# JudgeKit: Designing for PSS by increasing judgement of value

A Field Approach for Assessing Value to Product Service Systems: A Case Study in a Scooter Sharing Context

Constructive Design Research Paper (DCM100)

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Product service systems (PSS) offer a variety of benefits for the environment by stimulating closing resource loops. An aspect that influences closing the resource loops for PSS is the judgement of value (JoV). However, this aspect still remains underexplored. Therefore, this study aims to investigate how, through the social practice approach, designers can be aided in designing for PSS to enhance JoV. In turn, a toolkit that provides guidance for designing with JoV, JudgeKit, has been employed in a co-creation with design students for designing for shared scooter systems. The research provides insights into the practical application of JudgeKit within the PSS design process. The co-creation sessions with JudgeKit offer valuable insights on the toolkit's effectiveness and its potential to guide designers through the PSS design process with a focus on JoV. Consequently, a set of design principles are proposed through the lens of social practice theory (SPT).

**Additional Keywords and Phrases:** Product Service System, Judgement of Value, Social Practice Theory, Co-Creation, Toolkit

## 1 INTRODUCTION

Product Service Systems (PSS) represent an innovative framework that integrates both products and services to fulfill customer needs while at the same time minimizing resource consumption and environmental footprint (Mont, Bleischwitz & Stutz, 2017). The ongoing production, consumption, and disposal of products present significant sustainability challenges, resulting in unfavorable environmental impacts due to increased waste generation (Van Der Laan & Aurisicchio, 2020). In response, the emergence of Product Service Systems (PSS) offers a more sustainable approach to product consumption and production (Tukker, 2004).

A notable example of a PSS is the Bike Kitchen (TBK), a project that aims to address production challenges within the domain of cycling and promote a circular economy (Bike Kitchen – Urban Cycling Institute, n.d.). TBK serves as a shared workspace

where people can repair their bikes, gain knowledge, and foster a sense of community (Bike Kitchen – Urban Cycling Institute, n.d.).

However, this research will focus on public Product Service Systems, like shared mobility services. In particular, scooter sharing services, since this PSS is not part of a community and therefore faces different types of challenges than a PSS that can be more easily monitored. The resulting findings and strategies derived from this study will be generalized to a broader spectrum within PSSs, extending beyond the scooter sharing systems.

This research grasps the opportunity presented by the relatively unexplored elements of PSS, such as judgement of value (JoV) (Van Der Laan & Aurisicchio, 2020). PSS offers a sustainable approach to consumption and production by integrating products and services, with successful examples like TBK in cycling. This study shifts the focus to scooter sharing services and aims to provide innovative solutions for designers. By examining the judgement of value (JoV) and its role in closing resource loops, the

research aims to help create plans that make things more eco-friendly and deal with issues like resources becoming outdated and the buildup of waste. These findings might be useful for a wider range of PSS projects.

The research question connected to this specific problem and opportunity is: "How can a toolkit aid designers in designing for judgement of value (JoV) within product-service systems, when using a social practice approach?" In this study, a research artefact is devised, herein referred to as a 'toolkit', which is intended for designers to design for PSSs, focused on the context of shared scooter systems. This toolkit facilitates the social practice theory (SPT) (Shove and Warde, 2002), the judgement of value (JoV) (Laan and Aurissicchio, 2020) and the personal experiences of the researchers, all MSc Industrial Design students at TU/e (almost all with a BSc in Industrial Design). To provide guidance in addressing the main research question, several sub questions have been identified, namely:

1. At what stage of the design process should this toolkit be utilized?
2. Does this toolkit effectively aid designers in designing for judgement of value?
3. How should such a toolkit be formed and structured?

This research makes several contributions to the field of PSS design. Firstly, it addresses an existing research gap by directing its focus towards JoV, an area that is thus far underexplored, but does offer a promising role for closing the resource loop (Van Der Laan & Aurisicchio, 2020). Valuable insights extracted from the research enable the enrichment of the design process, particularly focusing on judgement of value (JoV). In addition, a toolkit specifically designed for designing PSSs with a judgement of value (JoV) perspective is introduced. This research provides concrete guidance for the adaptation and application of van Amstel's toolkit (in preparation) to the judgement of value (JoV) context, facilitating the practical design of PSS, other than the already existing methodologies. By examining PSS through the lens of the SPT, the researchers propose an alternative strategy that focuses on capturing the broader context and nature of practices, rather than the traditional user-centered design (UCD) perspectives. It offers a channel for developing a deeper understanding of JoV and its application in designing sustainable closed loop activities. Moreover, the inception and validation of this first version of a physical toolkit establishes a baseline upon which future researchers can build and enhance. To assist this process, we present a set of clear design principles and physical aspects that should be addressed in the design of toolkits in the future that share a similar goal or approach.

## 2 THEORETICAL BACKGROUND

### 2.1 Product Service System (PSS)

The non-stop production, consumption, and disposal of materials and products contribute to an abundance of waste (Van Der Laan & Aurisicchio, 2020). As a countermovement, designers are actively engaged in the development of sustainable solutions, such as PSS, aimed at creating a circular economy (Kjær et al., 2018) and closing the loops associated with production and resource utilization (Van Der Laan & Aurisicchio, 2020).

PSS represents an approach where products are accessible without the burden of personal ownership (Van Amstel et al., 2022). The shift from owning products to a PSS is the strategy used for the shift to a more sustainable world (Demyttenaere et al., 2016). Examples of PSS include GO scooters, The Student Hotel (Van Amstel et al., 2022), and The Bike Kitchen (Bike Kitchen – Urban Cycling Institute, n.d.).

The level of sustainability in PSS is influenced by factors like the shift in ownership, with users no longer being the legal owners of the products they use (Demyttenaere et al., 2016). While this shift has the potential to enhance PSS sustainability, it can also lead to reduced consumer responsibility, potentially resulting in misuse (Van Amstel et al., 2022) and careless behavior (Demyttenaere et al., 2016). Consequently, designers are actively exploring solutions to address these challenges within PSS (Van Amstel et al., 2022; Demyttenaere et al., 2016).

### 2.2 Judgement of Value (JoV)

PSS can be conceptualized within a structured framework, as described by Van Der Laan and Aurissicchio (2020). Herein, judgment of value, refered to as JoV, is mainly concerned with stakeholder dynamics as an intangible characteristic of a PSS and concerns the way people assess value to certain recources, based on experience, cultural and contextual dimensions (Van Der Laan & Aurisicchio, 2020). According to Lüdeke-Freund et al, closed-loop activities can only be realized if stakeholders recognize value in obselete recources. While some sustainable design strategies already delved into adressing resource values at specific moments

of a product's lifecycle (Bocken et al., 2016; Ellen MacArthur Foundation, 2013a; Mestre and Cooper, 2017), the way stakeholders assess value is dependent on many factors and is likely to develop during its lifespan. For designers, it becomes vital to study these factors and their application, in an effort to influence the way consumers connect value to their products.

JoV should not be confused with Value Centred Design (VCD) or Value Sensitive Design (VSD). Whereas JoV evaluates resource value based on factors like brand image and personal preferences related to experience and culture (Van Der Laan & Aurisicchio, 2020). VCD integrates ethics into design using practical techniques to assess technology's impact (Knight, 2008). VSD is an approach that integrates ethical considerations and human values into the design process of technology, aiming to create products and systems that align with the users' moral principles and societal concerns (Friedman et al., 2001).

### 2.3 Social Practice Theory (SPT)

Social practice theory, referred to as SPT, diverts its attention from the individual and its values and attitudes, and towards the 'doing' or 'behaviors' of various activities that make up a social practice (Shove and Warde, 2002; Welch, 2016). This theory aims to find relationships between everyday actions and the contexts and social situations in which they happen (Smolka, 2001). What makes this theory interesting (in relation to the aforementioned JoV) to designers, is its ability to grasp how a social practice and its elements exist, prevail and change (Hyysala, 2013). According to Frost et al. (2020), SPT consists of 3 main elements: 1) materials, the technologies and materials objects are made of; 2) competences, relating to the techniques and skills; and 3) values (referred to as meanings in this particular research), focusing on the social norms (Frost et al., 2020). Many behavior-change approaches focus on a set of interventions that are "coordinated sets of activities designed to change specified behavior patterns" (Michie et al., 2011). What differentiates SPT, is that values are seen as an integral part of an activity, rather than present in one's mind. (Hargreaves, 2011)

## 3 RELATED WORK

### 3.1 Value perceived in PSS

In the evolving landscape of service providers transitioning towards Product-Service Systems (PSSs), a fundamental shift has occurred. Unlike the traditional model of focused value exchange at the point of sale, PSSs have various value opportunities spread throughout their lifecycle. This is particularly notable in result-oriented and some availability/use-oriented PSSs, where the provider retains ownership (Meier et al., 2010). These opportunities include valuable information, data, strong customer relationships, and enhanced operational efficiency. The provider's capacity to capture value extends well beyond the initial product lifetime, including possibilities like remanufacturing.

Value models, as argued by Panarotto (2015), help clarify the trade-offs between benefits and sacrifices when choosing the most valuable alternative. Benefits relate to the fulfillment of needs, while sacrifices include factors like price, time, and effort. Additionally, Almquist, Senior, and Bloch (2016) have identified thirty distinct elements of value that can be linked to market value propositions, categorized into functional, emotional, change of life, and social impact aspects. In this complex landscape, the concept of value must consider the potential for trade-offs that can either benefit or harm different stakeholders, intentionally or unintentionally.

Here the limitation can be found in the value being approached only from a stakeholder perspective. Opportunities can be found in shifting to a holistic perspective that aligns more closely with reality.

### 3.2 Circular economy and Closed-loop systems

The rise of the circular economy has paved the way for innovative business models that combine economic and environmental goals (Geissdoerfer et al., 2017). Within this context, researchers have focused on the development of Product-Service System (PSS) models aimed at stimulating sustainable consumer behavior from a circular economy standpoint (Bocken et al., 2018). To address material waste reduction, strategies such as reuse, repair, and remanufacturing have been implemented as key measures within the circular economy framework (Mashhadi et al., 2019). PSSs have the capability to significantly diminish environmental footprints and enhance overall societal resource efficiency, particularly when implementing practices such as reusing and recycling. Their contribution is essential in advancing this initiative. (Mashhadi et al., 2019).

Closing the resource loop can be approached by designers in various ways, one strategy is through psychological ownership. Research done by Van Amstel et al. (2022) have approached this strategy by creating a design toolkit for PSS which involves end users in closing the loop activities. The toolkit was evaluated in a bicycle service context. The findings suggest that the application of psychological ownership affordances by designers can lead to a greater involvement of end users in closing the resource loop activities within a PSS. As the evaluation has been focused on a very specific context, it would be interesting to explore this in a wider context and verify the generalizability of the findings.

### 3.3 Designing PSSs

A recent toolkit developed by Dewit et al. (2021), offers a comprehensive solution for PSS design. This toolkit integrates a wide array of tools and methodologies to create a systematic approach to the PSS design process. Notably, the PSS design toolkit has received recognition in the form of the GPRC-quality label, signifying its alignment with international academic standards and a favorable peer review evaluation.

A significant outcome of this toolkit is the identification of "preconditions" essential for the PSS design process. These preconditions are categorized across the three key phases: understanding, exploration, and definition (Appendix A.1, figure 2). They serve as critical guidelines to ensure a structured and successful PSS design process (Valencia et al, 2015). Organizations would gain substantial benefits from following these preconditions as they play an important role in shaping the organization's approach to product-service integration (Nijssen et al, 2006).

For practitioners engaged in PSS projects, these preconditions offer a valuable reference point for assessing whether the necessary preconditions are met during the design process. Having a toolkit to design for PPS will also bring protentional challenges and barriers for the organizations when using it. The study has not examined this particular aspect.

### 3.4 Designing for stakeholders

When stakeholders perceive the value of resources differently than expected, it can lead to deviations from the intended resource flow. For instance, in a research investigation into consumer behaviour regarding outdated products, participants were observed holding onto multiple "extra" mobile phones beyond what one might consider necessary (Wilson et al., 2017). These individuals retained these devices due to uncertainty about their future utility. This uncertainty regarding value can consequently disrupt the flow of resources.

