The Bike Board: A Practice-Oriented Design Research Approach to Understand and Design for Social Practices at The Bike Kitchen

Running title: THE BIKE BOARD

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1 ABSTRACT

The Dutch biking culture is a visual overload like no other: deeply ingrained into the nation's identity for centuries, it not only reflects the potential for examining the Dutch people's preference for this desired manner of transportation, it also holds a promise for shaping a desired sustainable future. In this context, The Bike Kitchen at the University of Amsterdam introduces itself as a unique case study, in which a focus was set on designing sustainable toolkits that narrow, slow and/or close down resource use through a Practice-oriented design approach. The methods conducted in this field study include observational research, interviews, as well as the implementation of a research design probe to gather insights into visitors' experiences, perceptions, and interactions with TBK. During the thematic data analysis process, categorizing the insights into practices-as-entity or practices-as-performance stood central, in order to provide a conclusion on the relationship between materials, meanings, and competencies within TBK operations. The outcomes revealed an importance in the spreading of knowledge through various methods and interactions related to learning, particularly between participants and the mechanic. It was concluded that with the implementation of a research probe and gaining understanding of this through various other methods, useful insights were gained that could be used to adjust a space like TBK in order to narrow, slow, and/or close down the resource loop through learning-based practices.

Additional Keywords: Social Practice Theory, Practice-oriented design, UvA The Bike Kitchen, Sustainable mobility, product-service system, mobility as a service

2 INTRODUCTION

As soon as you set foot in the Netherlands, bicycles immediately catch your eye. You can't help but notice people balancing schoolbags, baskets of groceries, whole cabinets from IKEA (IKEA, 2023), or even a second bike on their back along the extensive 37,000 kilometers of bike lanes (Kenniscentrum Nederland, 2023). With approximately 22.3 million bikes present in the country, cycling isn't merely a means of transportation; it's a way of life, taught to children at an extremely young age (Kenniscentrum Nederland, 2023). Even though this biking culture in the Netherlands promotes a sustainable lifestyle, it still has some negative effects. As of 2023, approximately 10 to 15 thousand bikes are being fished out of the canals in Amsterdam per year, suggesting a remaining disregard for this alternative mode of transportation (NH Nieuws, 2023). Consequently, this imposes the question of how this disregard for sustainable value can be shifted with the deployment of new and effective design concepts, as the potential is clearly there.

Hence, in an era where a search for sustainability in the shifting paradigms of mobility is at the forefront of societal concerns, The Bike Kitchen (TBK) at the University of Amsterdam (UvA) emerges as an inspirational case study to the world. Under the guidance of Dirk Ploos van Amstel, a design researcher at the TU/e who is actively involved in TBK concept, a team of five Industrial Design students pursuing their Master's degree have performed field research through the lens of Social Practice Theory while aiming to narrow, slow and/or close the loop of resource use. This unique approach to research enables an understanding of the relationship between materials, meanings, and competencies in the current habitually performed practices within TBK. The current single and recently opened Bike Kitchen of the UvA in the Netherlands can therefore be considered as a hub for generating knowledge on what elements of the Social Practice Theory could be implemented in future design concepts. This knowledge was generated by first observing The Bike Kitchen environment without interfering, and afterward implementing and analyzing a research design probe, which later will be referred to as The Bike Board. The main research question pursued throughout the study can be described as: *'How can initiators/designers using a practice theories-based toolset support TBK participants in implementing new Social Practices that narrow, slow and or close resource use?'.* Furthermore, a set of three sub-questions were formulated as well: **'***How can knowledge on (social) practices about TBK be created through a design approach?, what do Social Practices within TBK look like?', 'How can socially/sustainably responsible behavior (proto-practices) through the use of Social Practices be encouraged',* and *'How can TBK create/enhance a bike community and ownership by changing Social Practices about bike usage/repair?'*

This paper will touch upon theoretical background and related works first. Subsequently, the design and study set-up will be described in detail. Moreover, a thematic analysis of the utilized research methods was conducted, including observation schemes and interviews. Various themes were created and categorized in either Practices-as-entity or Practices-as-performance. In this analysis, as described in the findings and discussion section, four themes had been analysed and described further in detail. Lastly, limitations and future directions will be discussed, whereafter a conclusion will be given.

3 THEORETICAL BACKGROUND

In this design research process, the research questions and TBK environment have been investigated through the lens of (Social) Practice Theory. This part will explain what Social Practice Theories are and why this research uses the lens of Practice Theories. The Related Works will explain other research that has been done through a Social Practice Theory lens.

