
Design to support Psychological Ownership in sharing experiences

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Final prototype of the project

Abstract

Access-based consumption and the sharing economy emerge as a solution to optimise available resources. Currently, the experience of using products, services and spaces that are shared by many but owned by none leaves much to be desired. The lack of Psychological Ownership within shared objects results in the products having short life cycles, bad user experiences and decreased usage. This dissertation approaches this problem through the lens of user experience design, aiming to explore how design can create a better sharing experience by supporting the development of Psychological Ownership. The target of research is the shared desk at the Design Informatic studio. The research outcomes can benefit the sharing economy, sustainable consumption, and other shared products and services.

The concept of Psychological Ownership (PO) stands for people feeling a sense of ownership over something without necessarily legally owning it. Legally owning something does not rule out the development of Psychological Ownership (Pierce, 2018)

Contents

Abstract	
1. Chapter One	
Introduction	4
2. Chapter Two: Literatures Review	5
2.1 Historical Background	5
2.2 The theoretical framework of PO	6
2.3.... The sharing experience	7
3. Chapter Three: Methods and project planning	8
3.1 Empathize	9
3.1.1 Cultural probe	9
3.1.2Semi-structured Interview	11
3.2 Define	12
3.2.1 Thematic analysis	12
3.3.... Ideate	12
3.3.1 Storyboarding	12
3.4.... Prototypes	12
3.5.... Evaluation and Discussion	12
4. Chapter Four: Research Results	13
4.1 Motivations	14
4.1.1 Lack of control	14
4.1.2Having a productive place	15
4.1.3Less demand for expressing Self-identity	15
4.2 Route	16
4.2.1 Personal Items as form of control	16
4.3 Consequences	17
4.3.1 Contaminated Interaction	17
5. Chapter Five: Design Ideation	18
5.1 Beginning of the PO journey	19
5.1.1 Configuration control	19
5.1.2 Temporal control	19
5.1.3 Preference recall	19
5.1.4 Territory protection	19
5.2 End of journey	20
5.2.1 De-configuration	20
5.2.2 Visual reminder	20
5.2.3 Force rejection	20
6. Chapter Six: Design and Build	21
6.1 Concepts	22
6.1.1 Concept one	22
6.1.2 Concept two	23
6.1.3 The Final Concept	24
6.2 Prototyping	25
6.2.1 Physical	25
6.2.2 Digital	26
7. Chapter Seven: Final Outcome	27
8. Chapter Eight: Evaluation	29
9. Chapter Nine: Summary & Reflection:	31

Chapter One

Introduction

Overpopulation, climate and biodiversity crises show tangible impacts on life and bring challenges to humans and nature. There is an urgent demand for people to rethink how they consume, own and design everyday products. To find a way to optimise available resources, the sharing economy and access-based consumption emerge as solutions. Instead of buying and owning things, these solutions prefer temporary access to goods and services, such as sharing cars, hotel rooms and library books (Bardhi & Eckhardt, 2012). People no longer require legal ownership to access resources and products. Currently, the experience of using products, services and spaces that are shared by many but owned by none leaves much to be desired. A study from Bardhi and Eckhardt shows that shared products are often poorly treated by some users, resulting in a short life circle, bad user experience and less usage (Bardhi & Eckhardt, 2012).

Studies indicate that a lack of Psychological Ownership (PO) is a significant obstacle to the success of the sharing of products and the development of a more sustainable lifestyle (Kessler, 2015) (Preston & Gelman, 2020). The concept of Psychological Ownership (PO) stands for people feeling a sense of ownership over something without necessarily legally owning it. Legally owning something does not rule out the development of Psychological Ownership (Pierce, 2018)

PO is driven by three humans’ natural desires: the desire to be able to control, express our self-identity, and have a place to dwell (Pierce, 2018). However, sharing can go against all three of these motivations (Baxter, et al., 2015) (Baxter & Aurisicchio, 2018). Facilitating the development of PO in shared objects encourage people to adopt a more sharing-oriented mindset and provide a better user experience, which benefits the sharing economy and creates more significant customer satisfaction and better usage of shared products.

The study of Psychological Ownership (PO) covers areas such as anthropology, philosophy, social studies, Human-Computer Interaction, and employee ownership (Pierce, et al., 2003) (Lee & Chen, 2010), (Kuzminykh & Cauchard, 2020), (Dawkins, 2017). As digital technology and data are starting to play a critical role in products and services, there are new opportunities for developing PO over shared objects. For instance, research has pointed out that people often confuse the meaning of digital possession and physical possession, resulting in the

digital possession of a physical product affecting how people feel about the physical product. For example, Baxter and his colleague (Baxter, et al., 2015) noticed that the Graphical User Interface (GUI) (Ishii & Ullmer, 1997), which is the interface shown on a screen, can affect the sense of ownership of the physical object it is attached to. This is because the PO of a computer or smartphone is more often defined by its digital attributes, such as the contents, layout and software, rather than the physical product itself. Therefore, when people transfer their data from an old smartphone to a new one, for example, they can establish a sense of ownership quickly. By adding a ‘digital layer’ to the object, the user shifts their ownership target from ‘my object’ to ‘my data’ without noticing, which helps the user to establish PO on a new object.

Unlike phones and computers, many everyday products and sharing experiences, such as hot desks and hotel rooms, do not interact with their user through a screen. Therefore, it is critical to consider promoting PO on physical objects and spaces based on a ‘tangible interface’ (Ishii, 2008). A tangible interface refers to ‘augmenting the physical world by coupling digital information to everyday physical objects and environments’ (Ishii & Ullmer, 1997) (Ishii, 2008), which can be used to modify an object to fit users’ needs based on their preference data. An example could be a shared desk that can support the development of Psychological Ownership by modifying its heights or offering other different settings based on who uses the desk.

However, a few questions also need to be answered while we reimagine the sharing experience. For example, how does PO occur in the shared object? How is it different compared to an object that only has one user? What are users looking for in a sharing experience? What should a sharing experience include? What process should we take to design a shared product? This dissertation will answer these questions by taking a Research through Design (RtD) approach (Stappers & Giaccardi, 2014) that involves methodologies such as cultural probes, interviews and thematic analysis. The RtD approach uses design to help gather knowledge and generate actionable insights for promoting PO in shared objects (Stappers & Giaccardi, 2014). The outcome will contribute knowledge to shared product design, benefiting the development of the sharing economy, access-based consumption and other sharing experiences. The research target will be the shared desks at the Design Informatics studio at the University of Edinburgh, and the users will be

Design Informatics students.

The paper is structured into eight chapters, after the introductory chapter that provides the background information for the research. Chapter two uses a literature review to investigate the current knowledge and frameworks related to Psychological Ownership and sharing experiences. Chapter three documents the methods and tools used and modified for the project. Chapter four focuses on finding insights and patterns from user research, answering some of the questions mentioned above. Based on the insights from chapter four, chapter five explores the ‘Affordances’ and goals a good sharing experience should include. Chapter six discusses the concept evaluation journey, leveraging user testing to evaluate the design concept. Chapter seven documents the making process and discusses how the final prototypes were built. Chapter eight examines the design outcome with a user testing workshop, which aims to identify the pros and cons of the design, as well as establish future research directions. Chapter nine summarises and reflects on project discoveries and learnings.

Chapter Two

Literature Review

2.1 Historical Background

PO refers to what people feel is theirs but they do not necessarily legally own. The ownership target goes beyond the physical object, including anything people think is theirs. For example, the feeling of “my email account”, “my organizations”, “my job”, and “my ideas”. (Pierce, 2018) (Baxter, et al., 2015) (Norton, 2011)

Although it is hard to determine when scholars started exploring the topic, the concept of “what I feel I own” is not new. In 1762 Rousseau argued that society and civilization began when people claimed ownership over objects or grounds (Rousseau, 1895). A hundred years later, in 1890, philosopher William James (James, 1890) brought the concept of ownership into the domain of psychology. Exploring the psychological state of owning and arguing what we think is ‘mine’ defines who we are and, as an extent of ourselves (Belk, 1988), exploring the feeling of ‘ownership’ from an individual’s perspective:

“A man’s self is the sum total of all that he CAN call his, not only his body and his psychic powers, but his clothes and his house, his wife and children, his ancestors and friends, his reputation and works, his lands, and yacht and bank account. All these things give him the same emotions. If they wax and prosper, he feels triumphant; if they dwindle and die away, he feels cast down, not necessarily in the same degree for each thing, but in much the same way for all.” (James, 1890)

Since then, people have slowly realized that the sense of ownership defines our relationships with the surrounding world and society (Snark, 1972). Most arguments, war, responsibility, love and hate between people and their surroundings, are related to people’s sense of ownership around ‘possessions’ (Rousseau, 1895). Arguably, the feeling of ownership affects how the world and civilization developed in the past, today and in the future.

However, Psychological Ownership (PO) did not go beyond the philosophical discussion until the 80s, when Pierce approached PO from an anthropological perspective by investigating how ownership occurs in

companies and job roles (Pierce, 2018). The outcome helped increase the sense of ‘ownership’ in a job position for a better working experience and performance. Such an approach empowers people to realize that the concept of PO can be used to construct human experiences, resulting in a combination between PO and areas such as ‘customer behaviour’, ‘anthropology’, ‘social studies’ and ‘Human-Computer interaction (HCI)’.

With the rise of human centred design, Psychological Ownership is now under discussion within the design community (Baxter & Aurisicchio, 2018). Many people and articles believe ownership is ‘dying’ because of the sharing economy (Martin, 2018) (Rifkin, 2001) (Alison, 2021), and the concept of owning seems less critical. Other people argue that although the requirement of legal ownership within consumption is reducing, PO that is powered by our natural motivations remains (Baxter & Aurisicchio, 2018). People still seek a sense of ownership of shared items (Bardhi & Eckhardt, 2012). Therefore, researchers like Baxter and Aurisicchio propose a PO approach to designing products and services (Baxter & Aurisicchio, 2018). This research forms the foundation of the combination between PO and design. From a user experience perspective, a good understanding of PO can enable positive engagement between user and product, which bring an exciting opportunity to rising sharing schemes such as rental cars, hot desks, hotel rooms, streaming services and luxury rentals.

There are multiple benefits to having a greater sense of ownership over products or experiences because PO can raise people’s willingness to protect, contribute, maintain, care and even sacrifice for the target object/space/community (Pierce, et al., 2003). For example, Preston and his colleague point out in their research that Psychological Ownership increases people’s willingness to protect the natural world (Preston & Gelman, 2020), resulting in a better natural environment. Avey and his colleagues discovered that Psychological Ownership encourages people to take more responsibility for a job position (Avey, et al., 2009). Jussila and her colleagues (Jussila, et al., 2015) also point out from a marketing perspective that Psychological Ownership can raise customer

satisfaction and brand loyalty.

However, ownership sometimes also negatively impacts the experience, especially when people develop what Higgins describes as a ‘prevention’ approach to the target (Higgins, 1998). Instead of developing ‘positive behavior’ such as caring and contributing, people with the ‘prevention’ approach are less willing to share and change (Avey, et al., 2009). Preferring to stick to the current rules and obligations. For example, people with a ‘prevention’ approach toward an object might feel overwhelmed by the burden of responsibility of taking care of it, and people who work in a group might develop behavior that violates group benefits because of unwillingness to change and share (Pierce, et al., 2003). As a result, an excellent sharing experience needs to avoid triggering the ‘prevention’ approach within the context of ownership.

2.2 The Theoretical Framework of PO

One of the most well-known theoretical frameworks of Psychological Ownership is from Pierce and his colleagues (Pierce, et al., 2003). Arguing that the root of Psychological Ownership is shaped by three human motivations or natural desires (why we want to own). These motivations connect to humans’ most fundamental needs, such as the ‘provision of security, comfort, and pleasure’ (Pierce, et al., 2003). These three motivations are: 1) efficacy and effectance, 2) self-identity and 3) having a place to dwell (Figure 1). An individual can develop a sense of ownership if some of these desires are satisfied. Efficacy and effectance refer to the desire to have control and access to an object or environment or idea at any given moment to produce the desired outcome. For example, people can access their phones and contact people anytime they want. Self-identity refers to people’s desire to use an object, space or possession to express or identify themselves. The most obvious example is the clothes we wear, which usually represent how we define ourselves and want others to recognize us. Having a place to dwell represents people’s desire to feel familiarity, comfort and security within a space or role. An example can be people feeling comfortable doing what they do in their homes or roles at the company.

Besides the three motivations, Pierce and his colleagues have discovered “routes”, i.e. what people do to own, that help them reach the three motivations, providing a framework to design a greater sense of ownership. They are 1) control, 2)self-investment and 3)intimate knowledge (Figure 1). Control refers to a person’s ability to access and control the target ‘possession’, which responds to the desire for ‘efficacy and effectance’ mentioned previously. For example, people can change the setting of their phone to supports the sense of ownership. Self-investment means the person invests ‘personal resources such as time, money, physical effort and psychological energy into an object’ (Baxter, et al., 2015). For example, the building experience of IKEA products creates a stronger attachment between the user and the products (Norton, 2011), fulfilling their demand for ‘self-identity’ and ‘efficacy and

effectance’. Intimate knowledge means gaining knowledge of the target ‘possession’ through use or interaction. For example, people often find a pattern of how the brake of their bike responds to them differently from other bikes, which can increase their sense of ownership.