Numerous elements within the framework of circular design process are widely explored in PSS research (Van Der Laan & Aurisicchio, 2020). Many of these commonly studied PSS elements are situated at the stakeholder level. Given the typical customer focused orientation of PSSs (e.g., Vezzoli et al., 2014) it underscores the undeniable significance of stakeholders, their demands, and the dynamics inherent in their interactions.

When designing for closed loop activities with PSSs one could focus on intangible characters at stakeholder level. Such an intangible character would be JoV. It is found that underexplored PSS elements such as JoV have a significant role in closing resource loops (Van Der Laan & Aurisicchio, 2020). For this, the behaviour of the stakeholders needs to be evaluated. Understanding what is expected from them in PSS and if they meet this behaviour is very important to achieve closed-loop resource flows.

## 4 DESIGN

The process of this research is visualized in Appendix 2, figure 3. The existing toolkit created by Van Amstel was used as a basis to create a physical design based on SPT. Observations were first made in the field, the results were analyzed and used to create helping cards for the toolkit. The researchers compiled 10 value cards to guide participants in designing for value judgment.

### 4.1 Toolkit

The toolkit named JudgeKit is designed as means of inquiry to collect data during the co-creation where participants designed for a shared scooter systems for JoV on three context levels: the physical environment, the product (scooter) and the digital environment in a way to increase JoV. To establish a foundation for JudgeKit, an existing toolkit created by Van Amstel was examined. This toolkit is based on the SPT and is intended to assist designers in designing a PSS for closed resource loop activities. The toolkit is

divided into six steps, with the first steps outlining the context based on social practices, followed by opportunities for designing and finally redesigning a PSS. JudgeKit is a physical implementation, focused on the topic of shared scooters systems, created to assist designers in the final steps of converting the context and problems into design opportunities during a co-creation session. The first 3 steps of the existing toolkit by Van Amstel (in preparation) in which the context is outlined were carried out by the researchers themselves through interviews and observations (see Methods section) because it uses data to provide information for the JudgeKit help cards.

The goal of the toolkit in this research is to guide participants during a co-creation for three different contexts during co-creation (three design sprints) is intended to address not only the interaction with the scooter but for example also the influence the city and its people have on a PSS. In short, JudgeKit which consists of 10 value cards and help cards, is designed for a co-creation session within the context of a shared scooter system.

#### *4.1.1 Value cards*

The value cards contain 10 different topics that should guide the participants during the design sprint to solve the problem addressed on the problem checklist. These topics were chosen by the researchers based on their experience in the field of design. This choice was made because there is no existing framework for designing JoV. The inspiration is drawn from various value elements in a PSS, including functional, emotional, life-changing, and social impact aspects (Da Costa Fernandes et al., 2019). It also incorporates existing values from frameworks for psychological ownership (Baxter et al., 2015), combining them with the aspects of JoV based on experiences, cultural factors, and contextual dimensions.

Furthermore, the same aesthetic style was chosen for the toolkit and co-creation session. The cards are designed to highlight the content, with colors and icons used to differentiate between various topics on the value cards to collect data on how designers design for JoV.

#### *4.1.2 Help cards*

The toolkit also contains helping cards, that could be requested by the participants as additional aid for designing. This context information was extracted from the initial observations and interviews conducted during the field research on shared scooters. They could choose between a user story, guiding question or picture, but could not see what was on the cards beforehand. For example, damage assessment can be communicated through visualization, and insights from the interviews were used to draw up a user story.

## 5 METHODS

The aim of the study is to implement the designed toolkit to gain qualitative insights on what design principles should be considered when supporting designers to design PSSs in a way that improves the JoV. This study has been performed through the field approach as this approach allows for contextualization to gain a more in-depth understanding of people, their needs, and the environment in which a design will be used (*Design Research Through Practice*, n.d.). This approach has been implemented to capture the social practices of the current shared scooter systems and to gain in-depth insights of the use of the toolkit when applied in context with designers.

### 5.1 Capturing the PSS through the Social Practice Theory

The social practice approach emphasizes that understanding society requires examining how materials, values and competencies interact to produce and maintain particular social behaviors (Frost et al., 2020). To capture these three components of shared scooter systems, a contextual observation study and interviews have been conducted. The study took place in Eindhoven at various shared scooter hubs in the city center. Here both the services and the users of the services have been observed (Appendix 3, figure 4) and open interviews with some of the users have been conducted. Eventually, 28 observations have been performed and 21 interviews were conducted. The aim of this study was to gain insights on how participants make use of the service and what problems they encounter, what kind of behavior they notice from other users and what the reason for misuse might be. The observations and interviews have been manually transcribed during the study. Through deductive thematic analysis the observations and participant answers have been divided in ‘materials’, ‘values’ and ‘competencies’ (Appendix A.4, figure 5). For this, digital platform Miro has been used. These results have in turn been listed as a range of problems with the scooter sharing system in which the three

components of social practices are all addressed. These would in turn be used during the co-creation (see appendix A.5, figure 7 for the process visual) to give participants insights on what problems with the PSS they can design for. Furthermore, as described in the previous section, the insights of this part of the study were also used for the development of the help cards in the toolkit.

## 5.2 The co-creation

### *5.2.1 Participants*

The participants gathered for the co-creation (figure 1) are Industrial Design students from the Eindhoven Technological University. The participants were recruited through convenience sampling with expertise selection, contacted from researchers' network. For this study six participants have been recruited, five of which were in their final stages of their bachelor's study and one participant was at the beginning of their studies.

### *5.2.2 Study setting and materials*

It was aimed to do a field study of the designers in the context of performing brainstorming sessions. Therefore, the co-creation took place in a spacious meeting room at the TU/e campus, chosen for its familiarity to the participants. The participants were provided with the toolkit and a worksheet (Appendix A.6). Via this worksheet they were presented with the overview of problems with the shared scooter system and a list of the value cards and helping cards from the toolkit. Furthermore, the participants were provided with various creative materials (e.g., cardboard, clay, and colored paper) for brainstorming and concept presentation. However, in order to stimulate the participants to brainstorm in ways they usually do and to prevent limiting them through the provided materials, they were informed beforehand that they had the freedom to bring their own brainstorming materials.

Figure 1: Co-creation impression

### *5.2.3 The procedure*

The co-creation started off with an introduction round, where the concepts of PSS and JoV were explained, after which the design challenge was presented. The participants were then divided into pairs, as this would allow for a more collaborative way of brainstorming in the way they are used to. Each pair had been assigned to a researcher.

In order to stimulate designing for a complete PSS, the co-creation existed of three rounds where the pairs were asked to design for the shared scooter system on three contextual levels: the physical environment (e.g., the parking hubs or city), the product (the scooter), the digital environment (the app). While designing, the participants had to carefully consider which of the given problems they wanted to solve and how they wanted to increase the JoV of the service. Before starting to brainstorm, the participants were given the time to carefully read the value cards, which they could utilize during the design sprints. They could not see the help cards beforehand, however, but had to request a user story, picture, or guiding question from their assigned researcher.

During the design sprints, the participants were observed by their assigned researcher, where the aim was to figure out how the participants reacted and implemented the tool and expressed delight or difficulty. Each design sprint lasted 15 minutes, after which they pitched their concept to their assigned researcher in 1 minute. This was followed by a short semi-structured interview (14 minutes), where it was aimed to gain insights on what problems they wanted to address, how they utilized the value cards and what role the helping cards played. On their work sheet they could tick the boxes of the problems they aimed to address, the value cards they used and the helping card(s) they requested. At the end of the co-creation a more in-depth semi-structured interview was held to gain insights on their overall experience and use of the toolkit when designing for PSS (see Appendix A.7 for the complete

procedure and interview questions). During the pitches and interviews, audio recordings (which were later transcribed) and manual notes were made by the researchers.

#### *5.2.4 Analysis*

The first part of the analysis aims at exploring JudgeKit's overall impressions, applications, and limitations. Additionally, the goal was to evaluate the tool's effectiveness in designing for JoV within PSS and the fundamental elements of the toolkit that support this effectiveness.

Qualitative data was collected through various methods, including notetaking during observations, post-design evaluations and a final interview. See table 1 for an overview of the different types of data collected.

Table 1: Overview of the types of data collected

| **What data is collected?** | **Why?** |
|---|---|
| 1.Noted of observations during each design phase of the co-creation session. | It gives a rather objective view of the use of the toolkit and its functionalities for each context. |
| 2.Notes of answers given to questions in the post-design evaluation after each design phase of the co-creation session. | Get a participant's view on the influence of the various cards and selected problems in a specific context. |
| 3.Notes of the answers given tot he questions in the final interview after the co-creation session. | Get a participant's view on the overall application and use of the toolkit |
| 4.A form filled in by participants in which they tick which problems were addresse**d** and which value and help cards were used. | As problems are linked to SPT elements, it allows us to link the design processes per design phase to the SPT as well. |

To supplement this, the frequency of problems and specific card selections in various contexts was documented in Appendix A.8, table 4. See Appendix A.8, figure 13 for a detailed overview of the data analysis process.

Initially, an inductive thematic analysis was performed on the observations, post-design evaluations and the final interview. This allowed for gaining a general overview of insights related to the overall impression and application of the toolkit. Simultaneously, a critical-incident analysis (Flanagan, 1954, p. 355) was performed on the same dataset, with a focus on extracting data that could help to assess the overall effectiveness of the toolkit in promoting JoV.

Throughout each design round, participants chose one or multiple problems within the current PSS to focus on during their process. These problems were associated with predefined elements from SPT: values, materials, and competences. Consequently, all notes taken during each design round were associated with one or more SPT elements, based on the selected problem and its associated SPT element(s). This created inherent links between the SPT themes for each design round. See Appendix A.4, figure 6 for the clusters divided among the SPT elements.

Given the aim of identifying design principles from the data, an inductive thematic analysis was conducted for each SPT cluster. This resulted in a list of eight design principles emerging from this data, with corresponding notes connected to each cluster (table 2) and Appendix A.4, figure 6 for an overview of the thematic analysis. The insights from each design principle were interpreted and concluded, which will be further elaborated upon in the following chapter.

## 6 FINDINGS

The findings of this research are divided into three sections: 6.1) General insights from interviews and observations, 6.2) Effectiveness in designing for JoV and 6.3) Design elements as seen through the SPT.

### 6.1 General insights from the interviews and observations

An overview of the main findings from the observations, post-design evaluations and final interview can be found in table 2. During the session, it was evident that participants enjoyed working with the toolkit, but some issues could limit the overall usefulness or effectiveness of the toolkit, for which several suggestions were provided by the participants. The toolkit was deemed most useful in transferring knowledge about the context and fostering idea generation and scoping. Therefore, its application is mainly found at facilitating the ideation phase within a design process, where important aspects of the context analysis are being explored. This

is in line with the preconditions for PSS design found by Dewit et al. (2021), as this toolkit supports users in understanding the context, exploring this context through the value and help cards and eventually defining the outcome in terms of a design and pitch.

Table 2: Overview of main findings

| | | |
|---|---|---|
| **Role of the toolkit** | Design phase | • The toolkit is assumed to be most useful in the beginning of the design phase or a new iteration to spark ideas and kick-start a project. |
| | Provocation of the toolkit | • The value cards were found especially useful in guiding the participants in scoping their process and making design decisions, especially when they felt stuck. (Design principle: Guidance)<br>• The toolkit was found useful in either guiding, challenging, or confirming design decisions and views. |
| | Transmission of knowledge | • The help cards, with visuals in particular, were effective in providing context for problems that they did not anticipate at first.<br>• The value cards supported designers in finding a scope for their research, focusing on values, which sped up their process. |
| **Issues with the toolkit** | • Some cards were too context-dependent, which limited their usefulness when being applied to environmental or external factors. (Design principle: applicability)<br>• Value cards were sometimes considered too broad, leaving the designers uncertain about the usefulness in different design scenarios.<br>• A higher level of familiarity of the designers with the selected PSS context, seems be closely related to a higher effectivity of the toolkit, regarding the application of value cards. | |
| **Suggestions for improving the toolkit** | • The problems should be categorized into themes to address more general design challenges, and the help cards should be more problem-centred based upon these themes.<br>• The emphasis on the importance of designing for JoV should be increased and repeated. | |

### 6.2 Effectiveness in designing for judgement of value

Users expressed their insecurities about their mis-/non-understanding of the definition of JoV. This was mainly due to the onboarding of JudgeKit, where the definition of JoV was rather shortly discussed by the researchers. Nevertheless, it seems like participants inexplicitly did show their proficiency in designing for JoV within their processes. This can be concluded from their discussions, in which various adjustments were made to the scooters and app, in order to influence the way users of the service perceived the product's overall value, advantages or disadvantages. Interestingly, two participants showed a different understanding of JoV, as they decided to make the scooter less attractive and hence decrease the chance of vandalism. To quote the participant: "I find it funny that you say expensive and pretty products equal more JoV and we make it ugly."

