests impact their tea-making method.
4. *Practical suitability*. Snippets where the participants explain how the design of artifacts facilitates their tea-making method.
5. *Emblematic suitability.* Snippets where the participants explain how artifacts and supplies convey aspects of their personality or cultural background.
6. *Aesthetic suitability*. Snippets where the participants talk about the attractiveness and decorative use of artifacts and supplies.
7. *Effective use*. Snippets where the participants share strategies to reduce the time and effort required to make tea at home.
8. *Frugal use*. Snippets where the participants share strategies to consume fewer supplies or save water and energy.

9. *Producing flavour*. Snippets where the participants share strategies to ensure the tea acquires the desired taste.

4.3.3 Reflections on Study 2

In Study 2, I formulated an interviewing strategy to collect primary data on EAs. I piloted this strategy by conducting a round of online interviews on tea-making. I analysed the collected data with a revised version of the analytical approach I devised in Study 1. The above efforts together constitute a framework for collecting and examining primary data on EAs.

Integral to this framework is the recognition that EAs are routine practices and therefore, study participants may struggle elucidating and communicating their motivations for conducting these practices in particular ways. Taking this into consideration, the interview process within the framework is divided into two distinct parts. The initial part involves questions aimed at prompting study participants to reflect on their unique approaches to the activity under examination. This reflective stage lays the foundation for the second part of the interview, during which participants demonstrate how they normally conduct the activity under examination.

Conducting the pilot interviews in Study 2 allowed me to identify key challenges associated with videotaping EAs. Carrying out EAs may involve moving within a room or between rooms. For example, the tea-making process of one of the participants began with the emptying of the residual water from the kettle. This action implied for the participant to move from the end of the kitchen where the kettle was plugged to the other end where the sink was.

When demonstrating actions such as the one above, the study participants followed one of two strategies. Some participants moved around holding and pointing in specific directions the camera on the devices they used to join the online interview. In contrast, other participants continually paused their tea-making demonstrations to adjust the position and framing of the camera on their devices.

While the above camera strategies can provide detailed video recordings of EAs they also have limitations. Having to reposition their devices can distract participants and therefore prevent them from providing detailed answers to questions posed by

researchers. Similarly, having to hold a communication device while demonstrating an activity can prevent participants from performing actions as they normally do. For example, actions that normally involve handling artifacts with both hands may have to be performed with only one hand (since the other is holding the communication device).

The range of cameras available in the market includes alternatives such as GoPro cameras, which can be attached to participants' heads or chests, thus freeing their hands. However, even if their hands are free, wearing a camera on the body may not be a comfortable or familiar experience for study participants. Therefore, this setup can still disrupt participants' normal movements and interactions with artifacts during EAs.

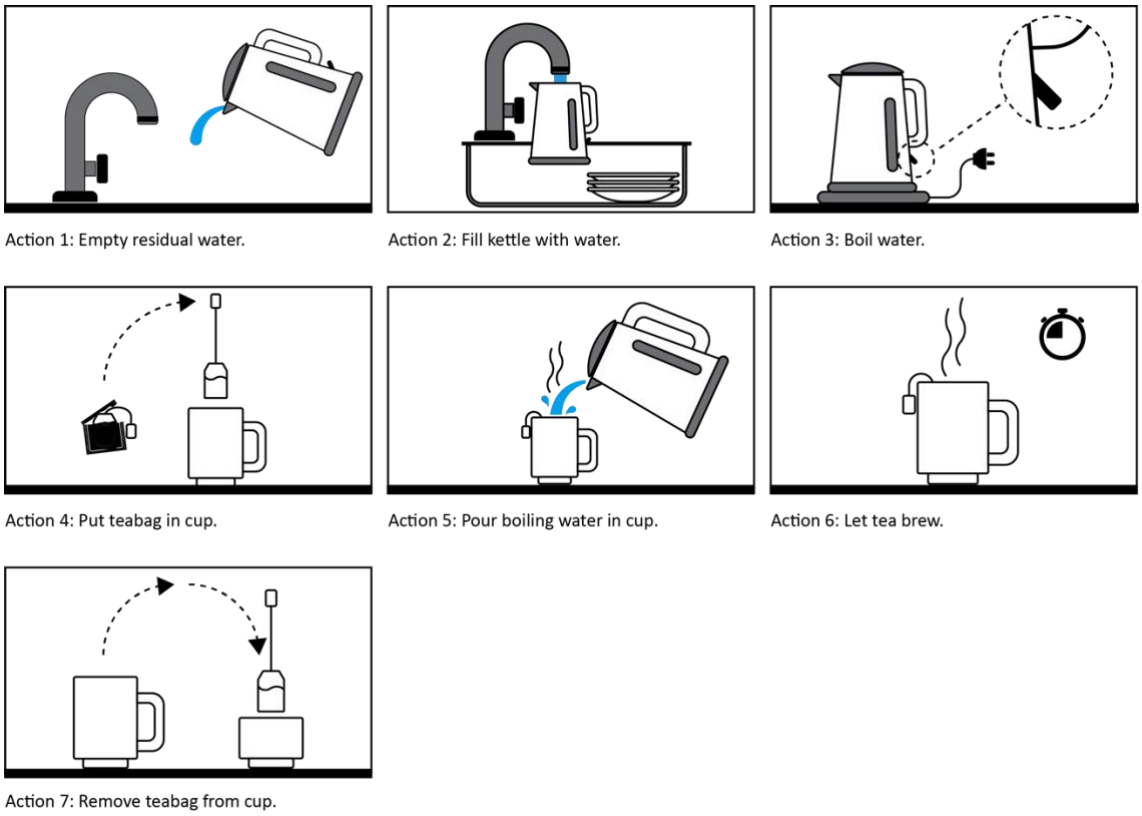
Situations such as the above do not make video recorded interviews an unsuitable method for collecting primary data on EAs. However, they do call for exploring less disruptive interview processes and video recording strategies to collect primary data on EAs.

The analysis of the interviews in Study 2 included both the deconstruction of participants' tea-making processes into actions and the examination of the artifacts and supplies that participants use in each action. Such an analysis allowed me to recognise that there were artifacts that the participants used more frequently than others during their tea-making demonstrations.

Figure 4.21 shows the actions I identified in the tea-making demonstration of one of the participants. As seen in this figure, the participant used the water tap only in Action 2 (Fill kettle with water). In contrast, the participant used a cup in four actions, namely, Action 4 (Put teabag in cup), Action 5 (Pour boiling water in cup), Action 6 (Let the tea brew) and Action 7 (Remove the tea bag from the cup).

Figure 4.21

Actions from the tea-making process demonstrated by one of the participants.



Situations such as the above prompted me to further expand the framework, so that it would allow designers to systematically contrast the number of actions in which people use artifacts in an activity. The aim with this extension would be to offer designers an avenue to reflect on matters such as: Which artifacts are more frequently used during an activity? What is the relationship between the frequency of use and the influence artifacts exert on an activity? Is the use in a high number of actions indicative of overdependence on an artifact to perform an activity? Are there artifacts that, despite being used less frequently, are highly influential in an activity? The extension made to the framework to support these types of reflections are detailed in the next chapter.

Summary

This chapter detailed the first two studies I conducted to develop a framework for examining everyday activities (EAs) at a granular level. Study 1 consisted of an analysis of user-generated videos (UGVs) I retrieved from video sharing platforms.

The UGVs I analysed show people demonstrating how they typically make a cup of tea at home. I analysed these videos by adapting the multimodal transcript, which is a data

analysis method originally used in the area of Multimodal Interactional Analysis (MIA) to examine videotaped interpersonal encounters. The adaptation I did of the multimodal transcript resulted in an analytical approach that allows for deconstructing EAs into actions and subsequently examining the artifacts and supplies people use in each action.

Study 2 was prompted by the recognition that crafting contextually-relevant design solutions requires a deep understanding of people's motivations and preferences, insights which are most likely to be gained through primary data analysis. Consequently, in Study 2 I focused on devising and piloting an interview strategy to obtain primary data on EAs. I then examined the collected data with the analytical approach I devised in Study 1. Doing so allowed me to refine the analytical approach developed in Study 1, ensuring that it served to examine primary data on EAs.

Together, Studies 1 and 2 resulted in a preliminary framework for examining EAs at a granular level. This framework allows for video recording people explaining their typical approach to EAs, and subsequently deconstructing people's explanations into actions. This preliminary framework also allows for examining the artifacts and supplies people use in each action, and identify themes that people continually refer when explaining their actions.

Chapter 5 Refining and extending the framework: Study 3

The preceding chapter provided a detailed description of two empirical studies conducted to devise a preliminary framework for examining everyday activities (EAs) at a granular level. This chapter delves into a third study conducted to more closely align the framework with designers' forms of inquiry with often involve the translation of observational and speech data into visual means.

This third study consisted of interviews focusing on a specific activity. The account of this study is organised in three sections. Section 5.1 presents and justifies the choice of activity that Study 3 interviews focused on. Section 5.2 details the interviewing strategy adopted in Study 3. Section 5.3 describes the analysis of the interviews, which included the use of data analysis and data visualisation methods adapted from Social Network Analysis (SNA).

5.1 The activity examined in Study 3

Study 3 was aimed at incorporating a visual representation component into the framework for examining EAs that was developed throughout the studies reported in Chapter 4. By integrating this new component, the framework was intended to offer a pathway for systematically examine the frequency with which people use specific artifacts in an activity. In addition, the incorporation of a visual representation component was made to more closely align the proposed framework with designers' forms of inquiry which often include the translation of observational and speech data into sketches, diagrams, and other visual means (Cross, 2006).

Study 3 consisted of a new series of interviews whose analysis was conducted using an updated version of the framework. In this updated framework, the analysis of the interviews involved the use not only of methods adapted from Multimodal Interactional Analysis (as in Study 2) but also of data visualisation methods adapted from Social Network Analysis (SNA).

Adhering to the methodology devised for this investigation, Study 3 interviews focused on a model activity. As established in Chapter 3 (Section 3.2.2), a model activity clearly

exemplifies inherent attributes of EAs and offers practical advantages to design researchers.

For Study 3, the decision was made to examine a model activity different to that examined in the two previous studies. The aim with this decision was ensuring the applicability of the newly devised framework. Specifically, it was considered that examining a new activity in Study 3 would confirm that the proposed framework was useful for examining activities beyond the one that served to establish the framework's foundations.

The selection of the activity to examine in Study 3 was carried out in two steps. Initially, the search for an activity was directed towards a specific realm of daily life in Aotearoa, New Zealand. Subsequently, a specific activity belonging to said realm of life was selected. The following sections provide details of this two-stage selection process.

5.1.1 General search for an activity

The search for a model activity in Study 3 was directed towards the realm of *hiking* (or *tramping* as it is known in Aotearoa New Zealand). Hiking involves traveling on foot over roughed terrain. Along these expeditions, which can last from several hours to multiple days, hikers conduct a number of EAs (e.g., cooking, eating, bathing, sleeping, etc.) in settings such as campgrounds and regional parks where infrastructure is limited[14] (Burch, 1965).

On the basis of the above, hiking is conceived in this investigation as a cluster of EAs carried out in close proximity to nature. To streamline discussions in the remaining of the chapter, the term *hiking-related activities* will be used to describe the EAs that people conduct during hiking trips.

The decision to direct the search for a model activity towards the realm of hiking was due to two reasons. First, hiking is integral to everyday life in Aotearoa New Zealand.

[14] For example, New Zealand's hiking options include 10 routes known as the *Great Walks* (Fagan & Kearns, 2017). The infrastructure available in the campsites along these walks is limited to toilets, handwashing sinks, and a water supply which may need to be purified before consumption (*Campsite Categories*, 2021).

According to the Mountain Safety Council New Zealand (2022), more than 1.14 million NZ adults went tramping in 2021. This figure is equivalent to 22% of the country's population.

In addition, hiking is a realm of life that offers advantages to better understand the cultural, individual, and physical dimensions of EAs[15], as these dimensions are defined in Chapter 2, Section 2.4.1. This point is better understood by considering Littlefield and Siudzinski's (2012) study, which consisted of in-depth interviews with both novice and expert hikers. The focus of these interviews was on understanding how the use and meanings assigned to hiking gear change as hikers gain outdoor experience.

Littlefield and Siudzinski's findings suggest that novice hikers initially engage in hiking-related activities by strictly following guidelines covered in hiking forums and manuals. In other words, novice hikers seem to operate under the assumption that there is a single optimal way, outlined in specialised manuals and forums, to engage in hiking-related activities.

However, as hikers gain experience, they develop their own personalised approaches to hiking-related activities. The development of these personalised approaches is an issue that expert hikers are acutely aware of, as shown in the excerpt below which was extracted from Littlefield and Siudzinski's work.

> There obviously is not one way to hike, you know, one right way to hike. It's just a matter of personal style, personal preference, so the best way to prepare is to get out there and hike, you know, hike for a week and see what works for you because you have to fine tune your style, you know, what you take with you, your routine when you are camping and that sort of thing. And I mean as many books as you can read, but again there is just no, the way it's been described to me when you are backpacking, you are trying to find a balance between being comfortable when you are camping and being comfortable when you are walking and it becomes a question of when you are camping what

[15] As detailed in Chapter 2, the cultural dimension of everyday activities (EAs) is given by cultural norms that influence people's everyday behaviour (Giard, 1998). EAs also possess an individual dimension, rooted in how cultural norms are individually interpreted and enacted (Garfinkel, 1964, 1991). Lastly, EAs have a physical dimension, which implies these practices vary due to the availability, design, and condition of artifacts (Gibson, 1977; Norris, 2004; Verbeek, 2010).

> is it that you are willing to give up, you know? And it always changes too, so I have never known a hiker who started with the same stuff that he or she finished with (Stewart Little, male in 20s, expert).

Testimonies such as the one above suggest that expert hikers are able to clearly articulate how hiking-related activities are influenced both by ideas widely disseminated in specialised media and personal preferences and experiences. In other words, using hiking-related activities as a unit of analysis can offer advantages for deepening the understanding of the tensions and alignments between the cultural and individual dimensions of EAs.

Hiking-related activities also offer advantages to better understand the physical dimension of EAs, especially in relation to artifact use. As established in Chapter 2 (Section 2.4.2), the range of uses people give to artifacts in EAs includes those that Ahmed (2019) designates as *queer*. Such uses stem from people's ingenuity and deviate from the main purpose for which artifacts are created.

Queer or unconventional uses are integral to hiking-related activities. Eager to reduce backpack weight, hikers often modify everyday artifacts to function as light-weight hiking gear. The excerpt below was extracted from Littlefield and Siudzinski's (2012). In this excerpt, a hiker comments on the reduced weight of two cooking/eating utensils he made himself: a stove he built from cat food cans and a cup he made by cutting a sports drink bottle in half.

> [I have] ended up building most of my equipment because I couldn't buy what I wanted so I made it all. So I am down to a nylon tent. My wife sewed it; I designed it and she sewed it together. It weighs 1 pound and 3 ounces. It sets up with my trek-king poles. I am down to one little titanium pot, an alcohol stove made out of cat food cans, a titanium spoon. And then drink out of a half Gatorade bottle for a cup and my kitchen thing now weighs six ounces. And I was carrying a 3-pound stove you know (Cherokee, male in 60s, expert).

Beyond the interest in reducing the weight of backpacks, the austere conditions in which hikers operate are inherently conducive to the discovery or delimitation of queer uses. On a hiking trip, the immediate replacement of a malfunctioning or broken piece of gear might not be feasible. As a result, hikers often find themselves repurposing everyday artifacts to repair malfunctioning equipment or as substitutes for the malfunctioning

equipment. For example, during a hiking trip, a shoelace can serve as a makeshift tensioner for a tent, a temporary strap for a backpack, as a cord to secure cooking utensils to the outside of a backpack, and so on.

The proactive search for queer uses is such an integral aspect of hiking-related activities that specialised handbooks and manuals often address this topic. The excerpt below was extracted from Karen Berger's hiking manual *Everyday Wisdom: 1001 Expert Tips for Hikers*. In this excerpt Berger presents a tent repair technique that involves creating an improvised pole splint with soda cans.

> Snapped poles. These are a cinch to splint if you packed along the aluminium pole splint the manufacturer should have included in the package when you bought the tent. Straighten out the tent poles, insert them into the splint, and hold them in place with duct tape. If you don't have the pole splint, improvise one by cutting a piece of metal from a soda can, or by using a half-moon tent stake (Berger, 1997, p. 184).

The consistent reference to queer uses in the hiking literature suggests that this type of uses are not only common but also readily noticeable in hiking-related activities. On this basis, it is plausible to infer that examining hiking-related activities can help to advance the understanding of the multifaceted roles that artifacts play in EAs.

To summarise, this investigation conceives hiking as a cluster of EAs conducted in close proximity to nature, and posits that examining these activities can enhance the understanding of the cultural, individual and physical dimensions of EAs. This stance towards hiking-related activities stems from two main realisations:

- Being acutely aware of their evolving understanding of the outdoor experience, hikers are well equipped to offer insights into how widespread ideas and personal views influence the unfolding of hiking-related activities.
- Hikers are continually driven to discover or invent queer uses for artifacts (Littlefield and Siudzinski, 2012), making hiking-related activities units of analysis suitable to better understand the multifaceted roles artifacts play in EAs.

Having elucidated the reasoning for focusing the search for a model activity in Study 3 to the realm of hiking, attention will now turn to the specific hiking-related activity that was examined in Study 3.

5.1.2 Narrowed search for an activity

Hiking trips entail a wide variety of activities ranging from setting up tents and lighting a fire, to washing dishes, bathing and sleeping. Given time and resource limitations, it was not feasible to examine multiple hiking-related activities in Study 3. Therefore, the decision was made to focus Study 3 on a single activity.

Food preparation during hiking trips was the activity examined in Study 3. The choice of this activity was due to two main reasons. First, as discussed in Chapter 4 (Section 4.1.1), food preparation is as an activity that aligns with the seven criteria established in this investigation for designating model activities:

1. A model activity is clearly influenced by cultural norms. The influence of cultural norms is evident in food preparation, where ingredient selection and cooking methods are often outlined in recipes and culinary traditions (Ayora Diaz, 2014; Ly, 2017).
2. A model activity varies widely due to individuals' personal views and choices. This criterion is readily noticeable in food preparation. Consider how individuals often adapt recipes to make dishes match their personal preferences and dietary requirements (Li et al., 2010; Sappelli, 2011).
3. A model activity clearly varies due to the design, availability and current conditions of artifacts. The cooking methods people employ can vary based on the cooking utensils that are available (Chang & Krishna, 2021; Demetry, 2018). In the absence of a steamer, a person can choose to cook vegetables by frying them in a pan.
4. A model activity facilitates the examination of a broad spectrum of artifact uses. Food preparation (even in the austere conditions of a hiking trip) involves the use of a wide range of utensils such as portable stoves, knives, cutting boards, pots, plates, spoons, and so on (Buckley, 2007; Logue, 2013; Skurka, 2017).
5. A model activity poses minimal ethical issues because its examination does not require collecting confidential or private data nor putting participants in potentially vulnerable situations. Food preparation can take place in shared spaces, whether it's a home kitchen or the shared cooking areas at

campgrounds, allowing for open observation without infringing on people's privacy.

6. A model activity is highly relatable. In other words, it is an activity that people with diverse profiles are keen to demonstrate and openly discuss. Food preparation garners wide attention in forums and publications, not only about everyday life but also about hiking, suggesting that a diverse range of individuals are keen to delve into and share their experiences and insights on this topic.
7. A model activity does not require multiple hours to complete, allowing for a streamlined approach to data collection and analysis. The variety of dishes people prepare, whether at home or on a hike, encompasses numerous quick-to-make options such as sandwiches, wraps, salads, dehydrated meals, and so on.

The second reason to focus Study 3 on food preparation was the significance this activity holds for the hiking community. Completing even a short hike of just a few hours is a physically demanding endeavour. Food provides hikers the nutrients required to maintain strength, stamina, and overall health throughout the journey (Sol et al., 2018).

Furthermore, the choices made regarding what meals to prepare during a hike can drastically impact the physical demands of the journey. Depending on the meals they choose to prepare, hikers might find themselves lugging additional utensils and ingredients, thereby adding to the weight of their backpacks (Thomas, 2013).

The importance of food preparation in the realm of hiking goes beyond practical matters. For many hikers in Aotearoa New Zealand, hiking is as much about life in the outdoors as it is about food. This sentiment is underscored by John Sawyer and Liz Baker in their 2007 book, *Gourmet Tramping in New Zealand*, where they emphasise the historical importance of food in the nation's outdoor life.

> For us, tramping is partially about exertion but mostly about indulgence, not only during the tramp (state-of-the-art tramping gear, extra-comfy walking boots, the latest range of Icebreaker clothing, gourmet scroggin), but also in the hut at the end of the day. So, having our senses bombarded all day with views of unparalleled New Zealand landscapes, we treat our tastebuds to a delicious gourmet meal.

> Gourmet tramping has been around in New Zealand ever since Polynesians first colonised Aotearoa. In those days people fed on moa, coprosma berries, crayfish and kina. Since then the gourmet theme has been adopted by some hunters and tramping clubs, who regularly feast in the bush on all manner of wild foods (Sawyer & Baker, 2007, p. 7).

Given the practical and experiential implications of food, many hikers thoughtfully and strategically select the dishes they cook and consume during their hiking expeditions. Thus, it was anticipated that discussing food preparation with hikers would result in a data set whose richness would offer a wide range of opportunities to adapt SNA methods for the examination of EAs.

5.2 Devising an interview strategy

As established in the previous section, the primary aim in Study 3 was to supplement the newly developed framework with methods adapted from SNA. To further emphasise this objective, I switch to a first-person narrative style at certain points in the remainder of this chapter.

The interview strategy I used in Study 3 was impacted by the Covid-19 pandemic. Specifically, I originally devised an interview strategy that I then had to adjust due to the changing restrictions imposed by the New Zealand Government in light of the pandemic. The subsequent sections delve into the specifics of the interviewing strategy I initially planned, the constraints that led to the infeasibility of this strategy, and the revised interviewing strategy I developed in response.

5.2.1 The original interview strategy

Study 3 began with the delineation of an interview strategy that was submitted for approval by the AUT Ethics Committee (AUTEC). The interviews contemplated in this strategy would be carried out at the campsites along the trails known as New Zealand's Great Walks (Fagan & Kearns, 2017).

The aim in conducting the interviews at these campsites was to observe the activity of interest (food preparation) at the settings where hikers normally perform it (Chamberlain & Crabtree, 2020; Ludwig et al., 2016). This approach was anticipated to offer advantages to better understanding how the physical context can influence EAs.

The interviews contemplated in the original strategy would be organised into two parts. In the first part, I would inquire about general aspects of food preparation during multi-day hikes. The intention with this first part of the interview was to help participants to situate themselves in a suitable mindset to share their visions and approaches about the activity of interest. Topics covered in this first part of the interview would include:

1. What makes a meal suitable for multi-day hikes?
2. What meal are you going to explain today?
3. What is that you like about this meal?
4. What gear and cooking items are required to prepare this meal?

In the second part of the interviews, the participants would explain the process for preparing a meal that they considered suitable for hiking trips. As participants progressed with their explanations, I would ask them questions regarding the cooking process. The intention with these questions was to gather insights on the ideas that lead participants to handles cooking utensils and ingredients in particular ways.

Allowing participants to select the dish they would demonstrate was a deliberate decision. By allowing participants to demonstrate a meal of their choice, Study 3 was structured to capture a potentially broader range of artifact uses than could have been obtained through multiple demonstrations of the same meal. Such a varied data set was expected to provide ample opportunities to further refine the newly devised framework, ensuring that it was suitable for examining a wide range of artifact uses within EAs.

Furthermore, providing the freedom to choose which meal to demonstrate was expected to make participants feel more engaged and therefore provide richer information about their individual culinary experiences during hiking trips. This notion aligns with widely used qualitative research methodologies in which participants are not viewed as mere informants, but rather as co-creators of meaning (DiCicco-Bloom & Crabtree, 2006; Weiss, 1994).

I submitted the proposal for Study 3 to the AUT Ethics Committee in July 2020. I received approval (with reference number 20/77) to conduct Study 3 in September 2020. Data collection was scheduled to begin after receive approval from AUT Ethics Committee. However, between September 2020 and September 2021, the restrictions imposed by

the New Zealand government to contain the Covid-19 pandemic varied continuously, from physical distancing measures and domestic travel restrictions to lockdown periods (Bandyopadhyay & Meltzer, 2020; New Zealand Government, 2022).

Depending on the current restrictions, NZ's conservation areas, huts, and campsites either operated at limited capacities (prioritising bookings made months in advance) or were entirely shut down (Espiner et al., 2023). These circumstances made unfeasible to conduct Study 3 interviews at the campsites along New Zealand's Great Walks.

Given the lack of access to the campsites, I considered the option of focusing Study 3 on an activity other than food preparation during hiking trips. However, the decision was ultimately to stick with the originally selected activity. This decision was based on the recognition that, under several circumstances (not just the Covid-19 pandemic), direct observation of EAs may not be feasible or advisable for practical and ethical reasons.

The previous point is effectively captured by Shadare (2021) and Kara and Khoo (2020) who highlight that pausing to re-evaluate research strategies in the face of crisis, rather than proceeding without modification, constitutes an ethical obligation. Moreover, these scholars stress the significance of employing research methods in creative or unconventional ways in order to provide participants greater autonomy over their data contributions.

> … researchers require not just a 'common sense' understanding that draws on their experiences and knowledge but must also exhibit a comprehensive ethical and methodological reflection, when undertaking challenging research. Nonetheless, nothing compares to the peculiar uncertainties and difficulties that arise when conducting research in fragile or conflict-affected environments where managing ethical tensions and ethical moments requires flexibility and adaptability (Shadare, 2021, p. 218).

> The online pivot has also generated creative research methods. Vanessa Braun, Victoria Clarke and Naomi Moller used story completion with adults to investigate rule-breaking in lockdown in New Zealand and the UK. Participants were presented with fictionalised 'story stems' to complete in writing, a non-intrusive technique which gave participants a high level of control over the data they provided as well as providing an outlet for some strong emotions (Kara & Khoo, 2020, p. 2)

Drawing inspiration from Shadare (2021) and Kara and Khoo (2020), it can be argued that even when direct observation of EAs is feasible, following this approach may not always be ethically justifiable. Directly observing people may inadvertently infringe on their freedom to select the information they disclose, thus bringing into question the degree of autonomy and informed consent in the research endeavour. For example, direct observation of household waste management may reveal private consumption habits or inadvertently capture financially sensitive information e.g., discarded bills or receipts.

Considering situations such as the above, I perceived the lack of access to the campsites as an opportunity to further extend the relevance and applicability of the framework I was developing. Specifically, I considered that tackling the challenge of investigating food preparation during hiking trips without resorting to direct observation would lead to strategic improvements to the proposed framework. These improvements were expected to make the framework a versatile tool that can be indistinctly used both in research scenarios where EAs can be directly observed and in scenarios where direct observation of EAs is not feasible or advisable. To this end, I made adjustments to interviewing strategy I originally devised for Study 3. Details of these adjustments are available in the following section.

5.2.2 Adjustments to the interview strategy in light of the Covid-19 pandemic

The revised interview strategy involved conducting Study 3 interviews within a staged environment. That is, a setting that replicates certain aspects of the real-world (Cem Kaner, 2013). Within this setting I asked participants to provide a simulated walkthrough of the process to prepare a meal they consider suitable for hiking trips. In other words, participants physically described the preparation of the dishes, but did not perform it full. In the following sections I justify and delve into the choice of this research approach.

The use of a staged-environment in Study 3

The inability to access NZ campsites, prompted me to conduct Study 3 interviews in a staged environment, that is, a setting that replicates real-world conditions at varying degrees of fidelity (Cem Kaner, 2013).

As previously discussed in Chapter 2, Section 2.5.1, the use of staged environments inherently places participants in unfamiliar conditions, potentially preventing them from

acting as they would normally do. However, rather than detracting from the relevance or validity of a study, this decontextualisation opens opportunities to gain a deeper understanding of EAs.

In their daily life, individuals often find themselves conducing EAs in diverse settings, some of which they might be experiencing for the first time (Anderson, 1995; Demetry, 2018). For example, on a given day, people might wash their hands at home in the morning, then do the same in a public bathroom at noon, and finally in the bathroom at a friend's house at dinner. Confronted with the unique characteristics of each of these settings, from differences in faucet designs to different types of soap (liquid vs soap bars), individuals may modify their handwashing techniques to varying extents.

The adaptability of people to unfamiliar conditions is a topic of interest to designers as evidenced by Hielscher et al. (2007), who used design probes with the explicit intention of disrupting participants' grooming routines, thereby encouraging them to discover alternative approaches to grooming. However, the variability of settings in which EAs take place introduces a multitude of contextual factors that can affect how individuals engage in these activities. This variability poses a challenge for designers trying to understand and leverage people's inherent adaptability to unfamiliar circumstances.

Staged environments provide a pathway to address the above challenge. By allowing for controlled testing, staged environments enable researchers to systematically explore how people adapt to specific contextual factors (Dai et al., 2018). In other words, staged environments make it easier to examine how people adapt to unfamiliar conditions, thus offering an understanding of EAs that naturalistic approaches to examining these practices may not easily provide.

Due to time and resource limitations, it was not feasible to recreate with high fidelity the conditions hikers experience at NZ campgrounds. Consequently, I chose to conduct Study 3 interviews in a low-fidelity staged environment set up at AUT City Campus.

The staged environment I used in Study 3 consisted of a room containing only an outdoor cooking set that I put together by consulting the hiking manuals by Buckley (2007), Logue (2013), Rietveld (2006), and Skurka (2017). According to these manuals:

- Aluminium pots are the preferred cookware because they offer the best balance of weight and price.
- Upright cookers and gas canisters are the most common cooking system because they are resistant and easy to operate.
- Lighters are convenient for lighting upright cookers because they produce a longer lasting and more wind-resistant flame than matches.
- Bowls are the preferred container in which to serve food because they can hold both solid and liquid meals.
- Depending on the amount of liquid that meals contain, people may cook and eat with spatulas, forks, knifes, spoons, or sporks (spoon-like device with fork-like tines that allow food to be speared).
- Hard plastic bottles and containers are suitable for transporting food and water because they are light and resistant.
- For both safety and weather conditions, people boil and drink hot water. Thus, cups/mugs are key for cooking outdoors.

Taking into account the previous points, I sought to put together a cooking set made up of utensils that could serve a variety of purposes in the preparation of both solid and liquid meals. As Figure 5.1 shows, the cooking set I put together includes a reusable water bottle (A), upright cooker (B), lighter (C), aluminium pot (D), wood spatula (E), gas canister (F), plastic bowl (G), plastic cup (H), reusable plastic container (I), plastic fork (J), plastic knife (K), plastic spoon (L), and titanium spork (M).

Figure 5.1

Cooking set made available to participants of face-to-face interviews.

The use of simulated walkthroughs in Study 3

The adjusted interview strategy maintained the originally outlined structure. That is, the interviews in the staged environment consisted of two parts. In the first part, I posed questions to participants to help them situate in a suitable mindset to share their visions and approaches about food preparation during hiking trips. In the second part, participants explained how to prepare a meal they consider suitable for hiking trips.