Based on these theories, Baxter, et al. discovered multiple ‘affordances’ to achieve each route (Figure 1) (Baxter, et al., 2015). The word ‘affordance’ is often used within User Experience design, meaning the possible interaction between user and object, helping users define their actions. In the context of PO, affordance refers to “how well the target of ownership allows an individual to control, intimately know, and self-invest” (Baxter, et al., 2015). This discovery provides insightful and direct instruction on what to include in a design to support a greater sense of ownership. The ideation stage of this dissertation is inspired by these affordances and modified based on the context of sharing, which will be discussed and explored in detail in chapter five.

Psychological Ownership Theoretical framework

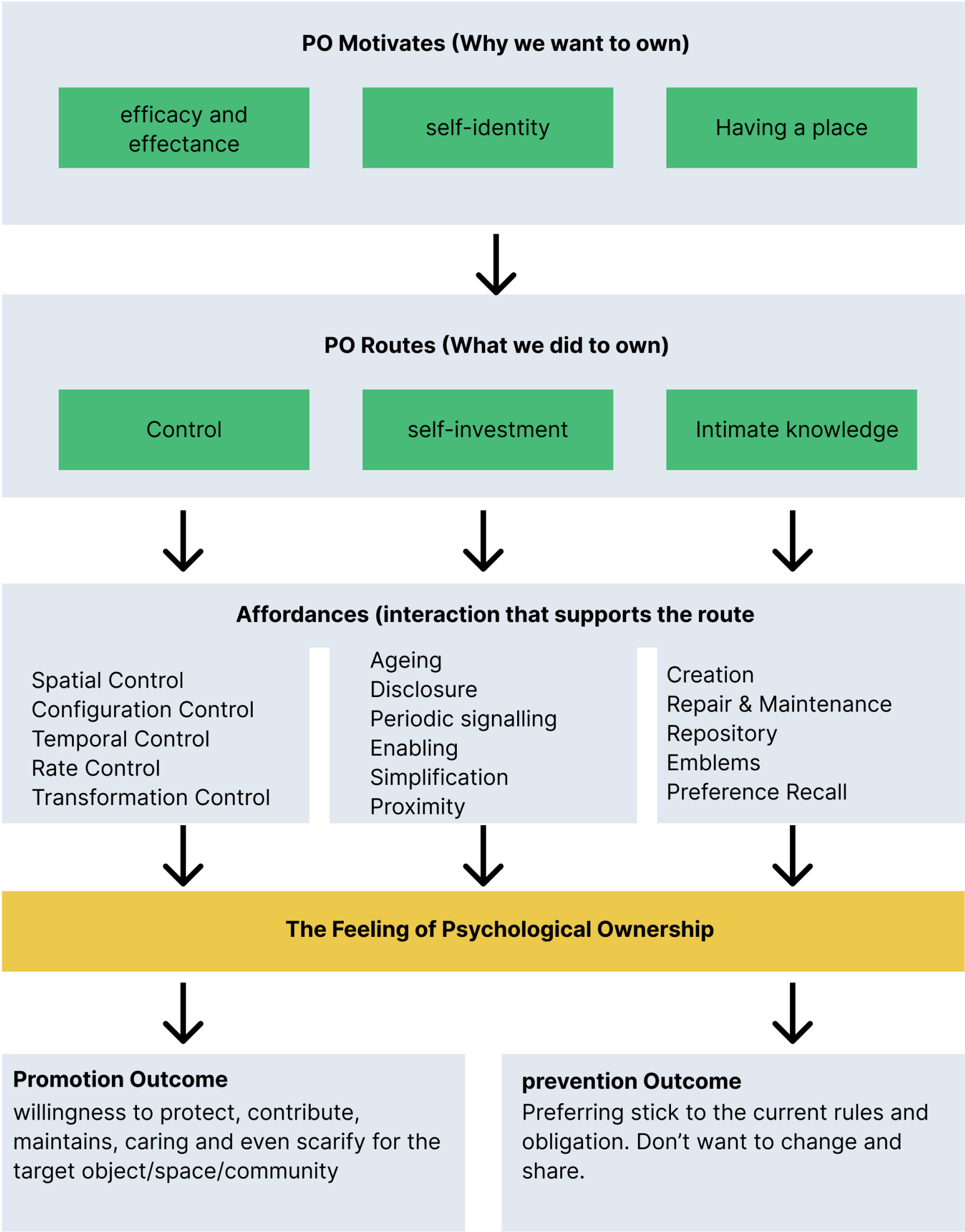


Figure 1 Psychological Ownership Theoretical Framework Summary

2.3 The Sharing Experience

The experience of sharing can be found in many products and services. Most of them take the form of rentals and leases such as hotel rooms, shared cars, and customer-to-customer sharing schemes like Airbnb. The benefit of sharing is obvious. By sharing products with others, we can spend less accessing products and services.

As a result of the rapid growth of population, limited resources and increasing difficulty for people to consume and own possession like in the past, the demand for sharing and other consumption models, such as car leasing, which does not require legal ownership, is increasing (Osztovits, et al., 2015).

While shared consumption does not require legal ownership, it is common to see PO occurring in the relationship between users and shared objects. As Baxter discovered, “users will describe accessed products in possessive language: my rental car, my online community or my hotel room.” (Baxter & Aurisicchio, 2018).

Unfortunately, while PO has a deep connection to our natural desire (Belk, 1988), the experience of sharing goes against all the motivations and desires to develop PO mentioned previously. For example, people want to use an object when they desire. However, due to its nature of being ‘collectively owned’, a shared object can often not fulfill such a demand (Gruning & Lindley, 2016), making people feel they are not in control. In addition, exchanging items between different users often means the evidence from the previous user can be found on the object, resulting in the current user being unwilling to use it. For instance, when people see other people’s items in a shared car, they are less willing to

use and protect them (Bardhi & Eckhardt, 2012). From their perspective, the objects are ‘contaminated’. With the short usage time of the shared object, many people do not want to invest the effort to mitigate the ‘contaminated surface’. Consequently, prevents people from having a good sharing experience.

The lack of PO results in the absence of responsibility and the desire for use. Products such as bicycles, cars and hot desks are often poorly treated by its user and have a short life cycle. According to some reports, a shared scooter’s average life only lasts 2-5 months. Some barely last a month, while personally owned scooters last for three years (Scott, 2021) (Aike, 2022) (Lekach, 2019). As scrapping and building a scooter brings enormous environmental impacts, it seems like sharing is not optimising the resource. Perhaps it is arguable to say that the sharing economy and access-based consumption puts extra pressure on our environment, and we are the ones who cause it due to our unfulfilled desires.

“Managing the complexities of the relationships between various people and objects should be a central goal of design research in the coming years”. (Baxter, et al., 2015), which is what the following chapters try to address.

Fortunately, the development of cloud technology and the mixture of data and physical products brings a new possibility to PO development. Aurisicchio and his colleague discovered that the PO of a phone or computer could be affected by the data it contains, such as the contents, layout, software and other elements within the digital interface, rather than fully defined by the physical device itself (Baxter, et al., 2015). This

is because people’s ownership target toward most data-driven products is the digital possession instead of its physical ‘container’. However, as it is difficult for our cognition system to articulate the difference between digital and physical possession, people often mix the two different ownerships target (Odom, et al., 2012), resulting in digital possession being able to affect the sense of ownership toward the physical possession. While such a finding means the study of PO will be more difficult, this dissertation views it as a possibility for developing PO within a sharing experience. By adding a ‘digital layer’ to the shared object and recalling it in each interaction, the user can quickly be helped with establishing PO toward the different physical objects.

A good example could be the memory seat in car interior design, which automatically recalls the position and angle of the seat for the driver. By adding a ‘digital layer’ to the seat, the user shifts their ownership target from ‘my seat’ to ‘my setting data’, which helps the user to establish PO quickly even if the car is shared between few different users (Baxter, et al., 2015). However, a single interaction cannot define PO and sharing experiences, as people can feel the different intensities of ownership through the user journey (Cedeño, 2022). Therefore, to develop a better sharing experience through the lens of PO, it is essential to go beyond the single interaction, understand and construct the PO through the lens of the user journey and user experience design. By taking a systemic design approach, the project offers valuable insights that help other designers and organizations develop better shared products.



Chapter Three

Methods

and Project

Planning

This dissertation project took a Research through Design (RtD) approach developed by Stappers and Giaccardi (Stappers & Giaccardi, 2014) and utilized cultural probes and interviews as the primary methodologies. The research targets were the shared desks at the Design Informatics studio at the University of Edinburgh, and the users were Design Informatics students. These parameters were chosen for the following reasons. 1) Shared desks are very common within sharing experiences, meaning the knowledge from the study can be applied to other shared targets such as shared rooms, offices and cars. 2) The shared desks at Design Informatics studio and the users are easy to access, reducing the time spent looking for participants, planning interviews and setting up user testing workshops. 3) Desks are clear ownership targets compared to targets such as space, ideas, and organisation. This makes it easier to communicate with participants and find insightful patterns. The project involved six participants for qualitative research. The participants were informed of all the activities in the project and had the right to leave at any time. All of them gave consent to have their data collected during the project. The table below provides a summary of the participants in this project.

The project was structured into five stages based on the ‘Design thinking process’ (Dam, 2022). The five stages are Empathise, Define, Ideate, Prototype and Evaluation. This approach allows the project to be structured better and understand the problem in a human-centric way (Dam, 2022), enabling a better understanding of the relationship between the PO and sharing desk. Each step included detailed research methods that helped the project move forward and generated new knowledge related to the research topic. To further supplement this knowledge and understanding, I asked for informal feedback from the participants throughout the process. In this chapter, the dissertation explains the methods and processes based on the ‘Design thinking process’ in greater detail.

Participant	A	B	C	D	E	F
Gender	Male	Female	Female	Male	Female	Female
Year	2	1	2	2	2	2

3.1 Empathize

The empathize stage aimed to collect data on the PO journey and how ownership occurs and develops in the context of sharing. Parallel to the literature review communicated above, the project has included cultural probes (Interaction DesignFoundation,, n.d.) and semi-structured interviews (Fylan, 2005).

3.1.1 CULTURAL PROBE

Although the concept of PO is not hard to understand, most people might not reflect on their relationships with surrounding objects with such a theory (Odom, et al., 2012). Therefore, directly approaching participants with interviews might overwhelm them. As such, cultural probes are a more gentle way to start user research because they offer the participants time and space to reflect on their relationship with their possessions and expose them to the topic, allowing for deeper engagement in the interview.

The cultural probe aimed to 1) learn how people take ownership of desks. 2) investigate the difference between individual ownership and share ownership. 3) create a method to measure the qualities of PO during the user journey, which provides a reference point for the evaluation stage. Most PO measurement methods today focus on the overall ownership experience of the target object instead of looking into the user journey (dyne & Pierce, 2004) (Avey, et al., 2009), which not able to provide actionable points for redesigning the user experience (Olckers & Zyl, 2017).

The cultural probe used in the dissertation was designed based on the PO mapping method created by Cedeño (Figure 2), which enables us to identify the weakness within a user journey and ‘understand the time dependent qualities of ownership’ from a user experience approach (Cedeño, 2022). However, Cedeño’s PO journey map cannot be directly applied to the cultural probe because 1) its language targets designers or researchers, meaning that users who do not have a relative background in design or PO might struggle to understand some of the wording. 2) although the method provides a space for the participants to ‘rank’ their sense of ownership alongside the interaction time, the lack of a ‘scaling system’ or any reference points such as grid and number may result in participants having different standards during the process, making the data hard to compare and learn from. 3) the ‘interaction stage’ of the PO mapping is not flexible, which is essential because everyone understands their ownership journey differently.