3.1 What is (Social) Practice Theory?

The basis of Practice Theory is that all social phenomena can be understood as Practices. It is mentioned that Practice Theories provide an account that all social life consists of Practices and are not merely a subset of groups that live in communities (Shove et al., 2012). A Social Practice approach puts people not as individual decision makers, but as capable social negotiators (Shove, 2003). Furthermore, an emphasis on Practices entails the notion of how individuals conceptualize their ways of doing and the mechanisms through which ordinary routines evolve, endure, and change across time. It should be noted that Practices are sustained, executed, and enacted through interactions with socio-material systems, indicating that Practices are influenced and organized by technological elements (Shove et al., 2005). This is supported by Spaargaren (2020) as he mentions that Social Practice approaches establish a direct correlation between the responsibilities and possibilities of the individual and the socio-material structures in play.

Social Practice Theory tool

To understand Practices in a particular environment, a deconstruction tool has been developed. Practices are shaped by three elements and the tool is therefore called the three-element model, which includes materials, competencies, and meanings (Shove et al., 2012). To enable the execution of Practices, Shove et al. (2012) point out that it is imperative that elements within all three categories are present, and connections between these elements are established. Material components encompass the technologies and tangible objects essential for the Practice. Competencies pertain to the requisite skills for Practice execution, as well as the

experiential knowledge inherent to the practitioner. Meanwhile, meanings encompass collective perceptions regarding what is deemed appropriate and correct by the wider community.

Practices-as-entity and Practices-as-performance

Practices can thus be viewed through materials, competencies, and meanings, but Practices can furthermore be seen through different levels. These levels are defined as 'Practices-as-entity' and 'Practices-as-performance'. Practices-as-entity are structured organizations of Practices, as explained by Cetina et al. (2001, p. 101), that specify 'how actions (including speech acts) ought to be carried out, understood, prompted, and responded to; what specifically and unequivocally should be done or said (when, where, …); and which ends should be pursued, which projects, tasks, and actions carried out for that end, and which emotions possessed – when, that is, one is engaged in the Practice.' Practices-as-entity are then perceived as Practices understood in people's minds. Practices-as-performance is zooming in on the Practice-as-entity on every particular situation. The elements of the Practice are now different each time. Practices-as-performance do not clarify a homogeneous picture but explain Practices as internally different on a variety of aspects (Warde, 2005). Practices-as-performances are then perceived as Practices carried out in the moment.

3.2 Practice-oriented design

Then why is Social Practice Theory important in this research? What is the connection of Social Practice Theory with Design Research? Practice-oriented design can give an answer to this. Practice-oriented design adopts Practices as its fundamental unit of analysis, with an emphasis on comprehending and shaping the development of Practices across space and time. Value is perceived as arising within the context of Practice and is subject to variation from one specific environment to another (Kuijer, 2014). Furthermore, Design Thinking or Design Research brings methods and tools to explore, form and examine ways to reconstruct human Practices (Hoolohan & Browne, 2020). Practice-oriented design thus goes through cycles of Practices as a unit of analysis, analyzing culture, history and performances, and through Practice as a unit of design, emphasizing the use of design methods to change Practices through artifacts (Kuijer, 2014). Even more so, in relation to the research question, the connection between design research and Social Practice Theories might enable users to develop sensitivities and skills needed for sustainable incentives (Lawhon & Murphy, 2012).

4 RELATED WORKS

This section will discuss The Bike Kitchen concept, its mission, and other Bike Kitchens located around the world to get a grasp on what the Bike Kitchen is and what it stands for. Moreover, related research on similar concepts like TBK (through a Social Practices lens) will be introduced.

4.1 The Bike Kitchen concept

At the Roeterseilandcampus (REC), one of the four open city campuses of the University of Amsterdam (UvA), there are approximately 20,000 bicycles parked in bicycle racks measured as of October 2023 (Universiteit van Amsterdam, 2023). In accordance with this Dutch enthusiasm for cycling, The Bike Kitchen, an environment physically described as a place where students and residents can repair their bicycles under the guidance of experts, has recently (October 19, 2023) opened its doors in the basement of the ABC-bicycle parking garage (Figure 1) (Universiteit van Amsterdam, 2023). Nonetheless, how can the precise origin of "The Bike Kitchen" concept be described, and what profound vision continues to drive this movement? These questions will be further explored to uncover hidden layers within The Bike Kitchen initiative, providing crucial insights for understanding the Practice within its full context.

The Bike Kitchen's mission

The Urban Cycling Institute, headquartered in the heart of Amsterdam, is a non-profit organization dedicated to shaping a sustainable future for urban mobility (Urban Cycling Institute, 2023). The organization is recognized as a co-founder of The Bike Kitchen initiative at the UvA and focuses on using urban cycling to examine the challenges, trends, and solutions that are shaping transportation in cities (Glaser, 2023).