A key difference between the original and adjusted interview strategy was the type of explanations I asked participants to provide. In the original strategy, it was contemplated that the participants would demonstrate the preparation of the meals. However, in the revised strategy, I asked participants to provide illustrative explanations or simulated walkthroughs of the meal preparation processes. In other words, certain steps in the cooking processes examined in Study 3 were partially performed or simply physically described by participants rather than performed in full.

While simulated walkthroughs do not capture the unfolding of EAs with the same level of detail as direct observation, they do offer advantages that compensate for this limitation, as previously discussed in Chapter 2, Section 2.5.1. As underscored by Kaptelinin and Nardi (2006), EAs often involve routine human-artifact interactions. Consequently, study participants may struggle to thoroughly explain why they perform EAs in particular ways. This situation may be particularly evident in studies that involve direct observation of EAs. For example, someone pouring hot water from a kettle may

be primarily concerned on avoiding spills and burns, rather than articulating in detail the reasons for using a particular pouring technique.

The above point is further reinforced by Hanington and Martin's description of the Think-Aloud Protocol (TAP), which is a method that combines direct observation with in-the-moment questioning. As Hanington and Martin emphasise (2012, p. 180), the focus of TAP is on "what is happening, as opposed to why". This comment suggests that, observing and inquiring on EAs in real time may not fully capture the underlying motivations leading people to perform EAs in particular ways.

Simulated walkthroughs offer a pathway to address the above limitation. By involving physical description rather than the full execution of EAs, simulated walkthroughs provide participants the opportunity to distance themselves from the immediacy of the human-artifact inherent to EAs. This distancing opens a space for reflection that can help participants articulate their perspectives on EAs with greater clarity and depth (Clancey, 2002).

The value of simulated walkthroughs as research approach is further evidenced by both their integration into widely used design methods, such as Scenario Testing and Scenario Description Swimlanes (Martin, 2012), and their application in scholarly research. For example, in the study by Kuijer et al. (2013), participants were asked to simulate their bathing routines using prototypes of new personal grooming products.

The dual format of Study 3 interviews

Due to ongoing changes to public health restrictions imposed by the NZ Government in the light of the Covid-19 pandemic, I anticipated potential challenges when conducting in-person interviews. On the one hand, I anticipated that there could be periods when heightened restrictions could make face-to-face meetings unfeasible. Furthermore, even when restrictions were more relaxed, some people might have personal reservations about attending an in-person meeting.

The above considerations prompted me to delineate a complementary strategy that would allow for conducting Study 3 interviews online. This strategy consisted of video calls lasting between 40 and 60 minutes made through video telephony services such as Zoom, Google Meet, and Microsoft Teams.

Like the in-person interviews, the online interviews were organised into two parts. In the first part, I posed questions to participants to help them situate in a suitable mindset to share their visions and approaches about food preparation during hiking trips. In the second part, participants used gear and supplies they had available at home to physically demonstrate how to prepare a meal they consider suitable for hiking trips.

5.2.3 Participant selection, recruitment and sample size

The recruitment of participants was done through digital advertising on social media and posters placed in AUT. Both the digital advertising and posters included contact information so that people interested in participating in the study could contact me. When selecting participants for this study I considered the following six criteria:

1. Trip length. Depending on their span, hiking trips may be considered short hikes, day hikes, or multi-day hikes (Vistad et al., 2020). Short hikes last less than three hours, require no special equipment, and generally do not involve food preparation. Day hikes last more than three hours, do not involve spending the night outdoors and may or may not involve cooking. Multi-day hikes involve overnight stays and preparing food outdoors. Since the study focuses on food preparation, participants had to be multi-day hikers.
2. Level of expertise. Participants had to have at least one year of experience conducting multiday-hikes. I established this criterion considering that people with more experience in hiking are more likely than novices to have found or defined artifact uses other than those designers have prescribed (Littlefield & Siudzinski, 2012; Prümper et al., 1991; Sauer et al., 2010).
3. Decision capacity. Participants had to be people legally considered adults in full use of their physical and mental faculties. I established this criterion for ethical purposes. People of legal age and in full use of their faculties can evaluate the implications of performing as participants of a study and decide for themselves whether they want to do so or not.
4. Technology access and literacy. Participants were required to have the means and skills to participate in the study remotely, if necessary, in light of the restrictions of the Covid-19 pandemic.
5. Place of residence. Participants had to reside in Aotearoa New Zealand. The intention with this criterion was to ensure that the study captured the vision and

approach of locals towards cooking during multi-day hikes, thus allowing my findings to reflect and resonate with the daily experiences of New Zealanders.

6. To avoid power imbalances, my PhD supervisors and the students of the courses I taught throughout my PhD were excluded from Study 3.

People who showed interest in participating in the study and met the selection criteria received a copy of the Participant Information Sheet (PIS). This document provided details on the goals, data collection procedure and analytical approach of the study. The PIS also explained that depending on the current restrictions imposed by the New Zealand government to contain the Covid-19 pandemic, participation in the study could involve attending an in-person or online session. After receiving the PIS, people had one month to confirm their participation.

The aim of Study 3 was not to assess trends or patterns on food preparation during multi-day hikes, but to leverage on primary data on a model activity to further extend a framework for examining EAs at a granular level. Thus, I considered that a sample size of 6 was appropriate.

I recruited three participants for face-to-face interviews and three for online interviews. In what follows, I refer to the participants of the face-to-face interviews as PA, PB and PC and to those of the online interviews as PD, PE and PF.

As Figures 5.2 and 5.3 show, I implemented a de-identification framework to ensure that participants could not be recognised in any of the images I included in this thesis. The framework consisted of a facial blur. In addition, I provided participants the option of indicating if they wanted me to supplement facial blur with segmentation and masking of gait and RGB transformations (Saunders et al., 2015b, 2015a). None of the participants made use of this option.

Figure 5.2

Participants from face-to-face interviews.

Figure 5.3

Participants from online interviews.

5.2.4 Data log

I videotaped the hikers' interviews for subsequent analysis. To videotape face-to-face interviews, I used a Canon M100 camera. For online interviews I used the *record call* feature available in video telephony services such as Zoom, Microsoft Teams, and Google meet.

I labelled and saved each interview as a separate file in an external hard drive. The file labels consisted of the acronyms with which I referred to participants. That is, PA, PB, PC, PD, PE, and PF.

I transcribed the interviews into text files using Otter transcription software. To facilitate the later analysis of the transcripts, I removed fillers ("err", "hmm", and similar sounds), repetitions (reiteration of ideas), stutters, and hesitations. I also replaced non-standard language forms, such as "gonna", "ain't", and "cause" with their more formal equivalents.

To ensure quality and accuracy, I shared the transcripts with my supervisors for review. Once reviewed, I saved each transcript as an individual text file. I labelled the text files in the same ways as the videos. That is, PA, PB, PC, PD, PE, and PF.

5.3 Analysis of the interviews

During the interviews each participant explained how to prepare a meal they consider suitable for multi-day hikes. As Table 5.1 shows, participants PA, PB and PC (face-to-face interviews) explained, respectively, how to prepare a burrito, lentil curry and a vegetarian meal. On the other hand, PD, PE and PF (online interviews) explained, respectively, how to prepare Boerenkool (mashed potatoes with kale), a dehydrated Italian meal and ramen with vegetables.

Table 5.1

Meals that participants explained.

Participant	Meal	Interview format
PA	Burrito	Face-to-face
PB	Lentil curry	Face-to-face
PC	Vegetarian meal	Face-to-face
PD	Boerenkool (mashed potatoes with kale)	Online
PE	Dehydrated Italian meal	Online
PF	Ramen with vegetables	Online

The analytical process I followed to analyse face-to-face and online interviews was the same. First, I revisited the videos of the interviews to deconstruct participants' explanations into actions. Next, I created descriptions of what participants did with artifacts and cooking items in each action and supplemented these descriptions with quotes from participants' explanations. Then, I examined these descriptions to identify the artifacts and cooking items participants used and/or referred to in each action. Then I conducted a Thematic Analysis (TA) of the interview transcripts. Finally, I adapted SNA methods to create visual representations of participants explanations. In the following sections, I illustrate the analytical process I followed in Study 3 using PA's explanation.

5.3.1 Activity deconstruction

The first step was to revisit the videos of the interviews to deconstruct the participants' explanations into actions (or steps). The intention of this step was to lay the groundwork for subsequently scrutinising the use of artifacts and cooking items at key moments in meal preparation.

As established in Chapter 4 (Section 4.3.2), the beginning and end of actions can be delimited by identifying specific transformations (physical modifications) or transfers (relocation) of artifacts and cooking items. For example, the action of pouring water from a kettle, can be considered to start when a person lifts a kettle containing water (transfer) and to end when the person brings the kettle back to straight position after tilting it (transfer).

However, the above approach to activity deconstruction was not feasible in Study 3, because the interviews consisted of physical demonstrations and not the actual preparation of meals. In other words, some transformations and transfers occurred partially, or were only physically described.

Taking into account the type of data available (simulated walkthroughs), I deconstructed participants' explanations following an approach similar to that in Study 1 (see Chapter 4, Section 4.2.1). That is, I deconstructed participants' explanations by establishing a distinction between *transformation* and *transfer actions*.

Transformation actions are mainly directed at physically modifying artifacts or cooking items. Figure 5.4 shows PA explaining how to boil rice. Such an action can be considered a transformation one because the main goal of PA is to physically modify a cooking ingredient.

Figure 5.4

PA explaining how to boil rice (PA. 29:53).

On the other hand, the main goal of transfer actions is to fully or partially relocate artifacts or cooking items. Figure 5.5 shows PA explaining how to add rocket to a meal. Such an action can be considered a transfer one because PA primarily seeks to relocate a portion of a cooking ingredient.

Figure 5.5

PA explaining how to add rocket (PA. 04:07).

Table 5.2 shows the actions I identified in PA's explanation on how to prepare a burrito. The first column in this table indicates the type of action. The second column contains labels that I assigned to PA's actions to distinguish them. The labels consist of a capital letter *A*, indicating the participant performing the action, and a number indicating the order in which PA performed the actions (A01, A02, A03, and so on). The third column provides succinct descriptions of what actions consist of.

Table 5.2

Actions PA followed to explain how prepare a burrito.

Action type	Label	What action consists of
Transformation	A01	Set up heat source
Transfer	A02	Add rice to pot
Transfer	A03	Add water to pot
Transfer	A04	Add chicken oil to pot
Transformation	A05	Turn on stove
Transfer	A06	Put pot on lit stove
Transformation	A07	Cook rice-oil mix
Transfer	A08	Put tortilla wrap in bowl
Transformation	A09	Turn off stove
Transfer	A10	Add rice-oil mix to wrap
Transfer	A11	Add chicken to wrap
Transfer	A12	Add rocket to wrap

After deconstructing the hikers' explanations into actions, I revisited the videos of the interviews and created more detailed descriptions of what each action consists of. I supplemented these descriptions with snippets I compiled from the transcripts of the interviews. For illustrative purposes, I have included below the descriptions I made of the actions of PA and snippets from the interview with such a participant.

Participant A's explanation on how to prepare a burrito

Action A01: PA assembles the portable stove and gas canister and places the assembled artifacts on a flat surface, which prevents the gas canister from rolling into the tents if it topples.

> *So, we would need the typical tramping canned gas. I have used this probably every time I have gone out. It packs light and it's small enough to just take it with you, which I quite like (PA. 08:11).*
>
> *…If it's breakfast or lunch, you just want a quick bite before you like leave for the next bit of your track. So, I would usually have cereal or muesli, something really quick. Dinner is the only time where you will need the canned gas and the cooker (PA. 08:23).*
>
> *…usually in an all campsites there are designated areas and you can see the spots where people have been cooking on. You want to find the flattest bit of land basically. That way, if the can of gas topples over it won't roll into your tent or into you. You want to keep it as safe as possible (PA. 13:31).*

A02: PA pours all the contents of a parboiled rice package into the pot.

> *The rice I usually can finish it in a single serving so, I bring it in its original packaging (PA. 04:35).*
>
> *A pack of rice is usually good for two servings. I have never really tramped alone. I am usually with another person, so I put the whole pack of rice in the pot (PA. 15:40).*

A03: PA visually estimates the amount of water the rice requires and pours such amount of water from a reusable bottle into the pot.

> *I don't really measure the water. I just eyeball how much is needed (PA. 15:55).*
>
> *…It's usually better to put more water than necessary because it evaporates off anyway (PA. 18:36).*

A04: PA opens a chicken can partially and pours the oil from the can into the pot containing water and rice.

> *The annoying thing is there's quite a bit of oil left in the can afterwards which is quite annoying. You can't pre drain it up or anything. So, I tend to drain it into the rice which is kind of gross but it stops me from dumping it out in the woods. So, it means I don't leave sweet chili sauce all over the woods (PA. 04:39).*

> *I never really go for proper cans because I would need a can opener and that again is extra stuff to carry. So, I use the ones that can be opened manually. I open it and then I press the cap so the juices would come out. (PA. 16:02).*

A05: PA uses a lighter to turn on the stove.

> *…I put the rice, water, and chicken oil in the pot first and then light the cooker. That way, we are not wasting gas (PA. 14:55).*

A06: To save gas, PA puts the pot with water, rice, and chicken oil on the stove only after the stove is burning.

A07: PA keeps the lid on the pot while the rice cooks to preserve the heat and save gas. Every now and then, PA stirs so that it cooks evenly and also to prevent the rice from burning and sticking to the bottom of the pot.

> *So, I usually go for the tomato basil rice. That works well with the sweet chili chicken. The thing with parboiled rice is that it's quite easy to cook and it's quite fast. So, if you're out in the world and it's raining, it's miserable, it doesn't take as long as just raw rice. I like Uncle Ben's rice because is quite well portioned so you don't end up with a whole bunch of waste or leftovers afterwards that you have to carry around (PA. 03:21).*

> *…I keep the lid on to keep it [rice-water-oil mix] as warm as possible. That way it heats up faster and you're not wasting as much gas (PA. 17:11).*

> *I stir it [rice-water-oil mix] so that it cooks evenly and it doesn't burn. It is actually pretty awful when it burns at the bottom [of the pot]. It's horrific to clean (PA. 18:12).*

> *So, you are looking for how much water is left. You are waiting for it to be absorbed into the rice. The goal is to have no water left in the end. But honestly, another big factor is hunger level. Sometimes you are at*

> *a point where think, I can eat it now because it's already half cooked, I can eat it partially raw. So, it depends on my patience. Otherwise, you're tasting it as you go to see how cooked it is. But, if I run out of patience I would think, it's fine, I'll eat it (PA. 19:36).*

A08: While the rice is cooking, PA gets a package of tortilla wraps, takes one out, and places it on a bowl. According to PA, the tortilla makes cleaning afterwards easy because it creates a barrier between the bowl and the rest of the wet foodstuff.

> *I prefer the wraps that are a bit smaller because they have a tendency to not break or bend as much when you put them in your bag. If you shove it in your bag they won't crack as much (PA 02:16).*

> *The wraps come in a package with a Ziploc. If it's just me, I'll take out how many wraps I need and put them in a separate Ziploc bag. But, if it's like a pack of 10 and I've got a few friends and we are cooking together, then I'll bring the original package with me (PA. 05:53).*

> *…with the wrap you can save yourself from washing up because it creates a barrier between your bowl and the rice and everything that is wet. So, it's easier to clean it out later (PA. 17:50).*

A09: PA turns off the stove once the rice is ready.

A10: PA uses a wooden spoon to take the rice out of the pot and put it on the tortilla wrap.

> *…I split up the rice between the two of us using the wooden spoon and I put it [rice] on the wrap (PA. 20:01).*

A11: PA opens the chicken can completely and uses a spoon to take out the chicken and put it on the tortilla wrap.

> *The sweet chilli chicken one of my favourites. You want some degree of normality when you are out there. Also, it works quite well in terms of flavour and everything (PA. 02:32).*

> *…I open it [chicken can] up completely and I grab the spoon to take out the chicken and put it on the wrap (PA. 20:04).*

A12: PA takes out rocket (arugula) from a Ziploc bag and puts the rocket on the tortilla wrap.

> *I like to bring some rocket because you can take one of these packs, take the lettuce or the rocket out beforehand, put it in Ziploc bag, take all the air out so it's quite flat and then put it in your bag and it's all fine. Also, it doesn't really require cooking, you could just chuck it in and it's a good source of veggies for when you're out on a tramp. Also, I think rocket goes well with everything else (PA. 01:24).*
>
> *…The thing with the rocket package is that is not resealable and there is quite a big bit of air in it. So, I take it [rocket] out of the package, put it in a Ziploc bag and take all the air out. That way, I can use it [rocket] for more than one meal. I can close it [Ziploc bag] and nothing gets in it. That is a big deal because when you chunk your food with the rest of your gear there is always dirt, mud, etc. which is not great in your food (PA. 4:32).*

5.3.2 Examining use

The next step was to identify the artifacts and cooking items that the participants used or referred to in each action. To this end, I revisited the segments of the videos in which participants explained each action multiples times. Doing so allowed me to define a six-question checklist which I then applied to all the actions of the participants. Table 5.3 shows the actions comprising the checklist.

Table 5.3

Question-based checklist to identify artifacts and cooking items that people use in an action.

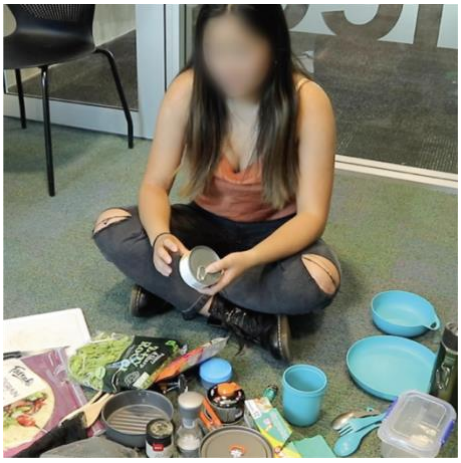
No.	Question
Q1	What artifact/ingredient does participant *X* want to transform/transfer in action *Y*?
Q2	What artifacts/cooking items enable and constrain what participant *X* does in action *Y*?
Q3	With what artifacts/cooking items does participant *X* touch in action *Y*?
Q4	What artifacts/cooking items does participant *X* manoeuvre with in action *Y*?
Q5	What artifacts/cooking items provide participant *X* with information about action *Y*?
Q6	What artifacts/cooking items does participant *X* refer to when explaining action *Y*?

For clarity, here I apply the checklist shown in Table 5.3 to the action I labelled A04. In this action PA adds chicken oil from a can into a pot containing rice and water (Figure 5.6). The first question (Q1) in the checklist is aimed at identifying the artifacts or cooking items whose use gives coherence to an action. A04 is a transfer action because PA's main aim is to relocate a cooking ingredient. Thus, for action A04, Q1 would be: *What artifact or ingredient does PA want to transfer in action A04?* The answer (chicken

oil) accounts for the *raison de être* of action A04. If the can of chicken did not contain oil, action A04 would not be feasible nor necessary.

Figure 5.6

PA explaining action A04 (Add chicken oil to pot) (PA. 04:57).



Actions may involve the use of multiple artifacts or cooking items. Yet, some of these uses can be so familiar and routine that participants may overlook them in their explanations. The second question in the checklist (Q2 in Table 5.3) can help to get around omissions of such kind. For action A04, Q2 would be: *What artifacts/cooking items enable and constrain what PA does in action A04?*

While PA decides how much to tilt the can when pouring the oil, the rate at which the oil comes out of the can varies depending on the physical characteristics of the can. Another aspect of A04, which PA does not fully control, is the oil spill area. PA does not pour the oil into a random place, but within the area delimited by the opening of the pot containing the rice. In other words, the size of the pot's upper opening constrains PA's options on where to pour the oil.

The use of artifacts and cooking items can be *embodied* or *disembodied* (Norris, 2004). Embodied uses are those that involve physical contact with artifacts and cooking items. In contrast, disembodied uses do not require people to come into physical contact with artifacts.

Questions 3 and 4 (Q3 and Q4 in Table 5.3) allow for identifying embodied uses. For action A04, Q3 and Q4 would respectively be: *What artifacts/cooking items does PA touch in action A04?* and *What artifacts/cooking items does PA manoeuvre with in action*

A04? The answer to these two questions is the same. In action A04, PA holds the can (physical contact) and then tilts it (manoeuvring) to pour the oil.

By not involving physical contact, disembodied uses may not be observable and instead be graspable only by examining what people say. Question Q5 and Q6 allow for identifying disembodied uses. For action A04 Q5 and Q6 would respectively be: *What artifacts/cooking items provide PA with information about action A04?* and *What artifacts/cooking items does PA refer to when explaining action A04?*

The excerpt below is part of PA's explanation of action A04. In this excerpt, PA describes the mixture of oil and rice as "kind of gross". This comment suggests that PA is observing the combination of these cooking items. This comment, being a characterisation, also suggests that the oil and rice serve as more than just cooking items in action A04. Otherwise, why would PA voluntarily make the meal gross? This is confirmed later in the excerpt when PA explains that mixing these cooking items is a way to prevent the oil from being discarded "in the woods". Succinctly, in action A04, PA uses the rice to capture and repurpose oil that would become waste.

> *The annoying thing is there's quite a bit of oil left in the can afterwards which is quite annoying. You cannot pre drain it up or anything. So, I tend to just drain it into the rice which is kind of gross, but it stops me from dumping it out in the woods (PA. 04:51).*

After applying the questions in Table 5.3 to all the actions of PA, I found that, in preparing a burrito, PA uses a total of 14 artifacts and nine cooking items. The artifacts that PA uses are a bowl, camping tent, chicken can, gas canister, lighter, pot, pot lid, reusable bottle, rice package, spoon, stove, tortilla bag, wooden spoon, and Ziploc bag. The cooking items that PA uses are chicken meat, fire, gas, lighter liquid, oil, rice, rocket (arugula), tortilla wrap, and water. Table 5.4 summarises the artifacts and cooking items PA uses in each action.

Table 5.4

Artifacts and cooking items PA used or referred to at every action.

Action	Artifacts	Cooking items
A01. Set up heat source	Tent, gas canister, stove	----------
A02. Add rice to pot	Pot, rice package	Rice
A03. Add water to pot	Pot, reusable bottle	Rice, water
A04. Add chicken oil to pot	Can, pot	Chicken meat, oil, rice
A05. Turn on stove	Lighter, stove	Fire, gas, lighter liquid
A06. Put pot on stove	Pot, stove	Fire, oil, rice, water
A07. Cook rice-oil mix	Pot, pot's lid, stove, spoon	Fire, gas, oil, rice, water
A08. Put tortilla wrap in bowl	Bowl, tortilla bag, Ziploc bag	Tortilla wrap
A09. Turn off stove	Stove	Fire, gas
A10. Add rice-oil mix to wrap	Bowl, wooden spoon	Oil, rice, tortilla wrap, water
A11. Add chicken to wrap	Bowl, can, spoon	Chicken meat, oil, rice, tortilla wrap, water
A12. Add rocket to wrap	Bowl, Ziploc bag	Chicken meat, oil, rice, rocket, tortilla wrap, water

5.3.3 Thematic Analysis of interviews

The next step was to conduct a Thematic Analysis (TA) of the interviews to better understand what leads participants to use artifacts and cooking items in particular ways. I conducted one TA for the face-to-face interviews and one for the online interviews. Doing so allowed me to triangulate data and corroborate that the findings did not depend on the format of the interviews. Since I found no significant differences between the two TAs, I report them together here.

The TA process consisted of three steps. First, I coded the transcripts of the interviews. A code is a tag that concisely describes the content/meaning of a portion of a text (Norris, 2004). Next, I examined the similarities and differences between the codes and compiled the snippets whose codes seemed to be related. Finally, I revisited all the snippets in each group and assigned each group with a name and description. Below I provide details on each step in the TA.

Initial coding

I began the TA by coding the transcripts of the interviews following the same analysis process as for Study 2. To illustrate my coding approach, below I provide an account of

the codes I assigned to two snippets, one from the interview with PA and one from the interview with PD.

In the first snippet below, PA explains that, by creating a barrier between the wet food and the bowl, tortillas make dishwashing easier. Since this snippet hints at simplifying subsequent washing, the code I assigned to it was *Less washing*. In the second snippet, PD emphasises that making instant gravy is easy, even more so because instructions for making it can be found on the package. Since PD points to the convenience of having the instructions for making gravy readily available, the code that I assigned to this second snippet was *Handy instructions*.

> *…with the tortilla wrap you can save yourself from washing up because it creates a barrier between your bowl and the rice and everything that is wet. So, it's easier to clean it out later. (PA. 17:30)*

> *…so, you can put some water in there [mug]. Then you add the gravy that you brought… and then just slowly bring it [gravy] to a boil until it's thick. It takes like a minute. It's instant gravy. It's super easy. The instructions are on the bag. (PD. 28:19)*

Grouping codes

The next step was to define initial themes. To this end, I examined the similarities and differences between the codes and compiled the snippets whose codes seemed to me to be related. For illustrative purposes, I have included here two snippets from face-to-face interviews that I considered to be thematically related.

In the first snippet below, which I coded *Eat as soon as possible*, PA explains that parboiled rice cooks quickly, which decreases the waiting time for the food to be ready. The second snippet, which I coded *I cannot be bothered*, shows that PC avoids frying tomatoes and mushrooms because doing so would lengthen the waiting time to eat. In different ways, the two codes I just discussed (*Eat as soon as possible* and *I cannot be bothered*) refer to minimising cooking time. So, I grouped these codes in a preliminary theme I called *Cooking efficiently*.

> *…the thing with Uncle Ben's [parboiled rice brand] is that It's quite easy to cook and it's quite fast. So, if you are out in the world and it's raining, it's miserable, it doesn't take as long as just raw rice. (PA. 02:52)*

> *Once I have fried off my onion, I would pour in the lentils, tomatoes, mushrooms and water. You could fry the tomatoes and mushrooms as well but I don't bother. I am probably hungry at that point and just want to eat. So, I just put everything in and boil it until the lentils are cooked. (PC. 10:31)*

As stated at the beginning of this section, I originally conducted one TA for the face-to-face interviews and one for the online ones. However, I found no significant differences between the two analyses. In other words, the themes I defined were consistent in both analyses. To clarify, consider how the following two snippets (which I extracted from the online interviews), could also fit into the theme *Cooking efficiently.* In the first snippet, PD explains that one way to speed up the preparation process is to fry the bacon at home before the trip. In the second snippet, PF highlights how dehydrated meals are a quick and easy dinner during hiking trips.

> *Something else you can add are little strips of bacon. I usually bake them at home as well, just because it's easier and faster, and they don't go off and it's also lighter when you cook them in advance and cut them up into little pieces (PD. 09:27).*

> *So, we go for the dehydrated meals because they are fast and convenient. They are pretty wholesome and healthy generally. So, good energy source. Just very quick and easy. Throw some boiling water and within 10 minutes and you are good to go (PF. 03:02).*

Defining themes

Together with my PhD supervisors I reviewed examples of the snippets comprising each group, to verify the validity of the groupings. After jointly validating the composition of the themes (or snippet groups), I created names and definitions for each.

The themes I defined from face-to-face and online interviews are *Cooking efficiently, Cooking safely, Experiencing food, Facilitating cleaning, Minimising waste, Nourishing the body, Managing supplies, and Travelling light*. Below I provide details on what each theme consists of.

Theme 1. Cooking efficiently

Cooking efficiently includes snippets on how the use of artifacts and cooking items helps to make cooking an easy and less time-consuming activity. In the first snippet below, PC explains how putting several cooking items in the pot at the same time, is a way to speed

up food preparation. In the second snippet, PA comments on how parboiled rice cooks faster than raw rice.

> *Once I have fried off my onion, I would pour in the lentils, tomatoes, mushrooms and water. You could fry the tomatoes and mushrooms as well but, I don't bother. I am probably hungry at that point and just want to eat. So, I just put everything in and boil it until the lentils are cooked (PC. 10:31).*

> *…But, the thing with Uncle Ben's rice is that it's quite easy to cook and it's quite fast. So, if you're out in the world and it's raining, it's miserable, it doesn't take as long as raw rice (PA. 02:52).*

Theme 2. Cooking safely

Cooking safely encompasses comments on how to prevent cooking-related accidents. In the first snippet below, PA talks about the importance of putting the gas canister on a flat surface. According to PA, gas canisters can be dangerous because if they topple, they can roll and set people's tents on fire. In the second snippet, PC emphasises the importance of ensuring the gas canister is stable and of clearing the area surrounding the gas canister.

> *So, usually in an all campsites there are designated areas and you can see the spots where people have been cooking on. You want to find the flattest bit of land basically. That way, if the can of gas topples over it won't roll into your tent… I'm trying to be as safe as possible (PA. 13:19).*

> *Try to make sure it [gas canister] is as stable as possible. Also, clear the area around so that nothing gets on fire (PC. 08:06).*

Theme 3. Experiencing food

Experiencing food consists of comments on which meals are appropriate for specific times on the day and also how to ensure meals acquire certain characteristics. In the first snippet below, PA comments on why cereal and muesli are appropriate for breakfast. In PA's view, breakfast should be a quick snack, not a cooked meal. In the second snippet, PC highlights how adding spices improves the taste of food.

> *If it's breakfast or lunch, you just want a quick bite before you like leave for the next bit of your track. So, I would usually have cereal or muesli, something really quick. Dinner is the only time where you will need the canned gas and the cooker (PA. 07:58).*

> *…I always carry a variety of pre-mixed spices so you can make your food taste good (PC 12:46).*

Theme 4. Facilitating cleaning

Facilitating cleaning comprises comments on how the use of artifacts and cooking items helps to minimise the need for washing up after cooking. In the first snippet below, PA explains that the tortilla wraps prevent food from coming into direct contact with the bowl and that, in turn, prevents the bowl from getting dirty. In the second snippet, PC comments that spatulas help prevent food from sticking to the pot, making it easier to wash the pot later on.

> *…you just get the wrap out and put it in your bowl and then just wait. So, instead of me just doing rice and veggies, with the wrap you can save yourself from washing up because it creates a barrier between your bowl and the rice and everything that is wet. So, it's easier to clean it out later (PA. 17:30).*

> *If you have a silicon spatula you can keep everything from sticking to the bottom of the pan which makes cleaning much easier (PC. 13:33).*

Theme 5. Minimising waste

Minimising waste encompasses comments on how to diminish residues and leftovers derived from cooking. In the first snippet below, PA explains that food packages containing adequate servings help reduce food scraps. In the second snippet, PC explains that incorporating leftovers from breakfast to dinner is one way of minimising food residues.

> *…Uncle Ben's rice is nicely portioned so you don't end up with a whole bunch waste or leftovers afterwards that you have to carry around (PA. 02:52).*

> *So, if I end up with leftovers or I had left wraps than I thought, then I would add whatever I have leftover into the pot so that it's getting eaten. Or, maybe I decide that tomorrow this carrot is not going to be good anymore, I would chop whatever is left and add it to the pot (PC. 14:49).*

Theme 6. Nourishing the body

Nourishing the body consists of comments on how artifacts and cooking items bring about health benefits. In the first snippet below, PB explains that lentils have nutritional value because they provide the body with carbohydrates and protein. In the second

snippet, PA highlights that sweet chilli chicken is a suitable food because it provides the body with protein.