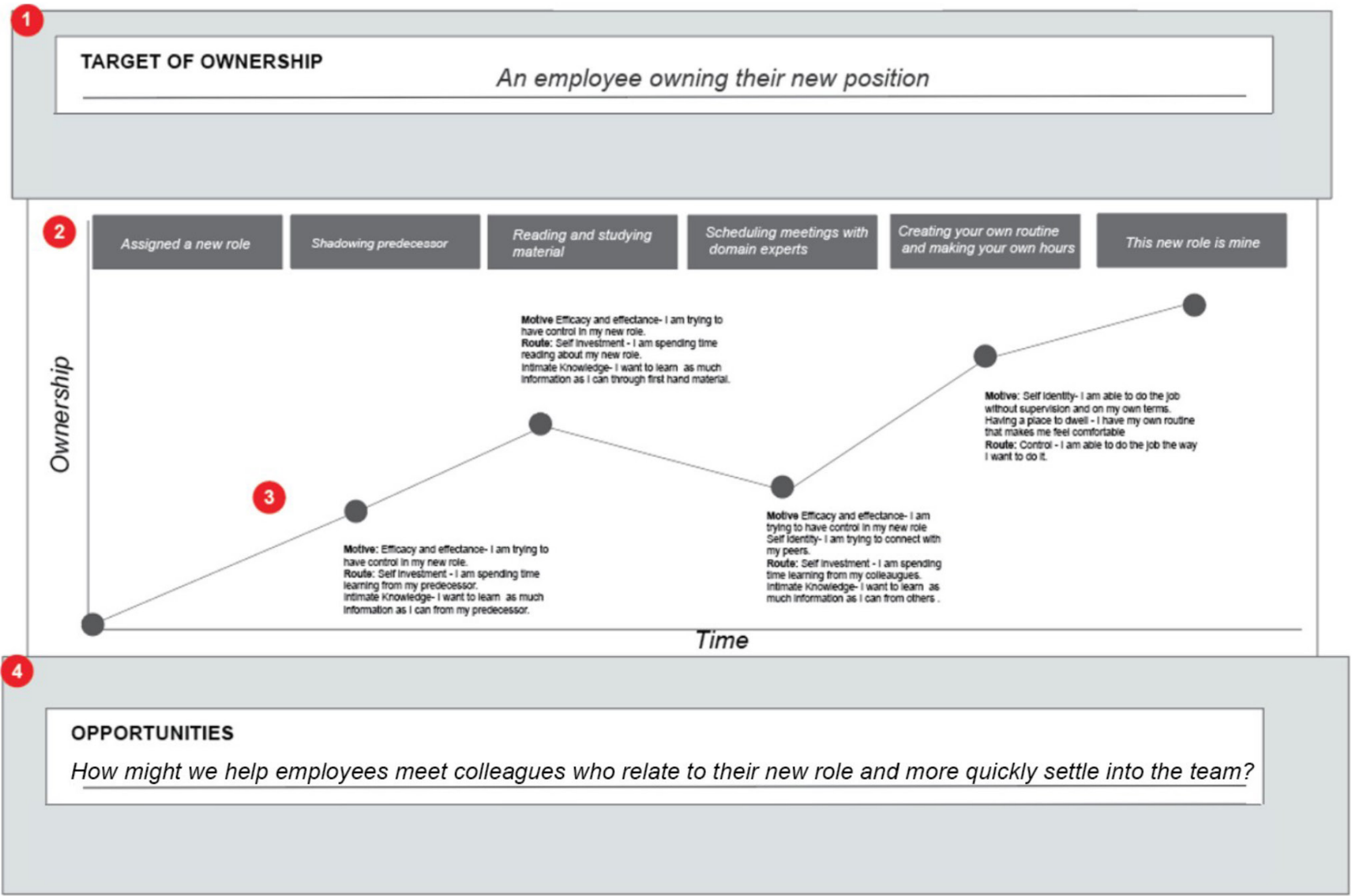


Figure 2 Psychological Mapping method from Cedeño (Cedeño, 2022)

To better adapt the probes for the intended participants, the project combined the PO mapping from Cedeño with the “Psychological Ownership Scale (POS)” developed by Dyne and Pierce (dyne & Pierce, 2004). The POS includes explicit instructions explaining the concept of PO to its user, ownership-related statements that need to be verified, and a five-point attitude scale that allows users to choose from each question. This dissertation reused the ‘instructions’ from the POS for the cultural probe because it was clear and has been field tested in many other studies. The final cultural probe also included a five-point Likert scale into the user journey map, which allowed for measuring the ‘qualities of ownership’ in a ‘scientifically accepted and validated manner’ (Joshi, et al., 2015) (Olckers & Zyl, 2017).

The finished cultural probe included two ‘sections’, and each ‘section’ included seven identical ‘components’. Section one (Figure 4) investigated users’ relationship with their desks at home. Section two investigated their relationship with the shared desks at the Design Informatics studio. The identical components allowed for a more accurate comparison of the two ownership journey differences. The first component explained the concept of PO, which was modified from the POS (dyne & Pierce, 2004). The second component communicated the target object for study. The third component explored the frequency of use with a six-point time scale. The fourth component asked the participants to upload photos of their personal and shared desks, providing visual references to their environment. The fifth component asked participants to describe their interaction steps, giving insights into their actions. The sixth component asked the participants to choose from a five-point Likert scale how their actions at the fifth component affected their feeling of ‘ownership’. The seventh component was different depending on the section it was in. In the section that focuses on the participant’s personal desk, the seventh component asked the participants to think about what might change their feeling of ownership in the future, providing extra insight into their idea of ownership. The seventh component in the section that focused on shared desks asked participants if anything could improve the ownership journey, leading to potential design opportunities. The cultural probe was sent to participants for a week for data collection.

The cultural probe was tested with a student in Design Informatics before sending to the participants. During the test, the student was asked to try to complete the cultural probe without instruction. The student provided feedback on some of the wording, which was adjusted for the final version of the cultural probes. Overall, the cultural probe was straightforward to finish.

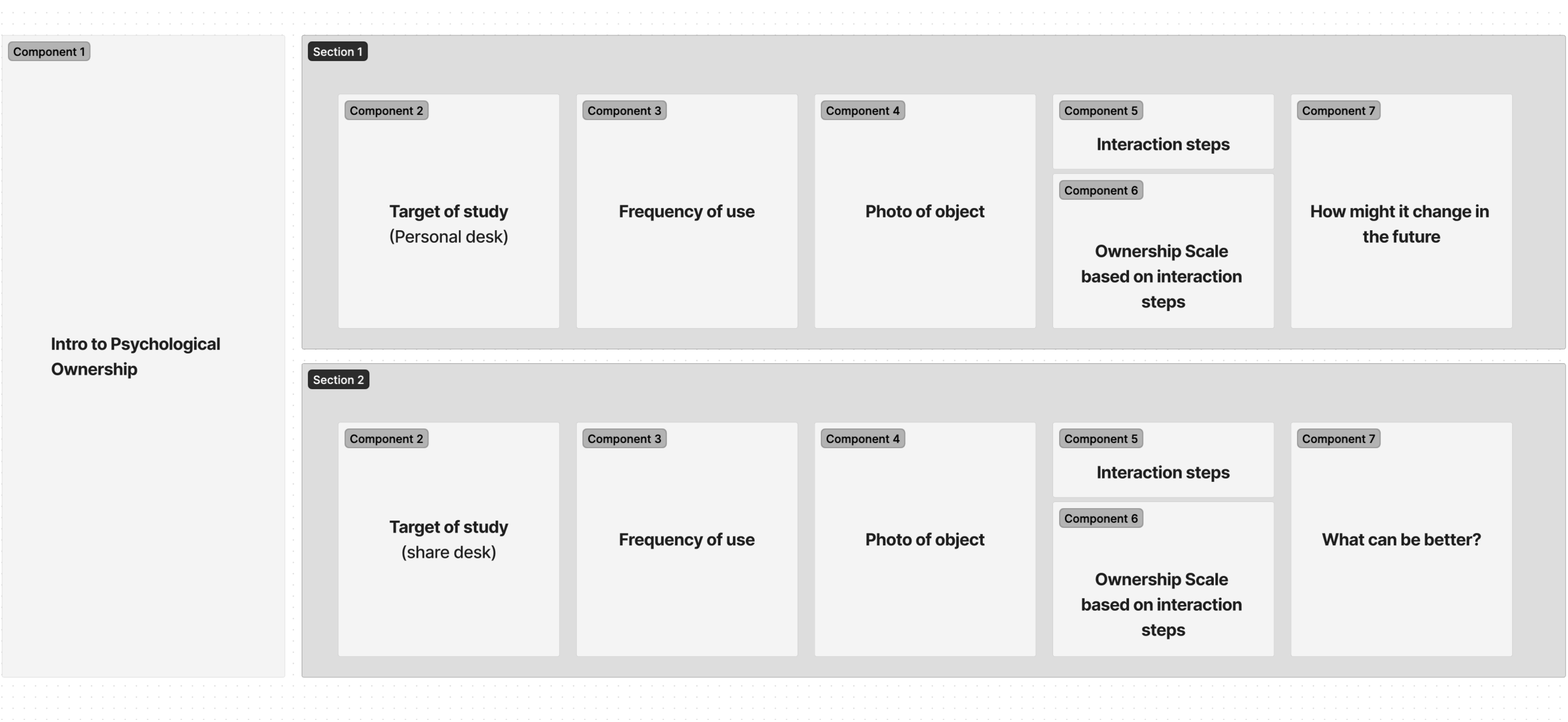


Figure 4 The cultural probe framework

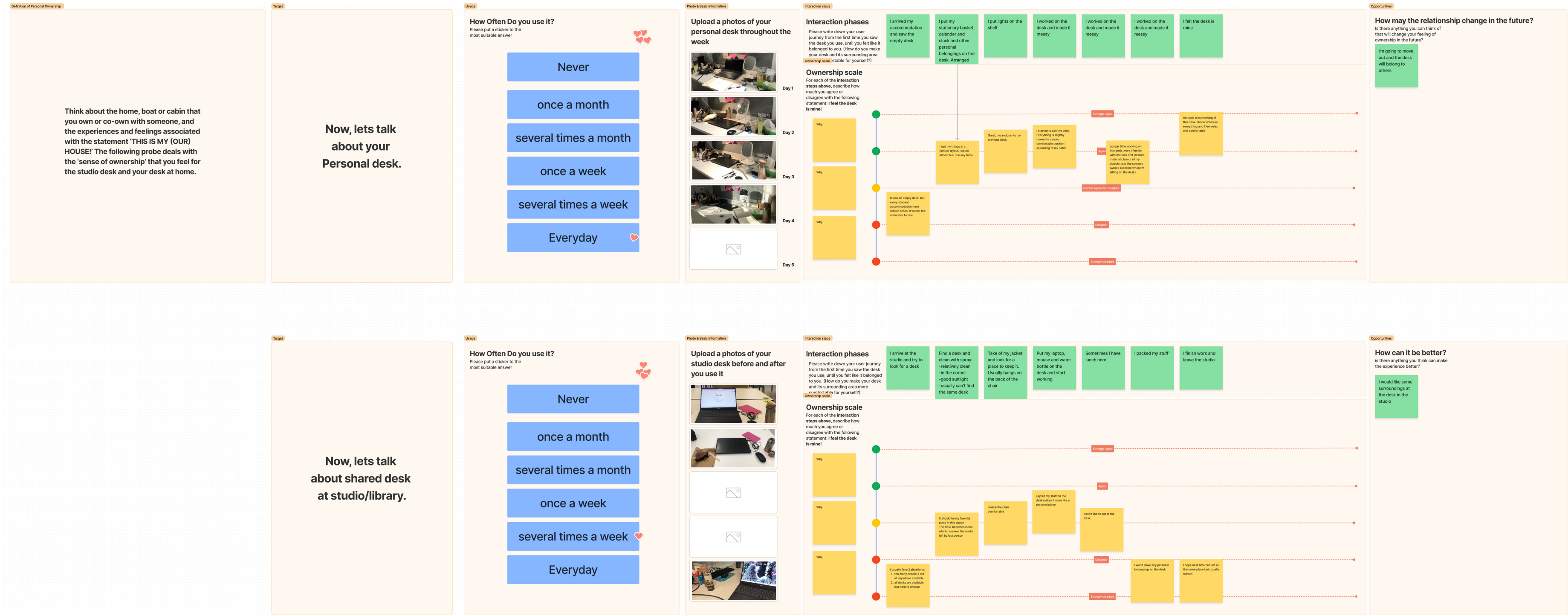


Figure 5 The cultural probe for the project.

3.1.2 SEMI-STRUCTURED INTERVIEW

The semi-structured interview was designed to fill any gaps from the cultural probes, understand the PO motivation behind the user journey and explore actionable design directions. Unlike the typical ‘structured interview’, in which questions are predetermined in topic and order, the semi-structured interview is “a data collection method that relies on asking questions within a predetermined thematic framework” (George, 2022). Such a method provides flexibility within the conversation and enables better engagement between the interviewer and participants. As a result, the interview can include more detail and richness of the collected data. Suitable for the type of interview with an ‘exploratory nature’ (George, 2022).

The semi-structured interview was structured into multiple one-on-one sessions that lasted for 30 minutes. Such a setup best protects the participant’s privacy and creates a comfortable environment for sharing personal experiences. The interviews were audio recorded and transcribed with Microsoft Word audio function for analysis.

The general questions were structured into three sections. The first section aimed to ‘warm up’ the conversation with simple questions such as “how do you personalise your desk at home?” The second section revisited the user journey sections from the cultural probe, aiming to understand the motivations behind some of the participants’ actions. For example, why participants used the desks in the studio even when they felt a strong sense of ownership of their desks. The third section aimed to identify the ideal shared desk experience.

3.2 Define

The Define stage aimed to analysed the data collected during the empathize stage and generate design directions. To do this, an understanding of the participant’s motivations, actions, the current gaps and what users seek in a sharing experience was needed. The result from the define stage will be covered in chapters four and five. While chapter four focuses on the research data analysis, chapter five uses the insights from chapter four to explore the goals and directions the design should take. This chapter focuses on the methods been used.

3.2.1 THEMATIC ANALYSIS

As most data are qualitative data, this dissertation used the ‘deductive approach Thematic analysis’ for data analysis. Thematic analysis is a ‘method for analyzing qualitative data that entails searching across a data set to identify, analyze, and report repeated patterns’ (Kiger & Varpio, 2020). The deductive approach means analysing the data based on a pre-existing framework (Kiger & Varpio, 2020). The interview data was analysed based on Baxter’s Psychological Ownership framework (Baxter, et al., 2015). This framework aims to understand research data through three stages: Motivations (Why people want own/what stops people from owning), routes (what people did to own) and consequences (what consequences come after). Such an approach allows for an understanding of ownership through the lens of the user journey. As a result, the end of this stage produces valuable insights related to the PO journey of shared ownership and what the user is looking for within a sharing experience. This led to the generation of design concepts during the ideation process.