These adjustments, however, tend to mostly relate to rather physical- and product-related issues. This was evident from the thematic analysis as well, in which was found that the value cards were often considered too context-specific and therefore limited its application for external factors for example.

### 6.3 Physical elements and design principles as seen through the social practice theory

Based on an inductive thematic analysis on the observations and post-design evaluations, key physical aspects, and a set of eight design principles have been identified.

First, the visual appeal, tangibility, and repeated presence of the cards within the periphery of the participants kept them engaged and focused on the application of value cards within their designs.

Second, the design principles have been generalized to a broader context which can be seen in table 3. Here, a distinction is made between the application of each design principle as seen through each individual element of the SPT. Interestingly clustering the notes into the SPT elements 'values', 'materials' and 'competences' and comparing these to the clustering of the problems into the same themes, revealed a relative similar notion of each SPT cluster. This would suggest that our toolkit provokes users to think about and apply each element on a similar level.

Table 3: The eight defined design principles

| Design Principle | SPT elements | Application |
|---|---|---|
| Accessibility | Values | How familiar users are with the PSS has a significant influence on the way social aspects of a PSS are understood and designed for. Users should be able to adhere their own interests and interpretations. |
| | Materials | Try to limit the influence of a mediator. Participants have proven to be creative and efficient within this area and should therefore be provided enough room to include their own perspectives, but only slightly steered to match the project's interests. |
| | Competences | While the mediator should be open to personal experiences of users, users seem to require more oral additional information about the subject, to grasp the context and improve the effectiveness of the process. Therefore, a higher influence of the mediator is advised. |
| Visuals | Values | Visuals should be used as often as possible to foster brainstorming and generate new ideas. However, the goal of visuals here is to develop rather dedicated places to design for or to challenge current thoughts, rather than solely overcoming a lack of inspiration. |
| | Materials | Visuals are a key aspect of inspiration and knowledge transfer within the material domain. Its effectiveness to foster brainstorming and spark new ideas is here optimal, as it transmits knowledge about practical, often product-related issues. |
| | Competences | While visuals tend to be less important, they do support idea generation and overall help to overcome a lack of inspiration. |
| Context | Values | The help cards were described to be useful in applications of an unfamiliar context, with user-stories in particular |
| | Materials | Users easily lack sufficient context and ideas for addressing the problem of scooter vandalism for example. Help cards that provide specific elements of a broad context can help users to more effectively go about their process. High levels of specificity are required. E.g. interactions and concrete thoughts. |
| | Competences | |
| (Contextual) Adaptability | Values | Focus on facilitating a broad range of applicability, by making value-cards less product-focused, and more problem-related. Herein, external factors like stakeholders and the environment should have an equal influence as more physical elements like material or technology. |
| | Materials | Dependent on the selected broadness of the chosen context, the toolkit should expect to need more help cards to support designers in staying inspired and creative overall. The more specific the context gets; the faster users will require handles for inspiration. |
| | Competences | When focusing on competence- and skill-related issues, the problems should be made broad enough, so users are provided enough room for solutions. If not, users tend to ignore certain value cards in their processes. |
| Inspiration | Values | Herein, it's important that help and value cards immediately trigger curiosity. Value cards that address social elements seem to be the most inspiring in this regard. |
| | Materials | Next to using the toolkit, users should be provided with creative material during brainstorming, which fosters brainstorming about the physical product as well. While value cards can help to structure the process, help cards are deemed less important. |
| | Competences | Providing examples of current competences stimulates idea generation and helps to specify ideas. Value cards were connected to their story in the end and were thus not perceived to be relevant during the process itself. |
| Time | Values | Especially for the value domain, designers should be given enough room to discuss and interpret the meaning and application of different value cards. The current time limit for the design sprint varied between 15 and 20 minutes, which was perceived to be too low. |
| Guidance | Values | Users should be guided in their design processes by steering towards specific ideas, confirming personal preferences, and considering the influence of emotional and social factors. This supports users in rethinking and focusing/scoping the selected problems, fostering exploration of different directions and developing a deeper understanding of the values and perspectives involved. |
| | Materials | Users were given direction and were guided in specifying/combining a broad range of ideas. Certain help cards challenged them to look at things from a different perspective. |
| | Competences | Certain help cards challenged them to look at things from a different perspective. |
| Applicability | Values | Value cards were found to be broad and sometimes challenging to specify. The effectiveness of cards varied depending on the design phase and the problem they were addressing. Some cards were considered less useful, while others guided them in specific directions. |
| | Materials | The cards supported users to develop an understanding of how to tackle product-related issues, but having a pre-defined problem in mind is recommended. |
| | Competences | The toolkit should address different problems and contexts and should look beyond the scope of solely product-related aspects, but also in using associated digital interfaces or the urban infrastructure in which the product is present. |

The interconnectedness of values, competences and materials within SPT is an important aspect of understanding the design process for PSSs. In this research, values are the core of the design process, influencing the JoV. Competences are about knowledge, skills and experiences that the designers use during the design process. This shapes how they engage with and interpret these values. Materials (both physical and informational) serve as the means through which values and competences are applied. These are practical tools and resources that guide and facilitate the design process.

Recognizing the interconnectedness of these different aspects of SPT allows designers to create more meaningful and effective PSSs. It shows the importance of focusing on the context in which the product will be used and the people who will use it, rather than only the end product itself.

## 7 DISCUSSION

In this study, JudgeKit has been developed in order to investigate how a toolkit can be designed to aid designers in designing for PSS with a focus on increasing the JoV. Whereas JoV is an important influencer in how people engage with a PSS, it was an underexplored topic in existing research (Van Der Laan & Aurisicchio, 2020). This research has, therefore, aimed to propose an initial set of value card topics that might stimulate designers to consider various aspects of a PSS in order to increase JoV.

There are existing tools, such as the one by Van Amstel, et al. (2022) which are designed to guide designers in creating PSS with an emphasis on increasing the sense of ownership, but also focuses on the specific case of The Student Hotel. What sets this research apart is not only the shift in focus towards enhancing JoV, but also because the chosen context is utilized to a broader community. The fact that the toolkit was utilized in the context of shared scooters, has led to stimulating designers to tackle larger scaled challenges.

Additionally, this research places a focus on understanding how designers experience the toolkit. Consequently, this research provides insights into how guidance can be offered to designers in actually understanding JoV and how it can be best applied in a design process with various design principles. This aspect differentiates the research from the focus of De Wit et al (2021), where their toolkit primarily focused on defining preconditions for designing PSS in various design phases.

Another distinctive aspect of this research is the focus on SPT during this research, as this theory is a proper guidance to encompass the interconnections between values, materials and competencies of a PSS. Rather than taking a user-centered design approach, SPT provides a comprehensive perspective for PSS design and is therefore often encouraged to utilize when designing for PSS. Consequently, the data analysis has also been performed with a focus on the three components of SPT to investigate if the toolkit stimulated participants to focus on all three of them.

Finally, this research involved a three-phase co-creation process, with the goal of stimulating designers to redesign on three contextual levels; physical environment, product and digital environment in order to make the applicability of the toolkit more generalizable for other PSSs.

### 7.1 Limitations

One of the limitations of this study is the sample size and participant profiles. The sample size was relatively small due to time and resource constraints. Since the participants worked in pairs, it can be argued that there was a shortcoming in the number of various insights. Furthermore, the participants were all Bachelor Industrial Design students. Therefore, the conclusion cannot be drawn that their experience with the toolkit would be the same for designers of different levels of experience.

Additionally, during the co-creation the designers had 15 minutes to design for each contextual level. Some participants mentioned this short time frame prevented them from feeling ‘stuck’ yet and therefore, felt less the need for guidance. It would have been more interesting to investigate the implementation of the toolkit in a more elaborate design process, but due to the given time frame for this research this was not possible.

Measures have been taken to increase the ability to generalize the outcomes of the study (e.g., choosing a more public PSS, that is used by a broader user group and by stimulating designers to focus on various contextual levels). However, it can be argued that the context of shared scooter systems is still rather specific in the field of PSS.

Furthermore, this research introduced aspects that designers can focus on when designing to increase JoV, because there was no existing framework on JoV available. Therefore, it can be argued that the theoretical substantiation may not be very grounded.

### 7.2 Future work

This research focuses a lot on the experience of designers, but not on the actual practical effectiveness of the results that come forth from designing with such a toolkit. As a result, future researchers may perform a longer-term investigation where prototypes are developed to a fidelity that allows for implementation and testing of their impact on users' JoV. In that way, stronger claims can be made on whether the proposed framework for JoV stimulates proper practice for designing for PSS with a focus on JoV.

Additionally, during the study, all designers mentioned to be familiar with the shared scooter systems. Therefore, in the future it can be investigated how designers would experience such a toolkit with a less well-known PSS.

In the future, researchers may also consider testing the applicability of such a toolkit in a different context, e.g., completely moving away from shared mobility systems.

Finally, by using the proposed design principles researchers and designers might be able to develop a more refined toolkit for PSS design to increase JoV. However, there are opportunities to experiment with applying the proposed design principles for developing a toolkit with another focus, distinct from JoV, for PSS design.

## 8 CONCLUSIONS

In the context of this study, the JudgeKit was developed to research the potential of toolkit-based support for designers in designing for Product-Service Systems (PSS) with a specific emphasis on enhancing the judgement of value (JoV). Inductive thematic analysis was conducted using observations and interviews from co-creation sessions to derive design principles for a toolkit. During this research, insights were gained through co-creation sessions with designers on guiding them in designing for JoV. The research employs a social practice theory (SPT) approach, clustering the defined design principles within one of its three elements. This proposed framework offers insights for comprehending the PSS design process with a specific focus on JoV within the context of SPT. While the research question has been addressed with a framework that offers insights into the key design principles for future toolkit design, further research is required to validate the framework in long-term design projects that allows testing the impact on users JoV.

## ACKNOWLEDGMENTS

We want to thank Dirk Ploos van Amstel for his guidance during this research, providing us with valuable and thought-provoking insights and challenges. Our collaboration with Dirk was a good experience, marked by regular meetings and good communication. We are grateful for the time he dedicated and the valuable perspectives he shared. In addition, we want to thank our lecturers, Lenneke Kuijer and Stephan Wensveen, for their insightful lectures and constructive guidance. Besides that, we want to thank the co-creation participants for their enthusiastic involvement in the study and the valuable insights we gained from their contributions. ChatGPT was responsibly used by the researchers as a brainstorm companion and spelling control. Under no circumstances was text fully copied, but always evaluated and interpreted by the researchers.