> *The dish I am going to make is a very simple lentil curry. I mainly go for it because it's simple and nutritious. Lentils are full of carbohydrates and have heaps of protein (PB. 04:38).*

> *The sweet chili chicken is one of my favourites… It works quite well in terms of flavour and also provides protein (PA. 02:20).*

Theme 7. Managing supplies

Managing supplies consists of comments on the rationing of cooking items. In the first snippet below, PC comments on how bottle measures serve as a reference to determine how much water to add. In the second snippet, PA explains that not turning on the stove until all the cooking items are ready in the pot is a way to save gas.

> *So, for every half cup of lentils I would use a cup and a half of water…my bottle does have measurements on it. I use those as a bit of a gage (PC. 11:19).*

> *I usually set up the cooker and then prepare all my stuff. Then I light the cooker and put the pot on top. So, I'll put the rice and the water in the pot first and then light the cooker. That way, we are not wasting gas (PA. 14:41).*

Theme 8. Travelling light

Travelling light consists of comments on the transportability of artifacts and cooking items. In the first snippet below, PD explains that kale and mashed potatoes are lightweight and that this makes these cooking items suitable alternatives for multi-day walks. In the second snippet, PC talks about the weight-related advantages that silicone spatulas offer.

> *The dish I will demonstrate is called Boerenkool which is mashed potatoes with kale. It's super easy to make and all of the supplies you can buy them dried and they are super lightweight. When I select a meal for a hike, the thing that's always at the front of my mind is the weight and how many nutrients it provides (PD. 00:26).*

> *I could use my spoon, but most of the time I carry a spatula… It's [spatula] super lightweight. You can get half-size. I have seen those and I would like to get one. But I have no real need, because I have this (PC. 39:22).*

Table 5.5 summarises the TA I conducted in Study 3. The first column contains labels that I have assigned to the themes to easily distinguish them. Labels consist of the capital letter *T* followed by consecutive numbers. Thus, the label of the first theme in the table is T1, that of the second theme T2, and so on. The second column shows the name I assigned to each theme. The third column shows succinct definitions of every theme.

Table 5.5

Themes from both face-to-face and online interviews

Label	Name of theme	Types of comments comprising theme
T1	Cooking efficiently	How to make cooking an easy and less time-consuming.
T2	Cooking safely	How to prevent cooking related accidents.
T3	Experiencing food	How to ensure meals acquire certain characteristics.
T4	Facilitating cleaning	How to minimise the need for washing up after cooking.
T5	Minimise waste	How to diminish residues and leftovers when cooking.
T6	Nourishing the body	How artifacts and cooking items bring about health benefits
T7	Managing supplies	The rationing of cooking items.
T8	Travelling light	The transportability of artifacts and cooking items.

5.3.4 Visual representation

The final step was to adapt methods from Social Network Analysis (SNA) to create a visual representation of participants' cooking explanations. The objective of this step was twofold. Firstly, I wanted to visually integrate the results of the prior steps in my analytical process. This involved:

- Indicating the artifacts and cooking items that the participants used or referred to in each action.
- Indicating the actions in whose explanations participants referred to each of the themes I identified.

Secondly, I wanted to create a visual aid to critically reflect on the impact that artifacts, cooking items, and themes have on the preparation of the meals that participants explained.

I created a visual model for face-to-face interviews and another for online interviews. In what follows, I refer to these visual models as M1 (face-to-face interviews) and M2

(online interviews). The intention in creating two visual models was to triangulate data and corroborate that the findings did not depend on the format of the interviews.

I created M1 and M2 using the same visualisation approach. For practicality, I illustrate said approach with only M1. The visualisation approach I followed builds upon two types of components *nodes* and *links*. In SNA, nodes are geometric figures (usually circles) that can represent people, companies, websites, or other entities capable of producing, disseminating, and receiving information (Prell, 2012). Links on the other hand are lines between nodes that represent interactions or information exchange. Drawing nodes and links results in matrices of relations or interactions known as *networks* (Caldarelli & Catanzaro, 2012).

Specifying nodes

Networks can be heterogeneous, that is, nodes in a network can represent different kinds of elements. In M1, I used nodes to represent six types of elements:

1. The actions of PA
2. The actions of PB
3. The actions of PC
4. The artifacts used by PA, PB and PC
5. The cooking items used by PA, PB and PC
6. The themes I identified in the explanations of PA, PB and PC

The following sections provide details of how I specified each type of nodes.

Specifying action nodes

Specifying nodes in SNA involves assigning them an identifier that allows to distinguish them and examine their position in a network. The identifiers for the nodes that represent actions in M1 were the labels that I assigned to participants' actions earlier in the analytical process (see the Section 5.3.1). Thus, action identifiers consisted of a capital letter indicating the participant performing the action and a number indicating the sequence of the actions.

The convention in SNA is to supplement identifiers with descriptions or details of the element that a node represents. The descriptions of action nodes in M1 consisted of short sentences (less than eight words) that explained what participants do in each

action. Tables 5.6, 5.7 and 5.8 show, respectively, the identifiers, and descriptions for the nodes that represent the actions of PA, PB and PC in M1.

Table 5.6

Identifiers and descriptions for the nodes that represent PA's actions in M1.

Identifier	Description
A01	Set up heat source
A02	Add rice to pot
A03	Add water to pot
A04	Add chicken oil to pot
A05	Turn on stove
A06	Put pot on burning stove
A07	Cook rice-oil mix
A08	Put tortilla wrap in bowl
A09	Turn off stove
A10	Add rice-oil mix to wrap
A11	Add chicken to wrap
A12	Add rocket to wrap

Table 5.7

Identifiers and descriptions for the nodes that represent PB's actions in M1

Identifier	Description
B01	Set up heat source
B02	Chop capsicum and carrot
B03	Turn on stove.
B04	Put pot on burning stove
B05	Add oil to pot
B06	Add chopped vegetables to pot
B07	Sauté vegetables
B08	Add curry powder to pot
B09	Add water to pot
B10	Cook vegetables
B11	Transfer vegetables to bowl
B12	Add water to pot
B13	Add lentils to pot
B14	Boil lentils
B15	Bring vegetables back to pot
B16	Add curry powder to pot
B17	Add couscous to pot
B18	Cook couscous
B19	Turn off stove

Table 5.8

Identifiers and descriptions for the nodes that represent PC's actions in M1

Identifier	Description
C01	Set up heat source
C02	Turn on stove
C03	Put pot on burning stove
C04	Chop onion
C05	Add onion to pot
C06	Dry fry onion
C07	Add lentils to pot
C08	Add water to pot
C09	Add spices to pot
C10	Boil lentils
C11	Chop leftover vegetables
C12	Add leftover vegetables to pot
C13	Turn off stove

Specifying artifact nodes and cooking item nodes

Modelling the nodes that represent artifacts and cooking items involved an extra step. Before assigning identifiers and descriptions, I retrieved the lists of artifacts and items that PA, PB and PC used or referred to in their explanations (see Section 5.3.3). Tables 5.9 and 5.10 show, in alphabetical order, the artifacts and items that each of these participants used.

Table 5.9

In alphabetical order, the artifacts that PA, PB and PC used or referred to in their explanations.

Participant A	Participant B	Participant C
Bowl	Bowl	Bowl
Camping tent	Chopping board	Gas canister
Chicken can	Couscous package	Knife
Gas canister	Curry sachet	Lighter
Lighter	Gas canister	Pot
Pot	Knife	Reusable bottle
Reusable bottle	Lentils package	Reusable container
Rice package	Lighter	Silicon spatula
Spoon	Pot	Stove
Stove	Reusable bottle	Wind breaker
Tortilla wrap	Reusable container	Ziploc bag
Wooden spoon	Stove	-----
Ziploc bag	Wooden spoon	-----
-----	Ziploc bag	-----

Table 5.10

In alphabetical order, the items that PA, PB and PC used or referred to in their explanations.

Participant A	Participant B	Participant C
Chicken meat	Capsicum	Capsicum
Fire	Carrot	Carrot
Gas	Couscous	Fire
Lighter liquid	Curry	Gas
Oil	Fire	Lentils
Rice	Gas	Lighter liquid
Rocket (or arugula)	Lentils	Mushroom
Tortilla wrap	Lighter liquid	Onion
Water	Water	Rocks (or stones)
-----	Oil	Spices
-----	-----	Tomato
-----	-----	Water

I then compared the artifacts shown in Table 5.9 and grouped them by category. I did the same with the cooking items shown in Table 5.10. The reasoning for this grouping was twofold. Firstly, I wanted to avoid duplicate nodes in order to facilitate the later analysis of M1 and M2. Secondly, and more importantly, thinking about categories rather than specific instances of artifacts and cooking items allows for a more encompassing reflection.

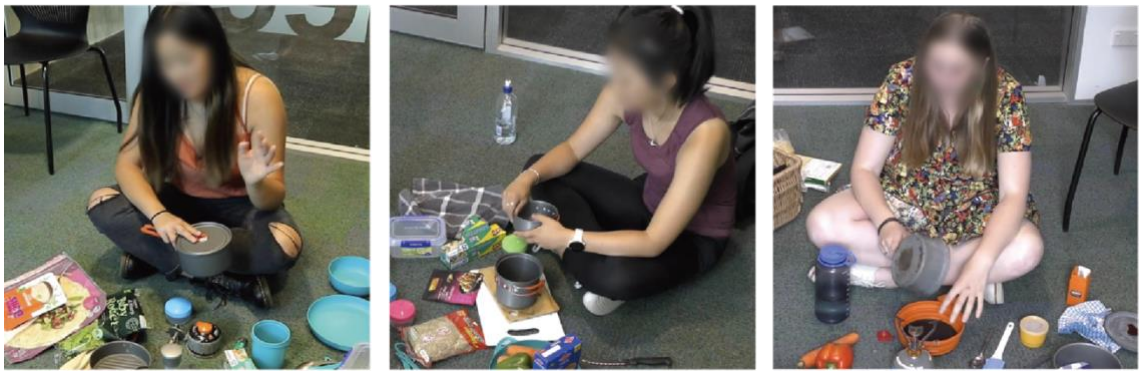
For example, consider the difference between reflecting on how *portable stove P* (instance) impacts on the way PA cooks, as compared with reflecting on how *portable stoves* (category) impacts on the cooking practices of PA, PB, and PC. The first reflection, although not without value, focuses on the behaviour of one individual. However, EAs are carried out by a wide range of people (Escobar, 2018). Thus, examining these practices requires considering the behaviour, needs, and preferences of different individuals.

In categorising artifacts and cooking items, I considered their similarities in shape, size and use. Take the pot as an example. As Figure 5.7 shows, all three participants from face-to-face interviews interacted with pots during their explanations. These pots are similar in shape and size. In addition, all three participants used pots for similar purposes, namely, boiling water, mixing cooking items and heating foodstuff. Therefore, I considered the pots that PA, PB and PC used as instances of the *artifact category pot*. Similarly, all three participants reported to cook using water they bring with them to multi-day walks. Since the properties of the water used by PA, PB and PC do not vary significantly, I considered the water they used as instances of the *item category water.*

Figure 5.7

PA, PB and PC using pots in their cooking explanations.

(PA. 08:21) (PB. 12:47) (PC. 19:42)



From analyses such as the above, I defined a list of artifact and item categories to incorporate in M1. The identifiers for the nodes representing artifact categories consisted of a lower-case letter *a* and consecutive numbers (a01, a02, a03, and so on). The identifiers for nodes representing item categories consist of a lower-case letter *i* and consecutive numbers (i01, i02, i03, and so on). Table 5.11 shows, the identifiers and descriptions for the categories of artifacts and items in M1.

Table 5.11

Identifiers and descriptions for the nodes that represent artifact and item categories in M1.

Artifact categories		Item categories	
Identifier	Description	Identifier	Description
a01	Bowl	i01	Capsicum
a02	Camping tent	i02	Carrot
a03	Food can	i03	Chicken meat
a04	Chopping board	i04	Couscous
a05	Disposable package	i05	Curry powder
a06	Disposable bag	i06	Fire
a07	Gas canister	i07	Gas
a08	Knife	i08	Lentils
a09	Lighter	i09	Lighter liquid
a10	Pot	i10	Mushroom
a11	Reusable bottle	i11	Oil
a12	Reusable container	i12	Onion
a13	Spatula	i13	Rice
a14	Spoon	i14	Rocket (or arugula)
a15	Stove	i15	Spices
a16	Wind breaker	i16	Tomato
a17	Ziploc bag	i17	Tortilla wrap
----	----	i18	Water

Specifying theme nodes

The identifiers for the nodes that represent themes consisted of a capital letter *T* and consecutive numbers (T01, T02, T03, and so on). The descriptions of the nodes that represent themes in M1 consist of the names of the themes. Table 5.12 shows the identifiers and descriptions for the themes in M1.

Table 5.12

Identifiers, element types and descriptions for themes in M1.

Element type: Theme	
Identifier	Description
T01	Cooking efficiently
T02	Cooking safely
T03	Experiencing food
T04	Facilitate cleaning
T05	Minimise waste
T06	Nourishing the body
T07	Managing supplies
T08	Travelling light

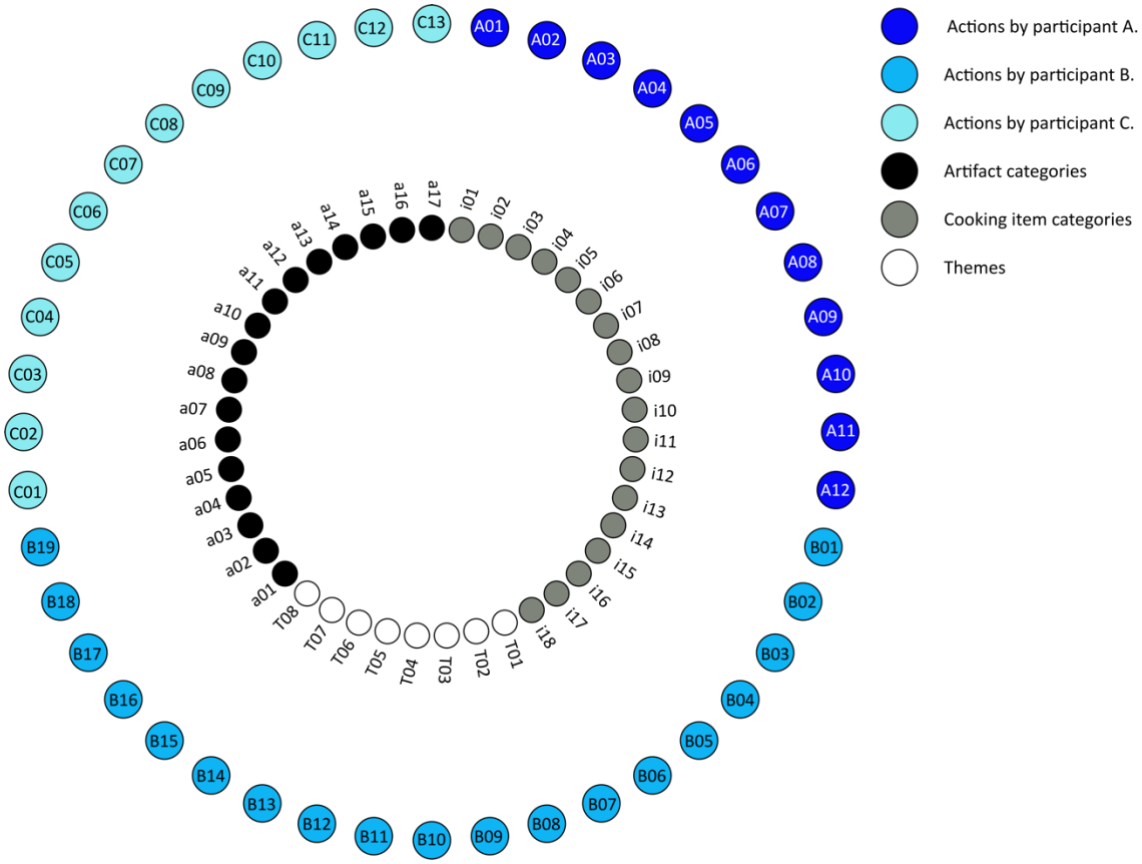
Visualising nodes

I captured the identifiers and descriptions of all the nodes that make up M1 in a table that I then imported into the social network analysis software (Gephi 0.9.2). This type of software usually offers different layouts to visualise nodes. The layout I used is called *dual circle layout* (Cherven, 2015). This layout consists of two concentric circles along which the nodes appear. I chose this layout for two reasons. First, this layout provides a neat view of all the nodes in the model, making it easy to locate those representing particular elements. Second, the diameter of the concentric circles along which the nodes appear can be scaled, which allows the model to be adjusted according to the number of participants in a study.

As Figure 5.8 shows, the outer circle in M1 comprises aqua nodes that represent the actions of PA, PB and PC. The inner circle in M1 is made up of black, grey and white nodes. These nodes respectively represent artifact categories, item categories and themes. For ease of reading, I have included the node identifiers in Figure 5.8.

Figure 5.8

Nodes in M1 representing actions, categories of artifacts, categories of cooking items and themes.



Note. Details of the elements that each node represents are available in Tables 5.11 and 5.12.

Specifying links

Networks can also be heterogeneous in terms of links, that is, links in a network can represent different kinds of connections or interactions. In M1, I used links to signal:

1. The sequence in which PA, PB, and PC performed actions
2. The categories of artifacts and items PA, PB, and PC used in each action
3. The actions in which PA, PB, and PC made references to each theme

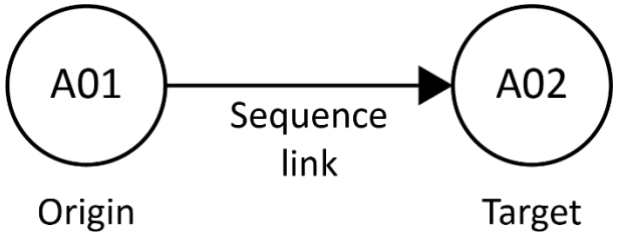
Modelling links in SNA involves specifying their *origin* and a *target*. The origin of a link is the node from which it departs and the target the node where it ends or leads to. Below I provide details of how I specified the origin and target of each kind of links in M1.

Links indicating the sequence of actions

I called the links that indicate the sequence in which the participants carried out actions *S-links*. The origin and target of S-links are given by identifiers of the action nodes they connect. For example, the first two actions PA performed consist of setting up the heat source and adding rice to a pot. As Figure 5.9 shows, these two actions are respectively represented by nodes whose identifiers are A01 and A02. So, I drew an S-link from node A01 (origin) to node A02 (target).

Figure 5.9

Sequence link between the first two actions participant A performs.



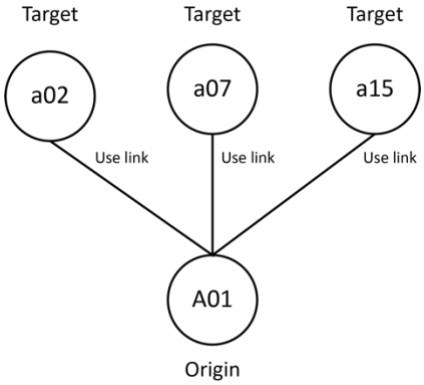
Links indicating the use of artifacts and cooking items

I called the links that indicate the categories of artifacts and items participants used in each action *U-links*. The origin and target of U-links are, respectively, the identifiers of the nodes that represent actions, and the identifiers of the nodes that represent categories of artifacts and items.

For example, in action A01 (Set up heat source), PA assembles the portable stove and gas canister and then places them on a flat surface, which prevents the lit stove from rolling onto the tents if it topples. In other words, PA uses the stove and gas canister to assemble a heat source for cooking, and the tent as a spatial reference to decide where to place the heat source. The identifiers of the nodes representing the tent, portable stove and gas canister respectively are a1, a7 and a15. So, as Figure 5.10 shows, I drew U-links from node A01 (origin) to nodes a2, a7 and a15 (targets).

Figure 5.10

Links showing the artifacts participant A uses in action A01 (Set up heat source).



Links indicating allusion to themes

I called the links that indicate the themes participants referred to in each action *T-links*. The origin and target of T-links are respectively the identifiers of the nodes that represent actions and the identifiers of the nodes that represent themes. The three snippets below are part of the explanation that PA gave of action A01 (Set up heat source). In the first snippet, PA alludes to the *Travelling light* theme when highlighting that gas cannisters are light and small. In the second snippet, PA explains that dinner is the only meal of the day that requires cooking with fire, which is an allusion to the *Experiencing food* theme. In the third snippet, PA talks about how to prevent the burning stove from falling and rolling into the tents, which is an allusion to the *Cooking safely theme.*

> *So, we would need the typical tramping canned gas. I have used this one probably every time I have gone out. It packs light and it's small enough to just take it with you, which I quite like (PA. 08:11).*

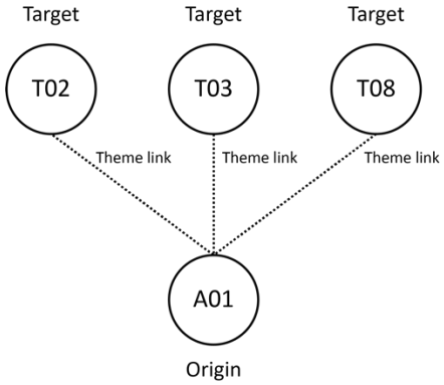
> *"If it's breakfast or lunch, you just want a quick bite before you like leave for the next bit of your track. So, I would usually have cereal or muesli, something really quick. Dinner is the only time where you will need the canned gas and the cooker (PA. 08:23).*

> *…usually in an all campsites there are designated areas and you can see the spots where people have been cooking on. You want to find the flattest bit of land basically. That way, if the can of gas topples over it won't roll into your tent or into you. You want to keep it as safe as possible (PA. 13:31).*

The identifiers of the nodes representing the *Cooking safely*, *Experiencing food* and *Travelling light* themes respectively are T2, T3 and T8. So, as Figure 5.11 shows, I drew T-links from node A01 (origin) to nodes T2, T3 and T8 (targets).

Figure 5.11

Links showing the themes PA referred to when explaining action A01.



Visualising links

I captured the origin and target of all the links that make up M1 in a table that I then imported into the same Gephi file that contained the data for the M1 nodes. The figures below show one by one the different types of links in M1. Figure 5.12 shows the S-links in M1. These links consist of arrows that indicate the sequence of actions of PA, PB and PC. Figure 5.13 shows the U-links in M1. These links appear as solid lines that indicate the categories of artifacts and items participants use in each action. Figure 5.14 shows the T-links on M1. T-links consist of dotted lines that indicate the actions in whose explanations I identified the snippets on each theme.

Figure 5.12

S-links showing the sequence of actions of participants A, B and C.

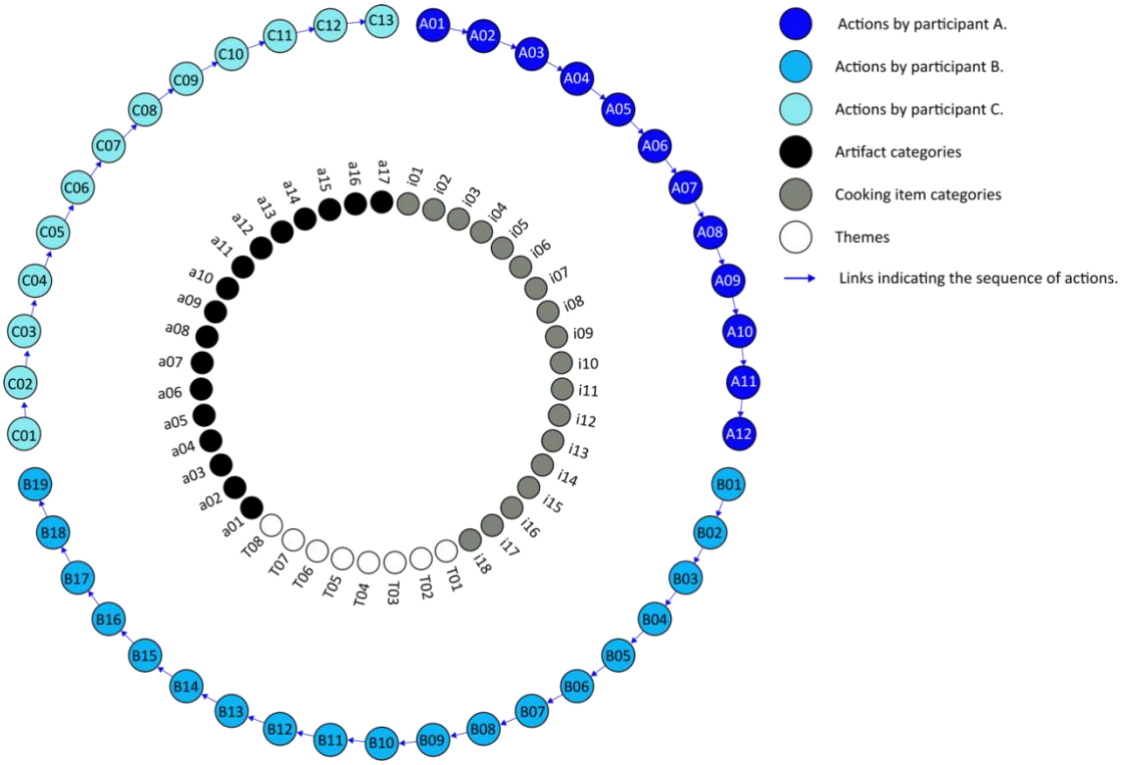


Figure 5.13

U-links showing the categories of artifacts and cooking items participants use in each action.

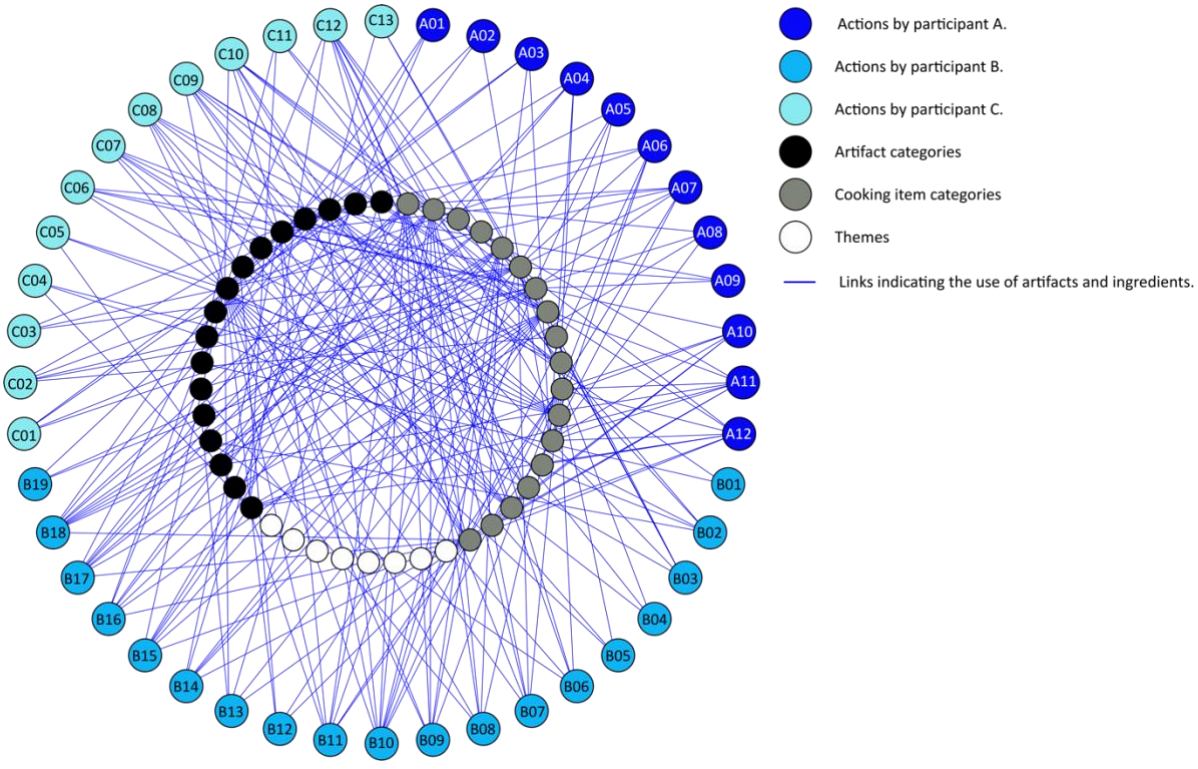
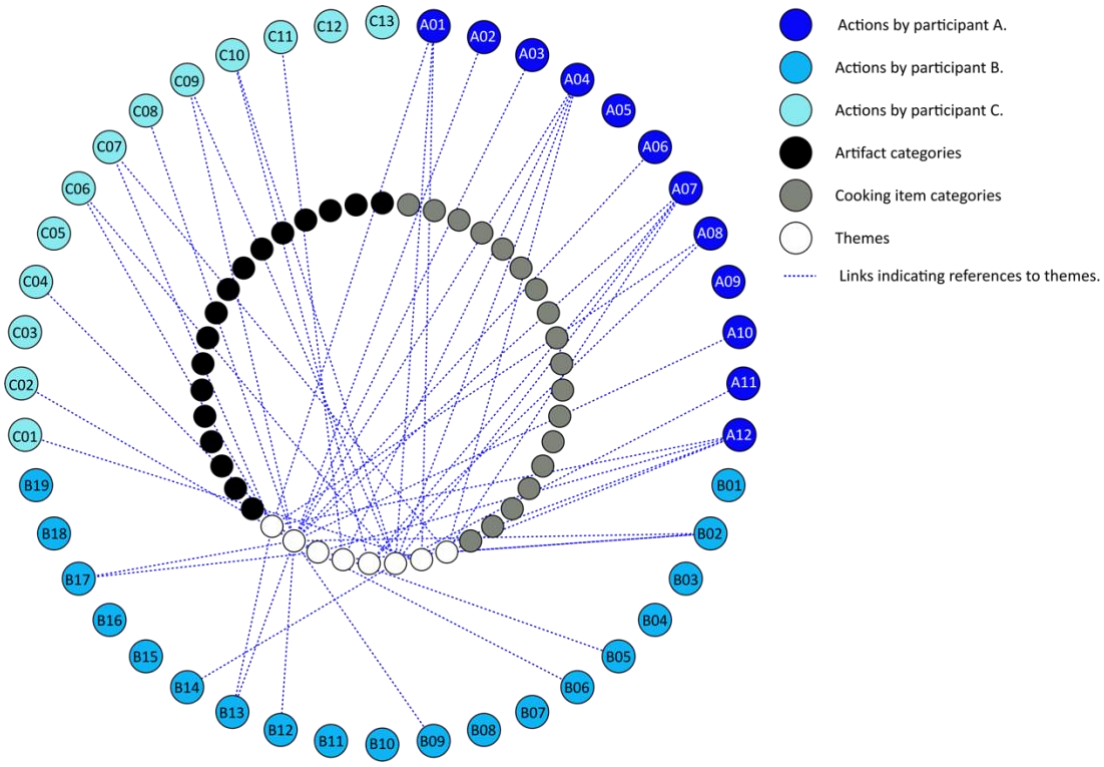


Figure 5.14

T-links showing the actions in whose explanations I identified snippets on each theme.