3.3 Ideate

Following the Define stage, the ideate stage aimed to produce design concepts based on the research.

3.3.1 STORYBOARDING

The storyboarding technique is originally from the animation and film industry. Artists use them for designing and refining their stories by visualising the critical sense from start to finish (InstructionalDesign.org, 2023). User experience designers and service designers prefer approaching design through the whole user journey instead of a single interaction (Interaction Design Foundation, n.d.), which means storyboarding can be an excellent tool for designers to visualize their concepts (Ideo, 2015). By applying the storyboarding technique in the ideation stage, a sharing experience can be built, which can cover all the gaps discovered during the define stage and help refine ideas by asking for user feedback.

3.4 Prototypes

The prototype stage went hand in hand with the ideate stage, which aimed to bring the artefacts within the user journey to life for the evaluation stage. The prototyping stage started with making low-resolution prototypes from the storyboard with paper or cardboard, which quickly communicated the ideas to the user for feedback and refining the design. Once there was a solid idea, a more well-made final prototype was created for the evaluation stage, allowing for a systematic examination of the design. Note that the dissertation focuses more on the experience, so there was no plan to build a fully functional prototype. The prototype was for demonstrating the idea and testing the interaction, not representing how the system works in real life. The final experience was communicated through the storyboard.

3.5 Evaluation and Discussion

The dissertation systematically reviewed the design outcome in the evaluation stage with a user testing workshop. The workshop was conducted in multiple one-on-one user testing sessions, which simulated how the sharing experience worked in real life (one person at a time, but the participants were aware that other users would be using the desk). At the beginning of the workshop, a storyboard that included the whole user journey was presented to the participants, giving them a brief understanding of how the design worked. Then, the participants were asked to sit in front of the desk and configure it to their preference. The next stage was a reenactment of the user journey, enabling the participant to experience the design in a tangible environment. During the interaction, components 5 and 6 (Figure 4) from the earlier cultural probes were reused as a tool for the participant to map their PO experience throughout the user journey, allowing for comparison with the original experience. A short semi-structured interview (George, 2022) was conducted at the end of the user testing workshop for the participants to reflect on their interaction with the sharing experience and identify potential drawbacks. Questions such as: 1) how would you describe your overall experience with this product? 2) what is the most impactful feature you found? 3) how would you improve the experience and why? Were asked in the interview.

Chapter Four

Research Results

Cultural probes and interviews explored how a sense of ownership develops for shared and personal desks. This resulted in a large amount of qualitative data related to the user experience. Using thematic analysis, valuable insights were gained into the nature and strength of PO within shared interactions. In this chapter, critical insights are discussed based on the PO framework (Figure 1), analysing the data through the lens of motivations (Why people want own/what stop people from owning), routes (what people did to own) and consequences (what consequence come after) within the context of the shared desk.

4.1 Motivations

4.1.1 LACK OF CONTROL

During the research, it was apparent that most participants did not have legal ownership of either desk, as their desk often belonged to the student accommodation or rented properties they were staying. All participants demonstrated a significantly different ownership journey between their personal and studio desks through the cultural probe. Participants felt a strong sense of ownership towards their personal desk earlier in the interactions compared to the shared desks, where it took much longer to achieve the same level of Psychological Ownership. In most cases, the shared desk’s Psychological Ownership level never got as strong as that of the personal desk. Although the cultural probe showed an attempt from participants to take ownership of the shared desk, the ownership curve in the PO mapping remained low in most cases. As participant D explained in their interview: “I feel ownership when I have an allocated desk... but with the desk in the studio, I do not even know where will I sit the next day...it feels there is no control. I do not bother to develop ownership since I have no control and only sit there for half day”

It appears the short engagement time and unpredictable ownership targets often make users think they cannot develop complete control of the table. This is reflected in Bardhi and Eckhardt’s work (Bardhi & Eckhardt, 2012). Basic motivations for PO, such as access to the table whenever they desire, were not fulfilled. This resulted in the user is not willing to invest and develop ownership over the object.

Helping the user to establish an ownership target, i.e. which desk will be theirs, before the interaction could be a way to help them gain a sense of control over the desk, which might help establish PO quicker at the beginning of the user journey.

Figure 6 PO journey of participant B's personal desk

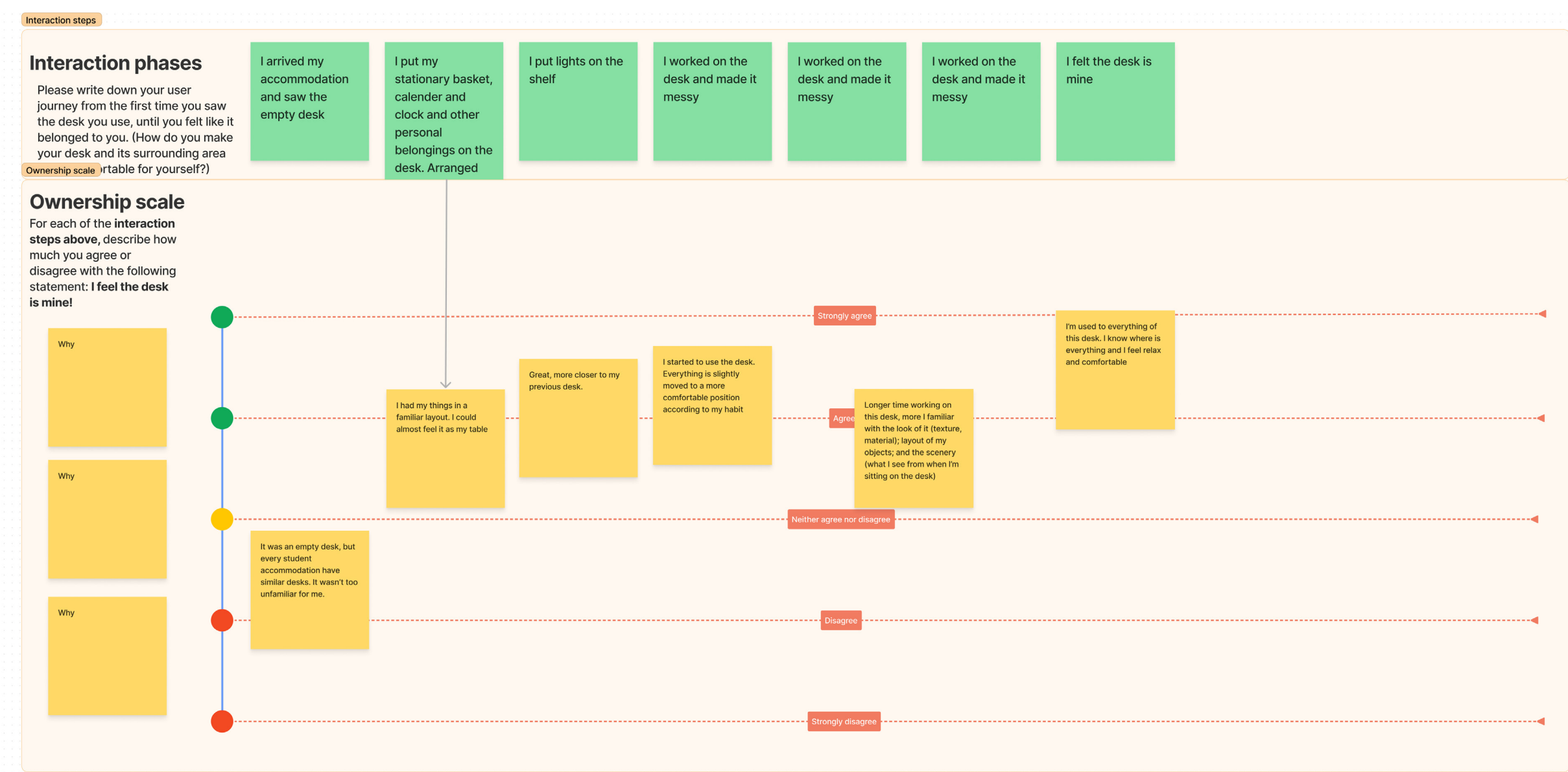
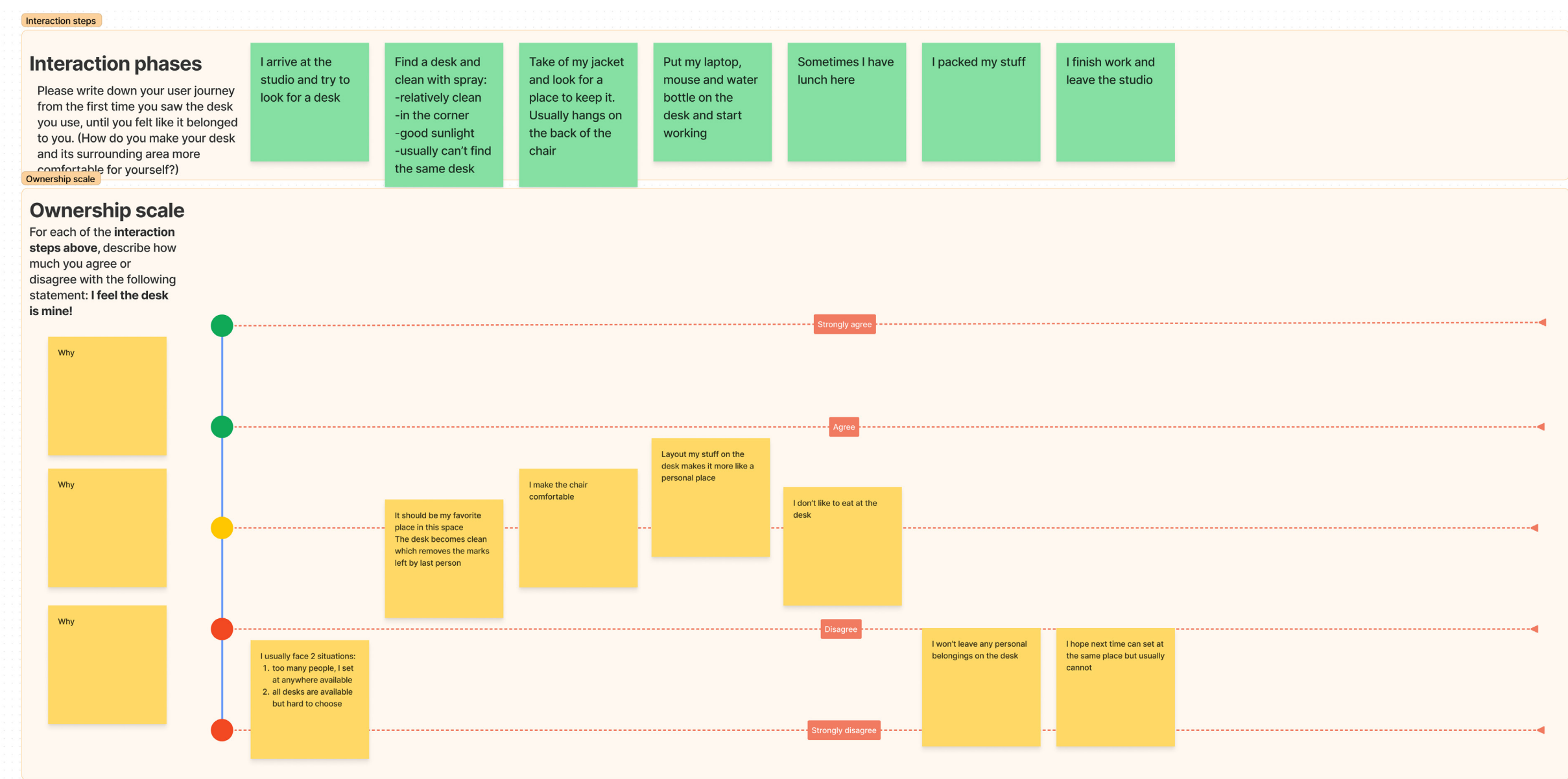


Figure 7 PO journey of the shared desk for participant B



4.1.2 HAVING A PRODUCTIVE PLACE

While people claimed they felt a strong sense of ownership over their personal desks, almost all participants showed high usage of the shared desks in the studio (Figure 8), at which they had less comfort and felt less control. It appeared that the studio desk offered something their personal desk could not. When participants explained their actions during the interviews, the answers were almost identical among all participants.

Aa participant D explained: “It is comfortable (at home), but when it is comfortable, I will want to do something comfortable and do not want to work at all. Therefore the environment here makes me more productive and less guilty of not working”.

Participant A mentioned, “Yeah, the home environment is very comfortable, but that will make you feel very comfortable, and then you may not be able to focus on what you want to do. The studio environment will make you feel a little cramped and restrained. Yes, but it will also make you feel I can concentrate more on what you want to do

now. I believe people cannot make themselves too comfortable if they want to get things done.”

Participant B mentioned, “I cannot study at home. The atmosphere there is not for study”.

The motivation for ‘having a place’ between private and shared desks seems to differ. While it means having a comfortable place to ‘live’ at home, the users are looking for a ‘working atmosphere’ at the studio, which they will even trade for part of their comfort. Note that there was still a need for comfort, as users would use personal items such as laptop stands, mouses or cups to support their work, but they put in less effort compared to how they made their desks more comfortable at home. Most items they brought to the shared desk were related to productivity.