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# A APPENDICES

## A.1 Preconditions design toolkit overview

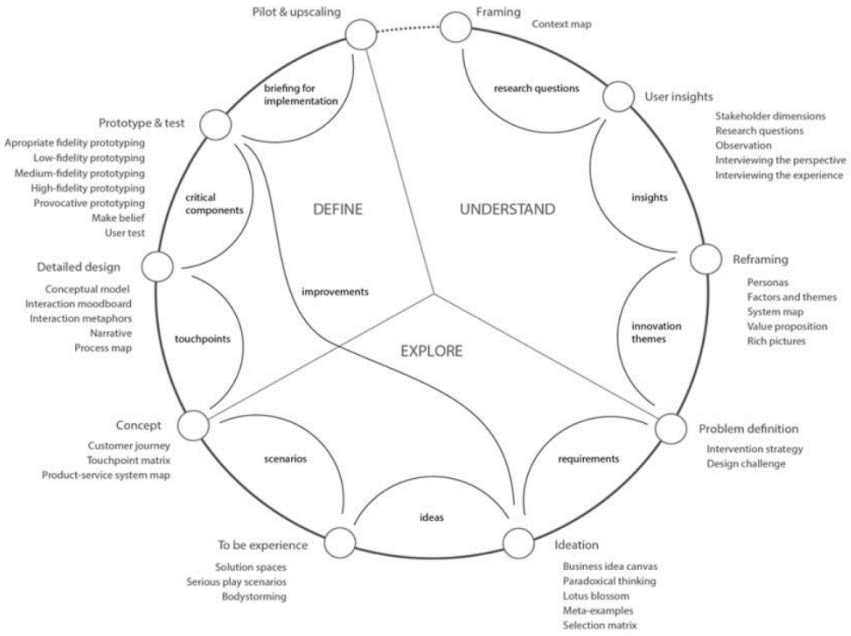



Figure 2: Overview of design toolkit from Dewit et al. (2021)

## A.2 Design process

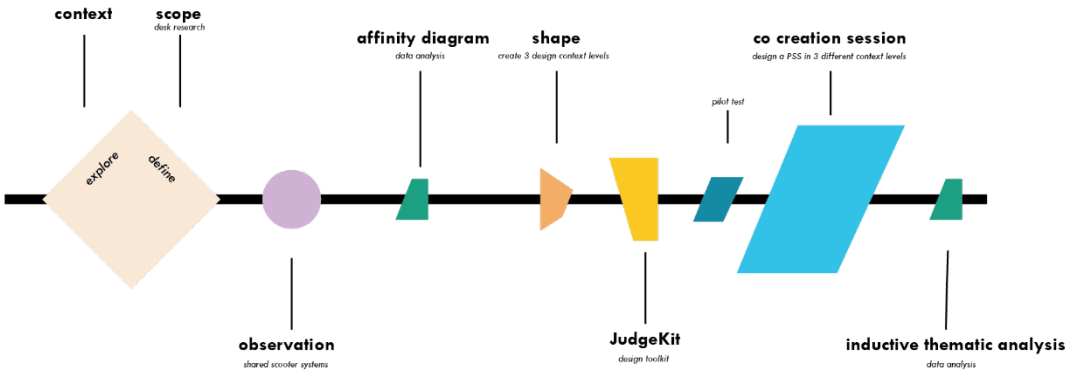



Figure 3: Design process visualization

### A.3 Field observations


Figure 4: Scooter observations around Eindhoven Station

## A.4 Division of SPT elements

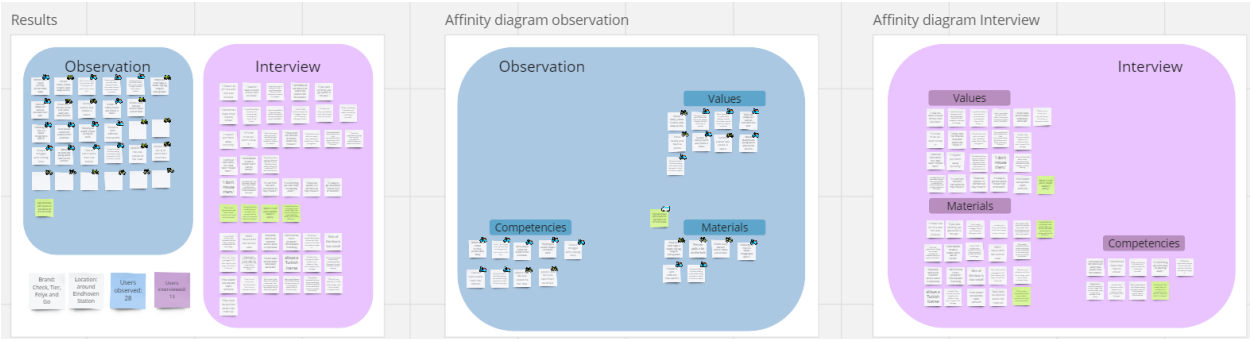



Figure 5: Observations for identifying our PSS context clustered in the SPT elements: ‘values’, ‘materials’ and ‘competences’.

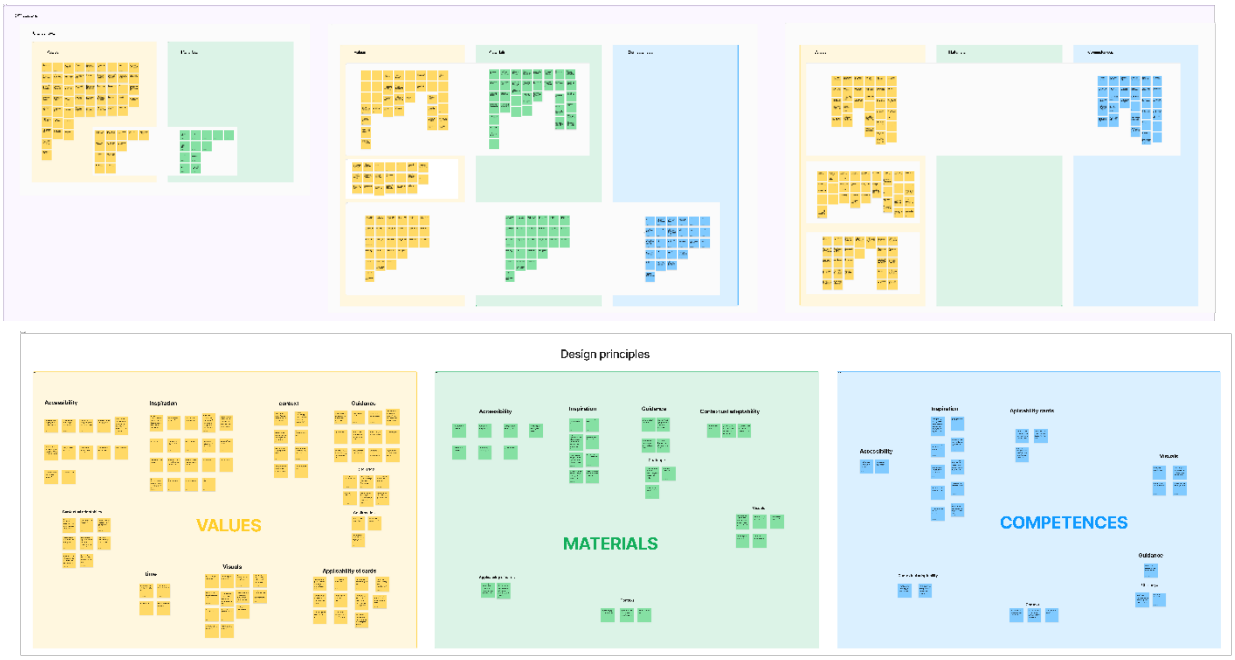



Figure 6: SPT clusters: values (yellow), materials (green), competences (blue) and their design principles clustered per identified (overlapping) design principle.

## A.5 Co-Creation procedure

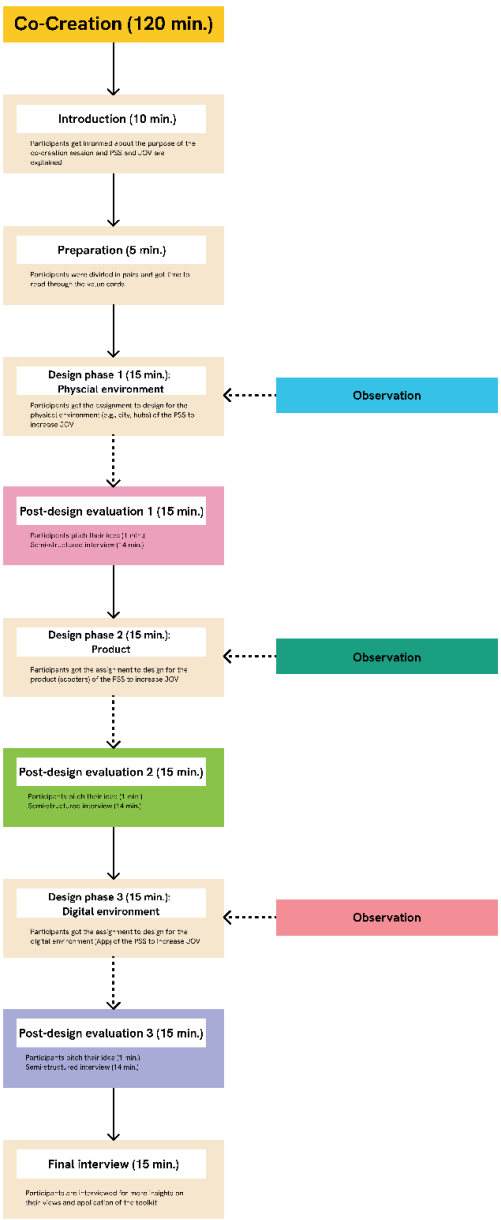
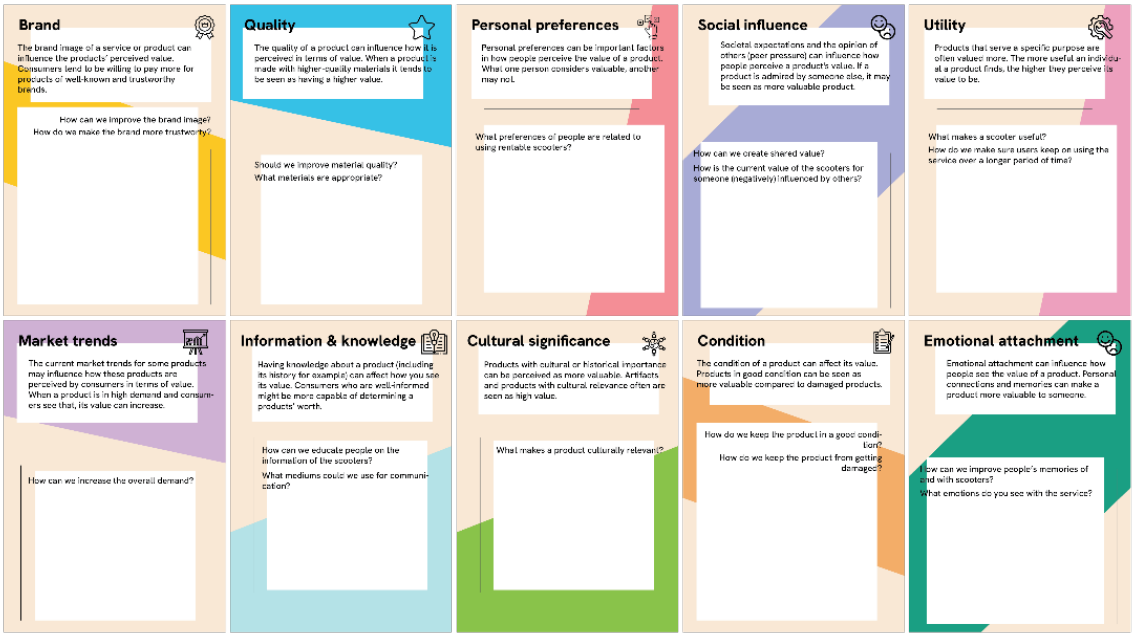



Figure 7: Co-creation procedure visualization

## A.6 Toolkit




### *A.6.1 Value cards*

Figure 8: Value cards

### *A.6.2 Help cards*


Figure 9: Help cards part 1 (contains images from: Boerma, 2022; Deunhouwer, 2023)

**Visual context**

**Scooter**

**User exerience**

Wernand often selects his scooter through the app remotely, choosing the one with the most battery.

**App**

**Context question**

How can we incorporate upgradability or customizable features to maintain the user's emotional

**City**

**User exerience**

Joost uses the shared scooters on a weekly basis. However, he frequently encounters recurring technical issues, like the helmet box not opening. Consequently, he frequently contacts customer service, who can promptly resolve the issue remotely by asking standard questions.

**App**

**Context question**

How can the infrastructure influence the way the shared scooters are used?

**City**

**User exerience**

Hima is often annoyed by the constantly changing green parking zones for his scooter. After he finishes his trip, he has to drive and stop multiple times to find an available spot to park his scooter

**City**

Figure 10: Help cards part 2 (contains images from: Michaelras, 2022)

**User exerience**

Jack doesn't feel responsible for the shared scooter because he believes it's not his own. He thinks, 'It's normal for them to be broken; that's the nature of shared scooters.'

**Scooter**

**Context question**

How can we craft a compelling story or narrative around the product to emotionally engage users?