Examining the visual representations

As noted in Chapter 3 (Section 3.4.2), within SNA, there are several statistical methods to systematically examine the composition and structure of a network. The method I used to examine M1 and M2 is known as the *degree centrality indicator*. This indicator ranks nodes considering their number of adjacent links. The higher the number of adjacent links a node has, the more central the node is (Maharani et al., 2014; Sharma & Surolia, 2013; J. Zhang & Luo, 2017).

The choice of the degree centrality indicator was due to the versatility it offers in its application, namely, this indicator can be calculated using specialised software (as I did in this study) or by manually counting links. This flexibility was considered advantageous as it can help designers and design students to incorporate the degree centrality indicator into their analysis and synthesis work.

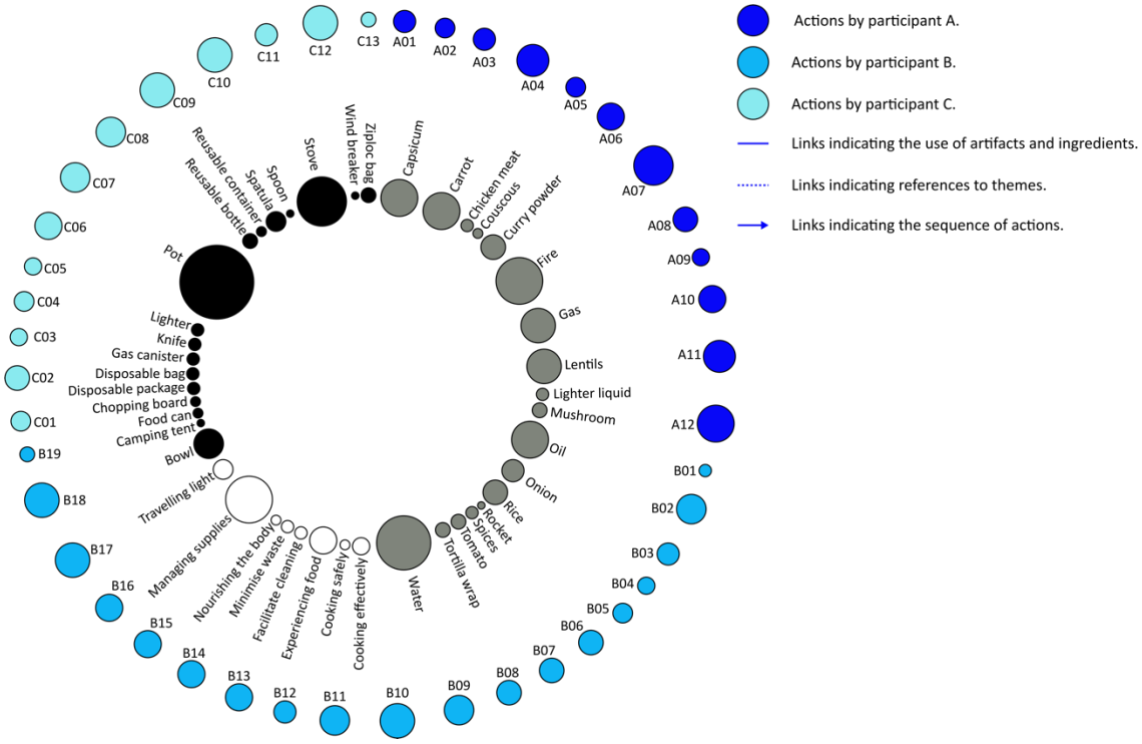
I used the statistical tools available in Gephi 0.9.2. to compute the degree centrality of nodes representing artifact categories, item categories and themes. The goal was to systematically assess the number of actions in which the participants used instances of

each artifact and item category, and also the number of actions in which the participants referred to each theme.

Figures 5.15 and 5.16 show M1 and M2 after calculating the degree centrality of the nodes representing artifact categories, item categories and themes. In these figures, the size of the nodes is indicative of the degree centrality of the nodes. The higher the degree centrality of a node, the larger the node. The tables that appear after Figures 5.15 and 5.16 specify the number of actions in which participants used instances from each artifact and item category, and also the number of actions in which participants referred to each theme.

Figure 5.15

Calculation of degree centrality in the network representing face-to-face interviews.



Boerenkool	Dehydrated meal	Ramen with vegetables
D01. Set up heat source	E01. Set up heat source	F01. Set up heat source
D02. Tear kale leaves	E02. Turn on stove	F02. Turn on stove
D03. Add teared kale to pot	E03. Add water to pot	F03. Add water to pot
D04. Turn on stove	E04. Put pot on burning stove	F04. Put pot on burning stove
D05. Put pot on burning stove	E05. Boil water	F05. Boil water
D06. Add water to pot	E06. Turn off stove	F06. Turn off stove
D07. Boil kale	E07. Open meal package	F07. Open cup of noodles
D08. Transfer kale to mug	E08. Loosen package contents	F08. Add vegetables to cup
D09. Dump water in pot	E09. Pour boiling water	F09. Add boiling water to cup
D10. Put pot on burning stove	E10. Stir meal	F10. Steam noodles
D11. Add water to pot	E11. Cook meal	F11. Chop boiled egg
D12. Boil water	E12. Turn package into bowl	

D13. Add potato-milk mix
D14. Cook potato-milk mix
D15. Add spices to pot
D16. Add boiled kale to pot
D17. Remove pot from lit stove
D18. Put mug on burning stove
D19. Add water to mug
D20. Add instant gravy to mug
D21. Heat instant gravy
D22. Turn off stove
D23. Serve contents of pot
D24. Pour gravy on meal
D25. Sprinkle fried bacon

F12. Add chopped egg to cup

Table 5.13

No. of actions where participants PA, PB and PC used instances from each artifact category.

Artifact category	PA	PB	PC	Total of actions
Bowl	4	2	4	10
Camping tent	1	0	0	1
Chopping board	0	2	0	2
Disposable food bag	1	2	0	3
Disposable food package	1	2	0	3
Food can	2	0	0	2
Gas canister	1	1	1	3
Knife	0	1	2	3
Lighter	1	1	1	3
Pot	6	16	8	30
Reusable bottle	1	2	1	4
Reusable container	0	1	1	2
Spatula	2	3	1	6
Spoon	1	0	0	1
Stove	4	8	6	18
Wind breaker	0	0	1	1
Ziploc bag	2	1	1	4

Table 5.14

No. of actions where participants PA, PB and PC used instances from each item category.

Item category	PA	PB	PC	Total of actions
Capsicum	0	11	2	13
Carrot	0	11	2	13
Chicken meat	3	0	0	3
Couscous	0	2	0	2
Curry powder	0	8	0	8
Fire	4	7	6	17
Gas	3	5	4	12
Lentils	0	7	5	12
Lighter's liquid	1	1	1	3
Mushroom	0	0	4	4
Oil	6	7	0	13
Onion	0	0	7	7
Rice	8	0	0	8
Rocket	1	0	0	1
Spices	0	0	3	3
Tomato	0	0	4	4
Tortilla wrap	4	0	0	4
Water	6	10	4	20

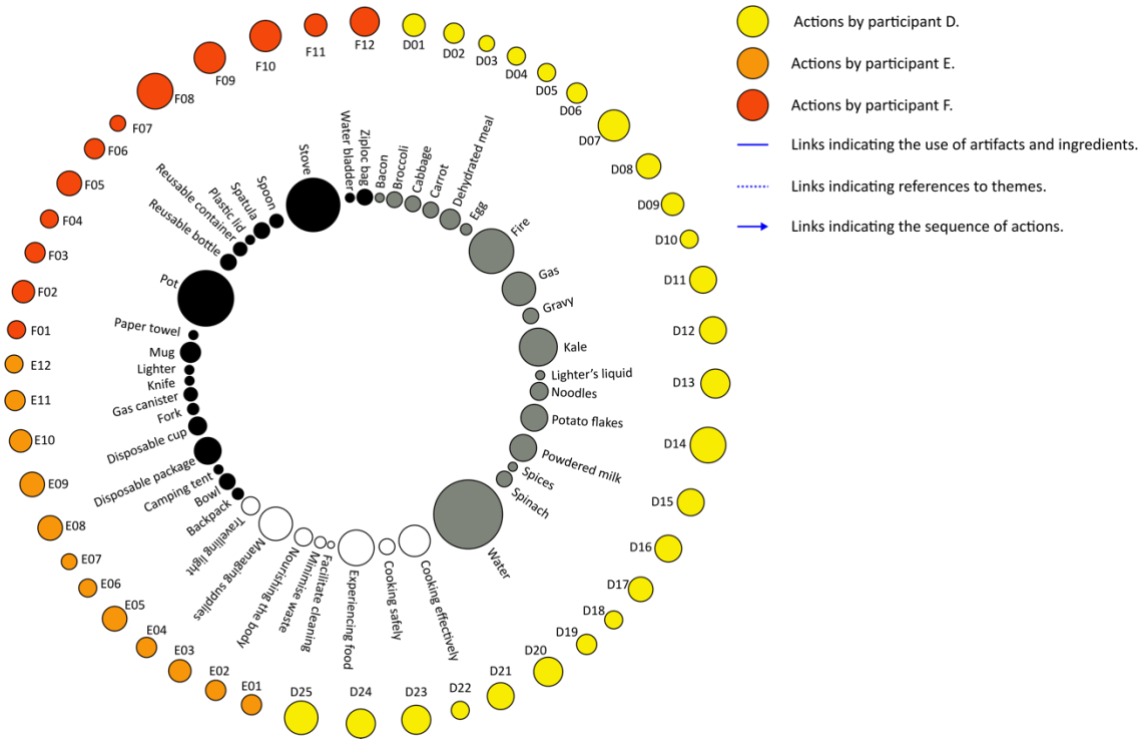
Table 5.15

No. of actions where participants PA, PB and PC made references to each theme.

Theme	PA	PB	PC	Total of actions
Cooking Effectively	3	1	1	5
Cooking Safely	1	0	1	2
Experiencing Food	5	1	3	9
Facilitating Cleaning	2	0	1	3
Minimising Waste	1	1	1	3
Nourishing the Body	1	1	0	2
Managing Supplies	6	7	4	17
Travelling Light	3	1	2	6

Figure 5.16

Calculation of degree centrality in the network representing online interviews.



<u>Boerenkool</u>

D01. Set up heat source
D02. Tear kale leaves
D03. Add teared kale to pot
D04. Turn on stove
D05. Put pot on burning stove
D06. Add water to pot
D07. Boil kale
D08. Transfer kale to mug
D09. Dump water in pot
D10. Put pot on burning stove
D11. Add water to pot
D12. Boil water
D13. Add potato-milk mix
D14. Cook potato-milk mix
D15. Add spices to pot
D16. Add boiled kale to pot
D17. Remove pot from lit stove
D18. Put mug on burning stove
D19. Add water to mug
D20. Add instant gravy to mug
D21. Heat instant gravy
D22. Turn off stove
D23. Serve contents of pot
D24. Pour gravy on meal
D25. Sprinkle fried bacon

<u>Dehydrated meal</u>

E01. Set up heat source
E02. Turn on stove
E03. Add water to pot
E04. Put pot on burning stove
E05. Boil water
E06. Turn off stove
E07. Open meal package
E08. Loosen package contents
E09. Pour boiling water
E10. Stir meal
E11. Cook meal
E12. Turn package into bowl

<u>Ramen with vegetables</u>

F01. Set up heat source
F02. Turn on stove
F03. Add water to pot
F04. Put pot on burning stove
F05. Boil water
F06. Turn off stove
F07. Open cup of noodles
F08. Add vegetables to cup
F09. Add boiling water to cup
F10. Steam noodles
F11. Chop boiled egg
F12. Add chopped egg to cup

Table 5.16

No. of actions where participants PD, PE and PF used instances from each artifact category.

Artifact category	PD	PE	PF	Total of actions
Backpack	1	1	0	2
Camping tent	1	0	0	1
Disposable food cup	0	0	6	6
Disposable food package	2	7	0	9
Fork	0	2	0	2
Gas canister	1	1	1	3
Knife	0	0	1	1
Lighter	0	0	1	1
Mug	6	0	0	6
Paper towel	0	0	1	1
Pot	15	4	4	23
Reusable bottle	3	1	0	4
Reusable container	3	0	2	5
Spatula	4	0	0	4
Spoon	1	2	0	3
Stove	11	5	5	21
Water bladder	0	0	1	1
Ziploc bag	3	0	1	4

Table 5.17

No. of actions where participants PD, PE and PF used instances from each item category.

Item category	PD	PE	PF	Total of actions
Bacon	1	0	0	1
Broccoli	0	0	5	5
Cabbage	0	0	5	5
Carrot	0	0	5	5
Dehydrated meal	0	6	0	6
Egg	0	0	3	3
Fire	9	4	4	17
Gas	6	3	3	12
Gravy	4	0	0	4
Kale	10	0	5	15
Lighter's liquid	0	0	1	1
Noodles	0	0	6	6
Potato flakes	9	0	0	9
Powdered milk	9	0	0	9
Spices	1	0	0	1
Spinach	0	0	5	5
Water	17	6	6	29

Table 5.18

No. of actions where participants PD, PE and PF made references to each theme.

Theme	Participant A	Participant B	Participant C	Total of actions
Cooking Effectively	7	3	1	11
Cooking Safely	1	2	1	4
Experiencing Food	9	2	3	14
Facilitating Cleaning	0	0	0	0
Minimising Waste	0	2	0	2
Nourishing the Body	4	0	1	5
Managing Supplies	6	3	3	12
Travelling Light	3	1	1	5

5.4 Reflections on Study 3

In Study 3, six hikers explained how to prepare a meal that they consider suitable for hiking trips. These explanations were illustrative, meaning that the participants provided a simulated walkthrough of the meal preparation process without actually cooking. As a result, certain transformations (e.g., boiling) and transfers (e.g., pouring) were either partially executed or merely described verbally by the participants.

Given the type of data collected in Study 3 (illustrative explanations), I did not find it feasible to deconstruct participants' explanations following the approach from Study 2, which involves delimiting the beginning and end of actions based on specific transformations and transfers. Instead, I adopted the activity deconstruction approach from Study 1. In this approach, a distinction is made between two types of actions: transformation actions, which are centred on physically modifying artifacts/items, and transfer actions, where the main objective is relocating artifacts/items.

A key takeaway from the deconstruction of EAs in Study 3 is that the concepts of transformation and transfer which were devised in this investigation specifically to support the deconstruction of EAs into actions are suitable for examining videos that depict EAs at diverse levels of detail.

Data analysis in Study 3 also included the use of methods adapted from SNA to create visual representations of the participants' cooking explanations. Within these representations, participants' actions, artifacts, cooking items and themes are depicted as interconnected nodes. A key takeaway from devising this visual representation approach is that SNA methods can be effectively repurposed to create images that integrate insights from analyses on both what people do and say during EAs. The next chapter will delve into how these visual insights can be used to define design tasks.

Summary

This chapter detailed the third study I conducted to develop a framework for examining everyday activities (EAs) at a granular level. Study 3 consisted of interviews with six NZ hikers. During these interviews the participants provided simulated walkthroughs on how to prepare a meal they consider suitable for hiking trips.

The analysis of the interviews was based on a combination of methods. Specifically, I employed the multimodal transcript which I had previously adapted in Studies 1 and 2 and two methods I adapted from SNA: network visualisation and the degree centrality indicator. The adaptation and integration of these methods allowed me to achieve six main outcomes:

- Systematically deconstruct participants' explanations into actions.
- Examine the artifacts participants use in each action.
- Identify themes participants continuously refer to throughout their explanations.
- Produce images that specify both the type of artifacts that the participants used in each action and the themes participants referred to when explaining each action.
- Contrast the number of actions where participants used artifacts of specific types.
- Contrast the number of actions where participants referred to each theme.

The next chapter will delve into how the above outcomes can be used to define design tasks.

Chapter 6 A practice-based step in the development of the framework

The preceding chapter detailed a study that consisted of a series of interviews in which six New Zealand hikers provided a simulated demonstration of the process to prepare a meal they consider suitable for hiking trips. The analysis of these interviews marks the closure of the empirical stage in the development of a framework to examine everyday activities (EAs) at a granular level, that is, focusing on individuals' views and experiences when performing EAs.

This chapter delves into a practice-based step taken as part of the development of the framework. This practice-based step involved conducting a design exercise based on the EA analysis from Study 3. The chapter is organised as follows: Section 6.1 discusses the rationale for including a practice-based step in the framework's development. Then, Section 6.2 details the design exercise comprising this practice-based step. Lastly, Section 6.3 presents the outcomes of the design exercise.

6.1 The rationale for a practice-based step

Throughout this investigation three empirical studies on EAs were carried out (reported in Chapters 4 and 5). Throughout these studies, a framework was developed that allows for systematically analysing videos in which individuals either demonstrate or illustrate how they typically conduct EAs. However, as widely acknowledged in the design literature, the scope of design extends beyond mere analysis or explanation. Design also involves envisioning and shaping possible futures through the crafting of artifacts (Nelson & Stolterman, 2012). In line with this perspective, the decision was made to supplement the empirical studies detailed in Chapters 4 and 5 with a design exercise.

The design exercise consisted of preparing a design brief based on the findings of the study reported in Chapter 5, which delves into the cooking practices of six New Zealand hikers. The brief was specifically crafted to guide the formulation of initial concepts or primary generators (Darke, 1979) for cooking utensils suitable for hiking trips. In other words, the design outcomes targeted with the brief were not finalised solutions, but rather foundational proposals that could be refined at subsequent design stages.

It is pivotal to underscore that neither the brief nor the concepts generated in response to it were conceived as seminal contributions to design. The brief was also not created to demonstrate or validate the usefulness of the framework developed in this investigation as a design tool. Doing so would imply that the newly devised framework was considered ready to be used in real design scenarios, which was not the case.

Rather, the design brief was a crucial step in the very process of developing a new framework for examining EAs at a granular level. Specifically, the creation of the brief was seen as a diagnostic effort, aimed at identifying aspects of the newly devised framework that could require further refinement before the framework could be used in real-world design contexts.

Given the specific objective pursued with the design brief (outline opportunities for further refining the newly devised framework), the decision was made that I would prepare the design brief myself. This decision was made for strategic reasons. Crafting a design brief is an intricate endeavour that requires the strategic use of the information available about the problem to be solved. This point is effectively captured by Hocking (2014, p. 14) who emphasises that "design problems cannot be comprehensively formulated at the outset because certain components of the problem only emerge through the actual process of generating solutions".

Furthermore, creating design briefs involves not only gathering the available information, but also discerning what specific bits of information are used to frame or define the problem to be addressed. As widely acknowledged in the specialised literature, incorporating too much information in a design brief can paradoxically narrow the scope of design exploration, stifling creativity and thus the emergence of innovative solutions (Hocking, 2014; Kocienda, 2018; Sosa Medina, 2019).

In light of the above challenges, my dual role as the creator of the framework and author of the brief was considered advantageous. As the creator of the framework, I possess a deep understanding of its underlying ontology. Therefore, it was considered that I was uniquely positioned to discern which insights obtained through the framework's application would be most valuable and effective in delimiting a design task. Engaging in this discernment process was expected to serve as a critical reflective exercise,

enabling me to confront and reassess my presuppositions about the framework's utility and relevance in design.

The view of my dual role as framework creator and brief author as advantageous resonates with the perspective of several scholars who underscore that design thrives thanks to the knowledge and personal experiences that designers bring to the table. For example, the work of Zhang and Wakkary (2014) shows how interaction designers often draw on specific experiences from childhood and adulthood to outline the characteristics of digital services. Likewise, in his seminal work *You make it and you try it out: Seeds of design discipline futures*, Peter Lloyd (2019) stresses that design methods are intended at guiding and challenging designers' intuitions and preconceptions, not to make of design a process free of subjectivities.

> In practice using a design method leaves the individual or group to make subjective judgements about objective data. A method guides and challenges designers to consider things outside of their intuition and preconceptions; they were never meant to enslave the designer in a mechanical process where their judgment has no value (Lloyd, 2019, p. 170).

It is essential to highlight that the choice to prepare and respond to the design brief myself does not negate the potential value of having other designers testing the applicability in design of the framework developed in this investigation. However, this approach was considered more suitable for later stages in the refinement of the framework, which were beyond the scope of the PhD.

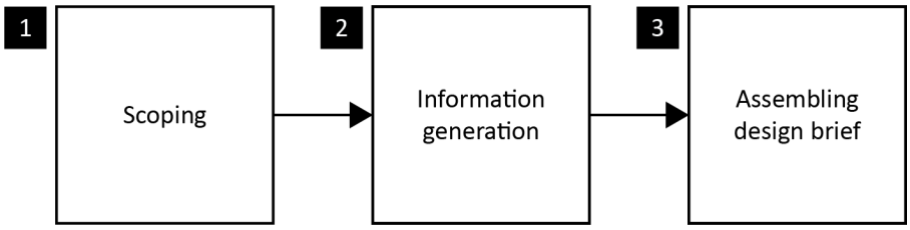
6.2 The process for preparing the design brief

I based the creation of the design brief in the study reported in Chapter 5. This study consisted of interviews with six New Zealand hikers whom I hereafter refer to as PA, PB, PC, PD, PE and PF. During the interviews the hikers provided a simulated walkthrough of the process to prepare a meal they consider suitable for hiking trips. The interviews with PA, PB, PC were conducted in person and those conducted with PC, PD, PE were online.

As Figure 6.1 shows, the briefing process I followed consisted of three main steps: scoping, information generation, and brief assembly. The following sections provide details on each of these steps.

Figure 6.1

Steps to formulate design brief.



6.2.1 Scoping

The first step in formulating the design brief was to select from the variety of artifacts I identified in the interviews with the hikers, a single artifact to focus on. The decision to focus the brief on one artifact was for considerations of practicality and quality.

When examining the cooking explanations of PA, PB, PC, PD PE and PF, I identified a total of 25 different types of artifacts. Creating a design brief that would account for all (or a number) of these artifacts would be time-consuming. Furthermore, incorporating too much information in a design brief is considered in the specialised literature as a practice that can lead to limited explorations of the solution space (Hocking, 2014; Kocienda, 2018; Sosa Medina, 2019).

I chose to develop the brief around the artifact that the interviewed hikers used in the greatest number of actions during their cooking explanations. I made this decision considering that an artifact used in a large number of actions would most likely serve multiple purposes, and therefore could inspire a wider range of design concepts than an artifact used in a small number of actions.

The artifact used in the greatest number of actions in both the face-to-face and online interviews was the pot. Participants from online interviews (PA, PB and PC) used pots in a total of thirty actions. For their part, participants from online interviews (PD, PE and PF) used pots in a total of twenty-three actions.

Tables 6.1 and 6.2 show, respectively, the actions carried out by the interview participants. In both tables, the actions that involve the use of pots appear in italic bold. To distinguish one action from another I have assigned them labels. The labels are composed of a letter that indicates the participant who performed each action. The

labels also include consecutive numbers that indicate the order in which the actions were performed.

Table 6.1

Actions performed by PA, PB and PC during face-to-face interviews.

Actions of PA to make a burrito	Actions of PB to make lentil curry	Actions of PC to make a vegetarian meal
A01. Set up stove	B01. Set up stove	C01. Set up stove
A02. Add rice to pot	***B02. Chop vegetables***	C02. Turn on stove
A03. Add water to pot	B03. Turn on stove	***C03. Put pot on stove***
A04. Add chicken oil to pot	***B04. Put pot on stove***	C04. Chop onion
A05. Turn on stove	***B05. Add oil to pot***	***C05. Add onion to pot***
A06. Put pot on stove	***B06. Add vegetables to pot***	***C06. Dry fry onion***
A07. Cook rice-oil mix	***B07. Sauté vegetables***	***C07. Add lentils to pot***
A08. Put wrap in bowl	***B08. Add curry powder to pot***	***C08. Add water to pot***
A09. Turn off stove	***B09. Add water to pot***	***C09. Add spices to pot***
A10. Add rice-oil mix to wrap	***B10. Cook vegetables***	***C10. Boil lentils***
A11. Add chicken to wrap	***B11. Put vegetables in mug***	C11. Chop vegetables
A12. Add rocket to wrap	***B12. Add water to pot***	***C12. Add vegetables to pot***
------	***B13. Add lentils to pot***	C13. Turn off stove
------	***B14. Cook lentils***	------
------	***B15. Add vegetables to pot***	------
------	***B16. Add curry powder to pot***	------
------	***B17. Add couscous to pot***	------
------	***B18. Let couscous cook***	------
------	B19. Turn off stove	------

Note. Actions that appear in italic bold involved the use of pots.

Table 6.2

Actions performed by PD, PE and PF during online interviews.

Actions of PD making mashed potatoes with kale	Actions of PE to make a dehydrated meal	Actions of PF to make ramen with vegetables
D01. Set up stove	E01. Set up stove	F01. Set up stove
D02. Tear kale leaves	E02. Turn on stove	F02. Turn on stove
D03. Add kale to pot	***E03. Add water to pot***	***F03. Add water to pot***
D04. Turn on stove	***E04. Put pot on stove***	***F04. Put pot on stove***
D05. Put pot on stove	***E05. Boil water***	***F05. Boil water***
D06. Add water to pot	E06. Turn off stove	F06. Turn off stove
D07. Boil kale	E07. Open meal package	F07. Open noodle cup
D08. Put kale in mug	E08. Loosen package contents	F08. Add vegetables to cup
D09. Dump water in pot	***E09. Pour boiling water***	***F09. Add boiling water***
D10. Put pot on stove again	E10. Stir meal	F10. Steam noodles
D11. Add water to pot	E11. Let meal cook	F11. Chop boiled egg
D12. Boil water	E12. Turn package into bowl	F12. Add egg to cup
D13. Add potato-milk mix	------	------
D14. Cook potato-milk mix	------	------
D15. Add spices to pot	------	------
D16. Add kale to pot	------	------
D17. Remove pot from stove	------	------
D18. Put mug on stove	------	------
D19. Add water to mug	------	------
D20. Add gravy powder to mug	------	------
D21. Heat gravy	------	------
D22. Turn off stove	------	------
D23. Serve contents of pot	------	------
D24. Pour gravy on meal	------	------
D25. Sprinkle fried bacon	------	------

Note. Actions that appear in italic bold involve the use of pots.

6.2.2 Information generation

The second step in creating the design brief involved generating information from the analysis of the hikers' interviews. The aim in generating this information was to ensure the brief would account not only for behaviours associated with the pot, but also for the ideas that guide or shape said behaviours. In line with this objective, I generated information of three main types: the uses the interviewed hikers give to the pot, the functions (or capabilities) of the pot associated with these uses, and the themes that the

hikers referred to when explaining actions involving pots. The following sections provide details on the process I followed to generate each of type of information.

Information on the uses of the pot

To generate information on the uses of the pot, I drew on my deconstruction of the hikers' cooking explanations (Chapter 5, Section 5.3.1). I specifically focused on this phase of the interview analysis because it sheds light on the distinct actions or steps taken by participants during their cooking explanations where pots were used.

I retrieved all the actions in the hikers' cooking explanations that involved pots. Then, as Figure 6.2 shows, I organised these actions into two groups: *transformations involving pots* and *transfers involving pots*. In the first group I included actions involving pots in which the primary objective was to modify the physical state of an artifact or ingredient (e.g., boiling water). In the second group I included actions involving pots in which the primary goal was to relocate an artifact or cooking ingredient (e.g., pouring water). The actions that comprise each of these two groups are shown, respectively, in Tables 6.3 and 6.4.

Figure 6.2

Categorisation of actions involving pots into transformation and transfer actions.

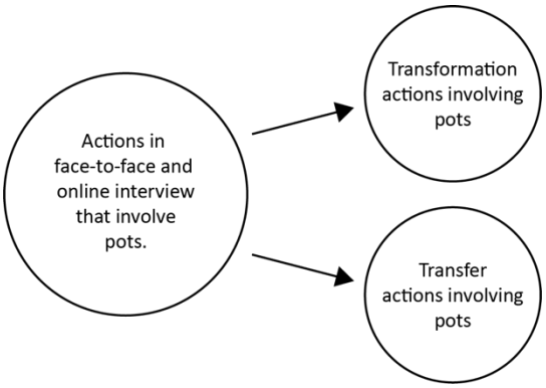


Table 6.3

Transformation actions involving pots in the cooking explanations of PA, PB, PC, PD, PE and PF.

Actions that involved pots mainly aimed at physically modifying artifacts or ingredients.	
A07. Cook rice-oil mix	C10. Boil lentils
B02. Chop vegetables	D07. Boil kale
B07. Sauté vegetables	D12. Boil water
B10. Cook vegetables	D14. Cook potato-milk mix
B14. Cook lentils	D21. Heat gravy
B18. Let couscous cook	E05. Boil water
C06. Dry fry onion	F05. Boil water

Note. The actions in these tables have labels made up of a letter that indicates the participant who performs them and a number that indicates the ordinal position that the action holds in the corresponding cooking explanation.

Table 6.4

Transfer actions involving pots in the cooking explanations of PA, PB, PC, PD, PE and PF.

Actions that involved pots mainly aimed at relocating artifacts or ingredients.			
A02. Add rice to pot	B11. Put vegetables in mug	C09. Add spices to pot	D15. Add spices to pot
A03. Add water to pot	B12. Add water to pot	C12. Add vegetables to pot	D16. Add kale to pot
A04. Add chicken oil to pot	B13. Add lentils to pot	D03. Add kale to pot	D17. Remove pot from stove
A06. Put pot on stove	B15. Add vegetables to pot	D05. Put pot on stove	E03. Add water to pot
A10. Add rice-oil mix to wrap	B16. Add curry powder to pot	D06. Add water to pot	E04. Put pot on stove
B04. Put pot on stove	B17. Add couscous to pot	D08. Put kale in mug	E09. Pour boiling water
B05. Add oil to pot	C03. Put pot on stove	D09. Dump water in pot	F03. Add water to pot
B06. Add vegetables to pot	C05. Add onion to pot	D10. Put pot on stove again	F04. Put pot on stove
B08. Add curry powder to pot	C07. Add lentils to pot	D11. Add water to pot	F09. Add boiling water
B09. Add water to pot	C08. Add water to pot	D13. Add potato-milk mix	------

Note. The actions in these tables have labels made up of a letter that indicates the participant who performs them and a number that indicates the ordinal position that the action holds in the corresponding cooking explanation.

To generate even more detailed information about the uses of the pot, I reviewed the written descriptions I created in Chapter 5 of the actions involving pots. Notably, these descriptions incorporated direct excerpts from the hikers' explanations, providing

firsthand insights into their interactions with the pot. This review allowed me to distinguish four types of transformations involving pots which I refer to as T1, T2, T3 and T4. These types of transformation are:

- Transformations directed towards water (T1). These actions involve heating water in a pot. Action E05 is an example of this type of transformations. As the excerpt below shows, action E05 consists of bringing a portion of water to a rolling boil.

  I usually let the water come to a full boil. If it is water that we have used from the hut, then we will boil it for a couple more minutes to make sure it is sterilised (PE. 11:18).