Figure 8 Participant A shows they use the shared desk a lot, same as other participants

4.1.3 LESS DEMAND FOR EXPRESSING SELF-IDENTITY

Following the previous insights that demonstrated how PO motivation could manifest differently in shared objects, the interviews also showed that participants care less about expressing themselves in the context of shared objects. Nothing indicated the need to express self-identity when using a shared object in interviews or cultural probes. Although personal items played an essential role when using shared desks, the motivations were not based on expressing self-identity but instead, on gaining control. This will be discussed further in the next section.

Due to the importance of a productive environment in the user’s motivations, which is related to the desire for ‘efficacy and effectance’ (Pierce, et al., 2003), self-identity was a lower priority in the context of the shared desk.

4.2 Route

4.2.1 PERSONAL ITEMS AS FORM OF CONTROL

During interviews and cultural probes, evidence showed that personal items play a significant role in the ownership journey. In both personal and shared desks, the rise and fall of ownership had a solid connection to the participants’ items. Take participant D, for example. As a student living in student accommodation, D’s personal desk was designed to be part of the room. It was fixed to the wall and not adjustable. As a result, he used his personal items as an alternative method to make the space comfortable. In the cultural probe, he wrote: “These devices have helped me to build a fortress of my comfort, and I would not move them at all, because at least in this long period, I feel this table is mine”. In the shared desk context, personal items play a similar role. For example, participant C pointed out during the interview, “I think I could get used to that shared desk very quickly if I see my setup is there.”

As the research dove deeper into what PO motivation the personal items were associated with, there was a significant difference between shared and personal desks. Within the context of a personal desk, personal items

were strongly associated with the self-identity motivation of PO, in which the items were used as decorations for the desk to express self-identity. Participant E said: ‘I felt I had many decorations because I wanted to decorate my room well when I first moved in. So that I feel the place is mine. I even thought of a colour...’.

On the other hand, the personal items on the shared desk seemed closely associated with the ‘efficacy and effectance’. Most participants used personal items to control the place and prevent others from using it so they could use the desk anytime. For example, participant C mentioned putting a sweater on the chair to signify that she would return to prevent other people from sitting there.

Besides the ‘efficacy and effectance’ motivation, personal items also fulfilled the ‘having a productive place’ motivation in two ways: 1) personal items helped create necessary comfort for a productive working environment. 2) the presence of personal items at the beginning of the

ownership journey created a sense of belonging to the user, allowing them to feel welcomed and comfortable. As a result, users felt they could access the place as desired. Evidence of this could be found during the interview when several participants tried to describe a good share desk experience.

Participant C: “Bringing everything back and forth each time is quite a lot of work. I kind of wish that all those things were already here... I think I could get used to that desk very quickly.”

Participant D: “I used to leave my computer directly.... So when I came the next day, I was welcomed by these setups and felt the table was mine.”

4.3 Consequences

4.3.1 CONTAMINATED INTERACTION

While personal items were used as a significant route for users to fulfil their PO motivations, they also negatively affected other users. Because the ‘leave behind’ personal item becomes the evidence of another user on the shared object, the previously mentioned ‘contaminated interaction’ develops. Preventing other users from using. For example, while participant C put a sweater on the desk to gain control, participant E mentioned during the interview: “I have recently thought of C’s sweater on the chair. It is very powerful. For some reason, I do not understand; I will not want to sit there.” Participant D also mentioned how trash or other people’s items prevent his seat at that table: “I will not choose a

desk that has any item on it. I will always choose an empty one”. As a result, shared ownership enters a bad loop. While users used their items to claim ownership, these items ‘contaminated’ the object, preventing other users from using it.

To summarise, unlike objects one person owns, the shared desk demonstrated a different relationship with its users. Not all three PO motivates need to be fulfilled. Participants cared less about expressing themselves but looked to have more control of the table for productivity. The desk and surrounding environment do not offer much to help

increase this sense of control, so participants used their items to modify the desk and fulfil their motivation. Consequently, their items prevented others from using the desks. These situations are not ideal for developing a beneficial sharing experience, as items were not fully used or correctly treated. Perhaps the desk could provide an alternative affordance to the user to achieve the same motivation without relying on personal items.

Chapter Five

Design Ideation

“People often choose products not because of what they are but because of their location. If I walk into the kitchen and see a plate of cookies on the counter, I’ll pick up half a dozen and start eating, even if I hadn’t thought about them beforehand and did not feel hungry. If the communal table at the office is always filled with doughnuts and bagels, it will be hard not to grab one now and then. Your habits change depending on the room you are in and the cues in front of you”. (Clear, 2018)

What James Clear says is that our behaviour is often affected by what the surrounding environment and objects ‘offer’. These ‘affordances,’ or what Clear calls the ‘cues,’ from the object help users to define what actions they should take (Norman, 1988). Such principles are broadly used in UX design for defining the relationship between people and objects (Interaction Design Foundation, 2023), which can be used for this project. If the appropriate ‘affordance’ is offered during the sharing experience, a better PO can be constructed within the shared journey.

Based on user research, the desire to have more control and a productive place, motivated the users to take ownership of the desk. However, because the desk itself had little to offer, users’ items became the affordance for the users to configure the space and take ownership of the desk. The use of personal items was a double-edged sword. While they helped users increase their sense of ownership, users did not want to remove the ‘effort’ they invested. Thus, the personal items turned the desk into a ‘contaminated object’ for other users. With the short engagement time, no one wanted to put much effort into mitigating contaminated objects and developing PO. The nature of the shared object also meant the users faced unpredictable ownership targets. This meant they did not know where they would be sitting before their arrival. Resulting in insecurity, preventing them from fulfilling the ‘efficacy and effectance’ and ‘having a place’ motivations.

Therefore, a well-designed shared desk is needed to achieve the following goals. 1) help the user establish control and comfort without relying on the user’s items. 2) ‘clean up’ the ‘contaminated surface’ for the following user by reminding the last user to take their belongings. 3) allow the user to feel ownership, control and have an ownership target while not using the desk.

Based on the PO route mentioned in chapter two, Baxter and his colleague identify 16 ‘affordance principles’ (Figure 9) of how an object can be designed to aid the development of PO (Baxter, et al., 2015). However, as most examples Baxter includes in his research are based on single-user ownership, some affordances are less critical within the context of sharing. For example, ‘ageing’ seems less necessary when using shared objects, as the user does not expect a long engagement

time with the desk.

In this chapter, these affordances will be analysed using insights from chapter four. Identifying the key affordances that should be included in the design, to help users achieve their goals. Note that not all the affordances below are based on the Baxter’s 16 Affordance principles. This dissertation proposes new affordances that are more suitable within the context of sharing and help fill up the gap within the user journey.

Affordance principle	Description
<i>Control</i>	
Spatial	Physically manipulate the object
Configuration	Arrange the object settings
Temporal	Use of the object when desired
Rate	Use as much of the object as desired
Transformation	Change the object as a result of interaction
<i>Intimate knowledge</i>	
Ageing	Capture stories in object changes as it ages with the user
Disclosure	Convey origins and former experiences
Periodic signalling	Communicate on an event-dependent basis
Enabling	Mediate meaningful experiences
Simplification	Eliminate distractions
Proximity	Communicate through closeness
<i>Self-investment</i>	
Creation	Bring something or part of something into existence
Repair and Maintenance	Service the object
Repository	Collect and store valuables within the object
Emblems	Signal information about identity
Preference recall	Remember previously established preferences

Figure 9 the 16 Affordance principles (Baxter, et al., 2015)

5.1 Beginning of The PO Journey

5.1.1 CONFIGURATION CONTROL

Configuration affordance refers to the functions that allow the user to arrange the object based on preference. The user research insights demonstrate how vital configuration affordance is within shared ownership. The shared desks did not offer configurable functions, so users often used their personal items as an alternative. Therefore, if the desk could offer certain degrees of configuration based on the user’s preference, such as a car allowing its user to adjust the seat, steering wheel and radio (Baxter, et al., 2015), it should help users feel comfortable and establish ownership quickly.

Unlike a configurable car seat which aims to provide physical comfort to the user, the configuration affordance for the shared desk should also focus on supporting the need for a productive environment. Inspired by what participant C said during the interview: “I kind of wish that all those things were already here. What if there is any way that the desk could come with the things I need from it, so if there is already a keyboard in it or it is higher for me”. An option here was to design a desk that included all the essential items that each user needed when using their studio desks, such as a plug, keyboard, and light. This way, the desk offered more control to the user and supported them to have a productive space without relying on their personal items.

5.1.2 TEMPORAL CONTROL

Temporal affordance is the ‘ability to use the object when desired’ (Baxter, et al., 2015). Users were often unable to access the desk when they wanted to, resulting in them using personal items to mark the space. Facilitating the feeling of temporal control into the user journey was another option to improve the shared desk experience. An appointment system that allowed users to choose their desks would provide a feeling of temporal control. By ‘forcing’ users to choose the desk they wanted to take ownership of, they established an ownership target and expectation of the desk before they come to the studio. As a result, they could often still feel they had access to the desk they wanted whenever they desired.

5.1.3 PREFERENCE RECALL

Preference recall refers to remembering settings based on the user’s initial configuration of the object, such as how a memory car seat can remember the user’s preference. In the context of the shared desk, the preference recall function went beyond a single desk, the user’s preference would be recalled for any desk the user wanted to use. The combination of preference recall and configuration affordance was key to promoting a sense of ownership at the beginning of the user journey.

5.1.4 TERRITORY PROTECTION

Territory protection is a new PO affordance, which was discovered based on user research. It means the ownership target (the desk) can defend itself from others to take ownership and only opens to the assigned user. During user research, participants often mention how they used their items to mark the ‘territory’ to prevent other people from using it. This caused a terrible sharing experience. Suppose the desk can help users protect their territory from other users. In that case, the need to use the personal item to mark decreases, and the user feels a sense of privilege with the knowledge that their ‘ownership’ is protected.

5.2 End of Journey

5.2.1 DE-CONFIGURATION

A good sharing experience needs a good solution for the contaminated surface. There are minimal guidelines to help achieve this goal. Therefore, revisiting the user research material for more insights is a good idea.

The research material demonstrated how the ‘affordances’ provided by the desk could affect the use of personal items. For example, participant C claimed she would only put her cup on the coaster on the table and would not put her cup there if the coaster was not there. Participant E also mentioned, “If the plug comes with the desk is broken, then I cannot sit there even if it is a perfect space. I cannot work on the desk if it does not offer what I need, I will pack all my stuff and move to another desk”.

It can be argued that by taking away the ‘affordance’ originally offered, the desk sends out a message to the user that their items are no longer welcome. What if the configuration provided to the user at the beginning of the user journey was removed at the end of use? Would it work as a reminder, asking users to clean up their things? For example, if the place the user plugged in their charger went away, would it convey that the desk no longer welcomed their items? Would it incentivize them to bring their charger home? If a laptop stand were provided at the beginning and was taken away at the end, would it tell the user to take their computer away? To mitigate ‘contaminated interactions’ the ‘de-configuration’ affordance could be integral to the design. De-configuration means resetting the desk, back to default, from the user’s preference at the end of the ownership journey.

5.2.2 VISUAL REMINDER

Direct stimulation of our senses with elements such as light, sound and smell are straightforward ways to raise our attention and highlight experiences (Lee, 2013). Examples can be found in the lights and sound on emergency vehicles, the smells from the restaurant and the taste of its food. Therefore, stimulating the senses could be a great way to remind users to clean their items, mitigating contaminated interactions.

Shared desks are often placed in public spaces, so it was essential to consider how the design would affect other users. With this in mind, the most practical sense to stimulate was the visual sense. It is the most dominant sense in our recognition system (Hutmacher, 2019), which provides a more significant impact, yet it also has the least effect on other users of the space.

5.2.3 FORCE REJECTION

While the previous two affordances worked as a reminder for the user, there was still room for the user not to pick up the cues and continue to leave their items on the desk. As a result, creating a more direct interaction to mitigate the contaminated surface was pertinent. The meaning of force rejection is like the Territory Protection affordance but reverses its target to the current user. By rejecting the user’s items at the end of use, the desk rejects the current user’s ownership and prepares for the following user.

A potential design direction to achieve both affordances is by applying robotic movement to the desk. Research from animacy in robotics demonstrated that our cognition system is reserved for perceiving motion. The movement of an inanimate object enables people to assign the object a personality, even though it is not alive (Schulz & Soma, 2018) (Nakayama & Yamanaka, 2016). Resulting in an improvement

in the affinity between humans and the object. In the context of the shared desk, adding characteristics to the desk to either help the user mark territory or reject their usage enables the user to establish a more personal connection with the desk. This allows people to respect the desk more during the user journey, and the desk can achieve the affordance and goals in a more playful manner which the user is more likely to accept, potentially avoiding the ‘prevention’ approach mentioned earlier.

Chapter Six

Design and Build

Based on the results from the ideation process, seven affordances were considered in the design. Through storyboarding techniques, different variations of design concepts were produced using different ‘components’ to respond to the affordances. Due to the limited time and resources available for this project, the final concepts aimed to respond to affordances with the most effective components to test the idea. More components and designs that can respond to the development of PO affordances are expected with further research, which will be covered in the evaluation chapter. The following chapter discusses the concept development process in more detail.