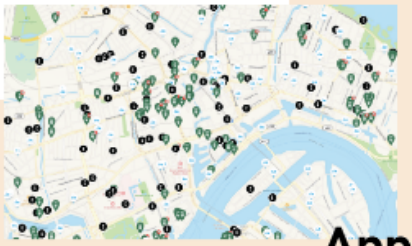
**App**

**User exerience**

Jasmine often doesn't report scooter damages at the end of her ride because she's afraid she'll be held responsible for the costs, even if the damage was pre-existing before she started the ride.

**Scooter**

**Visual context**



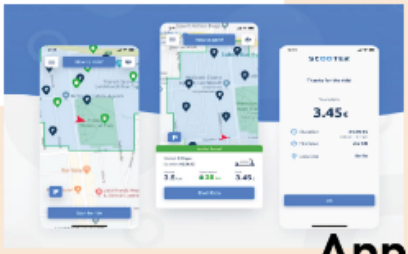
**App**

**User exerience**

Maud always sees it as a competition to reach another location as quickly as possible. This is not only to save money but also because she enjoys testing the acceleration of electric scooters.

**City**

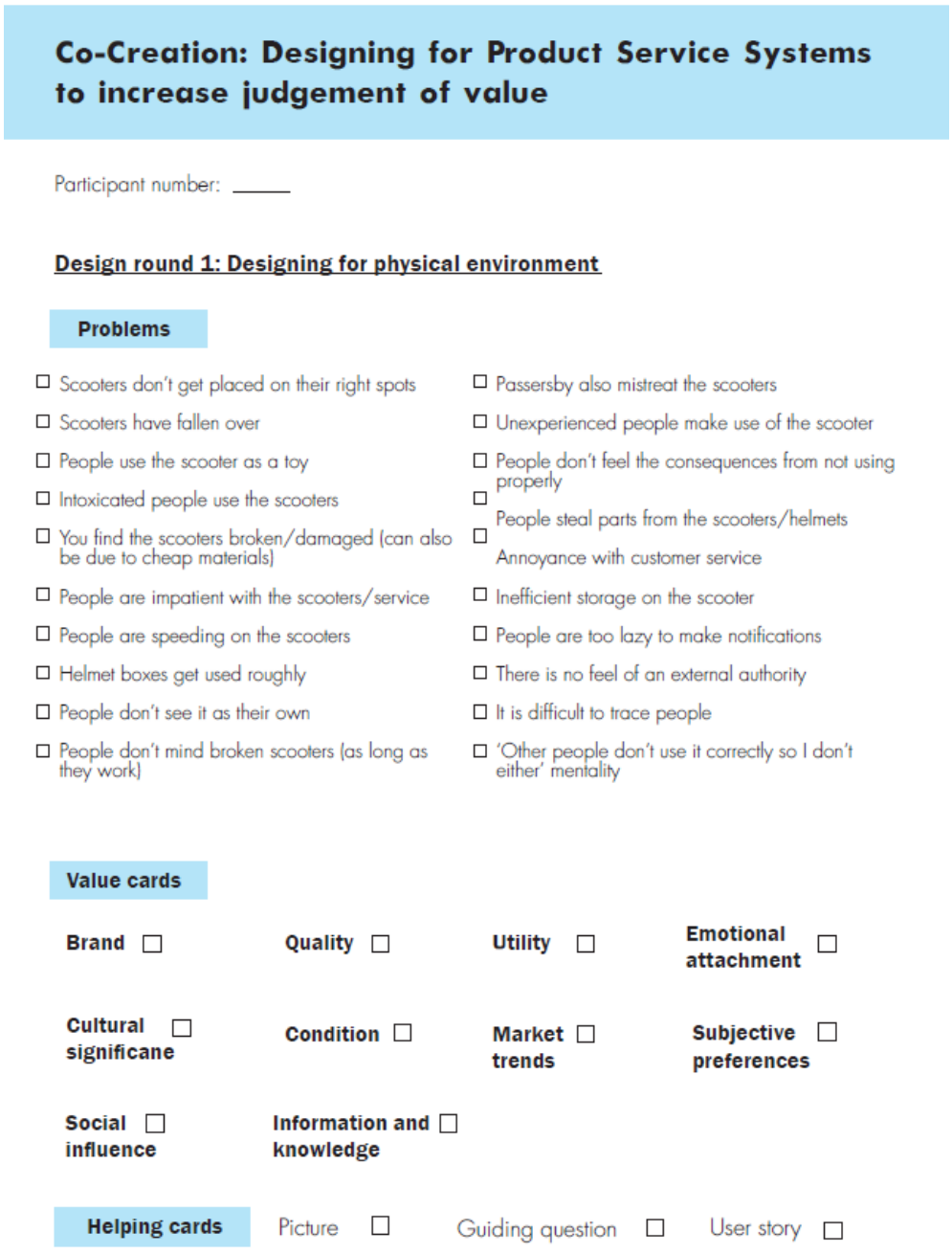
**Visual context**



**App**

Figure 11: Help cards part 3 (contains images from: Volkert, 2020; Mobindustry, 2023)

*A.6.3 Worksheet*



**Co-Creation: Designing for Product Service Systems to increase judgement of value**

Participant number: _____

**Design round 1: Designing for physical environment**

**Problems**

- ☐ Scooters don't get placed on their right spots
- ☐ Scooters have fallen over
- ☐ People use the scooter as a toy
- ☐ Intoxicated people use the scooters
- ☐ You find the scooters broken/damaged (can also be due to cheap materials)
- ☐ People are impatient with the scooters/service
- ☐ People are speeding on the scooters
- ☐ Helmet boxes get used roughly
- ☐ People don't see it as their own
- ☐ People don't mind broken scooters (as long as they work)
- ☐ Passersby also mistreat the scooters
- ☐ Unexperienced people make use of the scooter
- ☐ People don't feel the consequences from not using properly
- ☐ People steal parts from the scooters/helmets
- ☐ Annoyance with customer service
- ☐ Inefficient storage on the scooter
- ☐ People are too lazy to make notifications
- ☐ There is no feel of an external authority
- ☐ It is difficult to trace people
- ☐ 'Other people don't use it correctly so I don't either' mentality

**Value cards**

**Brand** ☐ **Quality** ☐ **Utility** ☐ **Emotional attachment** ☐

**Cultural significane** ☐ **Condition** ☐ **Market trends** ☐ **Subjective preferences** ☐

**Social influence** ☐ **Information and knowledge** ☐

**Helping cards** Picture ☐ Guiding question ☐ User story ☐

Figure 12: Worksheet

### A.7 Interview questions

Questions:

After each context

- Why did you choose for the specific judgement of value cards?
- Why did you choose to solve that/those problem(s)?
- Why did you take a help card?
- How did you take the user's perspective into account when designing for this aspect?
- Did you feel like the toolkit supported you in designing the PSS for this context?
  No --> why not?
  Yes --> How so?
- In what ways do you think your design will lead users to treat the product better and make it last longer?
- Did you fix the problem you checked at the beginning of the design process (checklist)?

After the co creation session

- What are your general impressions of the toolkit after using it in this session?
- How would you describe the role of the toolkit within the design process?
- Why would you use it again/or not when wanting to design for value?
- What aspects do you think were missing in the cards?
- What aspects could be combined?
- Which aspect do you feel like could have been removed completely?
- How did the context change your choice of value cards?
- Did the toolkit help you make more informed design decisions? Why (not)?
- What role did the helping card(s) have within the design process?
- How did the toolkit support you by identifying the opportunities within the PSS?
- What helping card (guiding question, user story, picture) do you think was most helpful? Why?
- Do you think the designs you created during the session are more likely to resonate with users and encourage product longevity? Why (not)?
- Did the toolkit help for understanding and design in judgement of value? Why (not)?
- Imagine you had to design a complete PSS of all the three contexts together, which judgement of value cards would you find most important?

### A.8 Data analysis

Table 4: frequency of problems and specific card selections in various contexts

| | Team 1 R1 | Team 2 R1 | Team 3 R1 | Team 1 R2 | Team 2 R2 | Team 3 R2 | Team 1 R3 | Team 2 R3 | Team 3 R3 |
|---|---|---|---|---|---|---|---|---|---|
| Problems with the PSS | | | | | | | | | |
| Scooters don't get placed on their right spots | x | | x | | | | | | |
| Scooters have fallen over | | | x | x | | | | | |
| People use the scooter as a toy | | x | | x | | | | | |
| Intoxicated people use the scooters | | | | | | | | | |
| You find the scooters broken/damaged | | | | | | x | | | |
| People are impatient with the scooters/service | x | | | | | | | | |
| People are speeding on the scooters | | | | | | | x | | x |
| Helmet boxes get used roughly | | | | | | | | | |
| People don't see it as their own | | x | | | x | | | | |
| People don't mind broken scooters | | | | | | x | | | |
| People experience problems with the technology | | | | | | | | | |
| Passersby also mistreat the scooters | | | x | x | | | | | |
| Unexperienced people make use of the scooter | | | | | | x | x | | |
| People don't feel the consequences for improper usage | | | | | | | | | x |
| People steal parts from the scooters/helmets | | | | x | | | | | |
| Annoyance with customer service | | | | | | | | | |
| Inefficient storage on the scooter | | | | | | | | | |
| People are too lazy to make notifications | | | | | | | | | x |
| There is no feel of an external authority | x | | | x | | | | | x |
| It is difficult to trace people | | | | | | | | | |
| Other people don't use it correctly so I don't either' mentality | | | | | | | | | |
| People don't use their own account | | | | | | | x | x | |
| Judgement of value cards | | | | | | | | | |
| Brand | | | | ~ | | | | | |
| Quality | | | | | x | x | | | |
| Utility | | | | x | | | | | x |
| Emotional attachment | | x | x | | | x | | | x |
| Cultural significance | | | | | | | | | |
| Condition | | | | | x | x | | | |
| Market trends | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Subjective preferences | | x | | x | | | | | x |
| Social influence | x | | | x | | | x | x | |
| Information and knowledge | | | x | | | | x | | |
| Helping cards | | | | | | | | | |
| Picture | | | x | x | x | x | | x | x |
| Guiding question | | | | | x | x | x | x | |
| User story | x | x? | | | | x | | | x |