- Transformations directed towards reducing the size of ingredients (T2). These actions involve the use of the pot in processes such as cutting, grinding or slicing, which result in the reduction of the size of the ingredients or their splitting into multiple parts. As the extract below shows, PB takes the dimensions of the pot as a reference to decide the size at which to chop the vegetables (action B02).

  …I would take them [capsicum and carrot] out and chop them into tiny cubes. They need to be small because you usually have limited space in your pot. So, you want to get the pieces as small as possible (PB. 11:21).

- Transformations that involve cooking ingredients in water (T3). These actions involve using the pot to hold hot water for ingredients to cook in. Action A07 is an example of this type of transformation. As the excerpt below shows, in this action PA uses the pot to stew rice.

  So, you are looking for how much water is left. You are waiting for it to be absorbed into the rice. The goal is to have no water left in the end (PA. 19:36).

- Transformations that involve frying ingredients (T4). These actions involve using the pot to hold dry ingredients over direct heat. For example, in Action B07, PB cooks vegetables in a pot with hot oil.

  Then, you have to put a bit of oil in the pot. Then, you throw the veggies in. You give it maybe a few minutes of sautéing (PB. 11:57).

Reviewing the written descriptions of the hikers' actions also allowed me to distinguish four types of transfers involving pots which I refer to as t1, t2, t3 and t4. These types of transfers are:

- Transfers of liquid ingredients (t1). These actions consist of pouring running ingredients into or from a pot. In action D09, PD empties the water in which the kale boiled. As the excerpt below shows, PD throws away such water to prevent food that will be cooked later in the pot from turning green.

  …Then you just gently boil it [kale] for two or three minutes, so it gets little bit softer. Then, you can put the kale aside. Put it in your mug for example or on your plate so the pot is empty again. You don't necessarily have to. but I like to put new water [into the pot] because otherwise everything is going to be green (PD. 26:39).

- Transfers of solid ingredients (t2). These actions consist of pouring chunky ingredients into or from a pot. As the excerpt below shows, in action C07, PC adds a portion of lentils to the pot.

  What I have in here [plastic container] is a pre-portioned amount of lentils. I just measure that at home and I put in mushrooms and tomatoes that I had on the fridge. This is an easy way to keep a whole meal contained in one place. Then, I just pour this [contents of plastic container] in the pot (PC. 05:43).

- Transfers of powdered ingredients (t3). These actions consist of pouring ingredients crushed into fine grains into or from a pot. As the excerpt below shows, in action B08, PB adds curry powder into a pot containing vegetables.

  …You give it [vegetable mix] maybe a few minutes of sautéing. At this point, I would add a bit of the curry powder (PB. 11:57).

- Transfers directed towards the pot (t4). These actions consist of putting or removing the pot from the fire. When explaining action A06, PA commented that placing the pot on the stove once it contains all the ingredients to be cooked is a way to save gas.

  I usually set up the cooker and then prepare all my stuff. Then I light the cooker and put the pot on top. So, I'll put the rice and the water in the pot first and then light the cooker. That way, we are not wasting gas (PA. 14:41).

Figure 6.3 summarises the categorisation and sub-categorisation I made of the transformations and transfers involving pots. Tables 6.5 and 6.6 show the actions that make up each subcategory of transformations and transfers with pots.

Figure 6.3

Categories and subcategories of transformation and transfer actions involving pots.

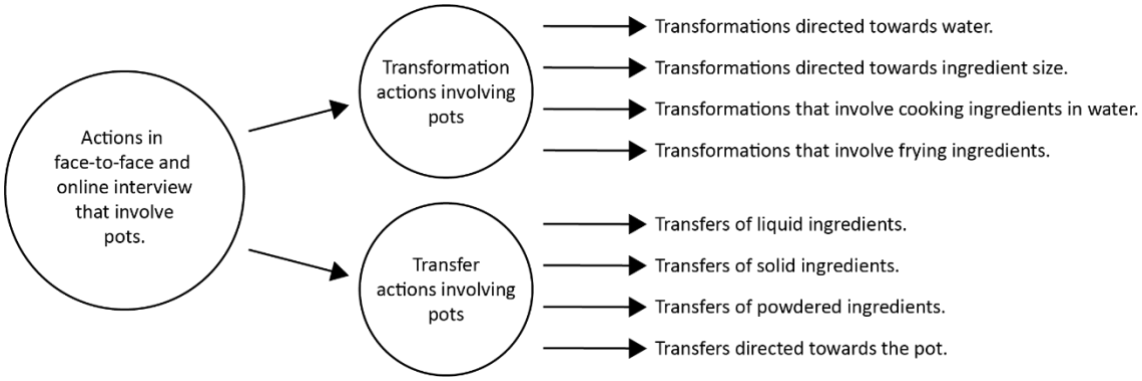


Table 6.5

Actions that comprise each subcategory of transformations with pots.

T1: Transformations directed at water	T2: Transformations directed at ingredient size	T3: Transformations that involve cooking ingredients in water	T4: Transformations that involve frying ingredients
D12. Boil water	B02. Chop vegetables	A07. Cook rice-oil mix	B07. Sauté vegetables
E05. Boil water	------	B14. Cook lentils	B10. Cook vegetables
F05. Boil water	------	B18. Let couscous cook	C06. Dry fry onion
------	------	C10. Boil lentils	------
------	------	D07. Boil kale	------
------	------	D14. Cook potato-milk mix	------
------	------	D21. Heat gravy	------

Table 6.6

Actions that comprise each subcategory of transfers with pots.

t1: Transfers of liquid ingredients	t2: Transfers of solid ingredients	t3: Transfers of powdered ingredients	t4: Transfers directed towards pots
A03. Add water to pot	A02. Add rice to pot	B08. Add curry powder to pot	A06. Put pot on stove
A04. Add chicken oil to pot	A10. Add rice-oil mix to wrap	B16. Add curry powder to pot	B04. Put pot on stove
B05. Add oil to pot	B06. Add vegetables to pot	C09. Add spices to pot	C03. Put pot on stove
B09. Add water to pot	B11. Put vegetables in mug	D13. Add potato-milk mix	D05. Put pot on stove
B12. Add water to pot	B15. Add vegetables to pot	D15. Add spices to pot	D10. Put pot on stove again
C08. Add water to pot	B17. Add couscous to pot	------	D17. Remove pot from stove
D06. Add water to pot	C05. Add onion to pot	------	E04. Put pot on stove
D09. Dump water in pot	C07. Add lentils to pot	------	F04. Put pot on stove
D11. Add water to pot	C12. Add vegetables to pot	------	------
E03. Add water to pot	D03. Add kale to pot	------	------
E09. Pour boiling water	D08. Put kale in mug	------	------
F03. Add water to pot	D16. Add kale to pot	------	------
F09. Add boiling water	------	------	------

Information on the functions of the pot

The term *functions* is understood in this investigation as capabilities that artifacts have due to their design (Houkes & Vermaas, 2010). I analysed the functions that are required as a minimum for the pot to be used in the transformations and transfers shown, respectively, in Tables 6.5 and 6.6.

The functional analysis I conducted was based on the principle of *delegation* proposed by Latour (1992). This principle states that everyday life involves a variety of jobs, some of which involve the deployment of human capabilities and others the deployment of artifact capabilities. For clarity, I include below the functional analysis of one subcategory of transformations with pots.

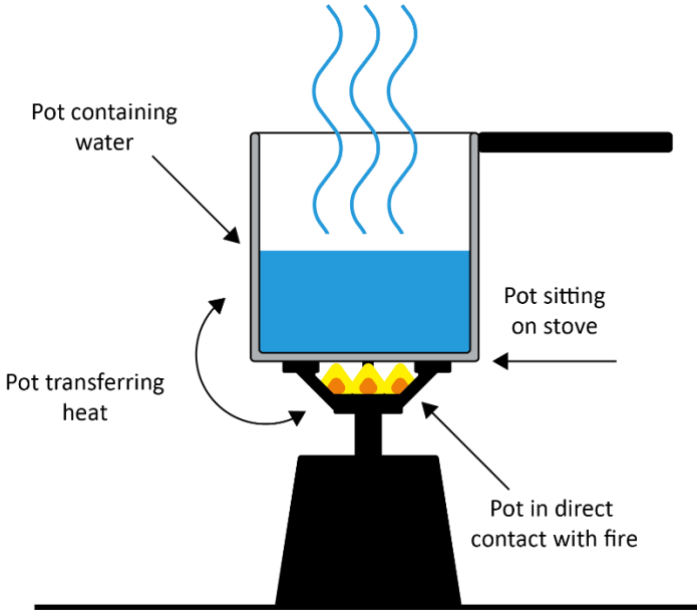
The subcategory of transformations designated in Table 6.5 as T1 comprises actions in which the interviewed hikers heat water in a pot. In performing these actions, the hikers

deploy cognitive and motor skills to perform jobs such as filling the pot with water, lighting the stove, placing the pot on the stove, regulating the flame's intensity, and so on. However, the hikers cannot use their hands to hold a volume of water over the fire to heat it up. This job, from Latour's point of view, is done by the pot.

Once an artifact job has been identified, it is possible to reflect on the artifact functions (or capabilities) that make such a job possible. This reflection can be guided by questions such as: what are the minimum functions required by artifact X to perform job Y? In order to serve to heat up water, a pot requires at least the functions to contain water, sit on a stove's burner, resist contact with fire, and transfer heat (Figure 6.4).

Figure 6.4

Minimal functions (or capabilities) the pot requires to have to be used to heat water.



I performed a functional analysis such as the above for each of the subcategories of transformations and transfers listed in Tables 6.5 and 6.6. The pot functions that I identified as minimally necessary to perform each of these subcategories of transformations and transfers are listed in Table 6.7.

Table 6.7

Minimal functions (or capabilities) the pot requires to have in each subcategory of transformations and transfers.

Subcategory of actions with pots	Minimal pot functions required
T1: Transformations directed at water	Contain water, sit on stove, resist contact with fire, transfer heat.
T2: Transformations directed at ingredient size	Receive ingredients, contain ingredients.
T3: Transformations that involve cooking in water	Contain liquid, solid and powdered ingredients, sit on stove, resist contact with fire, transfer heat.
T4: Transformations that involve frying ingredients	Contain liquid, solid and powdered ingredients, sit on stove, resist contact with fire, transfer heat.
t1: Transfers of liquid ingredients	Sit on stove or other surfaces, being held, being tilted, receive and contain liquids, eject contents.
t2: Transfers of solid ingredients	Sit on stove or other surfaces, being held, being tilted, receive and contain solids, eject contents.
t3: Transfers of powdered ingredients	Sit on stove or other surfaces, being held, being tilted, receive and contain liquids.
t4: Transfers directed towards pots	Being held, being lifted, contain liquid, solid, and powdered ingredients.

Information on the themes the interviewed hikers referred to

To generate information on the ideas that guide the uses of the pot, I drew on the Thematic Analysis (TA) I conducted of the hikers' cooking explanations (see Chapter 5, Section 5.3.3). Specifically, I retrieved the themes that hikers referred to when explaining the actions involving pots. For clarity, I include below the retrieval of themes that I made for the actions comprising T1 (Transformations directed towards water).

The actions that make up T1 are D12, E05, and F05 (see Table 6.5). The themes I identified in the explanations of these actions are:

- *Cooking efficiently:* comments on how the use of artifacts and ingredients helps to make cooking during multi-day hikes an easy and less time-consuming activity.
- *Cooking safely:* comments on how to prevent cooking related accidents during multi-day hikes.
- *Experiencing food:* comments on which meals are appropriate for specific times of a multi-day hike, and how to ensure meals acquire certain characteristics.

- *Managing supplies:* comments on the rationing of ingredients during multi-day hikes.

The following excerpts show the references that PD, PE, and PF made to the above themes when explaining, respectively, actions D12, E05 and F05.

> *So, I have got this [shows pot]. It is one of those pots that has ridges on the bottom, so it takes up a lot more heat. I tested what happens when you boil like 1 litre of water in a normal [with no ridges] and when you boil it in one of these [pot with ridges] and this [pot with ridges] is a lot faster. So, it saves you time, saves you gas. It is a win for everyone (PD. 15:01).*

In the excerpt above, PD makes references to two themes: *Cooking efficiently* and *Managing supplies*. The reference to the first theme occurs when PD points out that pots with ridges on the bottom allow water to be boiled in less time than pots with a plain bottom. On the other hand, the allusion to the second theme occurs when PD points out that boiling water faster helps to save not only time but also gas.

> *I usually let the water come to a full boil. If it is water that we have used from the hut, then we will boil it for a couple more minutes to make sure it is sterilised (PE. 11:18).*

In the excerpt above, PE alludes to the *Cooking safely* theme by pointing out that the water available in the hut requires a longer boiling time to become sterilised and suitable for cooking.

> *I boil all my water. I do everything based on boiling water as opposed to dehydrated stuff. I just do not like dehydrated stuff (PF. 03:16).*

The excerpt above includes a reference to the *Experiencing food* theme. Specifically, PF expresses a distaste for dehydrated meals and points out that, by boiling water, it is possible to cook and eat dishes other than dehydrated meals.

> *I have never used a whole can [of gas] on a trip. So, this [stove] has this twisty thing [shows the gas valve on the stove] … So, as soon as my water is boiling or close to boiling, I will turn it [stove] off. Then, also try to keep it out of the wind. If it is windy, I always put something around it. Sometimes I will put it not inside my tent, but in the front of the tent (PF. 24:53).*

In the excerpt above, PF refers to the theme *Managing supplies.* The reference to such a theme occurs when PF points out that turning off the stove as soon as the water starts boiling and keeping the stove out of the wind are ways to save gas during a multi-day hike.

I applied the theme retrieval process described above to all the subcategories of transformations and transfers involving pots. Table 6.8 summarises the themes the hikers referred to when explaining the actions in each subcategory of transformations and transfers.

Table 6.8

Themes in each subcategory of actions with pots.

Subcategory of actions with pots	Theme 1	Theme 2	Theme 3	Theme 4	Theme 5	Theme 6	Theme 7	Theme 8
T1. Transformations directed towards water	X	X	X				X	
T2. Transformations directed at ingredient size	X				X		X	
T3. Transformations that involve cooking ingredients in water	X		X	X		X	X	X
T4. Transformations that involve frying ingredients			X					X
t1. Transfers of liquid ingredients	X	X	X		X		X	
t2. Transfers of solid ingredients	X					X	X	X
t3. Transfers of powdered ingredients			X			X	X	X
t4. Transfers directed towards pots					X		X	

Note. Theme 1 (Cooking efficiently), Theme 2 (Cooking safely), Theme 3 (Experiencing food), Theme 4 (Facilitate cleaning), Theme 5 (Minimise waste), Theme 6 (Nourishing the body), Theme 7 (Managing supplies), and Theme 8 (Travelling light).

6.2.3 Assembling the design brief

The last step in creating the design brief involved integrating the three types of information that I generated from the analysis of the interviews with the hikers. The design brief begins with a short explanation of what hiking trips are. The brief then presents the pot as a common cooking utensil among a group of six hikers and poses the

challenge of redesigning this utensil to make it easier for said hikers to prepare food during their outdoor expeditions (Figure 6.5).

To incorporate information on the uses the hikers give to the pot, I included in the design brief succinct descriptions of the transformation and transfer subcategories listed in Tables 6.5 and 6.6. In order to illustrate the transformation and transfer subcategories more vividly, I created diagrams depicting them. I then organised these diagrams into two groups: one that provides a general notion of the use of pots to prepare dehydrated foods and one that provides a general notion of the use of pots to boil and fry food (Figure 6.6).

The first group of diagrams begins with one that illustrates the transfer of water into the pot (transfer subcategory t1). Then comes a diagram illustrating the process of boiling water (transformation subcategory T1). The diagram that follows is one that depicts the removal of a pot of water from the burning stove (transfer subcategory t4). The last diagram in this group shows the pouring of hot water from the pot onto a food packet (transfer subcategory t1).

The second group of diagrams begins with one showing the chopping of ingredients (transformation subcategory T2). The following two diagrams represent the addition of solid, liquid and powder ingredients to the pot (transfer subcategories t2, t3 and t4). The last diagram in this group depicts the boiling and frying of cooking ingredients (transformation subcategories T3 and T4).

I supplemented the diagrams with notes that provide details on the functions that are required as a minimum for the pot to be used for the purposes the diagrams depict. I also supplemented the diagrams with quotes from the hikers' interviews. These quotes are illustrative of the eight themes that I identified in the explanations that the hikers provided on the actions involving pots. These themes are: *Cooking efficiently*, *Cooking safely*, *Experiencing food*, *Facilitate cleaning*, *Minimise waste*, *Nourishing the body*, *Managing supplies*, and *Travelling light*.

The inclusion of both the notes on the pot's functions and the quotes from the hikers' interviews was strategic. The aim in including notes on the pot's functions was to ensure that the brief evoked reflection on how changes to the pot's design may impact hiker's

cooking practices. On the other hand, the inclusion of the hiker's quotes was also aimed at ensuring that the brief would provide insights not only on what the hikers do with the pot, but also of the ideas that guide those behaviours.

The finalised design brief, encompassing the diagrams depicting the uses the interviewed hikers give to pots, the notes on the pot's functions associated to said uses, and the quotes from the hikers' interviews, is presented in Figure 6.9.

Figure 6.5

Design brief created from the EAs analysis in Chapter 5.

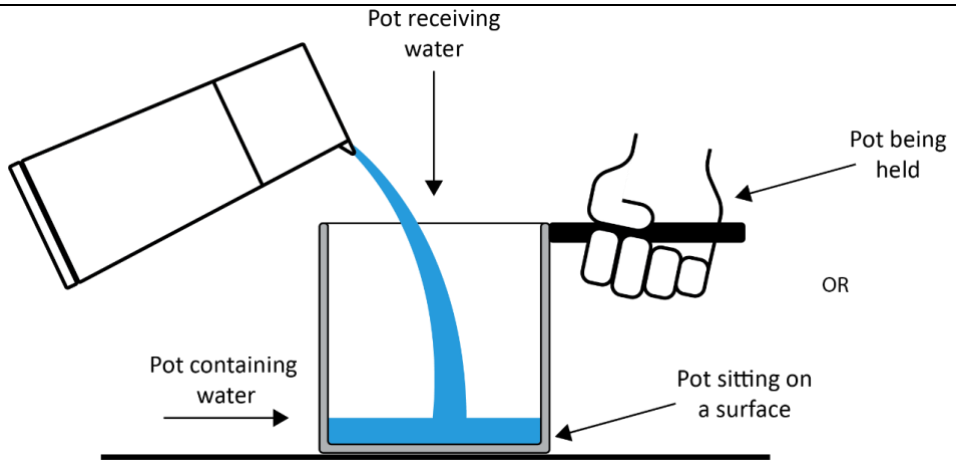
Cooking utensils for hiking trips.

Hiking trips consist of recreational walks over rough terrain that can involve overnight stays outdoors. During hiking trips, access to cooking utensils and ingredients is limited. Hikers get around these limitations by cooking with utensils and ingredients they bring from home.

A common cooking utensil among hikers is the pot. This utensil is appreciated by hikers because it allows the preparation of a wide variety of meals including wraps and burritos, curries, stews, mashed potatoes, noodles, and other dehydrated meals. **Your task is to conceptualise proposals for new pots or related utensils that make it easier for hikers to cook during their outdoor expeditions.**

The diagrams below provide an overview of how six New Zealand hikers use pots to prepare food during hiking trips. The diagrams are accompanied by quotes where hikers talk about their experiences cooking with pots on hiking trips.

A common practice among hikers is to use boiling water to cook dehydrated meals. The process of boiling water typically involves two steps: pouring water into a pot and placing the pot over a heat source until the water reaches a boil. As the following diagram shows, when pouring water into a pot, hikers can place said utensil on a flat surface or hold it in the air.

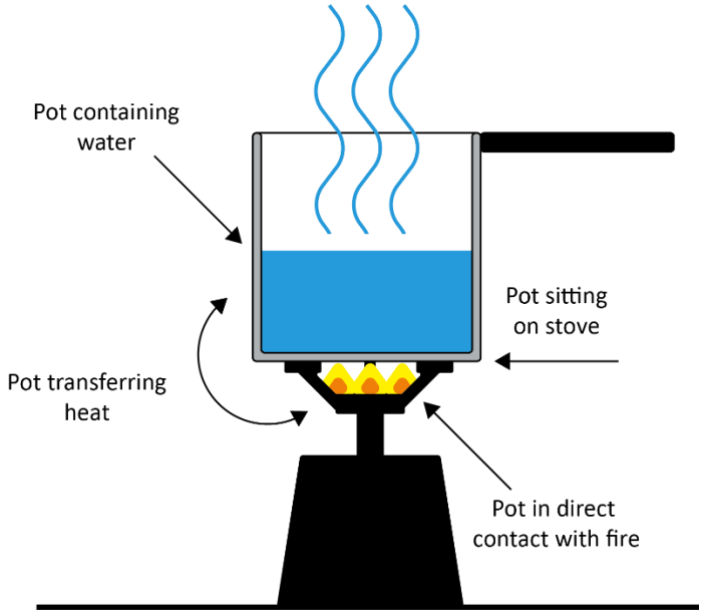


To help you better understand the implications of pouring water in a pot during hiking trips, here are some quotes where NZ hikers discuss such a task.

> *Quote 1. I don't really measure the water. I just eyeball how much is needed…It's usually better to put more water than necessary because it evaporates off anyway (Hiker A).*

> *Quote 2. … you have to either chlorinate or boil the water. I always start with water on me. I've got a two-litre bladder. But if I am cooking, I will always use the water at the camp sites because I'm going to boil it anyway (Hiker F).*

After pouring water into the pot, hikers can proceed to boil it. As the following diagram shows, boiling water often involves placing the pot with water on top of a lit portable stove.



Here are some quotes from NZ hikers talking about boiling water in a pot during hiking trips:

> *Quote 3. I have never used a whole can [of gas] on a trip. So, this [stove] has this twisty thing [shows the gas valve on the stove] … So, as soon as my water is boiling or close to boiling, I will turn it [stove] off. Then, also try to keep it out of the wind. If it is windy, I always put something around*

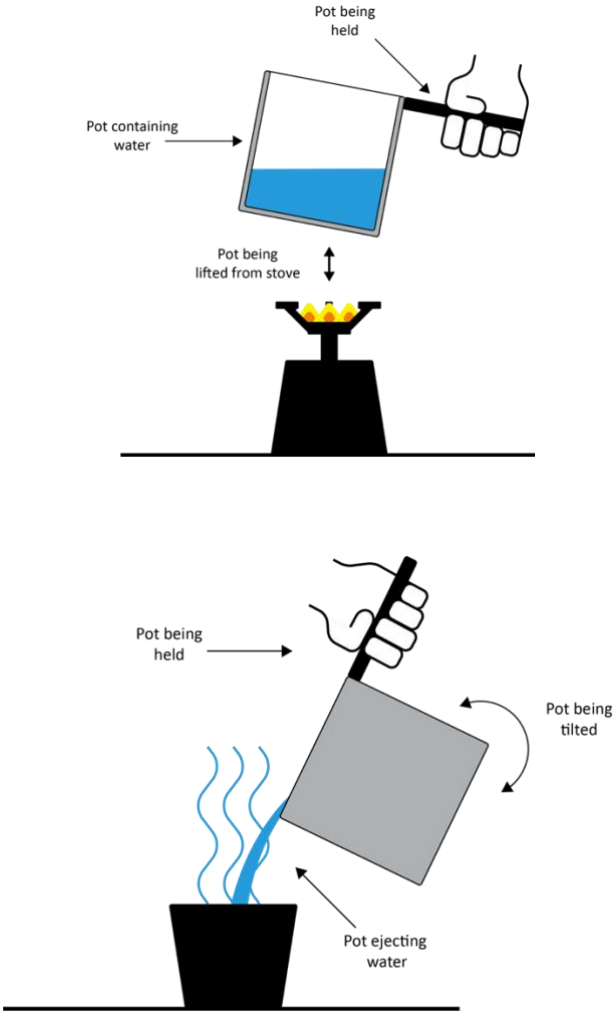
it. Sometimes I will put it not inside my tent, but in the front of the tent (Hiker A).

Quote 4. …So, I have got one of those pots that has ridges on the bottom, so it takes up a lot more heat. I tested what happens when you boil like 1 litre of water in a normal [with no ridges] and when you boil it in one of these [pot with ridges], and this [pot with ridges] is a lot faster. So, it saves you time, saves you gas. It is a win for everyone (Hiker D).

Quote 5. I usually let the water come to a full boil. If it is water that we have used from the hut, then we will boil it for a couple more minutes to make sure it is sterilised (Hiker E).

Quote 6. I boil all my water. I do everything based on boiling water as opposed to dehydrated stuff. I just do not like dehydrated stuff (Hiker F).

Once the water boils, hikers can remove the pot from the stove and pour the water into packets of noodles or other dehydrated meals.



Quote 7. …when you've got a pot of boiling water balanced on top of the stove it can be a little bit precarious. So, you do have to be quite careful

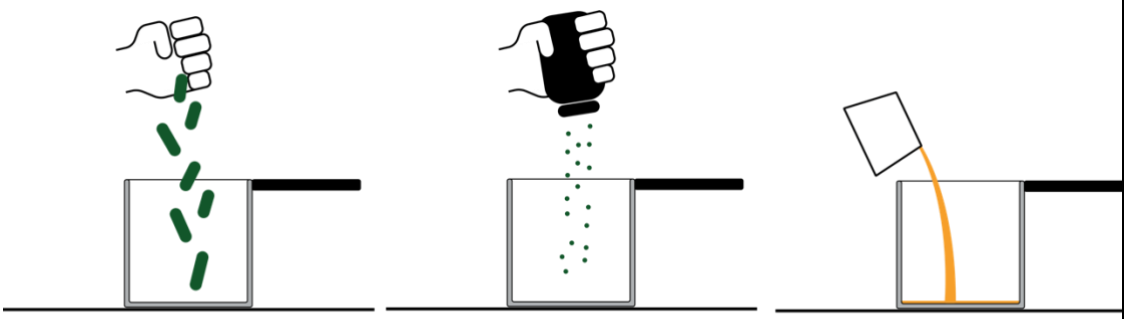
when putting the pot on and off [the stove] because you do not want to waste your precious boiling water (Hiker E).

Quote 8. …it is a matter of looking at the package and seeing the volume of water required. Some might need only 10 and others 250 ml. But then, when you water has boiled, and you are trying to pour 175 ml in one package and 250 ml in the other…its quite hard to get those exact amounts (Hiker E).

In addition to dehydrated meals, hikers can cook dishes whose preparation involves chopping different types of ingredients.

Quote 9. …I would take them [capsicum and carrot] out and chop them into tiny cubes. They need to be small because you usually have limited space in your pot. So, you want to get the pieces as small as possible (Hiker B).

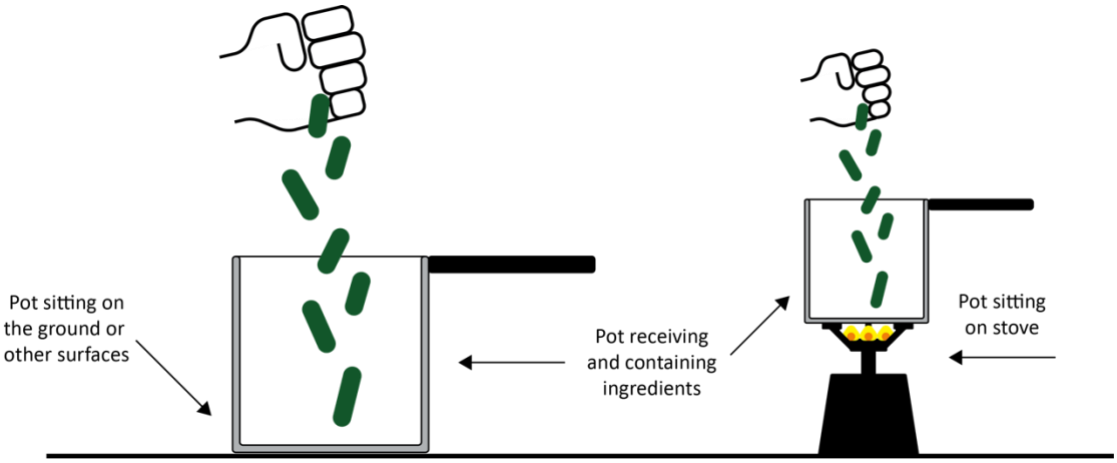
Once ingredients are chopped, hikers can add them into the pot. As the diagram below shows, in addition to chopped ingredients, the meals hikers cook may also require powdered ingredients (e.g., curry) and liquid ingredients (e.g., oil).



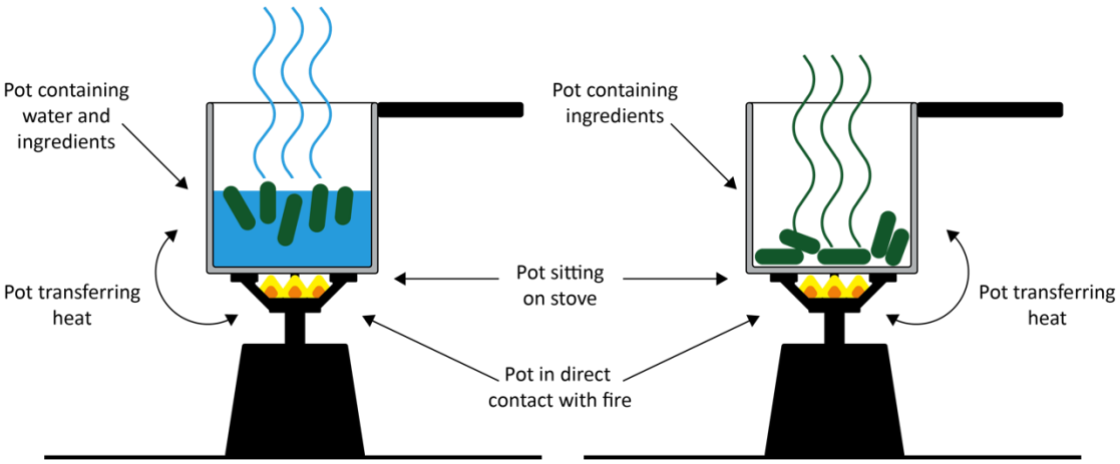
Quote 10. The annoying thing is there is quite a bit of oil left in the can afterwards which is quite annoying. You cannot pre drain it up or anything. So, I tend to drain it into the rice, which is kind of gross, but it stops me from dumping it out in the woods. So, it means I do not leave sweet chilli sauce all over the woods (Hiker A).

Quote 11. …I always carry a variety of pre-mixed spices so you can make your food taste good. It is a pretty good way to make other people in the hut jealous…I would probably add half of the spices to start with and then stirring around for a bit. Then I would see how it smells like. Same as cooking at home. You smell it, you taste it, and then you decide if it needs more (Hiker C).

When hikers add ingredients to a pot, said utensil can be sitting on a variety of surfaces, including the stove burner.



Likewise, when hikers add ingredients to a pot, said utensil may contain hot water or be empty. In other words, hikers can either boil the ingredients or fry them. As the diagram below shows, in both cooking processes, the pot needs to be placed in direct contact with the fire.



Here are some quotes from NZ hikers talking about boiling and frying ingredients in a pot.