6.1 Concepts

6.1.1 CONCEPT ONE

The initial concept included a physical desk and digital software. The software was an interactive touch point that responded to the ‘configuration’ and ‘temporal control’ affordances. It allowed the user to change their setting anytime they wanted and prepared the user’s expectations of the target ownership every time before using the table. This filled up the interaction gap while the users were away from the desk. The physical table included three moving components: 1) an LED light strip. 2) a laptop stand. 3) 2 cup holders. The components worked as physical representations of the user configuration data, which would act and move differently based on who the user was. The physical representation of their configuration data extended their ownership target from digital to physical, offering a sense of familiarity that supported the development of PO. The LED light was a visual reminder for the user to remove their items at the end of the journey.

During the concept one user journey, the user needed to book and configure their table on the software. Once completed, the LED light on the table would turn red 15 mins before the starting time, sending a signal to any other user that the desk had been taken. Once the user arrived, they would use their student card to ‘log in’, activating the desk to recall their personal preference/configuration data with its tangible interface (Ishii, 2008). At the end of the user journey, the table would reset its surface after the user logs out from the table. The LED would blink if the user had forgotten an item.

The concept was presented to testing participants with a storyboard (Figure 11) and a rapid prototype (Figure 10). This received much feedback: 1) many users believed that although the LED light was an excellent personalisation feature, it was not necessary for the context of

the studio environment, because it might affect other users of the space. 2) the cup holder also appeared less convincing as there was a lot of variation in where participants would place their cups. 3) Conversely, the built in laptop stand received positive feedback. 4) a few users suggested replacing the decorative LEDs with a lamp as a thing they might use when they do not want to switch on the main light in the studio. 5) a fixed booking time slot did not fit in with how the studio desks are generally used. Most people did not know how long they would work in the studio. Resulting in people wanting to book more time than they needed.



Figure 10 quick prototype of concept one

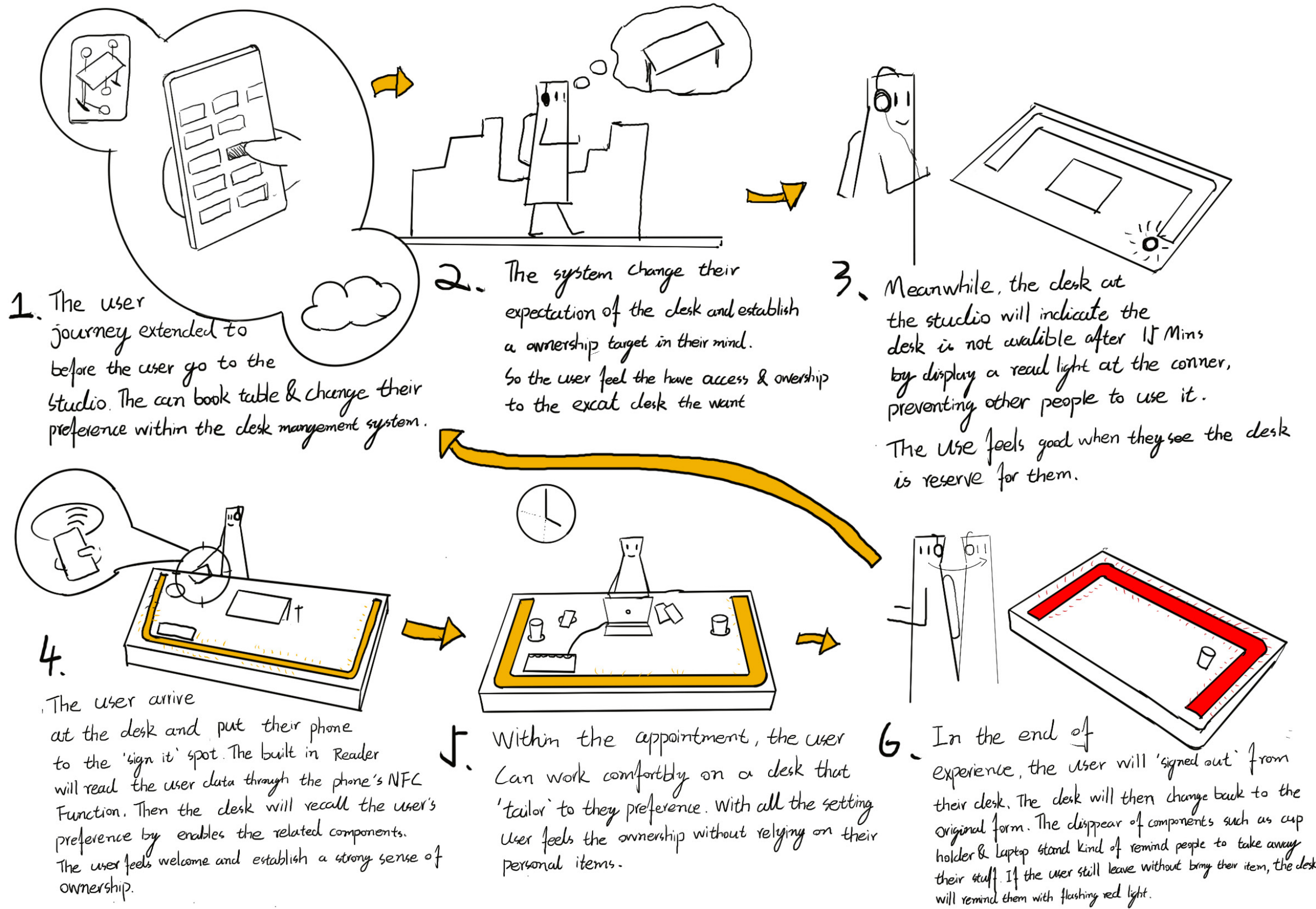


Figure 11 Concept one user journey

6.1.2 CONCEPT TWO

In the second variation of the design concept, the function and experience of the digital software remained the same, but there was no fixed time slot for the user to book. There was only a start time for the user, which gave them more freedom to access the table.

There was a significant change in the physical desk: A functional lamp that can stop at any position replaced the decorative LED strip. The cup holders were removed, providing more freedom for interaction. Inspired by the knowledge from animacy in robotics, humans often assign a personality and change how they interact with objects based on the object's 'movement'. Concept two added a wiper structure that has a similar movement to the wiper of a car. The function would prevent unrecognised users from placing their items on the desk to take ownership. The function would also 'force' the user to take away their items at the end of the user journey in a playful manner.

The user journey was similar to that of concept one. The user would start the journey by telling the system when they wanted to start. They could then work as long as they wanted after they had logged in to the desk. Once they logged out, the desk would become available on the booking system immediately. The desk would also remind the user to remove their items with a smaller scale LED light and finally a robotic arm would swipe any remaining items off the desk.

The concept was presented to the participants one more time for feedback. One of the main points brought up during the user testing was how logging into the desk, felt slightly unnatural and extra. A smoother, natural activation process would allow greater user-object attachment and PO development because technology would fade into the background and provide a better user experience (Mossberg, 2017).

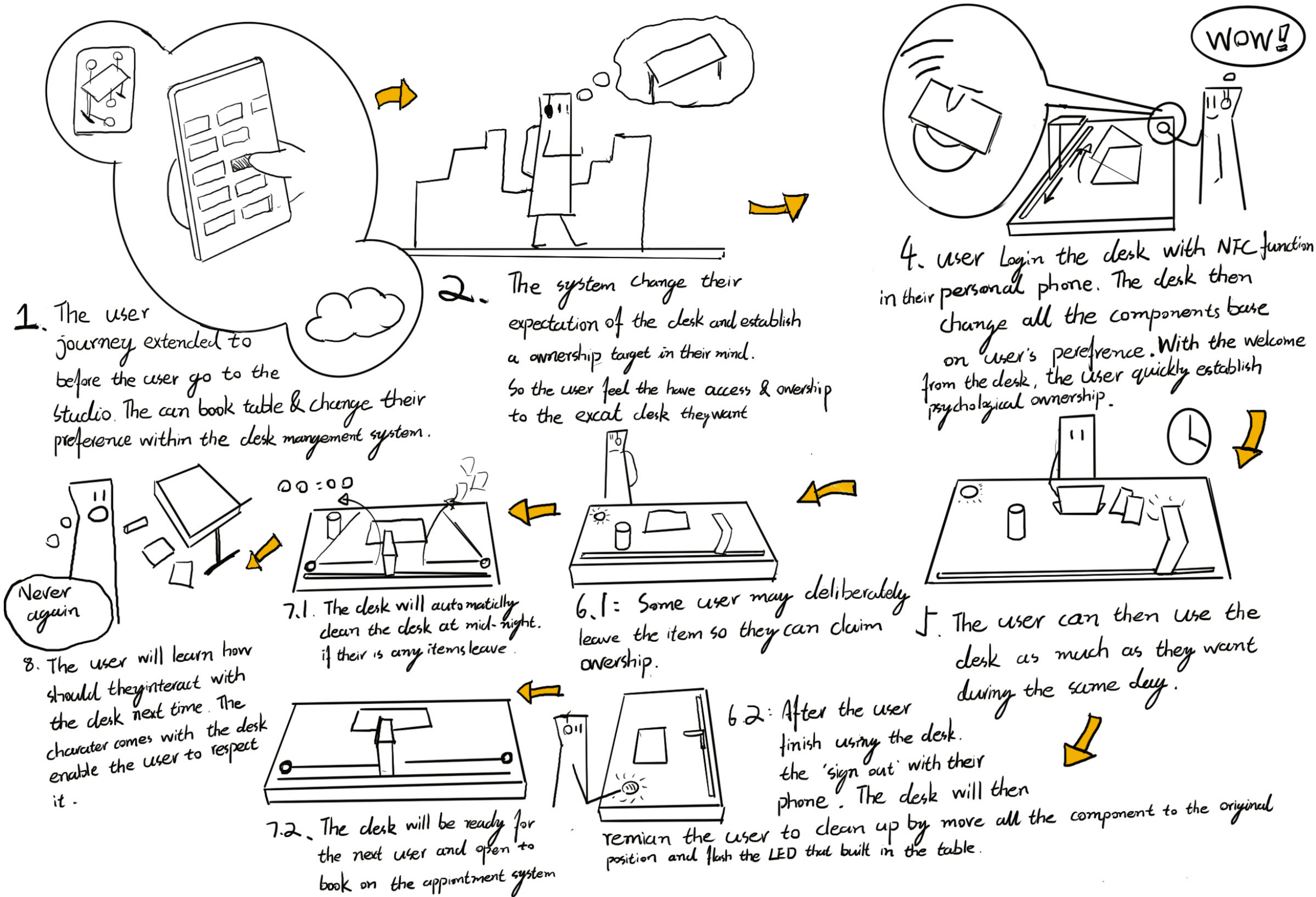


Figure 12 Concept two storyboard

6.1.3 THE FINAL CONCEPT

When refining the ‘activation’ process of the desk, an observation occurred at the studio that helped identify a better ‘log in’ interaction based on how users engage with the desk. One of the key findings was that almost all users begin their interaction by putting their items, such as laptops, phones, and water bottles, on the desk. These items work as a medium to mark the territory and expand the ownership target from a single object to the desk. If these items become the trigger to ‘log in’ to the desk would result in a much smoother interaction. With all the built-in contactless technology such as NFC and RFID, the smartphone appears to be one of the best options to smoothly activate the desk without the need for the user to carry extra hardware. Therefore, in the final concept, the whole desk surface was a contactless reader. The user would log in to the desk by placing their phone on it, anywhere they liked, and the desk surface would identify the user via their phone. Such design allows for a more engaging experience by hiding the technology

in the background. As the concept got more refined, it moved from the storyboard to physical making, in preparation for the evaluation stage. The final concept here does not refer to the ‘perfect’ concept. Instead, it is considered the last concept variation before the final prototype for the evaluation stage. The aim of this design was to demonstrate ways to apply design affordances to a shared object, which the success of which was evaluated in the evaluation stage.