One of the Urban Cycling Institute's missions is to provide fertile ground for sharing knowledge and understanding about urban cycling on all levels of the academic curriculum (Glaser, 2023; Urban Cycling Institute, (n.d.)). Consequently, The Bike Kitchen can be seen as a contributor for establishing a platform that generates knowledge and addresses the current limited academic focus on the multifaceted nature of urban cycling (Urban Cycling Institute, (n.d.)). Within this cooperative environment, The Bike Kitchen particularly takes on the responsibility of actively contributing to the development of research agendas, event forums, and

the valorization of knowledge, with the overarching goal of fostering a vibrant community centered around sustainable urban mobility (Universiteit van Amsterdam, 2023; Glaser, 2023).

Although The Bike Kitchen only recently opened its doors officially, the community upheld this responsibility by already hosting multiple workshops, openly welcoming the collaboration of the TU/e for social-Practiced based field research, and actively spreading knowledge about sustainable bike repair in general among their local community (Instagram, 2023).

The global reach of The Bike Kitchen concept

Although this unique approach of bicycle repair in the Netherlands is currently limited to Amsterdam with the UvA's The Bike Kitchen, the concept is not unknown to the world. It is part of a global collective with locations in cities such as Barcelona, Berlin, and Helsinki (Folia, (n.d.)). The term "Bike Kitchen" takes its inspiration from the concept of "Soup Kitchen," where individuals collaborate to prepare meals for those in financial need (Folia, (n.d.)). Comparably, The Bike Kitchen is committed to the collective repair of bicycles, promoting a culture of shared responsibility and the exchange of knowledge (Folia, (n.d.)).

The approaches and methods used by various Bike Kitchens to promote sustainable urban mobility, however, through e.g. the employment of tools and resources, vary to some extent. For example, The Bike Kitchen at the UvA is centered among university students and provides non-second-hand bicycle repair tools for hands-on learning from an expert mechanic (Figure 2) (MyUvA, 2023). Whereas in contrast, "The Bike Kitchen North-East" in Berlin, promotes primarily an environment for individual repair with access to recycled bicycle parts under the watchful eye of assistance (Figure 3) (The Bike Kitchen North East, 2020). Additionally, general Bike Kitchen initiatives offer workshops and guidance led by volunteers, fostering a sense of inclusivity within the cycling community (The Bike Kitchen North East, 2020; Helsingin Pyöräpaja. (n.d.); Bike Kitchen San Francisco, 2023). As a result, individuals with restricted financial means are wholeheartedly welcomed to The Bike Kitchen environment; a message already clearly displayed in the early stages of The Bike Kitchen development of the UvA (Figure 4).

Figure 1. The Bike Kitchen (UvA) (Universiteit van Amsterdam, 2023)

Figure 2. Mechanic (Instagram, 2023)

Figure 3. The Bike Kitchen North-East, Berlin (The Bike Kitchen North East, 2020)

Figure 4. TBK Inclusivity (FMG Fonds, 2022)

4.2 Sustainable toolkits design for sharing concepts

Relating to existing sharing concepts: MaaS and PSS

A concept related to TBK is moving away from user-based mobility towards access-based mobility: Mobility as a Service (MaaS) (Jittrapirom et. Al., 2017). With this concept, different modes of transportation are combined into one online platform, including possibilities for navigation, reservation, and payment (Jittrapirom et. Al., 2017). Implementing MaaS can provide a more sustainable transportation method by replacing the use of private transportation. MaaS can offer public transportation methods (e.g. buses, trains, and rail) but can also make use of sharing concepts (e.g. car-sharing, bike-sharing) (Hesselgren, M., Sjöman, M., & Pernestål, A., 2020). Remarkably, other research also shows that sharing concepts can increase the environmental impact despite its intention (Ploos van Amstel et al., 2022).

Earlier research examines another system related to TBK by reviewing related articles: the effect of product-service systems on environmental impact (Ploos van Amstel et al., 2022). A product-service system (PSS) is defined as "a mix of tangible products and intangible services designed and combined so that they are jointly capable of fulfilling final customer needs" (Tukker, A., 2015). With this system, consumers do not directly own the product but rather rent, lease, or share it. PSS has been seen as a way to increase sustainable production by giving producers ownership of their products. However, consumer behaviors and how PSS is implemented also have an environmental impact (Ploos van Amstel et al., 2022). If PSS is implemented and used poorly, it could increase the environmental impact instead of reducing it.