Quote 12. …You do not necessarily have to but, after boiling the kale I like to put new water into the pot. Otherwise, everything is going to be green (Hiker D).

Quote 13. …I keep the lid on to keep the rice as warm as possible. That way it heats up faster and you are not wasting as much gas (Hiker A).

Quote 14. I stir the lentils every now and then. Usually, when you cook lentils a lot of foam and bubbles appear at the top. So, every few minutes

you want to scoop that out and throw it in the sink or in the grass (Hiker B).

Quote 15. So, I would fry a quarter of an onion. I would not usually take the whole onion with me. Unless I am tramping for multiple nights… A lot of people would use onion powder. But the weight doesn't really worry me. I will happily carry an onion, but the powder works fine too…If I remember to bring oil, I will use that. Otherwise, I quickly dry fry it. It is not going to caramelise well but, it still gives onion flavour…If you have a silicon spatula you can keep everything from sticking to the bottom of the pot which makes cleaning much easier (Hiker C).

Quote 16. One tip, when you boil the kale, try to use as little water as possible because you can basically steam it. So, it just needs a very little bit of water. The more water you boil it in, the more of the vitamins you are going to lose. That is cooking 101 (Hiker D).

6.3 Concepts formulated from the design brief

The information contained in the design brief led me to formulate proposals aimed at reducing the time and resources required for cooking during hiking trips. Quote 3 in the design brief includes a comment about how turning off the stove as soon as the water starts to boil helps save gas. In turn, quote 4 includes a comment on how saving gas and reducing the time it takes to boil water as "a win for everyone".

A design solution that aligns with the interest in saving gas and reducing boiling time, as expressed in quotes 3 and 4 in the brief, would be a pot that maximises heat transmission. The more heat from the stove is absorbed by the pot, the faster the temperature of the water rises and, consequently, the less time it takes for the water to boil. Such efficiency in heat transmission also means the stove can be turned off sooner, which not only saves gas but also reduces overall cooking time.

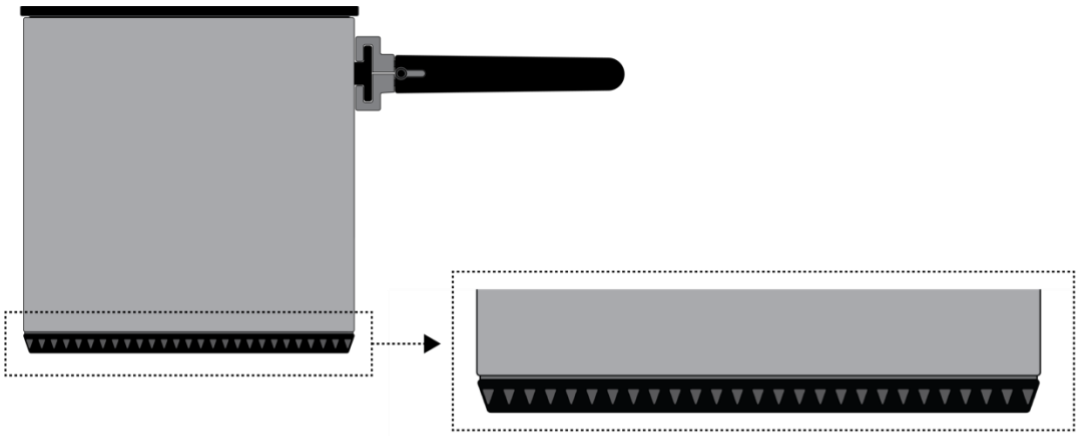
One way to maximise heat transfer is to provide the pot with a core made of aluminium which is a material with good thermal conduction (Sedighi & Dardashti, 2015). For healthy considerations, the aluminium core could be sandwiched between layers of titanium which is a durable and non-toxic material (Alabi & Adeoluwa, 2020).

In addition, the pot could feature a heat exchanger, i.e., a ridged structure located at the bottom of the pot. As the ridges comprising this structure heat up, they create additional pathways for the heat to travel and distribute throughout the body of the pot.

Such a heat distribution ensures that less heat is wasted, and more is directly utilised in heating the contents of the pot.

Figure 6.6

Frontal view of the pot with heat exchanger.



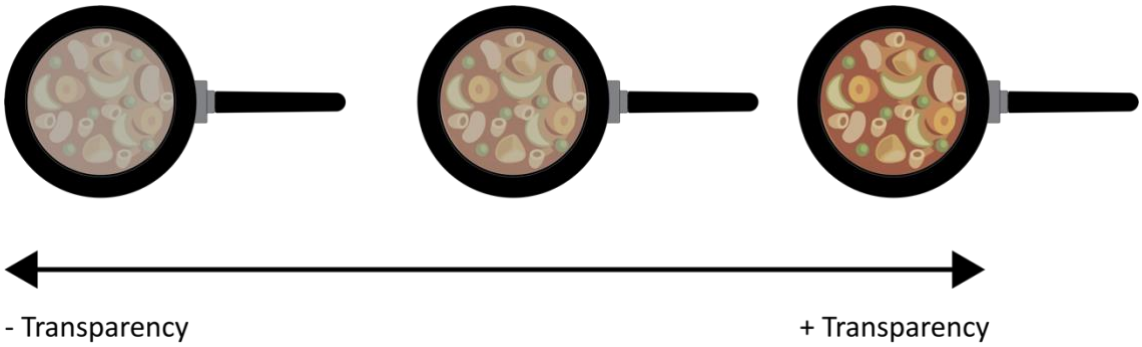
The pot could also feature a lid that prevents heat from escaping through the pot's upper opening. The design of this lid, however, requires some considerations. An opaque lid would prevent hikers from seeing the contents heating up inside the pot. This lack of visibility can lead to undesirable outcomes, such as boiling water unexpectedly overflowing, which is not only a waste of resources but also a safety risk.

Similarly, the lack of visibility of the pot's contents can lead to food burning. Depending on how much the food burns, hikers may have to throw it out and cook something else. Furthermore, burnt food can stick to the pot, which could impact the time and effort required later to wash the pot, as expressed in quote 15 in the design brief.

To prevent water and food waste situations, the lid of the pot could be made with various levels of transparency and/or be equipped with a steam valve that allows heat to escape from the pot in a controlled manner (Figure 6.12).

Figure 6.7

Top view showing pot lids with various levels of transparency.

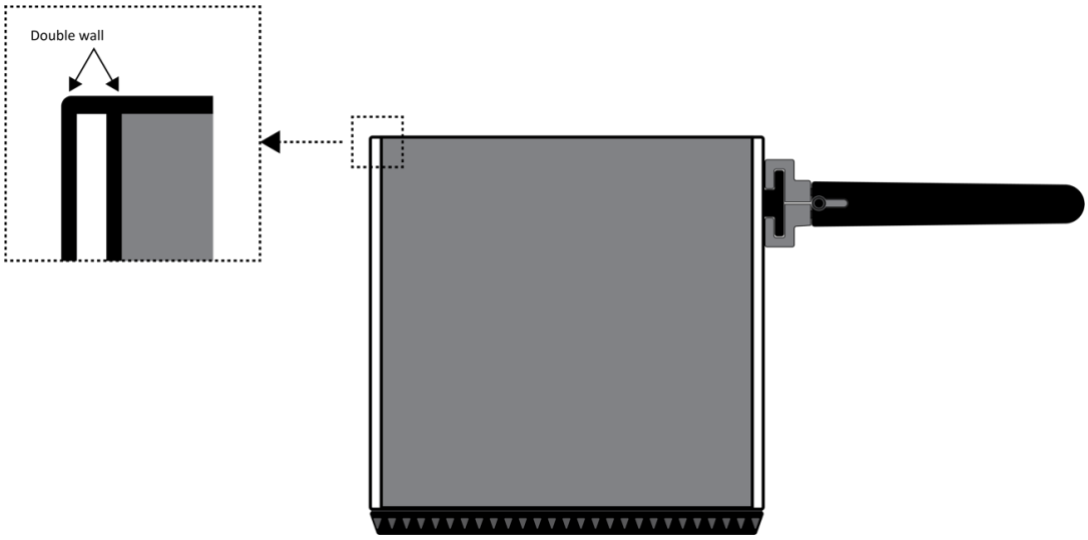


On hiking trips, food preparation often occurs outdoors, where environmental factors can lead to rapid cooling of food. To counteract this situation, hikers might either leave the pot containing the food on a low flame or find themselves reheating the food several times. Each of these measures (maintaining a low flame to keep the food warm or reheating food multiple times) would lead to a higher consumption of gas, as they both extend the period for which the stove must be on.

An alternative to address the above issue is a pot that retains heat effectively and thus allows hikers to keep their meals warm for extended periods even after the stove has been turned off. To maximise heat retention, the pot could be designed with a double-walled construction. The vacuum layer between the walls of the pot will act as an insulator, minimising heat loss through contact with air, thus keeping the contents of the pot warmer for longer without the need to use additional gas. For enhanced safety, such a pot could include a pressure release valve that would automatically vent steam if the pressure within the vacuum layer becomes too high, thereby preventing potential explosion or implosion.

Figure 6.8

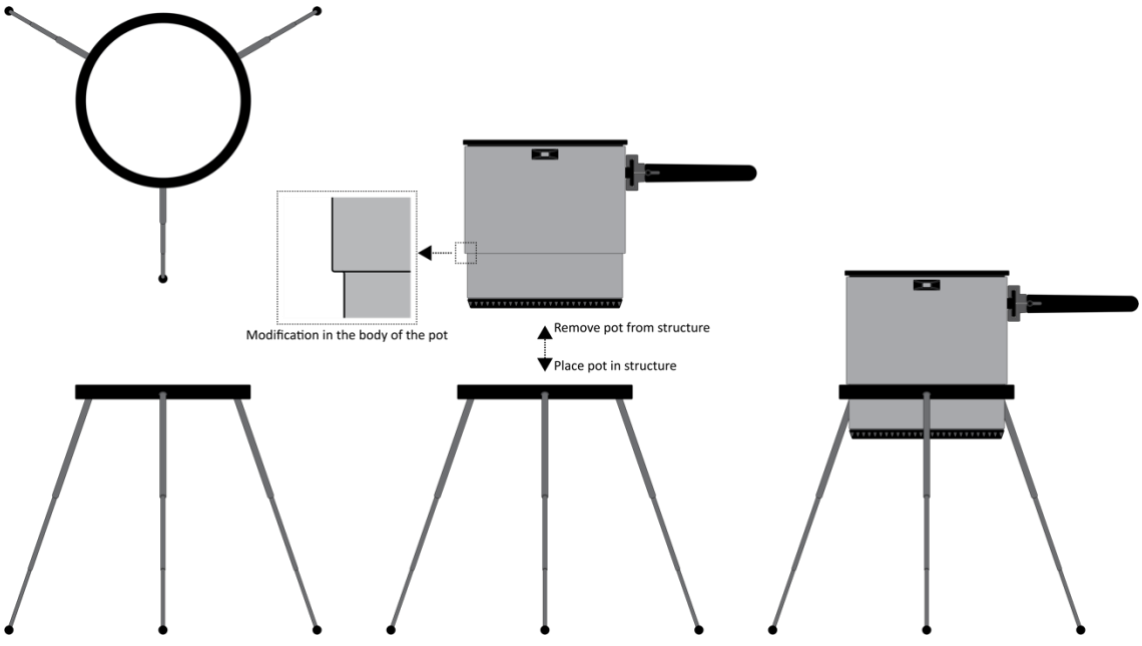
Cut view of the pot showing its double-walled body.



The information contained in the design brief led also prompt me to formulate proposals aimed at reducing water waste during hiking trips. In quote 7, one of the hikers underscores the risk of the pot tipping due its “precarious” coupling with the portable stove, potentially leading to spillage and wastage of boiled water (see design brief). An alternative to address this issue would be to incorporate a notch in the outer wall of the pot’s body (Figure 6.13). This notch would allow the pot to be placed on a ring supported by a tripod structure. For the pot to remain stable even when the hikers cook on uneven surfaces, the legs of the tripod could be extendable.

Figure 6.9

Structure supporting the pot.

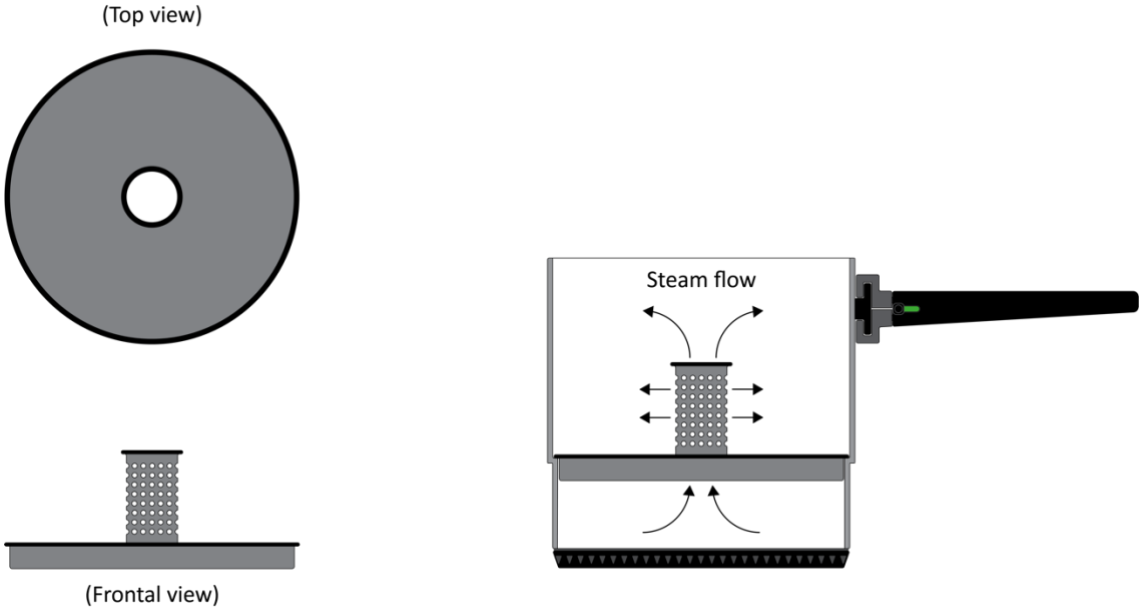


In Quote 12 one of the hikers highlights a specific form of water waste. The process of kale-boiling results in the water in the pot turning green. To prevent this tinted water from affecting other foods, the hiker discards it and adds fresh water to the pot for the next cooking steps.

To provide a solution that promotes water reuse while also aligning with the hiker's expectations of food colour, I devised a steamer that allows kale and other foods to be cooked without them coming into direct contact with the water. As shown in Figure 6.14, this steamer has a closed bottom where food can be placed. From the centre of this steamer rises a tube with perforations. The rim of this steamer couples with an indentation on the inside of the pot, which allows the steamer to remain suspended at a certain height from the bottom of the pot. When the water in the bottom of the pot begins to boil, the steam rises up the steamers' tube and then disperses onto the food through the tube's perforations. In this way, food is cooked without coming into direct contact with the water at the bottom of the pot.

Figure 6.10

Structure supporting the pot.



6.4 Reflections on using the framework to create a design brief

This section delineates how the analytical framework employed in Chapter 5 not only elucidated key aspects of the cooking practices of six New Zealand hikers but also supported the formulation of a design brief by:

- Providing a foundation for directing the brief towards a specific artifact.
- Yielding insights into the behaviours associated with said artifact as well as the underlying ideas guiding those behaviours.

In relation to the first point, the framework employed in Chapter 5 was instrumental in directing the design brief towards a specific artifact. As established in Section 6.1, the framework provided me with a comparative analysis of the frequency with which participants used various artifacts during their cooking explanations. Such a comparison allowed me to recognise the pot as an artifact that potentially played multiple roles in participants' outdoor cooking practices and therefore, could inspire a wide range of design concepts.

Regarding the second point, the analytical framework from Chapter 5 involved the deconstruction of participants' cooking explanations into discrete actions or steps. This activity breakdown provided me with a foundation for inventorying the various uses that the participants assigned to the pot during their explanations. Through this inventory, I was able to identify the minimum functions (or capabilities) that a pot must have to enable the cooking processes explained by the participants (see Section 6.2.2).

Furthermore, the EAs analysis conducted in Chapter 5 involved a thematical grouping of snippets from participants' cooking explanations. Revisiting these thematic groupings facilitated the retrieval of specific snippets where participants detailed their uses of the pot, thereby providing me with insights into the underlying ideas that inform and shape participants' behaviours.

The creation of the design brief also allowed me to identify areas within the framework from Chapter 5 that could benefit from additional refinement and development. As Engeström (2015) and Shove et al. (2012) highlight, people's approaches to EAs are influenced by sociocultural factors such as social conventions and traditions.

Examining how EAs are shaped by sociocultural factors is not the primary objective for which AIM was created. However, glimpses of the influence of sociocultural factors can be discerned, to an extent, in some quotes included in the design brief. For example, in quote 16, a hiker describes a process for boiling kale as “cooking 101”, suggesting that this hiker adheres to said process because it constitutes widely generalised knowledge on food preparation. Comments such as the one in quote 16 point to the opportunity to further develop the AIM framework, making it suitable for examining in detail how specific sociocultural factors influence individuals’ perspectives and experiences when carrying out EAs.

Summary

This chapter detailed a design exercise conducted throughout this investigation. This design exercise encompassed two main tasks. First, a design brief was prepared from the study reported in Chapter 5. This study consisted of interviews in which six NZ hikers explained the preparation of meals they consider suitable for hiking trips. Subsequently, a set of design concepts were formulated in direct response to the brief.

It is pivotal to underscore that the brief and design concepts presented in this chapter were not conceived as seminal contributions to design. Instead, the design brief was a crucial step in the very process of developing a new framework for examining EAs at a granular level. Specifically, the brief was seen as a pathway to identify aspects of the newly devised framework that might require further refinement before the framework could be used in real-world design contexts. These newly devised framework and the opportunities for its further development are respectively outlined in Chapters 7 and 8.

Chapter 7 Findings: the resulting framework

This chapter presents the framework that resulted from the adaptation and integration of methods that took place during the studies reported in Chapters 4 and 5. This chapter is organised into five sections. Section 7.1 introduces the resulting framework, named Activity-Instance Modelling (AIM), and explains how this name underscores the framework's primary objective: facilitating a granular analysis of EAs. This section also outlines the structure of AIM composed of three main components: data collection, data analysis, and data visualisation.

Section 7.2 then delves into AIM's data collection component, which consists of an interview strategy. Section 7.3 details the process followed in AIM to analyse interviews, highlighting how this process offers insights into artifact use. Finally, Section 7.4 elaborates on a process to translate the insights from the analysis of the interviews into diagrams intended to prompt designers to reflect on the importance of artifacts in EAs.

7.1 Activity-Instance Modelling: an emerging framework for examining everyday activities at a granular level

Central to this investigation was the recognition that current design methods for examining everyday activities (EAs) at a granular level do not provide a structured approach for data analysis. This situation may lead to designers (particularly novice ones) not reporting in sufficient detail the process to derive findings from the data. As a result, designers may struggle to effectively communicate and justify their design recommendations to their teammates (Kiernan et al., 2020; Krishnakumar et al., 2021).

Recognising the above gap, a research process that involved an empirical stage (in which three studies on EAs were carried out) and a practice-based stage (which involved a design exercise) was undertaken (see Chapter 3). This research process resulted in a framework that supports the systematic and comprehensive examination of EAs at a granular level, that is, focusing on the views and experiences of individuals when conducting EAs. This newly developed framework has been named *Activity-Instance Modelling.*

The name Activity-Instance Modelling (AIM) was deliberately selected to emphasise the type of analysis on EAs the framework supports. The term *Activity-Instance* indicates that the framework is specifically designed to examine individual perceptions and experiences performing EAs. Furthermore, the term *Activity-Instance* distinguishes the newly developed framework from other research tools such as Engeström's Activity System Model (2015), which provide a lens for examining EAs as practices embedded in a sociocultural context.

Complementing the name of the newly developed framework is the term *Modelling*. This second term indicates that the framework allows for creating diagrams depicting individuals' views and experiences performing EAs, thus facilitating a comprehensive and systematic assessment of the variety of uses given to artifacts in these practices.

The AIM framework comprises three primary components: data collection, data analysis, and visual representation of data (Figure 7.1). Each of these components works synergistically to facilitate the examination of EAs at a granular level. Details on how each component works within the framework are provided in the following sections. In detailing each of these components, emphasis is made on how they align with existing theoretical perspectives on EAs.

Figure 7.1

Three components comprising the AIM framework.

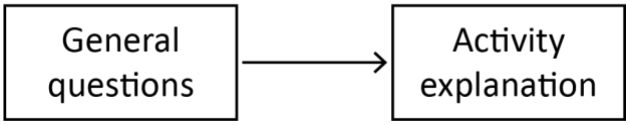
7.2 The data collection component of the framework

The data collection component of the AIM framework consists of a strategy for conducting interviews which are video recorded for subsequent analysis. Central to this strategy is the recognition put forth by Kaptelinin and Nardi (2012b) and Scott (2013), that EAs are routine practices, meaning that people carry out EAs without giving them much conscious thought. As a result, study participants may struggle to elucidate and communicate their motivations to engage in EAs in specific ways.

Taking into account the routine quality of EAs, the interview strategy within AIM is structured into two parts (Figure 7.2). In the first part, study participants are posed with general questions on the activity of interest. The topics covered in these initial questions include the frequency with which participants conduct the activity and the type of artifacts with which they prefer to perform the activity. The intention with these questions is to prompt participants to reflect on their typical approach to carry out the activity under examination. This reflection sets the stage for the second part of the interview, where participants are asked to explain how they typically conduct to the activity of interest.

Figure 7.2

Structure of interviews conducted with AIM.



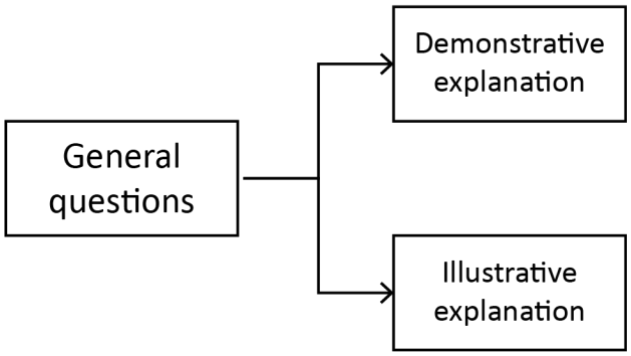
Within the AIM framework, a distinction is made between two types of participant explanations: demonstrative and illustrative (Figure 7.3). In demonstrative explanations participants discuss their typical approach to the activity of interest in real-time, that is, while actually conducting the activity. This type of explanations, which formed the data set collected in Study 2, are conducted in the settings where participants regularly conduct the activity of interest (see Chapter 4, Section 4.3.1).

On the other hand, in illustrative explanations participants operate in staged-environments[16] and provide a simulated walkthrough of their typical approach to conduct the activity of interest. In other words, in illustrative explanations participants do not actually perform the activity of interest. Instead, participants physically describe the steps they normally follow when performing the activity under examination. This second type of explanations formed the data set collected in Study 3, as reported in Chapter 5 (Section 5.2.2).

[16] The term staged environments refers to settings that replicate to varying degrees of fidelity, the conditions in which activities normally take place (Cem Kaner, 2013).

Figure 7.3

The two types of participant explanations considered in AIM.



Each of the above types of explanation (demonstrative and illustrative) offers distinct advantages. Demonstrative explanations provide a naturalistic view of an activity's progression, yielding detailed insights into how individuals use artifacts during the actual performance of an activity.

However, demonstrative explanations may not fully capture the underlying motivations that lead people to perform an activity in particular ways. The immediacy of performing an activity can make it difficult for participants to thoroughly articulate the ideas that lead them to use artifacts in particular ways. For example, a participant pouring hot water into a cup might be more focused on avoiding spills and potential burns than on elucidating and explaining to researchers their preference for drinking hot tea.

Illustrative explanations offer a path to overcoming the above limitation. In illustrative explanations individuals are detached from the immediacy of the activity. This detachment provides participants with the opportunity to more carefully consider and articulate their motivations to engage in an activity in particular ways. Additionally, illustrative explanations provide researchers with an avenue to collect data on activities whose direct observation is not feasible due to technical limitations or ethical considerations, as illustrated by Kuijer et al. (2013).

Given the unique advantages they offer, within the AIM framework neither type of explanation (demonstrative and illustrative) is considered inherently superior or more appropriate than the other. Instead, each type of explanation is recognised as a data collection approach that contributes to the versatility and applicability of AIM framework across diverse research contexts.

7.3 The data analysis component of the framework

The data analysis component in the AIM framework was devised by adapting a method called multimodal transcript (Norris, 2004, 2012), which was created within the area of Multimodal Interactional Analysis (MIA) to analyse interpersonal interactions. Details on the specific adaptations made to the multimodal transcript are available in Chapter 4 (Sections 4.2.2 and 4.3.2) and Chapter 5 (Section 5.3).

AIM's data analysis component was specifically designed to allow *systematic* and *comprehensive* examination of the uses that study participants give to artifacts in the activity of interest. The term systematic denotes that the analysis supported by the AIM framework is theory-based and carried out in a structured and explicit manner. Meanwhile, the term comprehensive indicates that the analysis conducted with the AIM framework considers not only what people do with artifacts, but also the ideas that shape such behaviours.

The analysis conducted with the AIM framework begins by reviewing the interview videos to deconstruct participants' activity explanations into actions, that is, steps participants consciously undertake to complete the activity under examination. For instance, when examined through the AIM framework, the activity of making a cup of tea can be deconstructed into actions such as boiling water, putting a teabag in a cup, pouring the boiled water into the cup, and allowing the tea to steep. This analytical approach resonates with Leontiev's notion of *hierarchical structure of activities*, which suggests that activities involve the achievement of several sub-goals each contributing to an overall purpose (Kaptelinin & Nardi, 2006).

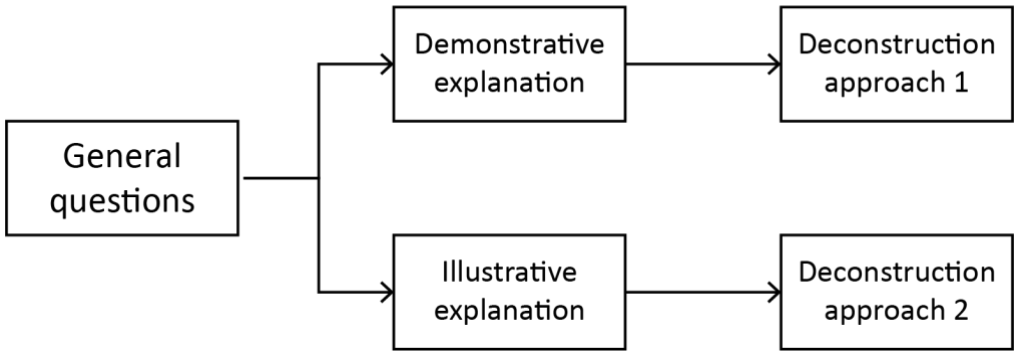
The deconstruction of EAs carried out with the AIM framework is based on two concepts which were defined as part of the original contributions of this investigation. These concepts are *transformation* and *transfer* (Montiel et al., 2020). The concept of transformation refers to the physical modification of artifacts or supplies (e.g., water). In turn, the concept of transfer denotes the relocation of artifacts or supplies.

Building upon the transformation and transfer concepts, the AIM framework introduces two novel approaches for deconstructing EAs into distinct actions. These approaches

were respectively tailored for deconstructing demonstrative and illustrative explanations of EAs (Figure 7.4).

Figure 7.4

The two types approaches to activity deconstruction used in AIM.



In the approach to deconstruct demonstrative explanations, transformations and transfers are considered as events that delineate the beginning and end of actions (see Chapter 4, Section 4.3.2). For example, in the context of making tea, the action of pouring boiling water from a kettle can be delineated from two transfer events: tilting the kettle so that water begins to flow out, and returning the kettle to an upright position to suspend the flow of water.

In contrast, in the approach to deconstruct illustrative explanations, transformations and transfers are regarded as two types of sub-goals that contribute to the overall purpose of an activity. In other words, in this second approach to deconstruct EAs, a distinction is made between transformation actions, which are directed primarily at transforming artifacts or supplies, and transfer actions, where the primary aim is relocating artifacts or supplies (see Chapter 5, Section 5.3.1). For example, the primary aim in chopping vegetables is to cut an edible item into small pieces. Therefore, chopping vegetables can be considered a transformation action. In contrast, adding the chopped vegetables into a pot is a transfer action because the primary aim is to relocate an edible item.

Within the AIM framework, the deconstruction of participants' explanations into actions is followed by a comprehensive examination of the artifacts that the participants use in each action (Figure 7.5). This examination considers five levels of human-artifact interaction: articulatory, kinetic, sensory, regulatory, and symbolic (see Chapter 4,

Section 4.2.3). These levels of interaction were defined as part of the original contributions of this investigation and are considered within AIM as intrinsic to artifact use in EAs.

The five levels of human-artifact interaction defined within the AIM framework inform the creation of a checklist consisting of specific questions (see Table 7.1). This checklist serves as a basis for analysing the video segments showing each of the actions the participants explain. This analysis allows for the identification of a broad spectrum of artifact uses, ranging from the tangible (e.g., opening a can of food) to the intangible (e.g., reading the label on a can of food). Such an approach is in line with the theoretical underpinnings of MIA, where it is recognised, that artifact use can be both embodied (involving physical contact with artifacts) and disembodied (involving perception or cognition without direct physical contact with artifacts) (Norris, 2004, 2012)

Figure 7.5

In AIM the deconstruction of activities is supplemented by an examination of artifact use.

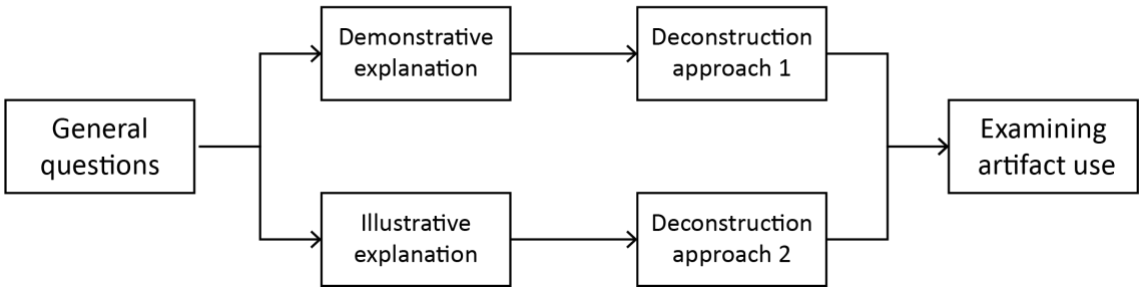


Table 7.1

Checklist within the AIM framework to examine the artifacts used in each action.