User Journey Map

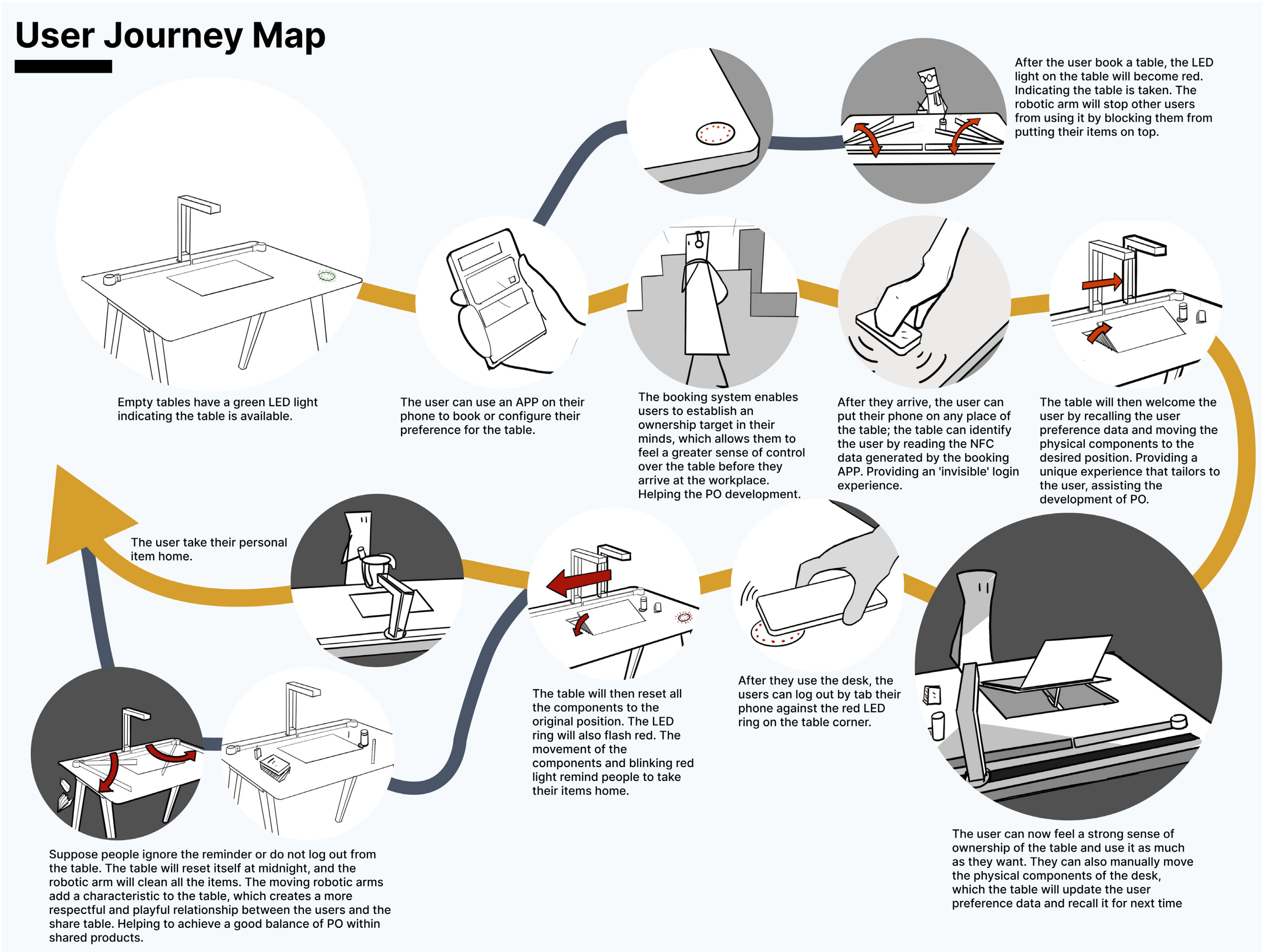


Figure 13 user journey map of the final concept

6.2 Prototyping

As mentioned in the previous chapter, the final concept involved systems that required complicated technology such as could computing and user database. There were not enough skills, time and technological resources to produce the entire system. Therefore, the digital and physical prototypes in this chapter focused on bringing the ideas to life.

6.2.1 PHYSICAL

The physical making stage started within the concept development stage, using cardboard to mock the idea up quickly. This approach allowed for the idea to quickly be tested in a tangible environment, with different iterations of the most effective components to include in the experience. Once the concept and components were clear, it was time to build a prototype to demonstrate and evaluate the design with greater detail.

Sketches, 3D models and renderings were made to investigate the final appearance and detailed structures of the desk. Allowing the making process to have less environmental impact and material waste. The software used to create the plans for physical making were Fusion 360, Illustrator and Blender. Fusion 360 and Illustrator provided accurate sizes and measurements to create the parts and build the structure of the desk. Blender provided render results to help communicate the intended outcome and test material combinations (Figure 14).



Figure 14 3D render of the design

The creation of the final prototype started with the mechanical structure because it largely affected the user experience. After online research and conversations with workshop technicians, the project used a stepper motor and linear guide to implement the functionalities for the following reasons: 1) The stepper motor and linear guide share the same code because they are based on the same stepper motor, which saved time and resources. 2) The linear guide saved vertical space for more legroom. 3) These materials were easy to access and modify with Arduino, which was available in the making environment. 4) They were some of the reliable solutions available given the constraints.

Even though the building started, carefully planned, with the mechanical structure and independent components, countless unexpected difficulties appeared during the making process. For instance, the laptop stand structure worked perfectly during the prototyping stage, but the little extra material on the final prototype exceeded the stepper motor’s weight

bearing limit. Making it unable to push the components to the desired position. After considerable time and resources were spent to solve the problem, the motor still failed to raise the laptop stand. Eventually, the problem was solved by lowering the motor speed for more torque but with considerably more noise. Besides the mechanical structure, the simple woodworking process also created many obstacles. There were many unexpected details that needed to be taken care of. All these obstacles made the prototyping process much longer than expected. Fortunately, extra time for unexpected delays was built into the project timeline during the planning stage, allowing it to still be finished on time.

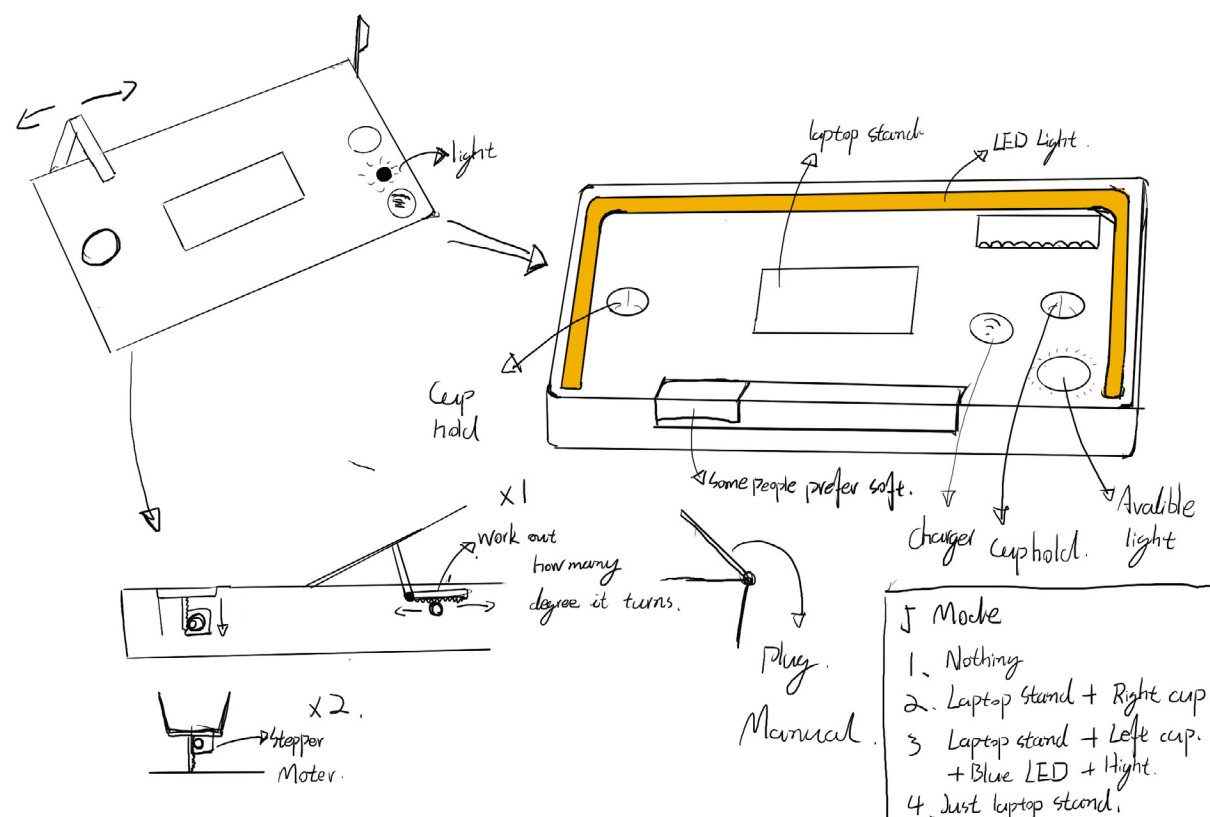


Figure 15 Sketches



Figure 16 Prototype during the physical making process.

6.2.2 DIGITAL

Digital making included the booking software and programs that drove the physical structures. The software was designed with Figma, a platform that allows people to design and deliver high-resolution digital interfaces without complex coding processes. The making started with wireframes of the interface and user testing, which helped identify gaps and refine the design.

As mentioned previously, the project was not meant to be a completely functional end-product. Therefore, the final prototype had manual controls for each desk component with buttons to simulate the interaction, operated by the person overseeing the testing. The making process was similar to physical making, starting with simple code and slowly adding more functions to the Arduino platform. Most components are very similar, which meant the code could be reused with slight modifications, saving much time. However, the drawbacks of using Arduino were apparent. Each Arduino board can only control one stepper motor, so the design needed five Arduino boards and six buttons,

causing cable management and power supply issues. The blinking LED design was also limited to a short time because Arduino could not detect other inputs while the light was animating. Meaning that the person controlling the buttons had to wait for the light to finish animating before clicking any other buttons.

Despite the technical limitations, the digital components of the design still managed to communicate the concepts of the final prototype well.

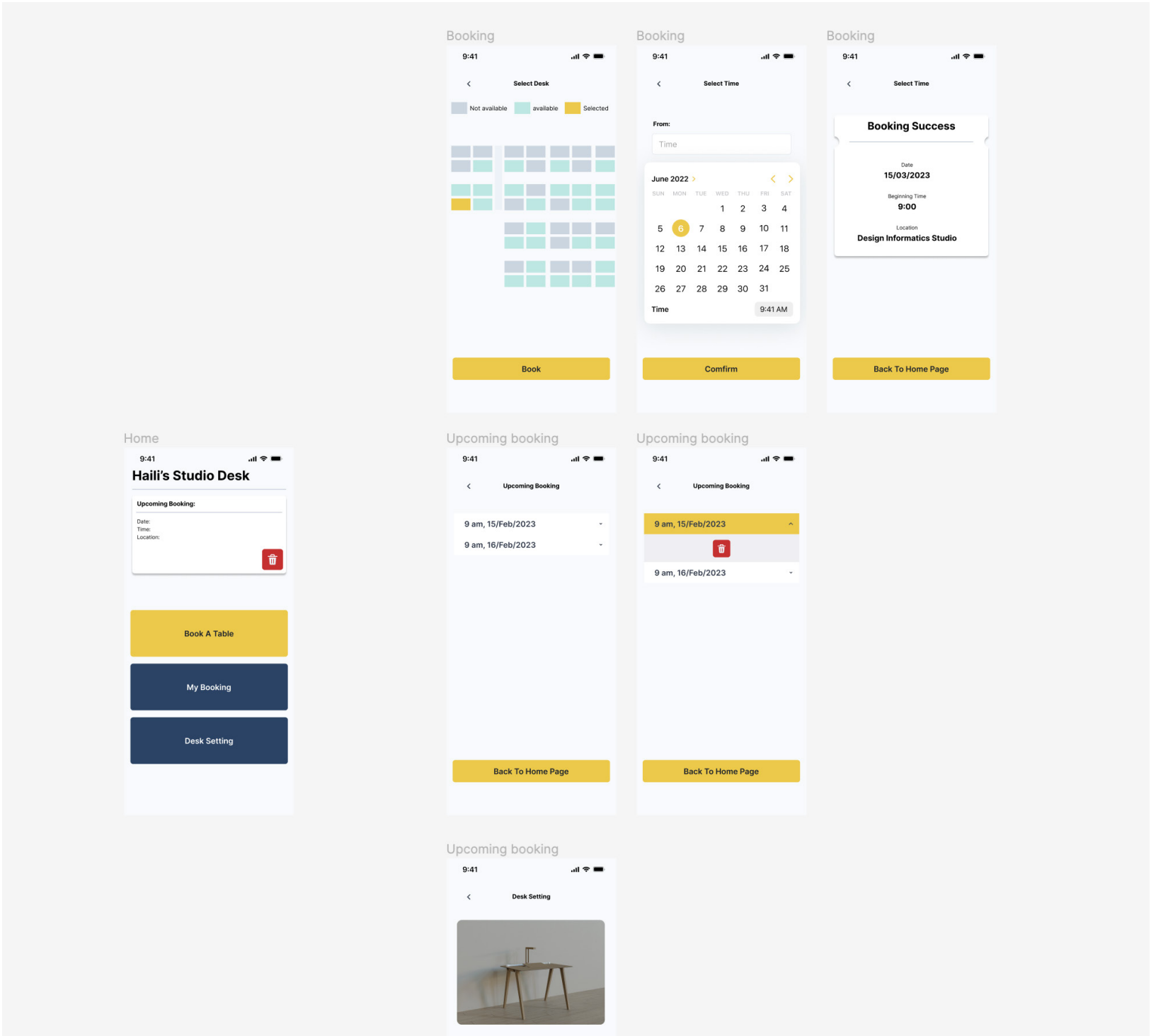


Figure 17 The booking system interface

Chapter Seven

Final Outcome

The outcome included a physical prototype (Figure 18), a booking system prototype (Figure 17) and a storyboard (Figure 13). The physical prototype was a 1:1 scale table that had four components: 1) a laptop stand that can go up and down, 2) a lamp that could travel from left to right, 3) two automatic wipers that prevent people from putting personal items on the table and 4) an LED light that worked as a visual reminder of the ‘status’ of the table. Each component was controlled by a stepper motor and Arduino Uno board. The booking system prototype was made of an interactive UI made in Figma, which allowed users to click through and interact with the system. While the physical and digital prototypes aimed to demonstrate and allow for examining the design, the storyboard communicated how the system worked through the lens of the user journey.