PSS designs that are related to TBK show the same kind of consumer behaviors that result in an increase in environmental impacts (e.g., SwapFiets). With a Swapfiets subscription, people can rent a bike from Swapfiets and receive repair and replacement services. However, leasing products tends to decrease how much care people take of the product (Tukker, A., 2015). With the

absence of caretaking, people might neglect maintenance, resulting in an increased environmental impact (Ploos van Amstel et al., 2022). This is where this research fills a gap: How is it possible to design for Social Practices that tackle topics on caretaking, maintenance, and sustainability in general and specifically in the setting of The Bike Kitchen?

Designing a sustainable toolkit

To engage designers in decreasing environmental impact in PSS, sustainable toolkits need to be provided to address consumer behavior. Ploos van Amstel et al. (2022) define design tools as intermediate knowledge that is gathered during the design process. Earlier research already tries to support designers with a design tool to engage consumers of PSSs to close the resource loop by focusing on psychological ownership (Ploos van Amstel et al., 2022). The research uses a related case study: the bike service at The Student Hotel (TSH). The differences between the bike service of TSH and TBK lie in the rental of bikes. While customers of TSH lease the bikes, customers from TBK bring their own bikes for repair and maintenance. Ploos van Amstel et al. (2022) provide interesting starting points for designing toolkits for designers. For instance, involving users in repair and maintenance activities can lead to shifting perspectives, which TBK already makes use of. Additionally, creating the possibility for feedback can lead to more self-investment, which can be used in our design tool (Ploos van Amstel et al., 2022).

However, the PSS implementation of TSH differs from the PSS implementation of TBK. For instance, with TBK, customers do physically own their bicycles and use services and materials from TBK to repair and maintain their bikes, instead of leasing the bikes from the company. Therefore, psychological and physical ownership plays a different role in the PSS implementation of TBK than in TSH, which calls for different approaches to designing sustainable toolkits.

4.3 Conclusion

To sum up, understanding The Bike Kitchen concept is of high importance to facilitate designing toolkits that improve sustainable urban mobility. Globally, The Bike Kitchen shares a mission to promote a culture of shared responsibility and the exchange of knowledge. This case study, the Bike Kitchen at UvA, aims to work upon this mission by providing non-second-hand bicycle repair tools for hands-on learning from an expert mechanic. Furthermore, PSS and MaaS can be seen as a benchmark to understand sustainability research with the use of Social Practices Theory. Despite PSS's intention to decrease environmental impact, it might result in the opposite, based on the lack of caretaking and maintenance. Therefore, this research can provide new insights by focusing on caretaking and maintenance. Eventually, sustainable toolkits can be designed, and looking at already existing toolkits may lead to new approaches.

5 DESIGN

5.1 Process

The decision was made to visit TBK to gain a clear firsthand understanding of the concept and to observe TBK as a self-repair shop for individuals who own a bicycle, since the literature on product-service systems differs in the sense of psychological and physical ownership as mentioned before (Tukker, A., 2015; Ploos van Amstel et al., 2022). This part of the research consisted of observations within TBK to see common themes, problems, and opportunities. Along with this, a semi-structured interview (see appendix A.4.3) was conducted with the initiator of TBK to better understand the vision driving TBK. After this visit to TBK, the results in the form of notes from the observations and semi-structured interviews were compiled and discussed. From this evaluation,