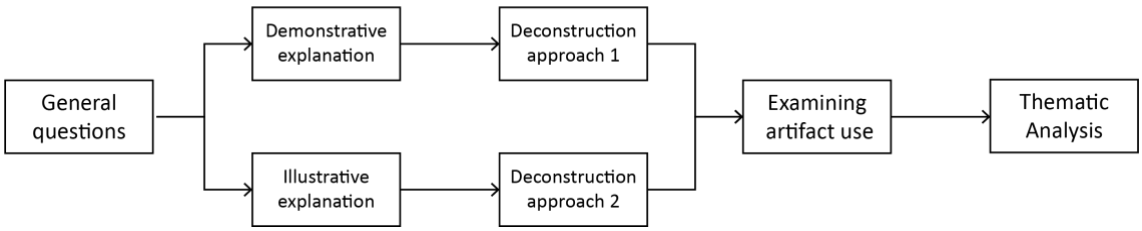
No.	Question
Q1	What artifacts/supplies does participant *X* want to transform/transfer in action *Y*?
Q2	What artifacts/supplies enable and constrain what participant *X* does in action *Y*?
Q3	With what artifacts/supplies does participant *X* touch in action *Y*?
Q4	What artifacts/supplies does participant *X* manoeuvre with in action *Y*?
Q5	What artifacts/supplies provide participant *X* with information about action *Y*?
Q6	What artifacts/supplies does participant *X* refer to when explaining action *Y*?

Note. Each of the questions shown in Table 7.1 serves a specific purpose in the analysis of participants' actions, as illustrated in Chapter 5, Section 5.3.2. The first question (Q1) allows for identifying the artifacts or supplies whose use justifies carrying out an action. The second question (Q2) allows for identifying artifacts or supplies whose use, being routine, may have been inadvertently omitted by the participants in their verbal explanations. The third and fourth questions (Q3 and A4) allow for identifying artifacts with which the participants came into physical contact when using them to complete an action. The fifth and sixth questions (Q5 and Q6) allow us to identify artifacts whose use in an action does not require coming into physical contact with them.

The examination of artifact use in AIM is supplemented by a Thematic Analysis (TA) of participants' verbal explanations (Figure 7.6). This process offers a lens for identifying and make sense of the ideas that lead participants to use artifacts in particular ways during EAs. This approach aligns with Leontiev's notion of *internalization-externalization*, which suggests that activities are distributed across an *internal dimension* (comprised by thoughts or mental representations) and an *external dimension* (comprised by body movements) (Kaptelinin & Nardi, 2006).

Figure 7.6

In AIM the examination of use is supplemented by examination Thematic Analysis.



As illustrated in Chapter 5 (Section 5.3.3), conducting the TA involves three main steps. First, participants' verbal explanations are transcribed. These transcripts are then coded,

meaning that tags are created to succinctly describe the content/meaning of the various snippets comprising the transcripts. Finally, the snippets whose codes have similarities are grouped and a name is assigned to each group of snippets. Within AIM, the names of these snippet groups are considered types of ideas that guide the uses that participants give to artifacts in the activity under examination.

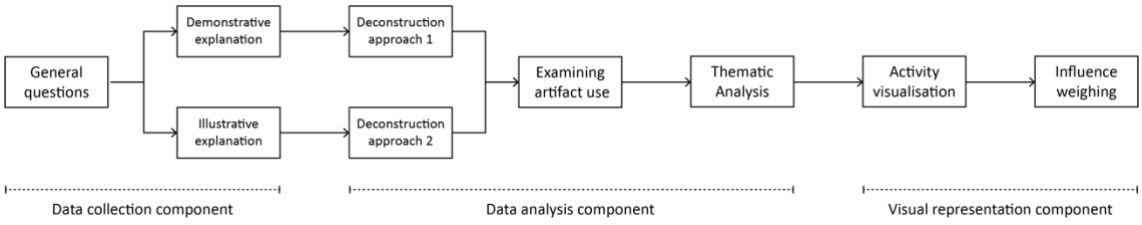
7.4 The visual representation component of the framework

As is widely recognised in the design literature, designers' forms of inquiry often include the visual representation and exploration of data (Cross, 2006; Do, 1996; Do & Gross, 1996; Tang & Gero, 2001). In line with this recognition, a visual representation component has been incorporated into the AIM framework.

As Figure 7.7 shows, AIM's visual representation component follows the data collection component and encompasses two steps: activity visualisation and influence weighing. These steps were devised by adapting two methods from the area of Social Network Analysis (SNA): network visualisation (Cherven, 2015) and degree centrality indicator (J. Zhang & Luo, 2017).

Figure 7.7

Visual representation component preceding data analysis in AIM.



Within SNA, network visualisation is often used to visually represent relations between different types of social actors (individuals, families, social groups, companies, and so on). In turn, the degree centrality indicator is typically used in SNA to measure how influential specific actors are within the system of relationships of which they are part.

Given that the AIM framework was tailored to examine artifact use in EAs, rather than relations between social actors, the application of network visualisation and degree centrality indicator within AIM differs from their conventional use in SNA.

As illustrated in Chapter 5 (Section 5.3.4), network visualisation is used in AIM to create diagrams where participants' actions and the artifacts and themes identified via AIM's data analysis component are represented as simple geometric figures termed *nodes*. Within these diagrams, links are drawn between specific action nodes and artifact nodes, to indicate the artifacts that participants use in each action. Links are also drawn between specific action nodes and theme nodes to indicate the actions in whose explanations participants referred to each theme.

In turn, the degree centrality indicator is used in AIM to contrast the number of adjacent links of each artifact node. The size of artifact nodes is then adjusted based on their number of adjacent links, i.e., links entering or exiting the nodes. The greater the number of adjacent links, the larger the size of the node within the diagram. The same procedure is then applied to the nodes representing themes.

The sizing of the artifact and theme nodes results in images that provide visual insights both about the artifacts that participants used in a greater number of actions and about the themes that participants referred to most frequently in their verbal explanations.

However, it is pivotal to note that within AIM, no artifact nor theme is considered to be inherently more important than others. Instead, the importance of artifacts and themes is considered to be situation-dependent, a view that is held also in Actor-Network Theory (ANT) (Khong, 2003; Latour, 1992, 2007). In other words, the diagrams created with AIM are not intended to indicate which artifacts or themes are most important, but rather to prompt designers to reflect on how and why certain artifacts and themes are relevant to the participants of a study. For example, does the use in a high number of actions indicate that an artifact serves multiple purposes in an activity? What if an artifact is used in only a few actions? Does this indicate that the artifact plays a critical and specialised role in the activity? Is the continued reference to a theme (e.g., security) due to deficiencies in the design of the artifacts used by participants? Or perhaps it is the opposite case, i.e., the design of the artifacts participants use makes them feel safe.

Summary

This chapter introduced a framework called Activity-Instance Modelling (AIM) as the primary outcome of this investigation. This framework was explicitly developed to

support the examination of EAs at a granular level. That is, focusing on individuals' perceptions and experiences when performing EAs.

AIM consists of three components: a data collection component, a data analysis component, and a visual data representation component. AIM's data collection component consists of an interview strategy explicitly designed to make it easier for study participants to elucidate and explain how they typically conduct EAs. These interviews are videorecorded and subsequently analysed.

Data analysis within AIM entails deconstructing participants' videotaped explanations into actions (or steps) and systematically identifying the artifacts participants use in each action. In addition, a Thematic Analysis (TA) is conducted, shedding light to the types of ideas that shape participants' typical approach to the EAs under examination.

The insights gained from data analysis inform AIM's visual representation component. This third component consists of a structured approach to creating diagrams that provide visual hints into the artifacts and themes participants respectively used and referred to during their explanations.

The next and final chapter specifies the contributions that the process of developing AIM makes to the field of design and also outlines opportunities to continue developing AIM beyond the doctorate.

Chapter 8 Contributions and future work

The objective set for this investigation was to develop a framework to examine everyday activities (EAs) at a granular level i.e., focusing on individuals' perceptions and experiences when performing EAs. The approach to developing this framework was grounded in practical application. Specifically, the framework was developed through a series of empirical studies on EAs (see Chapters 4 and 5). The development of the framework also included practice-based step, which is detailed in Chapter 6. This step consisted of a design exercise conducted specifically to identify aspects of the framework that might require further refinement before the framework could be used in real design contexts. The resulting framework, thoroughly detailed in Chapter 7, is called Activity-Instance Modelling (AIM).

This chapter serves as the final segment, effectively wrapping the account of the process for developing AIM. The chapter is organised into four sections. Section 8.1 offers an overview of the methodological approach used to develop AIM, highlighting how such an approach relates to seminal works in design literature. This section also outlines the specific contributions to the field of design derived from the development of AIM. Section 8.2 then describes the potential limitations associated with the development and use of AIM, and also elaborates on why these limitations do not detract from the overall value of this investigation. Next comes Section 8.3 where lines of future work are outlined to continue refining and expanding AIM after the PhD. The chapter concludes with comments and reflections on the experience of developing AIM.

8.1 The context and contributions of the investigation

The study of everyday activities (EAs) is not new in design. Designer's engagement with EAs as a unit of analysis is exemplified by studies such as that of Kuijer et al. (2013), which delves into bathing practices, and Hielscher et al. (2007), which investigate personal grooming. Designers' interest in EAs is further evidenced by the application of theoretical frameworks focused on EAs to develop design solutions. For example, the hierarchical structure of activity proposed in Activity Theory (AT) has been widely used to reimagine the unfolding of EAs through specific design interventions (Kaptelinin & Nardi, 2012b).

Existing design handbooks, such as that by Martin (2012), include a variety of methods for examining EAs. Given their focus, these methods can be categorised as either *holistic* or *granular*. Holistic methods offer a macro-scale perspective on EAs by providing an understanding of how such practices are influenced by specific sociocultural factors. The *Activity Checklist* developed by Kaptelinin et al. (1999) is a prime example of a holistic method. This method consists of a list of themes specifically integrated to prompt designers to consider how specific sociocultural factors such as social conventions and division of labour impact the unfolding of EAs.

Granular methods, on the other hand, focus on understanding and dissecting individuals' views and experiences when performing EAs. The spectrum of methods for examining EAs at a granular level includes observation-based methods such as the *AEIOU framework* (Wasson, 2007) and methods such as the *Think-Aloud Protocol (TAP)* (Hanington & Martin, 2019) which combine observation with questioning.

Central to this investigation was the recognition that current design methods for examining EAs at a granular level do not provide a systematic approach for data analysis (Sosa, 2021). This situation may contribute to EAs analysis performed with these methods not being thoroughly documented, which can hinder decision-making in organisations that depend on collective input to define product and service features (Drury et al., 2012; Moe et al., 2012). Without a clear understanding of how their peers produce design recommendations from research, designers are not well positioned to challenge or build upon those recommendations.

In response, the overall objective set for this investigation was: to develop a framework to systematically and comprehensively examine EAs at a granular level. This framework, thoroughly detailed in Chapter 7, is called Activity-Instance Modelling (AIM).

As established in Chapter 3, AIM was created through a *methodological bricolage* (Kincheloe, 2011; Yee & Bremner, 2011). Specifically, the creation of AIM entailed adapting and integrating methods commonly used in design with methods adapted from two research domains where systematic data analysis is prioritised: Multimodal Interactional Analysis (MIA) (Norris, 2004, 2012) and Social Network Analysis (SNA) (Prell, 2012). The methods that served as building blocks to create AIM are the interview (from design), the multimodal transcript (from MIA) and network visualisation and

degree centrality indicator (from SNA). These methods were adapted and integrated throughout three empirical studies on EAs, which are reported in Chapters 4 and 5.

The approach followed to develop AIM aligns with the perspective of several scholars who have delved into the use and creation of design methods. For instance, Schønheyder and Nordby (2018) discuss how designers working in the industry often merge design and human factors (HF) methods to create innovative and usable solutions. Similarly, Sosa (2021) underscores how combining design methods with traditional research methods allows designers to effectively unveil new problems and critically examine ideas and knowledge. Moreover, the work of Kara (2015), de Sousa Santos (2015, 2018), and Bhargava (2013), shows how, by supporting alternative forms of knowledge, the unconventional use of research methods can foster methodological innovation and decolonial design practices in both industry and academia.

As emphasised by Yee (2017), who builds upon Kincheloe (2011), employing a bricolage approach entails more than simply using several methods together; the bricoleur must skilfully discern alignments and reconcile tensions between differing epistemological perspectives. In other words, in developing innovative research practices, the bricoleur synthesises new knowledge to bridge conceptual gaps within and across various epistemologies. The subsequent sections will explore the conceptual contributions formulated during the creation of AIM and will also discuss AIM's potential a tool for informing and enhancing design practice.

8.1.1 The concepts of transformation and transfer

The type of data that AIM allows for analysing are videos where study participants explain their typical approach to carrying out EAs. The analysis of these videos begins by deconstructing participants' activity explanations into actions, i.e., steps participants consciously undertake to complete an activity. This analytical approach resonates with Leontiev's notion of *hierarchical structure of activities*, which suggests that activities involve the achievement of several sub-goals each contributing to an overall purpose (Kaptelinin & Nardi, 2006).

While Leontiev offers a conceptual basis for deconstructing EAs into actions, he does not outline a single or definitive technique to carry out such deconstruction. AIM contributes to fill this methodological void by introducing two concepts which were

defined as part of the original contributions of this investigation. These concepts are *transformation* and *transfer* (Montiel et al., 2020). The concept of transformation refers to the physical modification of artifacts or supplies (e.g., water). In turn, the concept of transfer denotes the relocation of artifacts or supplies.

Building upon the transformation and transfer concepts, AIM delineates two novel approaches for deconstructing EAs into actions. In the first approach, transformations and transfers are considered as events that delineate the beginning and end of actions (see Chapter 4, Section 4.3.2). For example, in the context of making tea, the action of pouring boiling water from a kettle can be delineated from two transfer events: tilting the kettle so that water begins to flow out, and returning the kettle to an upright position to suspend the flow of water.

In the second approach, transformations and transfers are regarded as two types of sub-goals that contribute to the overall purpose of an activity. In other words, a distinction is made between transformation actions, which are directed primarily at transforming artifacts or supplies, and transfer actions, where the primary aim is relocating artifacts or supplies (see Chapter 5, Section 5.3.1). For example, the primary aim in chopping vegetables is to cut an edible item into small pieces. Therefore, chopping vegetables can be considered a transformation action. In contrast, adding the chopped vegetables into a pot is a transfer action because the primary aim is to relocate an edible item.

It is pivotal to underscore that the intention with AIM is not to offer a single or superior way to deconstruct EAs, but rather a benchmark on how said process can be carried out from a design point of view. In other words, it is acknowledged that there may be numerous other valid approaches to deconstruct EAs, in addition to those postulated in AIM.

8.1.2 Five levels of human-artifact interaction

Within the AIM framework, the deconstruction of an activity is followed by a comprehensive examination of the artifacts used in each of the actions comprising an activity. This examination draws on the notions proposed in MIA of *embodied interaction* (involving physical contact with artifacts) and *disembodied interaction* (not involving physical contact with artifacts) (Norris, 2004, 2012).

However, the focus of MIA is on interpersonal communication, not artifact use. Therefore, it is to be expected that the conceptual foundations provided by MIA do not offer designers a comprehensive roadmap for examining the use of artifacts in EAs. Specifically, the notions of embodied and disembodied interaction, as outlined in MIA, offer a binary perspective that may not fully capture the complexity of artifact use, which often involves the interweaving of different forms of human-artifact interaction (Crilly, 2010). For instance, the act of reading a book entails an embodied interaction through the physical holding of the book, while also involving a disembodied interaction as the reader visually navigates the text.

AIM contributes to fill the above conceptual gap by introducing five levels of human-artifact interaction, which were defined as part of the original contributions of this investigation. These levels of interaction are: articulatory, kinetic, sensory, regulatory and symbolic (Montiel et al., 2020). These levels of interaction, thoroughly defined in Chapter 4, Section 4.2.2, offer a lens for framing artifact use as a multi-layered event involving multiple types of interactions that can range from the tangible (e.g., opening a can of food) to the intangible (e.g., reading the label on a can of food).

8.1.3 Activity-Instance Modelling: an emerging design tool

As illustrated in Chapter 6, Section 6.2.2, the deconstruction of activities carried out with AIM allows for differentiating the uses that people give to artifacts at specific moments during an activity. In other words, AIM provides a basis for inventorying uses of artifacts. From these inventories, functional analyses can be performed, specifically aimed at identifying the artifact functions enabling each use. In other words, through AIM it is possible to delineate connections between particular characteristics of artifacts and specific human behaviours. These connections can be valuable in the design process, as they may help designers to more effectively devise solutions that target specific aspects of human conduct. This targeted approach to design resonates with emerging frameworks within Behavioural Design such the Action, Actor, Context, Target, Time (AACTT) framework, which focus on the detailed specification of behaviours to be modified through the implementation of new technologies (Presseau et al., 2019).

The analysis carried out with AIM involves thematically grouping snippets of the interviews with the participants (see Chapter 5, Section 5.3.3). These groups of snippets

can be revisited to retrieve those snippets where participants discuss the uses they give to specific artifacts (see Chapter 6, Section 6.2.2). This process offers designers a deeper understanding of the underlying ideas that prompt individuals to use artifacts in particular ways. This understanding can be valuable in the design process, as it can help designers to develop solutions that cater the needs and values of specific individuals or groups, which resonates with emerging design approaches such as pluriversal design (Escobar, 2018).

8.2 Limitations and other considerations

While AIM can offer valuable insights for creating artifacts, it is essential to recognise the potential limitations associated with both the development and application of this framework. The following sections provide details on these limitations and also clarify specific aspects of AIM's development that may raise concerns among design researchers.

8.2.1 Sample size

The development of AIM involved conducting three studies in which specific EAs were examined. These studies are respectively referred in this thesis as Study 1, Study 2 and Study 3. The sample size in all three studies was 6. Given this sample size, the findings from Studies 1, 2, and 3 cannot be generalised to broader populations. However, the primary objective of Studies 1, 2 and 3 was not to deepen the understanding of the activities under examination nor making statistically significant claims about how people perform these activities. Instead, the goal in these studies was to use empirical data as a basis for developing a framework for examining individuals' views and experiences when performing EAs. In this context, the limitations related to sample size do not undermine the validity of this investigation.

8.2.2 The dual format of the interviews in Study 3

Study 3 involved conducting six interviews with participants. Half of these interviews were online and half in person. While the dual format of interviews in Study 3 may pose limitations in data comparability and consistency, this does not compromise the study's validity. The primary objective of Study 3 was not to contrast individual approaches to the activity under examination. Rather, the goal in Study 3 was to leverage empirical

data to make targeted refinements to the AIM framework, a goal that remains unaffected by the dual format of the interview.

8.2.3 The use of staged-environments and simulated walkthroughs in Study 3

Given the restrictions imposed in Auckland due to the Covid-19 pandemic, the interview strategy in Study 3 had to be adjusted. These adjustments involved not conducting the interviews at actual camping sites, as originally planned, but within a staged environment. Within this setting, participants were asked to provide a simulated walkthrough of the process to prepare a meal they consider suitable for hiking trips.

As discussed in Chapter 5, the insights gained from staged environments and simulated walkthroughs, while distinct from those acquired through direct observation, are valuable for a deeper understanding of EAs. On the one hand, staged environments enable controlled testing, which makes it easier to examine how people adapt to unfamiliar conditions.

On the other hand, simulated walkthroughs provide advantages for collecting rich data sets. By involving physical description rather than the full execution of EAs, simulated walkthroughs allow participants to distance themselves from the immediacy of the human-artifact inherent to EAs. This distancing opens a space for reflection that can help participants articulate their perspectives on EAs with greater clarity and depth (Clancey, 2002).

It is critical to note that the intent here is not to suggest that staged environments and simulated walkthroughs are a more effective approach to data collection than direct observation of EAs. Instead, the aim is to acknowledge that staged environments and simulated walkthroughs are valuable research approaches in their own right. Thus, the application of these methods in Study 3 can be seen as a decision that enriched this investigation by allowing the examination of EAs to extend beyond the scope of traditional research approaches.

8.2.4 The authorship of the design brief

The development of AIM also included a practice based step. In this step I myself translated findings from the interviews analysed in Study 3 into a design brief. Assuming the dual role of creator of AIM and author of the brief could have led to a conflict of

interest, had the objective been to demonstrate the AIM's utility as a design tool. However, such a demonstration was not the intent. Instead, the design brief was envisioned as a crucial step in the very process of developing AIM. The goal was to effectively identify aspects of AIM that could require further development before the tool could be used in real design scenarios.

Given the above objective, my dual role as the creator of AIM and author of the brief was considered advantageous. As the creator of AIM, I possess a deep understanding of its underlying ontology. Therefore, it was considered that I was uniquely positioned to discern which insights obtained through the framework's application would be most valuable and effective in delimiting a design task. In addition, engaging in this discernment process was expected to serve as a critical reflective exercise, enabling me not only to identify areas of opportunity for further refining AIM but also to confront and reassess my presuppositions about the AIM's utility and relevance in design.

8.2.5 The scope of the framework

AIM is a framework created specifically to examine individuals' views and experiences when performing EAs. As Engeström (2015) and Shove et al. (2012) highlight, people's approaches to EAs are influenced by the sociocultural context in which they operate. Although traces of the influence that the sociocultural context exerts on individual behaviour could be discerned in studies conducted with AIM (see Chapter 6, Section 6.4), the AIM framework itself does not explicitly investigate nor analyse in depth the characteristics and dynamics of participants' sociocultural contexts.

The above situation does not make AIM an unsuitable framework for examining EAs, but rather highlights the potential for integrating AIM with other tools such as the Activity Checklist (Kaptelinin et al., 1999), which focus on the sociocultural aspects of EAs. This integrated approach can offer a more comprehensive perspective on EAs, shedding light on how particular sociocultural factors shape individuals' perceptions and experiences when performing EAs.

Another aspect that requires consideration is the emphasis AIM places on artifact use. The AIM framework was specifically developed to examine artifact use in EAs, thereby producing insights to guide artifact design. However, current design practices encompass not only the creation of artifacts but also the generation of other types of

outcomes such as business models (Chatterjee, 2013), public policies (Blomkamp, 2018), social innovation initiatives (Manzini, 2015), and environmental conservation strategies (Vezzoli & Manzini, 2008), which AIM does not directly address.

Rather than detracting from AIM as a design tool, the broader scope of design underscores an opportunity to further refine the AIM framework so that it can be effectively integrated with design approaches that target broader outcomes. The identification of this opportunity resonates with the views of Ceschin and Gaziulusoy (2016, p. 147) who underscore that "the potential environmental benefits of a PSS [Product Service System] cannot be achieved if the products included in the solution are not designed to reduce and optimise resource consumption." This notion, although specific to Design for Sustainability (DfS), captures a situation applicable to multiple design domains. Regardless of the purposes for which it is created, the effectiveness of a systemic solution is contingent on the design and seamless integration of the individual artifacts that comprise it.

8.3 Future work

In this section of the chapter, different lines of work are outlined to continue refining and expanding AIM beyond the PhD. As detailed in Chapter 7, AIM is a framework encompassing three main components: data collection, data analysis, and visual representation. Lines of work have been outlined to refine not only each of these individual components, but also how these components articulate to provide deep insight into how people conduct EAs. Lines of work have also been outlined to assess AIM's practical utility in design contexts, integrate AIM with tools for the holistic examination of EAs, and explore potential applications of AIM in design education.

8.3.1 Advancing data collection with Activity-Instance Modelling

The data collection component of AIM consists of an interview strategy where participants explain how they typically conduct EAs. This strategy was implemented in this investigation both through an online format and an in-person format.

A line of work to advance both interview approaches (online and in-person) would be to leverage on film-making techniques to devise multi-camera setups that allow participants' activity demonstrations to be video-recorded in greater detail. These

camera setups are envisioned to be highly adaptable so that they can be effectively installed regardless of the specific layout and infrastructure available at the locations where data is to be collected.

The use of multi-camera setups also opens opportunities for integrating an unmoderated approach to data collection into the AIM framework. Specifically, computer vision (P. Wang et al., 2018) and image processing technologies (Prodan & Nascu, 2014) could be incorporated into the multi-camera setups so that the recording of EAs automatically starts when study participants execute certain actions (e.g., entering a room).

This unmoderated approach to data collection may help participants feel more comfortable and therefore engage in EAs more freely and naturally, thus enhancing the richness and accuracy of the data collected.

8.3.2 Advancing data analysis with Activity-Instance Modelling

A line of work has been also outlined to further develop AIM's data analysis component. This line of work involves the organisation of individual follow-up sessions once data collection is complete. The focus of these sessions would be to review, together with each participant, the video where they demonstrate the activity of interest.

This joint review would allow researchers to directly confirm and clarify their interpretations of the video data with the participants themselves, thus increasing the accuracy of the analysis. Materials such as card-toolkits, board games, and probes could be designed and utilised during the follow-up sessions to facilitate participant engagement in the joint analysis of the videos.

A second line of work proposed to improve the data analysis component of AIM focuses on supplementing the Thematic Analysis (TA) of participants' verbal explanations with quantitative methods for analysing spoken language. This could involve examining the frequency with which participants used specific terms, contrasting the length of the verbal explanations participants provide for different actions, assessing the variability of words preceding and following the mention of specific artifacts, and so on.

By integrating quantitative methods with the qualitative insights from the TA, this line of work aims to provide a more robust understanding of participants' views of the activity of interest.

8.3.3 Advancing visual representation with Activity-Instance Modelling

AIM's visual representation component consists of a method to create diagrams where participants' actions, artifacts, and themes are represented by simple geometric shapes called nodes. Within these diagrams, links are drawn between specific action nodes and artifact nodes, to indicate the artifacts that participants use in each action. Links are also drawn between specific action nodes and theme nodes to indicate the actions in whose explanations participants referred to each theme.

A line of work to advance AIM's visual representation component would be to devise a method for creating interactive diagrams where clicking on a node results in the display of data associated with the element that the node represents. For instance, clicking on an action node could trigger the playback of the video segment where that specific action is performed or explained. Similarly, clicking on a theme node could display a collection of participant quotes that exemplify that particular theme. In turn, clicking on an artifact node could display a list of the functions of that specific artifact that participants harnessed during their explanations of EAs.

This interactive approach could significantly enhance the accessibility of information within the diagrams produced with AIM, thus facilitating the translation of a study's findings into actionable insights for creating artifacts.

8.3.4 Assessing the practical utility of Activity-Instance Modelling

Chapter 6 includes both a design brief I created from an EAs analysis carried out with AIM and a series of design concepts which I also formulated myself based on this brief. Another line of work could involve a comparative analysis where the design concepts I developed in Chapter 6 are contrasted with those formulated by other designers in response to the same brief. If other designers formulate concepts that drastically differ from those I generated myself, it would suggest that briefs created using AIM might accommodate and inspire a wide range of design approaches.

The opposite case would be that design concepts formulated by other designers closely align with those I developed in Chapter 6. This alignment would suggest that briefs created from AIM only support limited explorations of the solution space. In such a case, it would be necessary to review and potentially redefine both the process used to create the brief and AIM's analytical component itself.

8.3.5 Integration with other tools and frameworks

AIM is a framework specifically developed to systematically and comprehensively examine EAs at a granular level. However, as discussed in Chapter 2 (Section, 2.2.2), the spectrum of resources to examine EAs also encompasses tools for scrutinising EAs as practices embedded in sociocultural contexts. A line of work has been defined to devise ways for using AIM in conjunction with said type of tools. The objective of this integration is to foster a more holistic understanding of EAs by simultaneously considering micro- and macro-scale factors that impact the unfolding of these practices.

The Activity Checklist is one of the tools with which designers can examine EAs as practices embedded in sociocultural contexts (Kaptelinin et al., 1999). This tool consists of a list of themes specifically integrated to prompt designers to reflect on how sociocultural factors, such as cultural norms and the division of labour, impact the uses people give to artifacts in EAs.

The themes included in the Activity Checklist could serve as a basis for formulating questions that supplement those currently considered in the interview strategy used in AIM. This revised set of questions is anticipated to provide designers with a pathway to assess how specific sociocultural factors influence participants' perceptions and approaches towards EAs.

8.3.6 Pedagogical applications of Activity-Instance Modelling

The analysis process followed in AIM includes a systematic examination of five levels at which people can interact with artifacts when using them in EAs. These interaction levels are: articulatory, kinetic, sensory, regulatory and symbolic (see Chapter 4, Section 4.2.2).

Each of the above levels of interaction opens opportunities to facilitate design students to understand and therefore apply different theoretical principles during the conceptualisation and development of design solutions. To further clarify this point, the

following paragraphs outline how the analysis of interactions at the regulatory level could help understand and apply key notions postulated in Actor-Network Theory (Latour, 1992, 2007).

Interactions at the regulatory level involve the joint modulation of an event. Consider how the speed with which the water flows from a kettle varies depending on both the angle at which people tilt the kettle and the size and shape of the kettle's spout.

Observing how both human action (tilting the kettle) and artifact characteristics (spout design) contribute to a common outcome (pouring water), can make it easier for design students to understand the principle of *delegation*. In the context of Actor-Network Theory, said principle posits that EAs involve multiple jobs some of which are done by people and some by artifacts (Sayes, 2014).

Understanding the principle of delegation, as exemplified through the study of regulatory interactions, could provide design students with a foundation to conceptualise design solutions. This could involve devising solutions that perform the jobs of existing products more effectively. Alternatively, design students could devise solutions that make it easier for people to perform specific jobs, or even solutions that allow jobs previously performed by people to now be performed by artifacts (or vice versa).

8.4 Closing remarks

I conclude this chapter with a brief reflection on how developing AIM has prompted me to redefine my identity as a designer. As established in Section 8.1, developing AIM involved adapting and integrating methods from three distinct areas: design, MIA and SNA. The integration of methods from these areas led me to formulate the concepts of transformation and transfer, as well as to outline five levels of interaction associated with the use of artifacts in EAS: articulatory, kinetic, sensory, regulatory and symbolic interaction (see Chapter 4, Section 4.2.2).

The formulation of the above concepts and interaction levels has allowed me to recognise that besides informing the creation of innovative solutions, design research can be an innovative process in itself. In other words, in addition to creating design

solutions, designers can focus on devising new approaches for framing and examining the wicked problems to which these solutions are directed.

I close this section by encouraging other designers to venture into creating and using novel research approaches to examine phenomena that are of interest to design. The road is full of challenges but none of them compares to the satisfaction that comes from reinventing yourself through creative-intellectual work, thus expanding not just your skill set but your very perspective on what it means to be a designer.