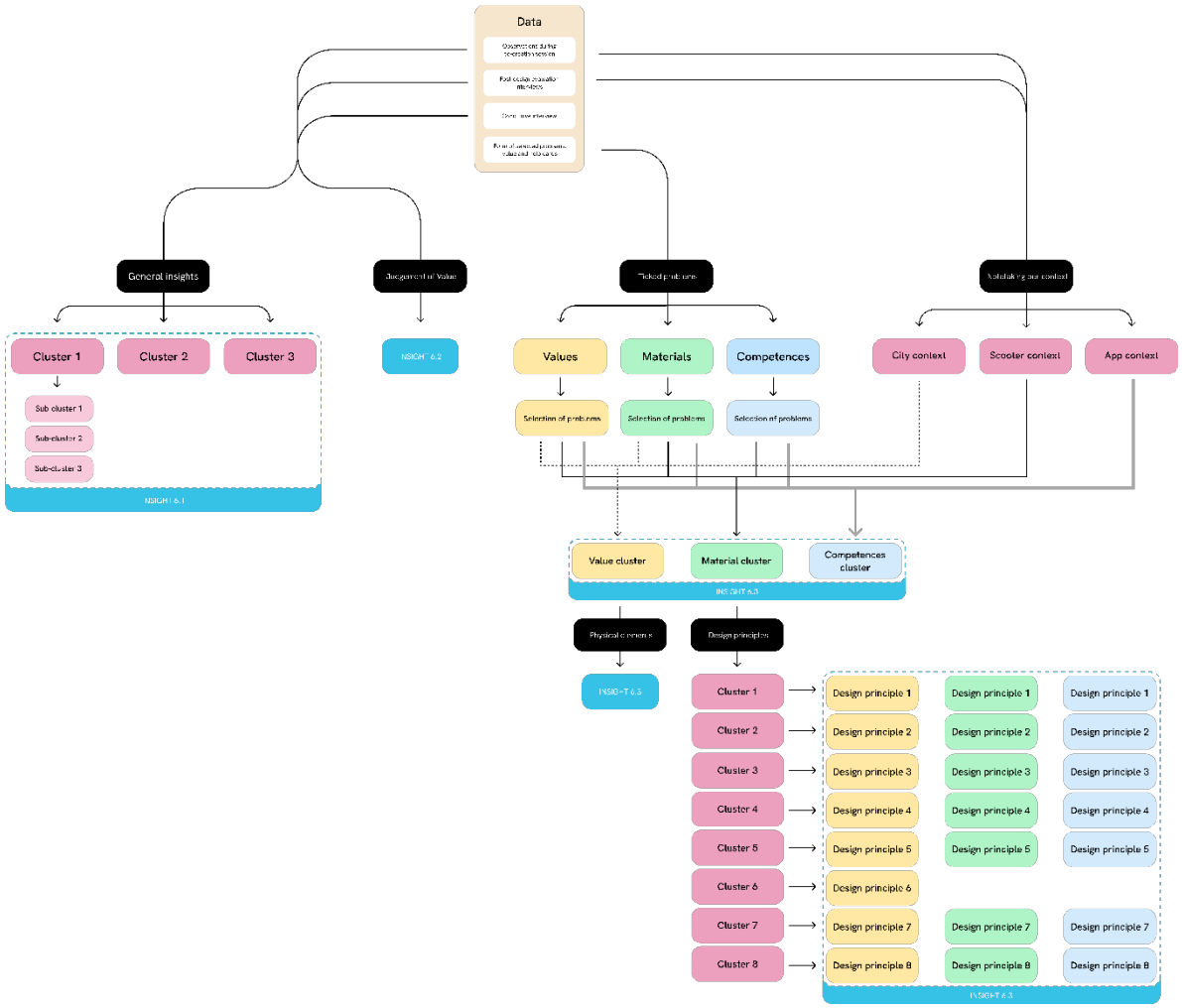



Figure 13: Data analysis process visualization

### A.9 Contribution in research

#### *A.9.1 Emir Kadrić*

Mechanical Engineering, Industrial Design

In the research I took the task of defining the gaps in existing literature, identifying areas where our work would make a valuable contribution. These contributions are thoroughly outlined in the "Related Work" section of the paper. Moreover, I played a role in data collection and observations during the co-creation session. Following this a thematic analysis was done to extract our findings.

#### *A.9.2 Timo Maessen*

During my four years of studying Industrial Design and being part of two design-oriented student teams at the University of Technology Eindhoven, I have found a passion within the domain of digital-physical interaction from a human-centered perspective. I envision a future, where play is seen as a central force in design, reshaping how we interact with the digital and physical realm. This vision is grounded in my strong belief that play has unbounded power, which transcends age boundaries and sparks our creative minds. I get excited by researching and applying emerging technologies in novel applications, that fosters ecological and societal impact.

I prefer to design for the present, as it enables me to place my design in a realistic context and evaluate its impact on the spot. I seek adventure in hands-on exploration, both in the digital and physical realm, where I turn concepts into interactive experiences.

During the process, my main contribution was the alignment of everyone's vision on the project by challenging current beliefs and assumptions. I handled this by preparing digital schematics of promising methods and corresponding data flow. I was partly responsible for the ideation and realization of our physical toolkit. I facilitated the co-creation session, through the means of preparing and presenting slides, as well as supporting the researchers during their sessions. Next to that, I was responsible for the approach and execution of data analysis and interpretation. Hence, I have written the section Findings and contributed to rewriting and optimizing other parts as well.

#### *A.9.3 Amna Strojil*

Industrial Design

My main contribution to the research was in the development of the co-creation as I tried to ensure that the co-creation set-up was structured and clear. I was responsible for developing the protocol and printed materials like the worksheets and eventually being the main responsible for the Methods section. Furthermore, I also looked into the limitations, link to related work and proposed future work of our research for the discussion section. Finally I supported the data analysis and introduction section where needed.

#### *A.9.4 Jens Vervoort*

Industrial Design

At the beginning of the research there were complicated times and meetings, I hope that with my contribution I ensured that we were on the same page as a team. I have always tried to understand everyone and keep a good atmosphere in the team. During the co-creation I was one of the observers. I also focused on creating the toolkit and writing the design part.

#### *A.9.5 Rosa van Wershoven*

Industrial Design

In this research, my primary role involved the theoretical background that served as the base of the study. Additionally, I took on the task of writing the introduction and formatting the final paper in the ACM template. I also played a significant role in transcribing a substantial part of the interviews. Finally, I offered support at the very beginning of the data analysis and assisted in the findings section where needed.

## A.10 ERB

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

# Ethical Review Form

**(Version 2.1)**

This Ethical Review Form should be completed for every research study that involves human participants or personally identifiable personal data and should be submitted to ethics@tue.nl. For more information about how this process works please click here. Please check if you are using the correct form: Ethical Review Form (version 2.1). Please click here to obtain this latest version.

| Part 1: General Study Information | | |
|---|---|---|
| 1 | Project title / Study name | The Bike Kitchen |
| 2 | Name of the researcher / student | Emir Kadric<br>Timo Maessen<br>Jens Vervoort<br>Rosa van Wershoven<br>Amna Strojil |
| 3 | Email of the researcher / student | e.kadric@student.tue.nl<br>t.f.m.maessen@student.tue.nl<br>j.a.j.vervoort@student.tue.nl<br>r.c.v.wershoven@student.tue.nl<br>a.strojil@student.tue.nl |
| 4 | Supervisor(s) name(s)<br>*Additional explanation: Please write down the name of your direct supervisor. You can mention several supervisors if appropriate, but at least one supervisor should be mentioned.* | Stephan Wensveen (lecturer)<br>Lenneke Kuijer (lecturer)<br><br>Dirk Ploos Van Amstel (researcher) |
| 5 | Supervisor(s) email address(es)<br>*Additional explanation: Please give the email address of the supervisor(s) mentioned in question 4.* | s.a.g.wensveen@tue.nl<br>S.C.Kuijer@tue.nl<br><br>Dirk.ploosvanamstel@hu.nl |
| 6 | Department / Group<br>*Additional explanation: Please specify group if relevant e.g. JADS or HTI* | Industrial Design |
| 7 | What is the purpose of this application? | ☐ Scientific study<br>☐ Bachelor education. Course:……<br>☒ Master education. Course: Constructive Design Research (DCM100)<br>☐ Other (e.g. external, following external regulations):…… |
| 8 | Research location<br>*Additional explanation: Where will the data collection take place? On campus, in a company, in public space, online, etc.* | ☒ Eindhoven University of Technology campus<br>☐ Other, name organization(s):……<br>☒ Public space<br>☐ Online |
| 9 | Start date data collection<br>*Additional explanation: Please state when your data collection will start. Please note that you do not have to provide information about your complete (PhD) project, but only on this particular sub-study that you are submitting for approval in this form.* | 25/09/2023 |
| 10 | End date data collection | 02/11/2023 |
| 11 | Does your project receive external funding (e.g., NWO, relevant for special regulations from funders)? | ☐ Yes. Name Funder:<br>☒ No |

1

# Ethical Review Form

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| **12** | Which internal and external parties are involved in the study? Think about sharing data or information between TU/e and other universities, commercial companies, hospitals, etc.<br>*Additional explanation: Describe all internal and external parties that are involved in the study or project, including:*<br>• *researchers or research groups at the TU/e who participate in the study;*<br>• *(Researchers at) other universities/institutions that provide data/services, help analyzing the data, etc.;* | Internal parties<br>• Researcher(s):<br>Emir Kadric<br>Timo Maessen<br>Jens Vervoort<br>Rosa van Wershoven<br>Anna Strojil<br>• Supervisor:<br>Stephan Wensveen (lecturer)<br>Lenneke Kuijer (lecturer)<br>Dirk Ploos Van Amstel (researcher) |

2

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

# Ethical Review Form

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| | • *(commercial) partners, companies, government bodies, municipalities, consultancy firms, hospitals or care institutions that provide data (e.g., contact details of participants, data for further analysis).*<br>*Indicate which role each party plays: who defines the means and purposes in the study, who will supply the data (external parties?), who will process/handle the data, who will be able to access the data during and after research (only researchers at TU/e or also others)?* | External parties<br>• Other universities/institutions:<br>• Others: …… |
| 13 | Have any special agreements already been made with an external party, such as a Non-Disclosure Agreement (NDA) or a data sharing agreement? | ☐ Yes, namely:<br>☒ No |
| 14 | Has your proposal already been approved by an external Ethical Review Board or Medical Ethical Review Board?<br>*Additional explanation: For example, when you are collaborating with another university and the project has been approved by their Ethical Review Board, or when you received a WMO-waiver from a Medical Ethical Review Board.* | ☐ Yes<br>☒ No |
| 15 | If yes: Please provide the name, date of approval and contact details of the ERB. Please also include the registered number for your project approval. Additionally, please send in the Ethical Review Form upon which ethical approval was granted together with this form. | |
| 16 | If you process personal data that are likely to result in high privacy risks for participants, you need to perform a Data Protection Impact Assessment (DPIA). Have you done this for this or a very similar project?<br>***Please read the information below: a DPIA is not the same as a regular privacy impact assessment. More detailed questions on privacy will follow in the section below.***<br>*Additional explanation: A Data Protection Impact Assessment (DPIA) is a formal document that must be drafted under the guidelines of the General Data Protection Regulation (GDPR). Think of research with vulnerable people, high-risk medical research,*<br>*The Dutch DPA (Autoriteit Persoonsgegevens) and our website provides more information about a DPIA.* | ☒ Not applicable (no high privacy risks)<br>☐ Yes (the form is attached to the application)<br>☐ No |
| **Part 2: Medical study** | | |
| 1 | Does the study have a medical scientific research question or claim?<br>*Additional explanation: Medical/scientific research is research which is carried out with the aim of finding answers to a question in the field of illness and health (etiology, pathogenesis, signs/symptoms, diagnosis, prevention, outcome or treatment of illness), by systematically collecting and analyzing data. The research is carried out with the intention of contributing to medical knowledge which can also be applied to populations outside of the direct research population. If your research contains questions about health and health related parameters (such as well-being, vitality, feelings of anxiety or stress) but your research question is not primarily medical, then you can answer 'no' to this question.* | ☐ Yes*<br>☒ No<br>*If yes or in doubt, please contact Susan Hommerson via s.m.hommerson@tue.nl |

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

Ethical Review Form

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| **Part 3: Use of (medical) devices in the study** | | |
| 1 | Does your research include a device?<br>*Additional explanation: A device is a complete piece of physical hardware that is used to compute or support computer functions within a larger system. Devices can be divided into input-, output-, storage-, internet of things-, or mobile device.* | ☐ Yes, not self-made<br>☐ Yes, self-made<br>☒ No |
| 2 | Please describe your device or link to an online description of the device | |
| 3a | Will you use a device that is 'CE' certified for **unintended use** (meaning you will use existing CE certified devices for other things than they were originally intended for) or use a device that is not 'CE' certified?<br>*Additional explanation: You can find more information about CE certification here* | ☐ Yes<br>☐ No<br>☐<br>☐ |
| 3b | If no: Please explain to what extent the device was assembled according to relevant standards and provide a risk assessment<br>*Additional explanation: You can find more information about a risk assessment here* | |
| 3c | If yes: Do you use a device or software that has a medical purpose such as diagnosis, prevention, monitoring, prediction, prognosis, treatment or alleviation of disease or injury? | ☐ Yes, my device or software currently has a medical purpose<br>☐ Yes, my device or software could have a medical purpose in the near future<br>☐ No<br>☐ I'm not sure |
| **Part 4: Information about the study** | | |
| 1 | What are your main research questions?<br>*Additional explanation: You need to provide at least one clear research question.* | How should designers design for judgement of value in PSS when evaluating the context through the social practice theory in order to encourage sustainable, closed-loop activities? |
| 2a | Please check the box that indicates the relevant study population<br>*Additional explanation: Please select which persons are eligible for your study.* | ☒ Students<br>☒ General healthy population<br>☐ General population with specific feature, e.g., pregnancy, specifically .....<br>☐ Patients, specifically .....<br>☐ Other, specifically ..... |
| 2b | Age category of participants | ☐ Younger than 12 years of age<br>☐ Older than 11 and younger than 16 years of age<br>☒ 16 years or older |
| 3 | Description of the research method (select all that applies) | ☒ (Semi-structured) interviews<br>☐ Surveys |