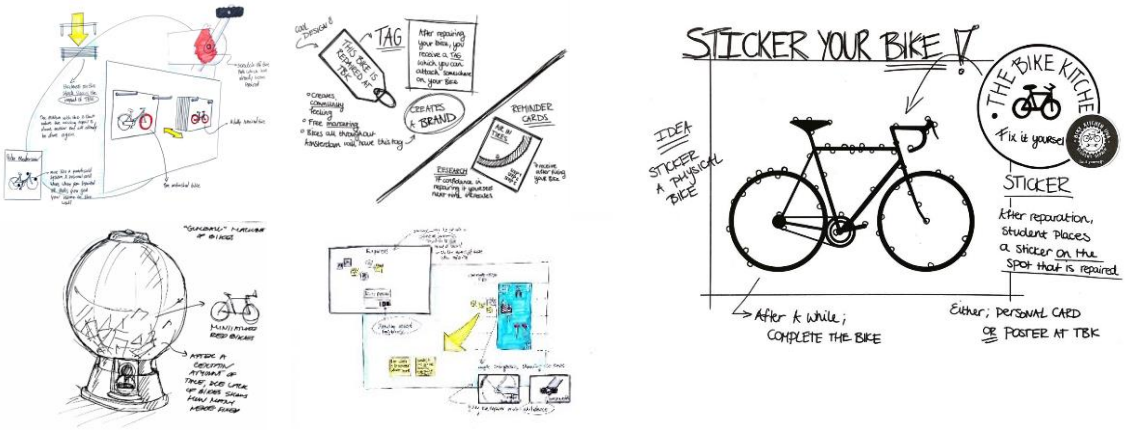

Figure 5. Ideation sketches

focus points (see Appendix A.2) were formed to kickstart ideation through the creation of a mind map. The main focus points being activating the community, the bicycle as a symbol for self-repair, how to improve feelings of ownership of the repairers towards their bicycles, showing usage of materials, reducing usage of materials, and showing the impact of TBK. After this evaluation, many ideas were generated among the researchers, individually as well as in the shared ideation sessions. Some examples of the ideas generated can be seen in figure 5. To conclude, using the observations and interviews as practices as a unit of analysis led to using these practices as a unit for design, which will be described later on in the paper.

5.2 Final design

After this ideation process, the preferred idea was to show the impact TBK has as well as making people aware of the community that is forming and how they contribute to it. Eventually, the design that was chosen for the research probe was a virtual bicycle board to realize this idea. The concept is that students put name-tagged stickers on the virtual bike to show the part of their bike that they repaired during their visit to TBK. This is done in order to visualize their personal impact, as well as the collective impact. Along with this, the students get to take a sticker home, hoping to create some sense of community. In addition to this, an evaluation board was added, in combination with an insights board for general insights for participants to share with the community. Together, this formed the bike board, which will now be referred to as TBB.

After defining the concept, the items were designed with multiple iterations to improve the aesthetics as well as the understandability of the items. The design was finalized, and the items were made by laser cutting and engraving TBB out of MDF, printing the stickers on sticker paper, and printing the questionnaire sheets and empty response sheets for the study. The final designs placed in TBK and more detailed images of the stickers and answer sheets can be seen in figure 6.

Figure 6. Final design of the research probe (TBB)

6 STUDY SET-UP

The study was done using the field methodology, in which the role of the researchers is integrated into the context of the study (Koskinen et al, 2012). This included various methods such as using the previously mentioned research probe, conducting interviews, and observational research in combination with Social Practice Theories to gain contextual understanding of the space and the interactions within it (Koskinen et al, 2012). The research was guided by a main research question, which was framed through the Social Practice Theories lens: *'How can initiators/designers using a Practice theories-based toolset support TBK participants in implementing new Social Practices that narrow, slow and or close resource use?'* (Kuijer, 2014). Several sub questions, as already mentioned in the introduction, were also used to guide the research process.

6.1 Observational research

Firstly, half of the researchers were positioned within TBK and observed the participants (students of TBK) during a time span of 3,5 hours. In total, 6 main participants were observed as they interacted with the space, the tools, the mechanic, and their bicycles. These 6 participants are characterized by being students of TBK who had booked appointments to repair their bicycles at TBK and will be referred to as "participant 1, 2, etc.'. 5 of these participants were university students of UvA and 1 participant was a professor, each spending approximately 10 minutes to 1 hour in TBK. Although these were not the only people who interacted with the TBK environment and who were observed in the research, they played a larger role in the TBK environment. Any participants who did not have an appointment and came in for activities such as pumping their tires or to ask questions will simply be referred to as

'other participants'. The observations were recorded via notetaking within the framework of an observation scheme created by the research team to guide the process (see Appendix A.3). This observation scheme organized possible activities through the three-element model of materials, competencies, and meanings (Shove et al., 2012). Relating to Social Practice Theory, this portion of the study addressed Practices-as-performance, as the elements of each repair were situational (Warde, 2005).

6.2 The Bike Board use

The second part of the study included the use of TBB which was further divided into three sub steps. The first step was the evaluation board in which participants were asked to complete three questions on a card that was then placed on the board. The three questions that they were asked were: 'Have you ever fixed your bike before coming to TBK? What did you fix?', 'How did the connection with your bike change after TBK experience?', and 'Do you feel connected to TBK community? Why or why not?'. The questions all link back to the three-element model of Social Practice Theory (Shove et al., 2012).The next step of TBB included participants placing a sticker with their name on it onto a part of the bike on TBB to reflect which part of their bike was fixed. They were also provided with a different sticker with the TBK logo to take with them, which could be placed on their bike, laptop, or any other surface as a symbol of completing their repair at TBK. The final step asked participants to write any thoughts, notes, or opinions on the third panel of TBB, the Insight Board. However, this step was not done by every participant if they did not have any more thoughts to share. All participants were informed of TBB when they first entered TBK for their appointment to ensure transparency early on. While TBB and the data collected from it can be considered to fit within the Practices-as-entity framework, each individual interaction between the participants and TBB can be viewed through the Practices-as-performance lens due to the variety of interactions and experiences created (Warde, 2005).