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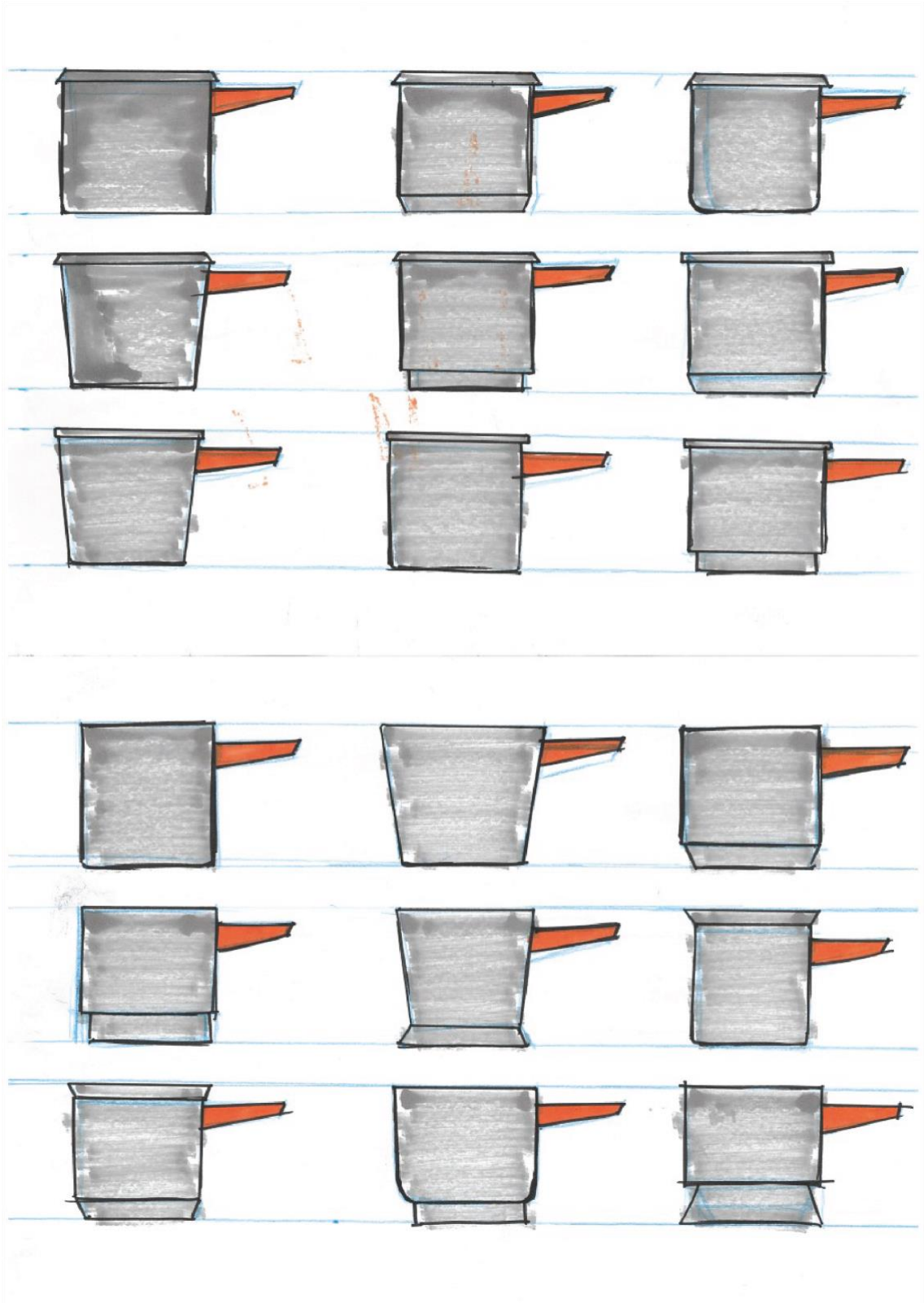
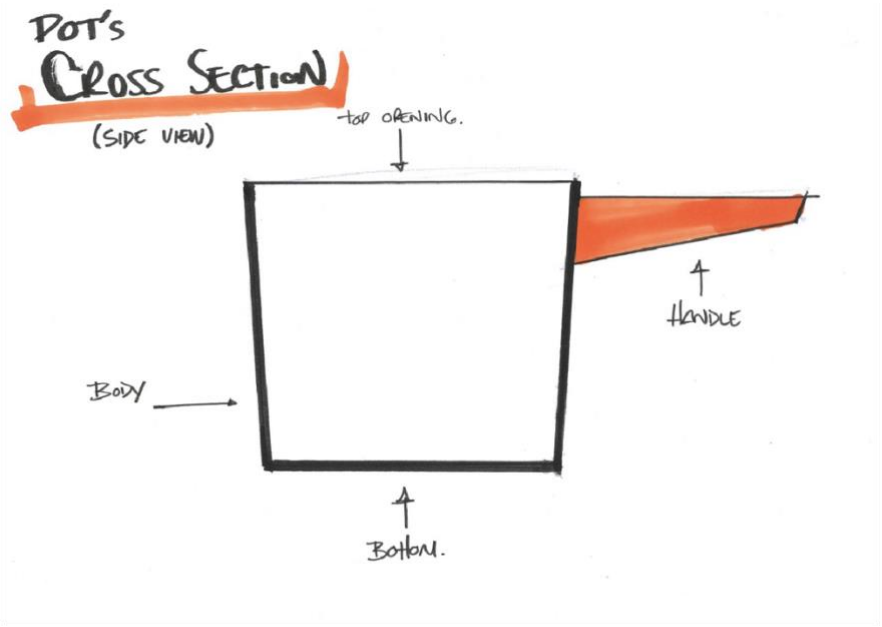
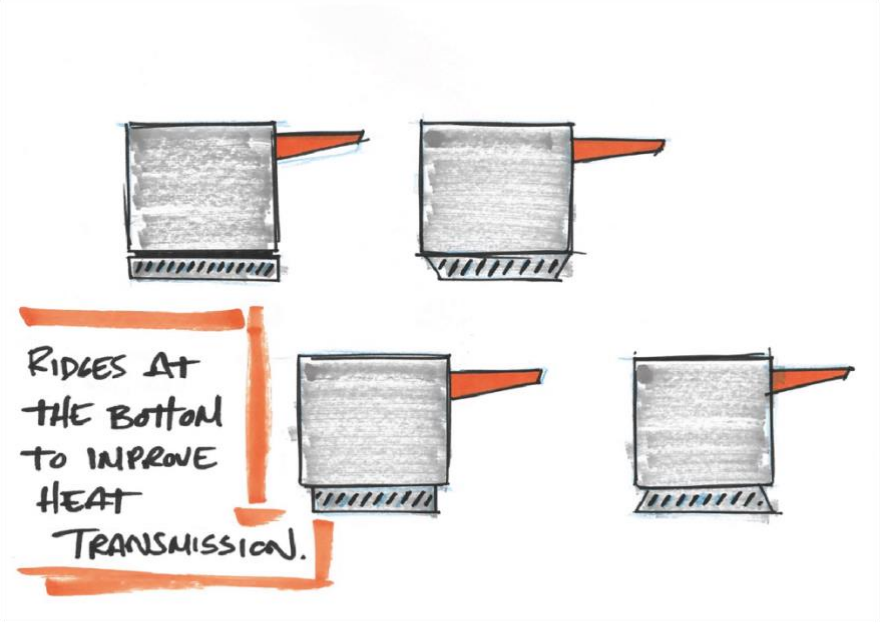
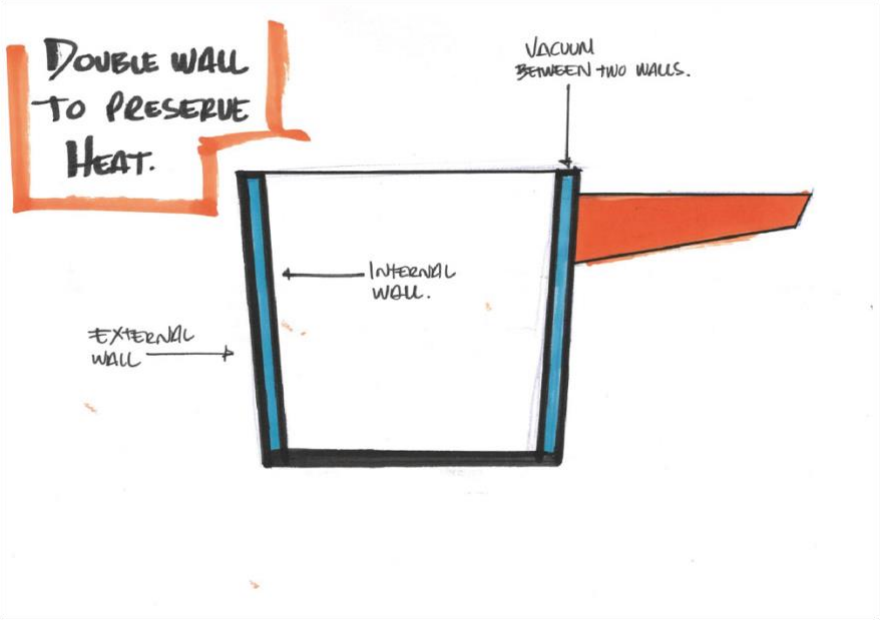
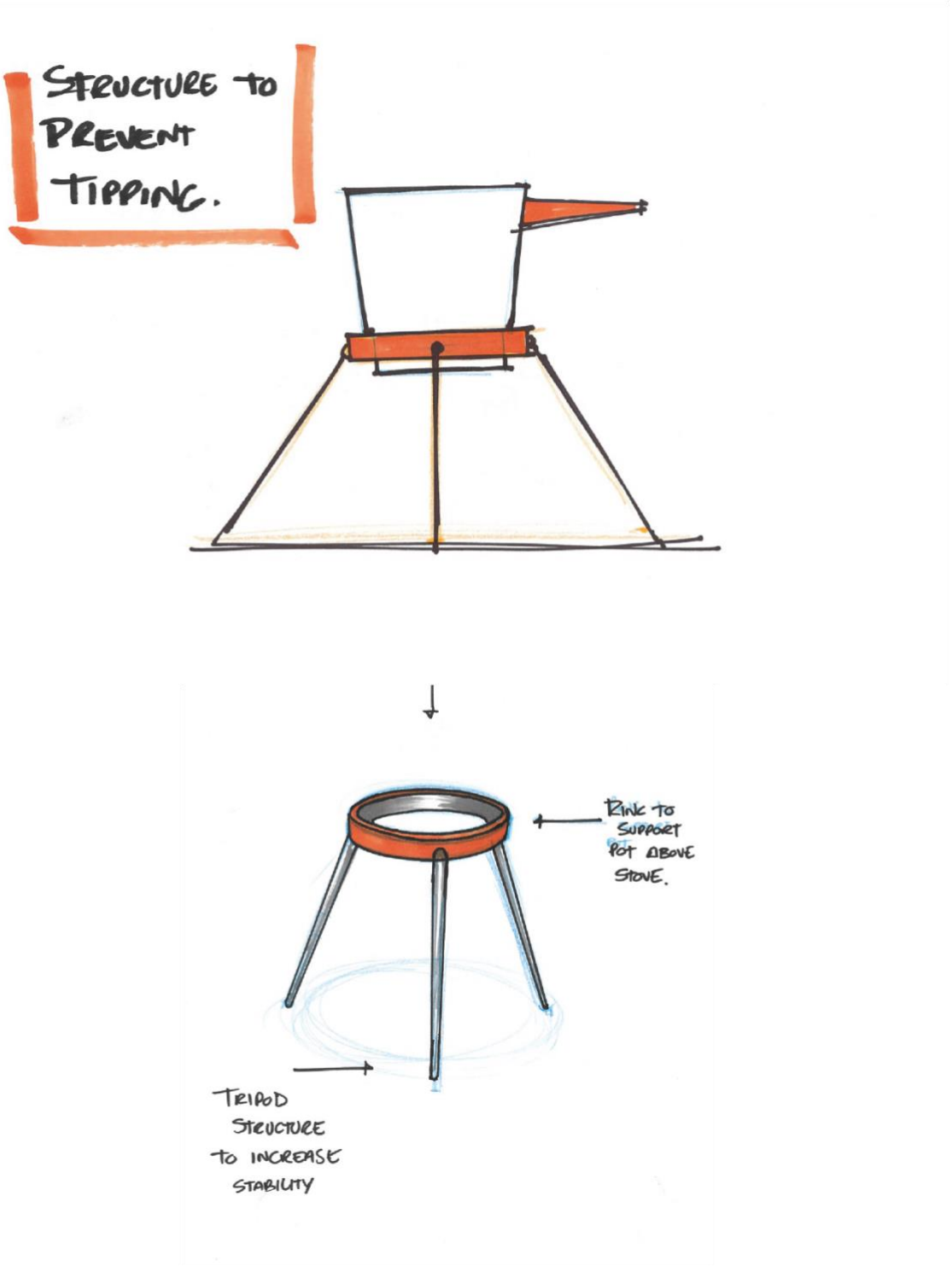
Appendix A. Primary generators developed from the design brief.




POT'S
CROSS SECTION
(SIDE VIEW)
TOP OPENING.
HANDLE
BODY
BOTTOM.

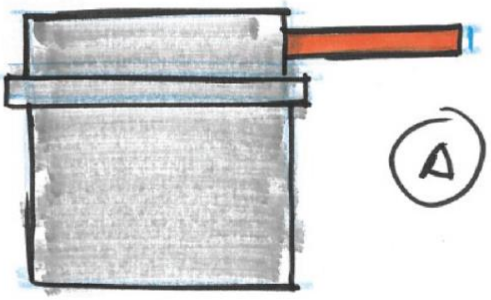

RIDGES AT THE BOTTOM TO IMPROVE HEAT TRANSMISSION.


DOUBLE WALL TO PRESERVE HEAT.
VACUUM BETWEEN TWO WALLS.
INTERNAL WALL.
EXTERNAL WALL


STRUCTURE TO PREVENT TIPPING.
RING TO SUPPORT POT ABOVE STOVE.
TRIPOD STRUCTURE TO INCREASE STABILITY

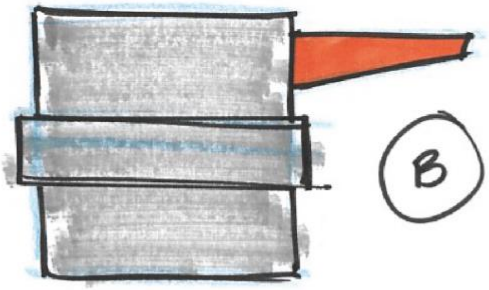
VARIATIONS IN THE BODY OF THE POT THAT ALLOW IT TO SIT ON THE RING.

INDENTATION IN THE UPPER PART OF THE POT'S BODY →



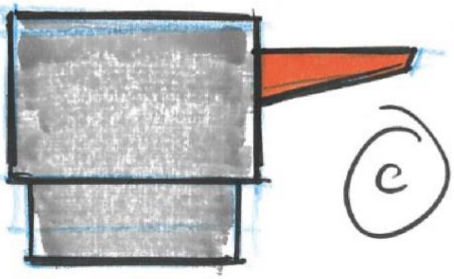
A

INDENTATION IN THE MIDDLE PART OF POT'S BODY →

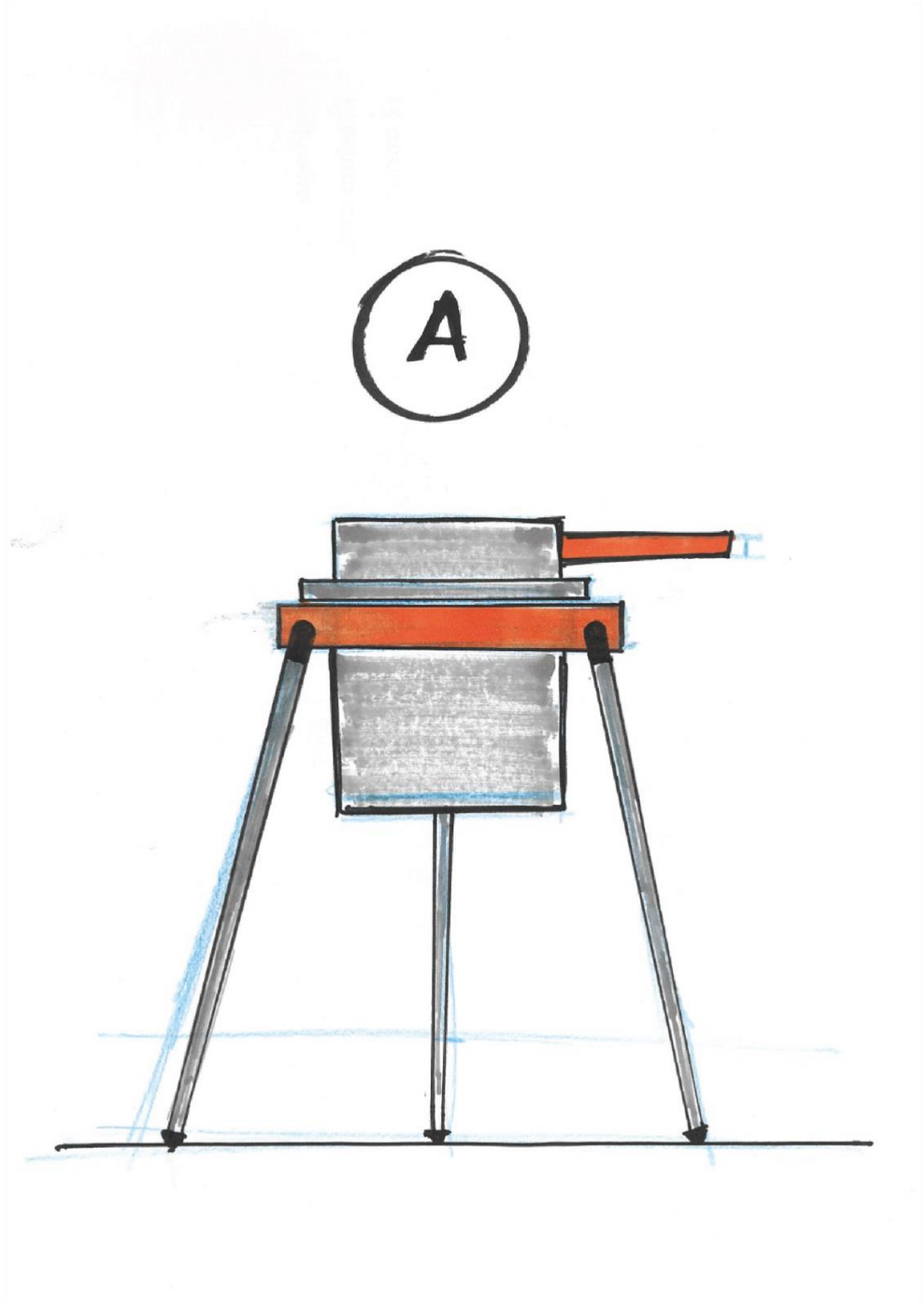


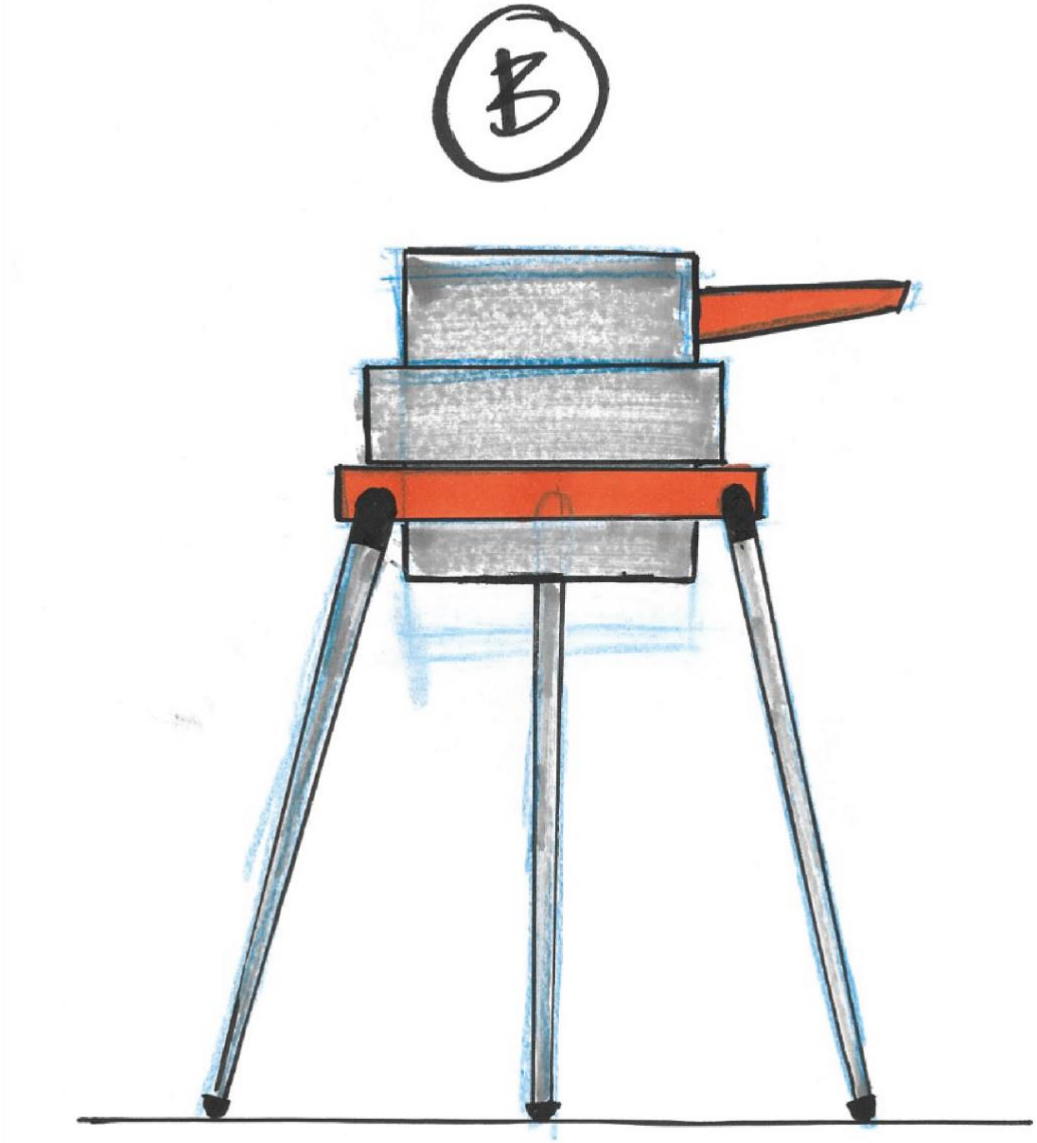
B

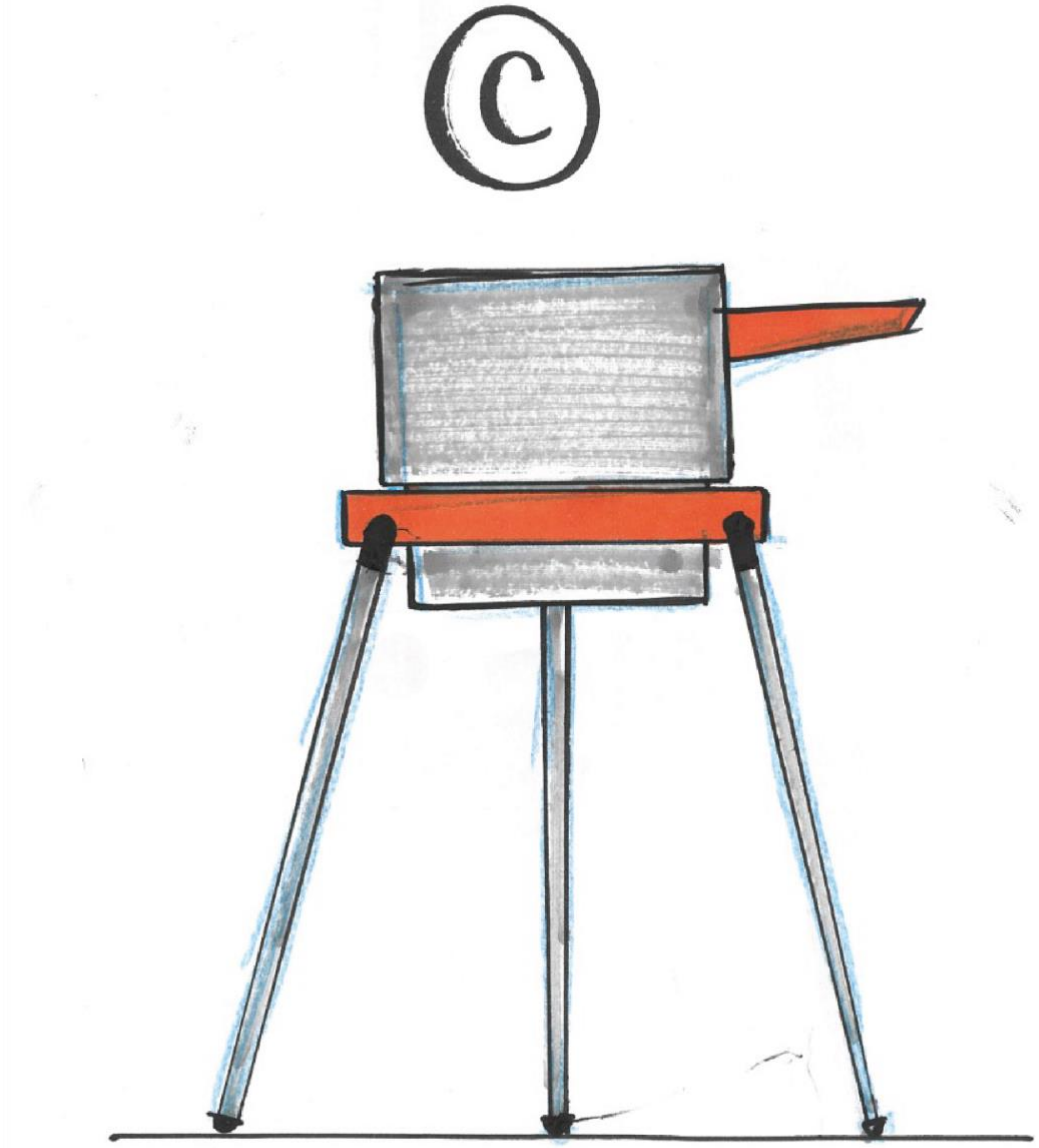
INDENTATION IN THE LOWER PART OF POT'S BODY. →



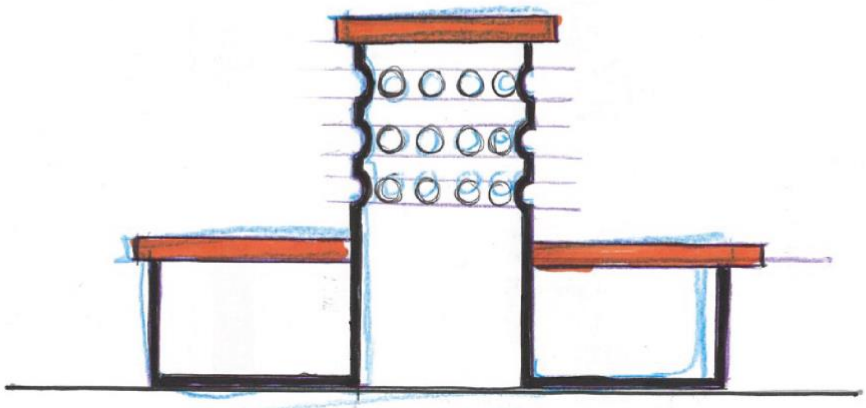
C

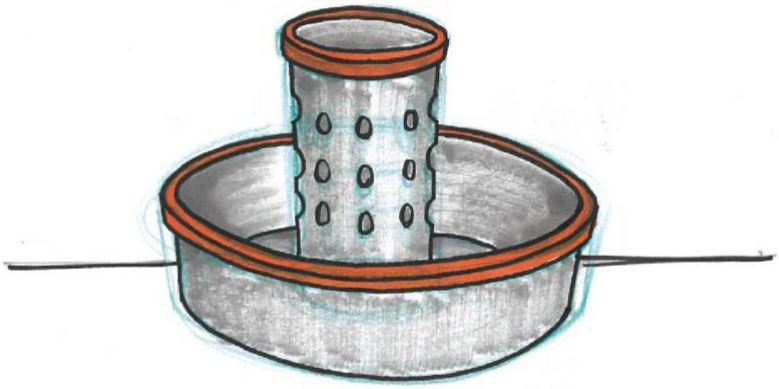

A

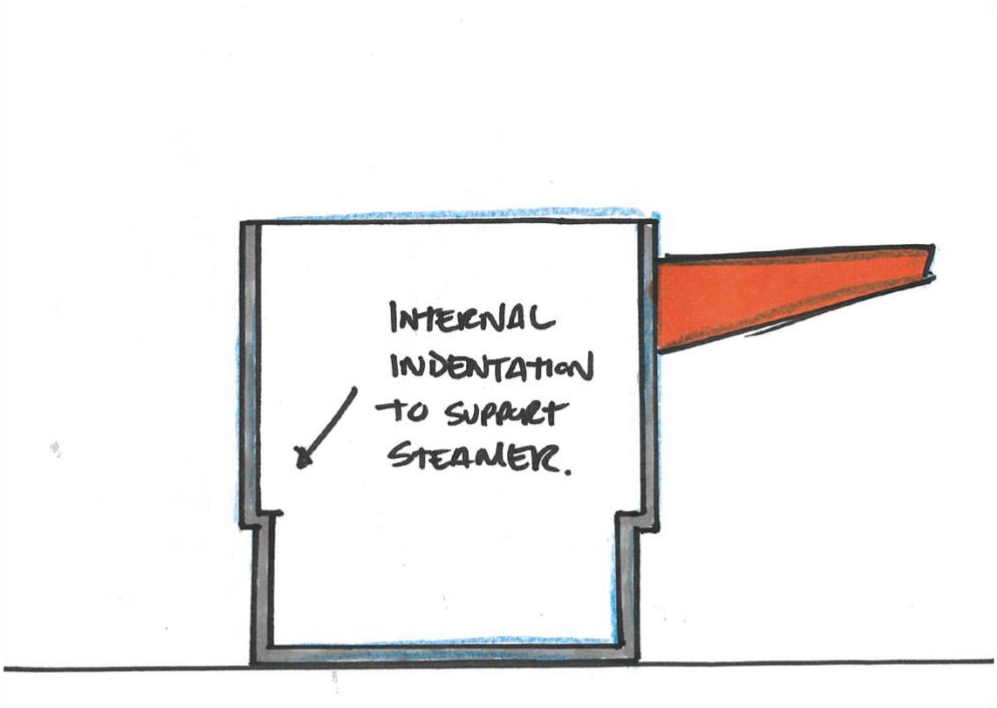

B

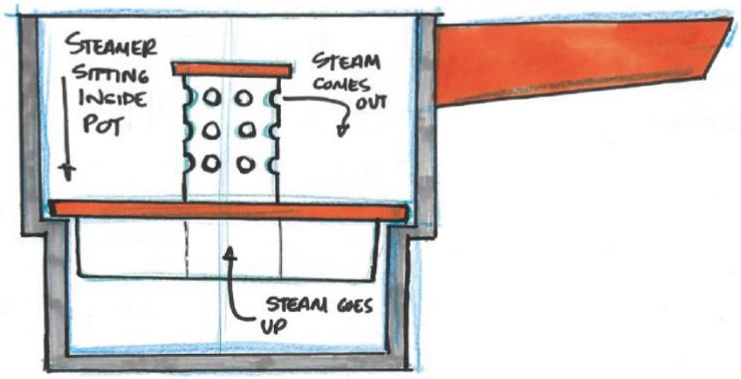

C

STEAMER
CROSS SECTION.
(FRONTAL VIEW)






INTERNAL
INDENTATION
TO SUPPORT
STEAMER.


STEAMER
SITTING
INSIDE
POT
STEAM
COMES
OUT
STEAM GOES
UP