4

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

# Ethical Review Form

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| | *Additional explanation: Please specify your research method. Note that you need to provide information about the research method in an additional file that you attach to the ERB form. E.g., for interviews you provide the interview questions, for surveys you provide the survey questions, etc.* | ☒ Group workshops/roundtable discussios<br>☐ Diary studies<br>☒ Behavioral observations<br>☐ Building sensor data<br>☐ Wearable device (e.g. Fitbit watch, on-skin sensors)<br>☐ User testing<br>☒ Pilot study<br>☐ GPS tracking/location data<br>☐ Living Lab<br>☐ Other, namely ..... |
| 4 | Description of the measurements and/or stimuli/treatments<br>*Additional explanation: Think about your outcome measures and the variables you will be collecting and describe them in a way such that another person understands what the participant will experience. For example: Participants will perform task A and see pictures from database B, and we measure validated Scale 1.* | Part 1: Observation and interview<br>People making use of a shared product system (in this case shared scooters like GO, Felix, Check) will be observed to find out how they make use of the system and how they treat the product. Some participants will also be interviewed to gain more in-depth insights on how they use/treat the products/system and why they think the system might be misused.<br><br>Part 2: Co-creation, observation and interview<br>Participants will be asked to design a product service system in a way to give users of the system an increased judgment of value. During this co-creation they might get some questions and will be observed. For the co-creation session they will be given a toolkit (e.g., helping cards and crafting materials). After the session questions will be asked to gain insights on how the toolkit has been used and how useful it was. |
| 5 | Describe and justify the number of participants you need for this study. Also justify the number of observations you need, taking into account the risks and benefits.<br>*Additional explanation: Think about if you need 3 or 30 participants for example, and why? Do they need to provide their input once, or several times, and why? If relevant, specify the duration of the study per participant and the compensation that is needed for the study.* | Part 1: Observation/interview<br>5-40 participants. This number of participants has been chosen so that we have an amount of observations and answers from which reliable conclusions can be drawn from thematic analysis. All participants only need to provide their input once.<br><br>Part 2: Co-creation and interview<br>1-15 participants. This number has been chosen so that patterns from the results and answers can be identified, but still make it manageable to organize a co-creation session with where participants can also be observed. |
| 6 | Explain why your research is societally important. What benefits and harm to society may result from the study?<br>*Additional explanation: What benefit will the results of your study have to society in general?* | The challenge in achieving a closed loop within a product service system lies in the reliance on the meaningful contributions of all stakeholders involved in the process, particularly the customers utilizing the service. They are expected to handle the offered products with care, but in practice, a different behavior is often observed. This can have many causes with one of them being lack of judgement of value. An undervaluation of the product may result in its mishandling, potentially affecting other users within a social practice environment. Encountering such behavior from others may, in turn, diminish one's own assessment of the product's value.<br><br>The opportunity here therefore lies in understanding and harnessing the influence of rather unexplored elements of PSSs, like judgement of value. Judgement of value is concerned with the way humans assess the value of resources based on experience, cultural and contextual dimensions. This element has proven to be effective when it comes to closing the resource loop. By studying a rather unstudied field of practice, we believe we can provide innovative and novel solutions for designers, to support them in develop strategies that promote sustainable, closed-loop activities and address challenges concerned with resource obsolescence and waste accumulation. |

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

Ethical Review Form

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| 7 | Describe the way participants will be recruited<br>*Additional explanation: How will you recruit participants for your study? For example, by using flyers, personal network, panels, etc.* | ☐ Survey link posted online, e.g., social media platforms<br>☐ On campus flyers<br>☒ Personal network<br>☐ Via a company, namely ……<br>☐ Via a hospital, namely ……<br>☐ Via an organization ……<br>☐ By a Consortium Partner, namely ……<br>☒ Other, namely by approaching them on the street |
| 8 | Provide a brief statement of the risks you expect for the participants or others involved in the study and explain. Also take into consideration any personal data you may gather and associated privacy issues.<br>*Additional explanation: Risks for the participants can be anything from risk of data breach to risk of safety or well-being (think about stress, extreme emotions, visual or auditory discomfort). Describe these possible risks and describe the way these risks are mitigated.* | There are no expected risks for the participants or others involved; the study does not include sensitive information or harmful activities. |

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

Ethical Review Form

## Part 5: Self-assessment checklist

| | *Note: answers in the blue boxes indicate that your research is eligible for fast-track approval* | Yes | No |
|---|---|---|---|
| 1a | Does the study involve human material? (e.g., surgery waste material derived from non-commercial organizations such as hospitals) | | x |
| 1b | Will blood or other (bio)samples be obtained from participants? (e.g., hair, sweat, urine or other bodily fluids or secretions, also external imaging of the body) | | x |
| 2 | Will the participants give their consent – on a voluntary basis – either digitally or on paper? Or have they given consent in the past for the purpose of education or for re-use in line with the current research question? | x | x |
| 3 | Are the participants, outside the context of the research, in a dependent or subordinate position to the investigator?<br>Additional explanation: Think about doing research on your own students or on your own employees. When there is a dependency or power imbalance between you and the research participants, you need to answer 'yes' to this question. | | x |
| 4 | Does the study involve participants who are particularly vulnerable or unable to give informed consent? (e.g., children (<16 years of age), people with learning difficulties, patients, people receiving counselling, people living in care or nursing homes, people recruited through self-help groups) | | x |
| 5 | Will participating in the research be burdensome? (e.g., requiring participants to wear a device 24/7 for several weeks, to fill in questionnaires for hours, to travel long distances to a research location, to be interviewed multiple times)? | | x |
| 6 | May the research procedure cause harm or discomfort to the participant in any way? (e.g., causing pain or more than mild discomfort, stress, anxiety or by administering drinks, foods, drugs, or showing explicit visual material) | | x |
| 7 | Will financial inducement (other than reasonable expenses and compensation for time) be offered to participants?<br>Additional explanation: For an explanation of what is considered a reasonable compensation, see the topic participant fees from the HTI group | | x |
| 8a | Will it be necessary for participants to take part in the study without their knowledge and consent at the time? (e.g., covert observation of people) | x | x |
| 8b | If yes: Will you be observing people without their knowledge in public space? (e.g. on the street, at a bus-stop) | x | |
| 9 | Will the study involve actively deceiving the participants? (e.g., will participants be deliberately falsely informed, will information be withheld from them, or will they be misled in such a way that they are likely to object or show unease when debriefed about the study) | | x |
| 10 | Will participants be asked to discuss or report sexual experiences, religion, alcohol or drug use, suicidal thoughts, or other topics that are highly personal or intimate?<br>Additional explanation: Think about your research population. For some participants, particular topics can be considered sensitive or intimate, whereas the same topics will not be perceived as such by other participants. | | x |
| 11 | Elaborate on all boxes answered outside of the blue boxes in part 5. Describe how you safeguard any potential risk for the research participant. | | |

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

Ethical Review Form

## Part 6: Self-assessment on privacy

The following questions (1-11) concern privacy issues, as laid down in the General Data Protection Regulation (GDPR). The Data Stewards and – if necessary – privacy team of TU/e will assess these questions. In some cases, more information is required to assess the privacy risks. If this is the case, you will be notified that the Data Stewards team will contact you.

The GDPR defines 'personal data' as any information relating to an identified or identifiable natural person ('data subject'). Personal data also includes data that indirectly reveals something about a natural person. Personal data can lead to the physical, physiological, genetic, mental, economic, cultural or social identity of a natural person. There are two main categories of personal data: regular personal data and special category personal data.

If you are not sure whether some of these questions below should be answered with a Yes or No, please contact a Data Steward first through rdmsupport@tue.nl.

| | *Note: answers in the blue boxes indicate that your research is eligible for fast-track approval* | Yes | No |
|---|---|---|---|
| 1 | Will the study involve discussion/collection/processing of **regular** personal data, or will you collect and (temporarily) store video or voice recordings for the purpose of conducting interviews?<br><br>*Additional explanation: For example, name, address, phone number, email address, IP address, gender, age, video or interview recordings? If you are not sure whether your data contains personal data, please contact the Data Stewards Team (rdmsupport@tue.nl).* | x | |
| 1A | If yes: Please describe which regular personal data you will collect in this study? | For one part of the study, we will note down the participants' occupation (they will all be design students from the TU/e) and we will make voice recordings of interviews and take pictures of the co-creation session where the participants will be unrecognizable | |
| 2 | Will the study involve discussion/collection/processing of **special category** personal data or other **sensitive data**?<br>*Additional explanation: Examples of special category personal data are race, religion, health information, political views, genetic or biometric data for the unique identification of a person, sexual preference, etc. Health information concerns personal data of the physical or mental health of persons, including the provision of health care. Examples of other sensitive data is information such as communication data, financial records or credit scores, camera surveillance data, location/GPS data, internet-of-things data, employee monitoring, observing or influencing behaviour, criminal records, data of vulnerable persons (children, people with disabilities, refugees), BSN number etc. Please be aware that the use of special category personal data in research requires extra security measurements in order to safeguard the privacy of data subjects and to comply with the GDPR. Processing of this special category data is prohibited, except for specific purposes and under certain circumstances. If you need to process special category data, please consult the data stewards at rdmsupport@tue.nl.* | | x |
| 2A | If yes: Please describe which special-category personal data and/or sensitive data you will collect in this study? | | |

*If you answered yes to either question 1 or 2, please answer the questions below. If you answered no to both questions, you can skip this part and continue onto part 7. Also, if an answer to any of the following questions is 'yes', please contact a Data Steward at rdmsupport@tue.nl*

| | | Yes | No |
|---|---|---|---|

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

Ethical Review Form

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| 3 | Will your project involve the processing of personal data on a **large scale**?<br><br>*Additional explanation: In general, any processing that involves more than 10.000 data subjects should be considered "large scale". However, if the data of approximately 1000 persons (or more) are involved, the data processing may still be considered large scale. In that case, besides the number of persons involved in the study, one should also assess (i) the amount of data collected from these persons taking into account the type/risk level of the personal data, (ii) the duration of the data processing, (iii) the geographic scope or extent of the processing. For example, if you would collect and process data across several European countries with 10+ socio-economic data items of 1200 individual persons for several years in a row, that is likely "large-scale processing". Other examples of a large-scale processing activity are:*<br>• *Monitoring driving behavior of road users on Dutch highways*<br>• *Collecting data of Covid patients*<br>• *A hospital that processes patient data as part of its usual operations* | | x |

9

# Ethical Review Form

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| | • *A transport company that processes travel information of people who travel by public transport in a certain city. For example, by tracking them through travel maps.* | | |
| 4 | Does this processing activity involve the use of new or innovative technologies?<br>*Examples of a new technology: combining fingerprints and facial recognition for physical access control, the use of bodycams in public spaces, the use of new technical methods in conducting research such as AI. This question also refers to new technologies that have not been deployed by TU/e so far.* | | x |
| 5 | Does your study involve systematic (c.q. automated) monitoring of persons?<br>*Additional explanation: Consider data processing activities that have the purpose of observing, monitoring or controlling individuals, for example in circumstances where the individuals are not aware by whom their personal data is collected and how it is used. Examples of such activities are using camera systems to monitor driving behavior on highways, monitoring email inactivity or employee phone use, certain applications of machine learning and artificial intelligence.* | | x |
| 6 | Does the study involve collaborations (with third parties) in which data are shared or exchanged in order to link or combine data?<br>*Additional explanation: This may often apply in a collaboration between the university and a commercial party, contract research, etc. It is important to assess this for all data in the entire project, not just your own data.*<br>*An important consideration in this situation is whether the person whose data is involved could have expected that data from these different databases or sources of information were to be combined. For example, it is less likely for data subjects to expect that databases from different parties will be combined and the results are used for different purposes than one could reasonably expect; this may apply for example in a collaboration between the university and a commercial party.* | | x |
| 7 | Will the study include data processing activities that prevent data subjects from exercising their rights or using a service or contract?<br>*Additional explanation: Examples include processing operations carried out in public places that people cannot avoid (train station, airport, shopping mall, public university premises, etc.) or processing operations whose purpose is to allow or not allow data subjects to use a service or enter into a contract (examples: by refusing to pay a benefit, not being able to apply for a loan, etc.).* | | x |
| 8 | Will the study process personal data to score, rank or profile persons?<br>*Additional explanation: Examples: monitoring (highway) roads to give road users a "score" based on their detected driving behavior, a bank assessing its customers based on their creditworthiness, or an organization building behavioral and marketing profiles based on use of their website or navigating their website.* | | x |
| 9 | Does your data processing include activities that involves composing "**blacklists**" – and, in particular, in relation to sensitive or special category data, such as communication data, financial records or credit scores, genetic data, biometric data, health data, camera surveillance data, location/GPS data, internet-of-things data, employee monitoring, observing or influencing behaviour, etc.<br>*Additional explanation: This situation will not be a common occurrence in research, but you may indirectly be involved in this. In general, this typically concerns processing operations involving personal data relating to criminal convictions and offences, data relating to unlawful acts, data concerning unlawful or annoying behaviour or data concerning bad payment behaviour by companies or individuals are processed and shared with third parties (blacklists or warning lists, as used, for example, by insurers, hospitality companies shopping companies, telecom providers as well as blacklists relating to unlawful behavior of employees, for example in the healthcare sector or by employment agencies, etc.).* | | x |
| 10 | Will personal data be transferred or shared outside the EU/EEA?<br>EU data protection rules apply to the European Economic Area (EEA), which includes all EU countries and non-EU countries Iceland, Liechtenstein and Norway.<br>*Additional explanation: The GDPR has drafted additional requirements for transfers data outside of the EU/EEA. Typically, additional safeguards must be implemented to protect the personal data of residents in the European Union. For example, if you collaborate with an American, Indian or Chinese university or other third party outside the EU/EEA, you must first check whether this is allowed and under which conditions this is allowed. Another typical example is storage of data on American providers of cloud (storage) services. Please contact the data stewards first to discuss this.* | | x |
| 11 | Will any raw or anonymized personal data or any other sensitive data or research results from the project possibly be transferred to a high-risk country*?<br>***High risk countries:** China, Russia, Iran, Turkey, and North Korea.*<br>*If personal data or other potentially sensitive data is exchanged with one of these countries, or if part of the data processing takes place in one of these countries: **an advice from the Data Protection Officer, the kennisveiligheidsteam (Knowledge Security team), and the CISO (Chief Information Security Officer) is ALWAYS required.*** | | x |