6.3 Interviews

The final part of the study included interviews by the other half of the research team. The researchers were positioned outside of TBK in the ABC bicycle parking garage of the UvA. The researchers within TBK who had conducted the first two steps of the study then directed the participants to the researchers outside of TBK after their repairs were finished to participate in the interviews. These interviews were done in a relatively casual setting, lasting no longer than 10 minutes. The participants were asked a set of 11 questions related to their TBK experience and their connection to their bikes through the framework of the three-element model (see Appendix A.4.1). A 5-question interview was also conducted with the bike mechanic to gain understanding of the interactions and experiences from the perspectives of both the educator (the mechanic) and the students (TBK participants) (see Appendix A.4.2). These findings were framed through a Practices-as-entity framework, as they were gained through a structured setup (Cetina et al., 2001).

6.4 Analysis

After the study was completed, the research team proceeded to perform a thematic analysis of the data (see Appendix 5). Firstly, each individual piece of data from both the observational research and the interviews was coded into the three categories of the three-element model, as well as a fourth called 'other notes/observations'. This system of coding was then used to group pieces of data together into several categories.

The data from the observational research was all placed into the category of Practices-as-performance, further organizing it into many themes, which were then reduced to 7 general themes: *Learning, Social Interactions, Community, Time Investment, Understanding of TBK Concept, Reactions to TBB, and Resource Usage*. These categories were even further reduced by combining *Time Investment* and *Community* due to similarities in the data collected. Secondly, the data collected from the interviews was organized using the category of Practices-as-entity. Then, the same process of performing a thematic analysis was done, also leading to 7 themes: *Learning, Emotional Connection, Value of the Bike, Community Building, Resource Usage, Reactions to TBB, and Opinions About TBK*. Between the Practices-as-performance data and the Practices-as-entity data, several similar themes were found, those being *Learning, Community, Reactions to TBB*, and *Resource Usage*. Data from TBB had the greatest thematic overlap due to it generating data through both Practices-as-entity activities and Practice-as-performance activities. The results of the thematic analysis (see Appendix A.5) were then used to find similarities between findings, leading to the insights produced by the study.

7 FINDINGS & DISCUSSION

Using the themes identified in the thematic analysis, which was organized under the Practice as a unit of analysis lens allowed the research team to interpret the findings through the Practice as a unit of design lens (Kuijer, 2014). Each finding and interpretation reference Social Practice Theory and considers future possibilities for applications of this knowledge, as well as limitations of the study.

7.1 Practices-as-performance

From the thematic analysis of the data collected from the observational research, the research team focused on three themes of *Learning, Community and Social Interactions, Reactions to TBB* that proved to be most relevant, in that most of the data could be categorized under one of the three (see Appendix A.6 for the rest of the findings).

Learning

Within the context of TBK, learning is done in several different ways: by observing, discussing, and doing. However, most of these interactions rely heavily on the mechanic. For example, during her appointment, participant 4 did not feel confident enough to remove the bike pump while the mechanic was not present, so she waited for him to supervise rather than removing it on her own, showing that the task was very dependent on his presence. Others, such as participant 5, who is a more experienced TBK visitor, still spent a lot of time speaking to and learning from the mechanic before proceeding to repair his bike on his own. Aside from interactions with the mechanic, observational research also showed that students have the opportunity to learn from each other, but it is not happening in a structured manner. This was seen when participants 5 and 6 were seen discussing repairs together during their appointments. Overall, these observations show that the balance between the involvement of the mechanic and the student's role is dependent on various factors such as how busy TBK is, the level of the student, and the difficulty of the repair, however, ultimately, almost all student learning is dependent on the interactions with the mechanic.

Community and Social Interactions

The general interactions within TBK are very respectful and friendly, particularly between the students and the mechanic, even when the repair does not go as planned. During participant 2's repair, the mechanic assessed the problem, which resulted in a bracket breaking and him telling the participant 'you won't be riding home tonight'. The interaction remained calm and respectful, even though the participant was likely upset about the damage being worse than he had realized, which ultimately led to the creation of an educational experience. Other observations that were noted about TBK included seeing a difference between the inside of the space as compared to the immediate area outside it, seeing a conflict between TBK initiators' desire to build a community and TBK participants' desire to not have to return, and differences in time management between participants. One other participant stated: 'if I don't come back, it's good', while participant 6 was making his third visit to TBK. Overall, it might be said that community building at TBK is currently dependent on accidental outcomes, rather than being intentionally fostered, although the desire for doing so is there.