The design was based on the observation that people often confuse digital and physical possessions, which results in digital possessions, such as user data, affecting the sense of ownership of a physical object. Therefore, the design argues that by adding a ‘digital layer’ to the shared object with a tangible interface (Ishii, 2008) and recalling it in each interaction, users can quickly be helped in establishing PO toward different physical objects.

In the final design, the user journey was as follows: users started their journey by booking a table from the booking system. The system helped

the user to establish an ownership target, which achieved the affordance of ‘temporal control’ before they arrived at the studio, allowing them to have expectations for the upcoming experience. The booking systems allowed the users to modify the desk with choices around how the laptop stand and lamp would position themselves when the desk was in use. The system would upload the configuration data to the cloud and recall it anytime the user logged in to the desk. The components work as a tangible interface, a physical representation of user data. This created a bespoke experience that supported the sense of PO. During use, the user could manually adjust the components to suit their needs, after which the system would update the configuration data. Besides supporting the development of PO, the desk also prevented unauthorised users from taking ownership by using the automatic wiper to stop people from putting their items on the table. Such interaction allowed for a stronger sense of ownership from the authorised user because the desk could defend its ownership. It also kept the desk surface free from any ‘contaminated interactions’ in a playful manner, creating a new relationship between users and shared items.



Figure 18 final prototype

Chapter Eight

Evaluation

The evaluation stage aimed to examine the design concept and identify future research directions systematically. As mentioned previously, there were three sections in the user testing sessions. Section one used a storyboard to communicate the user journey to the participants. Section two allowed the participant to experience the function and user journey in the real world. Section three critically reflected on the user journey and experience by conducting an interview and asking the participant to fill in the PO mapping tool, which was also used during the user research. The same participants from the semi structured interviews were asked to participate in the evaluation stage, providing a way to compare the design with the current experience. In this chapter, the design is examined by critically analysing the user testing materials.

Many people outside the participant group showed a strong interest in the experience during the desk demonstration and asked to try it. Some even hope to replace all the studio desks with the design if possible, meaning the design answers their demand well.

Based on the PO mapping tool and interviews, all the participants felt a high degree of ownership at the beginning of the user journey without relying on their items. This meant that the booking system and the wiper structure supported the development of PO by providing the ‘temporal control’ and ‘territory protection’ affordance. Allowing the user to develop PO before arriving at the shared desk. Participant E explains in the interview: “I like the combination of the booking system and the robotics arm because I can claim ownership before arriving at the studio, and the desk will protect my ownership. It feels great! And Special!”

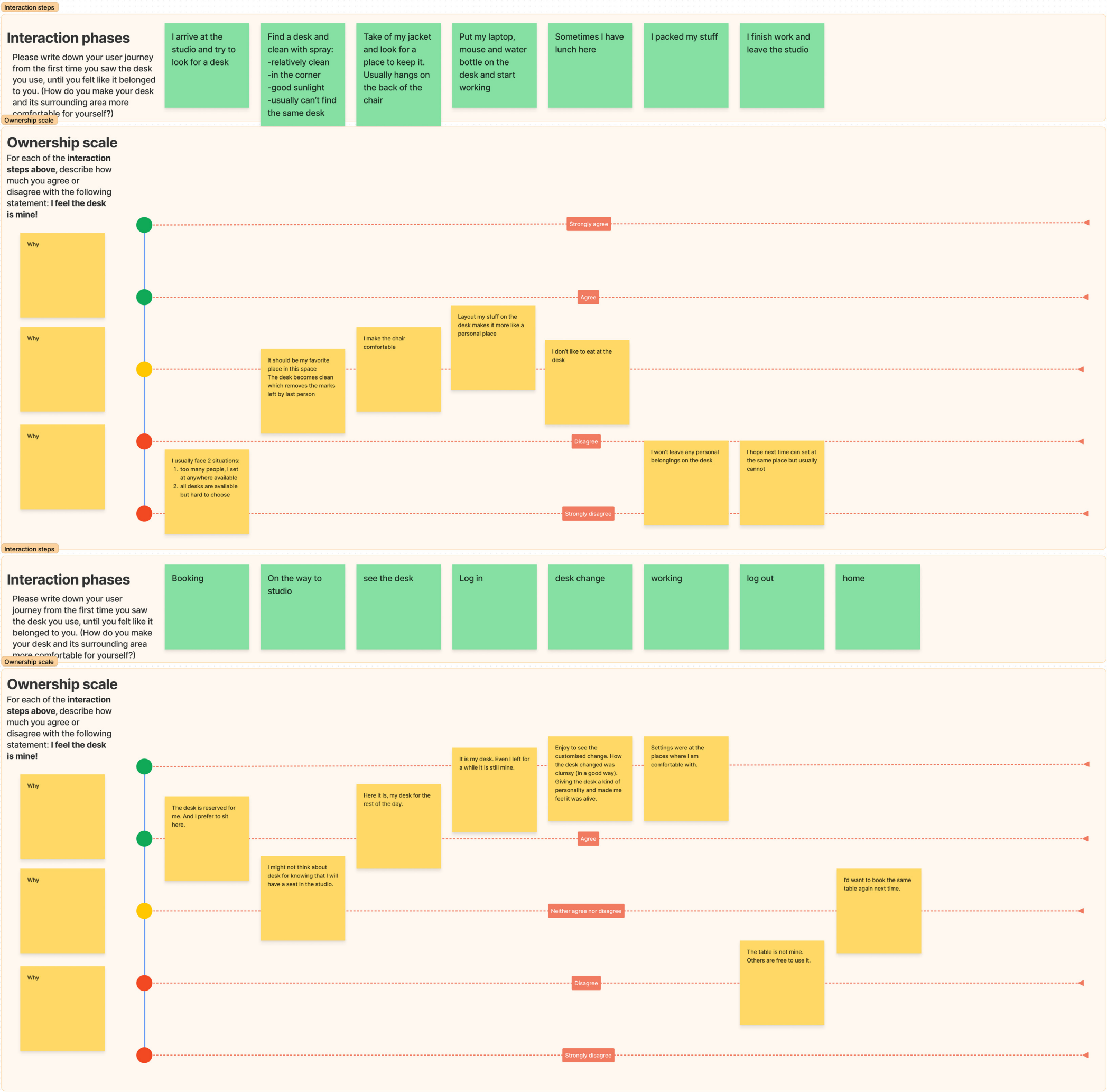


Figure 19 the PO mapping from participant B shows the PO of the design(bottom) develop faster and higher than the current shared desk (top).

The excitement from the users continued to rise when they experienced the login process, in which the desk provided ‘configuration control’ and recalled the configurations after they logged in to the desk. “The movement of the components makes me feel special. It is like the whole desk is bespoke! It is like living in the future! I feel a strong sense of ownership”, said participant B during the interview. It appeared that their ‘preference data’ supported the development of PO of the physical desk. The success of the login process could not be done without the smooth and hidden login interaction, which identified the user when they placed their phone at any position on the desk. Such interaction hides the technology from the user, allowing for a more natural interaction. As participant A said: “The login interaction is so smooth and natural that I do not feel it exists. It almost feels like a secret handshake between me and the table, making the experience more magical, which makes me feel more substantial ownership.”

Besides the moving component, the wiper structure also caught people’s attention positively. As hypothesized previously, most users assigned personality to the desk because of the wiper, which changed how they interacted with the desk. As Participant E said: “the arms bring the table to life. It is cute! Like a cat ... I do not think I will get mad if something like that swipes my items to the ground. It makes me feel like I should treat the desk better”. Consequently, the users were more willing to remove their items at the end of usage and treat the desk better. Adding characteristics to the interaction appeared to be a way to incentivise users to treat the shared object better.

The ‘de-configuration design’ that aimed to remind the user to clean the desk at the end of the journey also appeared to work. Participant B said, “It is such a potent reminder for me to take my stuff home when the laptop stand returns to its normal position while my laptop is still on there. It is a rejection of my item.’

However, the design was not perfect. The user testing section also suggested a few places to improve that required further research. Firstly, a few users pointed out that the noise from the stepper motor was too loud, which made them feel embarrassed to use the desk within a shared space because it might catch ‘unnecessary attention’. Although the mechanical structure only demonstrates the idea, it is essential to remember that the noise could affect the experience in the public space.

Secondly, while some users liked to see the components moving, some thought it would be better if the table would recall the function before they arrived, making them feel as if the table never changed. Perhaps the two different demands could be preference settings for the users

to choose from. From a practical standpoint, this might be a problem as the laptop stand blocks the wipers from doing their job. Perhaps the wiper structure can be placed in a different location or replaced by an alternative structure.

Thirdly, although the booking system helped users establish an ownership target, it added an extra step before users went to the studio. Investigating how to simplify the interaction is essential in future research. Perhaps the user interface could be simplified, or an auto-booking system could be added.

Fourthly, during the user testing, one participant mentioned that although the table did a great job supporting the development of PO, it could only respond to one user at a time. Studio desks often needed to be shared by multiple people during discussions or meetings. Therefore, identifying how the table might respond to multi-user scenarios is critical. One potential solution could be having a single-user mode and multi-user mode, but further research on how the multi-user mode would change the desk needs to be done.

During the test, one participant also pointed out that although the login and logout experiences were smooth, there were no instructions for new users to learn how to operate the system. Therefore, in future studies, it is essential to investigate solutions to communicate how to use the desk effectively.

Compared to the ‘de-configuration’ function that reminded users to take away their stuff, the visual reminder based on the LED light was less obvious. There were a few participants who ignored the design during the interaction. Therefore, it is worth considering how to make the visual reminder more visible without disrupting the space at large. Perhaps the LED light ring could be replaced by an LED strip around the table, similar to concept one (Figure 11).

Finally, although the components in the current design successfully supported the development of PO, there were only limited settings the user could play with. During user testing, participants provided many suggestions of what other components could be included. For example, the ability to adjust the height of the desk, a cup holder, a clock, a light that can change colours and a power station. However, as most of these options were based on personal preferences, it would be essential to identify those that can make a more significant impact. A systematic way to identify what components should be included would be exciting to explore.

Chapter Nine

Summary & Reflection:

This dissertation explored how design can create a better experience of shared objects by supporting Psychological Ownership. The design concept was inspired by how people are often confused by the concept of ‘digital’ and ‘physical’ ownership. While such a finding makes the study of PO more challenging, I took it as an opportunity to design a better sharing experience. By adding a digital layer that contains the user’s data on a physical object, users can expand the ownership of their data to the physical object, resulting in a better sharing experience. This dissertation proved the theory by redesigning the shared desk at the Design Informatics studio, demonstrating a new approach to designing for shared objects.

Besides reimagining what sharing experience could be, the project also discovered much insight during the research stage. Gaining knowledge about how PO occurs in shared objects, how people develop ownership of the shared object, what people are looking for in shared objects and what affordance shared objects should include.

The project journey also unveiled design methods and theories that could potentially assist other designers and the industry to create better sharing experiences. For example, the modified PO mapping and cultural probes can be used in another project for investigating and comparing how different types of ownership occur on objects. Through thematic analysis of the cultural probes and interview data, it was discovered that a well-designed shared desk needs to achieve the following goals: 1) help the user establish control and comfort without relying on their personal items. 2) ‘clean up’ the ‘contaminated surface’ for the following user after the current use section. 3) allow the user to feel ownership, control and have an ownership target while not using the desk. Based on these goals, this dissertation identified seven affordances that should be considered in a sharing experience. They are 1) configuration control, 2) temporal control, 3) preference recall, 4) territory protection, 5) de-configuration, 6) the visual reminder and 7) force rejection. While some of these affordances were based on Baxter’s research, some are original to the project. Note that these affordances could be changed and expanded in future research.

Although the project had limited access to technologies and resources, the final prototype showed a good sharing experience during the

evaluation stage. The rise of PO within the user journey enabled users to be more willing to share and treat the shared products better. This would result in a more sustainable sharing economy in the future. Besides the sharing economy, the project could also potentially benefit other shared products and services such as luxury rental, hotel experience design and public transportation design.

The research outcomes were based on a very limited group of people, meaning the insights might not apply to users from different contexts or cultural backgrounds. Therefore, besides the points mentioned in the evaluation chapter, future research should examine the theories and design methods with a larger user group. The project also based most of its theoretical framework on other studies, lacking a critical approach to the theories themselves, which may transform some of the fundamental understanding related to PO or shared, helping us to discover valuable insights.

As for self-reflection, I am proud of the outcome and the insights I have found during the project. Especially around how I can critically look at some of the existing methods and theories and modify them to the existential conditions. I am also happy about my time management in the project, I gave myself a deadline for each stage and worked hard to finish the tasks on time, so I did not have to rush at the end. Using design frameworks such as the double diamond (Design-council, 2019) and the design thinking process (Dam, 2022) helped me understand what I should do and were excellent ways to manage time. I will continue to use these methods in the future.

Besides the places I did well, there were some areas for improvement. 1) I often take too long to process answers during the interviews, making the interview less smooth for the participants. 2) I underestimated the effort it would take to make a physical object. It would be better to prepare for it mentally and allow more experimentation time.

Overall, I immensely enjoyed the project because I could deeply explore the human factors and behaviour behind an experience. I hope to continue my research and passion and contribute more knowledge for a better society.

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