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

Ethical Review Form

| Part 7a: Processing of research data | | |
|---|---|---|
| 1 | Is consent your legal basis for processing the personal data in your study?<br>*Additional explanation: What is a legal basis? One of main principles in the GDPR is to ensure that personal data is processed lawfully, fairly, and transparently. To comply with this principle, the processing of personal data also requires that you have a valid legal basis for the personal data processing activity.*<br>*In research projects, the legal basis is often but not always consent. However, it is possible that it is not clear or not possible to establish whether to use consent as a legal basis.*<br>*Some examples where consent may not be applicable as legal basis are covert research, data collection in public spaces, secondary data analysis of existing data, data that are transferred to you by a third party, consent is not possible or would require disproportionate effort, etc. In that case, please indicate which legal basis you think that applies or (preferably) contact a data steward first.* | ☒ Yes and it will be obtained via ……<br>An informed consent template* is attached to this application. (for co-creation and interview/discussion)<br><br>☒ No, I will use another legal basis to process the data. Namely, verbally inform participants what we use the data for (street interview/observation)<br><br>* You can download a suitable template **here**. |
| 2 | Where will the data come from? | ☐ Data obtained from another party (secondary data use)<br>☒ New data collected only by my research team<br>☐ New data collected together with collaborators |
| 3 | Which of the following tools will you use to process personal data? | **Surveys**<br>☐ Qualtrics<br>☐ Limesurvey<br>☐ MS Forms<br>☐ Other, namely ……..<br><br>**Interview/workshop recordings**<br>☒ Voice/video recorder<br>☐ Phone in a flight mode<br>☐ MS Teams<br>☐ Other, namely ……..<br><br>**Transcription**<br>☒ Manual transcription<br>☒ Microsoft Office software (e.g. Word, Teams)<br>☒ Other, namely Miro or Figma<br><br>**Statistical analysis**<br>☐ SPSS<br>☐ R<br>☐ Other, namely ……..<br><br>**Other tools**, specifically…… |
| 4 | Where will the data and in particular the personal data be stored during and after completion of the study? If you have already uploaded your Data Management Plan, you can refer to your Data Management Plan. | ☐ SURF drive<br>☒ Onedrive<br>☐ Research Drive<br>☐ Network Drive |

11

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| | *Additional explanation: University supported-storage facilities are SURFdrive, SURF Research Drive, Ceph, departmental drives (this includes BE Project Drive), and the TU/e instance of Microsoft OneDrive. For most personal data, the use of SURF Research Drive, departmental drives (including BE Project Drive) and SURFdrive is required.* | ☐ Research Manager<br>☐ Other, namely …… |
| **Part 7b: Safety and security measures** | | |
| 1 | Will you pseudonymize/anonymize the data?<br><br>*Additional explanation:*<br>*Anonymization: remove all direct identifiers (name, address, telephone number etc.) but also indirect identifiers (age, place of birth, occupation, salary) that, linked with other information, can lead to a person's identification. Anonymization to the point that a data subject is no longer identifiable means that the anonymized data is not considered to be personal data anymore.*<br>*Pseudonymization: replacing the unique identifier of a data subject with an artificial pseudonym. This means that identification is still possible with the identification key. The identification key needs to be stored securely and separately from the pseudonymized data. If the data subject can be identified by combining data with additional information, the data is also called pseudonymous.* | ☒ Yes<br>☐ No<br><br>If yes, describe how:<br><br>Participant answers and results from the co-creation will be anonymized by using Participant 1, Participant 2, P3... etc. The participants will get their identification number and will not be required to mention their name. |
| 2 | Is access to (personal) data restricted? (Select all that apply) | ☐ No<br>☐ Yes, via access control<br>☐ Yes, via password protection<br>☒ Yes, access only given to TU/e research team<br>☐ Yes, access only given to research team, including non-TU/e collaborators<br>☐ Other, specify…… |
| 3 | Who will have access to the data during and after completion of the project? (Select all that apply) | ☒ Main researcher<br>☒ TU/e supervisor(s)<br>☐ External supervisors<br>☒ TU/e research team<br>☐ Other, specify…… |
| 4 | Will you store data for future research? | ☒ No<br>☐ Yes, in a public data repository<br>☐ Yes, in a public data repository under restricted access<br>☐ Yes, in a TU/e-recommended storage (SURF Research Drive, Network Drive) |
| 5 | Will you share data outside the TU/e? | ☐ No<br>☒ Yes, in a fully anonymized form<br>☐ Yes, raw or pseudonymized data*<br><br>*If you selected this box, make sure that a suitable data agreement is put in place. You can contact the Data Stewards for support in preparing such an agreement |
| 6 | How long will data be stored after the end of the project? | 5 years |

12

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Ethical Review Form

| Part 8: Closures and Signatures | | |
|---|---|---|
| 1 | Enclosures (tick if applicable and attach to this form): | ☒ Informed consent form<br>☐ Informed consent form for other agencies when the research is conducted at a location (such as a school)<br>☐ Text used for ads (to find participants)<br>☐ Text used for debriefings<br>☐ Approval other research ethics committee<br>☐ The survey the participants need to complete, or a description of other measurements<br>☐ Data Protection Impact Assessment checked by the privacy officer<br>☐ Data Management Plan checked by a data steward |
| 2 | Signature(s) | Signature(s) of applicant(s)<br><br>Date: 10-12-2023<br><br>Signature research supervisor<br>D. Ploos van Amstel<br><br>Date: |

13

## A.11 Consent form

**Information sheet for research project "The Bike Kitchen"**

### 1. Introduction

You have been invited to take part in research project The Bike Kitchen, because you have been contacted by one of the researchers as an available designer/design student.

Participation in this research project is voluntary: the decision to take part is up to you. Before you decide to participate we would like to ask you to read the following information, so that you know what the research project is about, what we expect from you and how we deal with processing your personal data. Based on this information you can indicate via the consent declaration whether you consent to take part in this research project and the processing of your personal data.

You may of course always contact Amna Strojil via a.strojil@student.tue.nl, if you have any questions, or you can discuss this information with people you know.

### 2. Purpose of the research

This research project will be managed by Emir Kadric, Timo Meassen, Jens Vervoort, Rosa van Wershoven and Amna Strojil.
The purpose of this research project is to find out how designers can design for a product service system for closed-loop activities in a way that users are given an increased judgement of value. Data will be used in a scientific report (that will not be officially published, but delivered as a course assignment).

### 3. Controller in the sense of the GDPR

TU/e is for processing your personal data within the scope of the research. The contact details of TU/e are:

Technische Universiteit Eindhoven
De Groene Loper 3
5612 AE Eindhoven

### 4. What will taking part in the research project involve?

You will be taking part in a research project in which we will gather information by:

- Perform a co-creation session on a design context that has been provided by the researchers. During this part, photos will be taken during the session (where participants will not be recognizable) and photos will be taken of the designs resulting from the session
- Interviewing you about your experience with the tools given for the co-creation and to write down/record your answers via audio/video. Also, we will make a transcript of the interview.
- Observation

For your participation in this research project you will not be compensated.

### 5. Potential risks and inconveniences

Your participation in this research project does not involve any physical, legal or economic risks. You do not have to answer questions which you do not wish to answer. Your participation is voluntary. This means that you may end your participation at any moment you choose by letting the researcher know this. You do not have to explain why you decided to end your participation in the research project.

## 6. Withdrawing your consent and contact details

Participation in this research project is entirely voluntary. You may end your participation in the research project at any moment, or withdraw your consent to using your data for the research, without specifying any reason. Ending your participation will have no disadvantageous consequences for you.

If you decide to end your patricipation during the research, the data which you already provided up to the moment of withdrawal of your consent will be used in the research.
Do you wish to end the research, or do you have any questions and/or complaints? Then please contact the Amna Strojil via a.strojil@student.tue.nl .

If you have specific questions about the handling of personal data you can direct these to the data protection officer of by sending a mail to functionarisgegevensbescherming@tue.nl. Furthermore, you have the right to file a complaint with the Dutch data protection authority: the Autoriteit Persoonsgegevens.

Finally, you have the right to request access, rectification, erasure or adaptation of your data. Submit your request via privacy@tue.nl .

## 7. Legal ground for processing your personal data

The legal basis upon which we process your data is consent.

## 8. What personal data from you do we gather and process?

Within the framework of the research project we process the folllowing personal data:

| Category | Personal data |
|---|---|
| *Student data* | *Faculty, study year, university name* |

## 9. Confidentiality of data

We will do everything we can to protect your privacy as best as possible. The research results that will be published will not in any way contain confidential information or personal data from or about you through which anyone can recognize you, unless in our consent form you have explicitly given your consent for mentioning your name, for example in a quote.

The personal data that were gathered via audio recordings, (on-line) surveys, interviews, observations, photos and other documents within the framework of this research project, will be stored storage facilities that are supported by the ICT service of TU/e.

The raw and processed research data will be retained for a period of 5 years. Ultimately after expiration of this time period the data will be either deleted or anonymized so that it can no longer be connected to an individual person. The research data will, if necessary (e.g. for a check on scientific integrity) and only in anonymous form be made available to persons outside the research group.

This research project was assessed and approved on 16/10/2023 by a supervisor of the study.

***** Scroll down for the consent form *****

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## Consent form for participation by an adult

By signing this consent form I acknowledge the following:

1. I am sufficiently informed about the research project through a separate information sheet. I have read the information sheet and have had the opportunity to ask questions. These questions have been answered satisfactorily.

2. I take part in this research project voluntarily. There is no explicit or implicit pressure for me to take part in this research project. It is clear to me that I can end participation in this research project at any moment, without giving any reason. I do not have to answer a question if I do not wish to do so.

Furthermore, I consent to the following parts of the research project:

3. I consent to processing my personal data gathered during the research in the way described in the information sheet.

   YES ☐ NO ☐

4. I consent to making (sound/image) recordings during the interview and to processing my answers into a transcript.

   YES ☐ NO ☐

5. I consent to using my answers for quotes in the research publications – without my name being published in these.

   YES ☐ NO ☐

6. I consent to retaining research data gathered from me and using this for future research in the field of designing for PSS (products as a service) in which recognized ethical standards for scientific research are respected, and for education purposes.

   YES ☐ NO ☐

| | |
|---|---|
| Name of Participant: | Name of researcher: |
| Signature: | Signature: |
| Date: | Date: |