Reactions to TBB

Lastly, the general reactions that took place with the use of TBB were either ones that were positive, neutral, or confused. For example, participant 1 seemed happy to receive a free sticker, while participant 2 seemed to not have much of a reaction and was initially confused about what the purpose of the sticker was. These mixed reactions could be the cause of various factors such as the research team's presence in the space, leading to participants facing it with hesitation. It is uncertain whether the researchers' presence interfered with the use of the board or if it encouraged the use of it, but it could be too early in the research to determine such a conclusion.

7.2 Practices-as-entity

Secondly, the thematic analysis of the data from the interviews led to the research team also focusing on three themes with the most relevancy, those being *Learning, Value of the Bike, Reactions to TBB* (see Appendix A.7 for the rest of the findings).

Learning

The findings from the interviews within this theme are very similar to the ones from the observational research, being that participants mainly learn by observing, discussing, or doing, all of which are highly dependent on the mechanic's involvement. The mechanic himself acknowledged this when stating “I’m looking forward to having more students who would like to become a mechanic. I already met two or three people who know how to fix their bike and want to learn and want to become mechanics in the future. That’s what we are looking for. I share my knowledge, but the knowledge is not disappearing, it’s staying somewhere and someone else can share the knowledge further.” Many participants also noted never leaving TBK without having learned something, but always emphasizing the mechanic's role in that process as an educator. It can be said that there is currently only a single learning interaction at TBK with the mechanic, but there is potential for learning from multiple sources within the space/community of TBK.

Value of the Bike

The interviews with both the participants and the mechanic produced data about how the bike is viewed both in the cultural context, as well as in each individual case. It was found that each individual participant had very different perspectives regarding the value of their bike. For example, participant 2 came to TBK for preventative care, rather than waiting for a bigger problem to happen, showing that she already came to the space with a high perceived value of her bike. Participant 1 also stated: 'I already value it a lot. The fact that you can fix it if something is broken is nice because instead of giving it to another guy to do it, it's all yours', when asked whether he experienced a shift in the value of his bike after his TBK visit. Participant 4 also stated: 'I would not say that I value my bike more, because it is very hard to value this bike even more (referring to his VanMoof bike), but if I didn't have such an expensive bike then yes, I would have', showing very personal experiences regarding how one values their bike. The mechanic also noted that 'In Holland, it (the bike) is just a tool, but it does not need to be just a tool. It can be something to bring you joy and be proud of", indicating that there is potential for a space like TBK to affect personal perceptions of a bike's value, as well as the overall cultural one.

Reactions to TBB

As seen in the observational research, TBB was met with positive, neutral, or confused reactions, particularly in not understanding the concept overall or not understanding the purpose. Participants noted that this could be caused due to various reasons such as TBB not being filled with enough notecards or stickers yet or its placement within the space. However, the mechanic stated, 'Already, I can say that this board is very helpful', which could indicate that it may have more impact for someone who spends more time within TBK (the mechanic) as compared to someone who dedicates at most an hour to TBK community (participants). Several participants also viewed TBB as a tracking tool, which revealed that the tracking aspect could be a way to connect the community of TBK over time. However, it is too early to come to such a conclusion due to how new both TBK and the implementation of TBB are.

7.3 Relevancy & future directions

This research on TBK has specifically build on the work of Ploos van Amstel et al. (2022) by looking at how to design sustainable toolkits for other contexts than PSS. This research has provided new insights by focusing not only on caretaking and maintenance, but also on other Social Practices such as learning, community building, social interactions, and value perception of bikes. All within the context of TBK through a design probe that was used (TBB). Eventually, this research is a step-up for designing sustainable toolkits that slow, narrow or close the resource use through a Practice-oriented design approach.

Learning (both Practices-as-performance and Practices-as entity)

The understanding of how learning takes place in a setting such as TBK through both interviews and observations, as well as understanding the interactions between all parties and why they occur, can lead to (research on) designing more spaces that encourage learning about your bike instead of designing just a repair shop. The insights drawn from the data can allow designers to apply them to other projects for the purpose of promoting learning.

Community and Social Interactions

The insight that was drawn from the study regarding community in TBK was that it is often fostered in a way that is accidental. However, there is opportunity to encourage community building and social interactions that are more intentional and go beyond just the repair of bikes. This study can be used a baseline for future research projects that focus on community building through the understanding that was gained of accidental and time-dependent interactions in such a space.

Reactions to TBB (both Practices-as-performance and Practices-as-entity)

It is too early to tell if a tool like TBB will bring a community together and allow for proto-practices that are more sustainable. This is due to the short repair time existing in TBK, as well as TBK being a newly opened space. Although TBB received mixed reactions, such a tool has the potential to create precedent for future tools/probes that aim towards building a community, sharing knowledge, and narrow, slow down or close the resource use.

Value of the Bike

Using the knowledge gained from the field research methodology, understanding the perception of bicycles within the cultural context can serve as a foundation for future research and for possibly changing the perceptions that people have of their own bikes, as well as altering the cultural perception as a whole.

7.4 Limitations

There are various limitations apparent in this research. Firstly, TBK has opened only recently. Although it was not the goal of this research, it makes comparison of Social Practices before and after the implementation of TBB more difficult. It is therefore harder to measure if the research probe would work in an already longer existing environment. Even more so, due to TBK being a new environment at the UvA, the focus in this research has, for a big part, been on understanding the Social Practices occurring. The focus on the design probe (TBB) has therefore been less than intended.

Secondly, due to the set-up of TBK, around eight appointments can be made during a four-hour timeslot. It was therefore difficult to get more detailed information from more participants. More thorough research might need approximately a week to observe and gain saturation of data, which did not fit in this research scope.

Thirdly, TBK is a small environment without a place for covert observations which makes the impact of the researchers more significant. The researchers' presence in the space is necessary for contextualizing it (Koskinen et al, 2012). Therefore, the team was divided for observations and interviews to ensure the least amount of intervention within the study, Nevertheless, the role of the researchers might have influenced the interactions and events that took place in the study due to the small space. It was not the focus on letting the research probe work standalone, but future research could use observations from a farther distance via other tools such as cameras.

Fourthly, regarding TBB itself, there was no text on TBB that instructed what visitors should do. It could have been unclear for people to know what they had to do without the researcher’s explanation, which might have influenced the data.

Lastly, the evaluation part of TBB was in the end not that useful for the analysis of the data. The interviews and observations gained the same insights as the evaluation part of TBB. Moreover, the insight panel was an already existing idea of the initiator of TBK, which made the insight panel unnecessary for this research.

8 CONCLUSION

This research has framed TBK through a Practice-oriented design approach. The main occurring/researched Practices at TBK are learning, community building and social interactions, value perceptions of the bike, and reactions to the research probe used (TBB). A significant takeaway from the research at TBK is that learning plays a substantial role in the Social Practices which are performed in TBK. From a design approach, a conclusion could be drawn that design for Social Practices should focus on how to facilitate learning from student to mechanic and from student to student, so that knowledge is passed on that is sustainably and socially relevant to other visitors, therefore building on a community. Nevertheless, the limited space hinders the community building in TBK. Having a more welcoming and open space would encourage new students to join without having an appointment. Moreover, the place is focused on the function of repairing which makes community building through other social interactions difficult, in part because of accidental encounters within TBK. Furthermore, on the one hand, TBB element that showed the impact of TBK by adding stickers onto the virtual bike was received with mixed thoughts. On the other hand, the use of TBB was seen as a tracking tool by many participants and the mechanic, which revealed that the tracking aspect could be a way to connect the community of TBK over time. Moreover, visitors of TBK do value their bike, but there is an opportunity for spaces like TBK and design process like TBB to change people’s perception of their bike on a cultural level.

The knowledge gained from the research at TBK can allow designers to use the Social Practices Theories related to learning to facilitate changes in resource use. In the case of TBK, the resource use is highly dependent on knowledge, however, designers can apply similar principles to TBK and similar spaces in order to encourage more responsible usage of resources in the future.

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APPENDICES

A.1 Individual background of researchers

Max Crutzen

Max Crutzen finished his bachelor's degree in Industrial Design at the TU/e. And is continuing his studies in Industrial Design in the master's program at the TU/e. Max focuses on technology and realization & creativity, creativity & aesthetic, and math data & computing in the field of Industrial design. Conceptualizing and prototyping are the parts of the design process which he specializes in.

Susan Draaijer

Susan Draaijer is an empathetic designer with a focus on psychology-driven approaches in product development. She recently completed her bachelor's degree in Industrial Design at the TU/e, where she honed her skills in UI design. She has now embarked on her Master's program, specializing in the expertise areas of technology & realization and user & society in the context of designing for behavioural change in the healthcare sector.

Rosanna Henstra

Rosanna Henstra finished her bachelor's degree in Liberal Arts and Sciences with a major in Cognitive and Neurobiological Psychology at University Utrecht. Continuing with a master's program in Industrial Design at the TU/e, she focuses on implementing psychological theories in industrial design perspectives. With this combination, she tries to enhance design for social constructs, and/or use design for behavioural change.

Teun Veelenturf

Teun Veelenturf has finished his bachelor's degree in Industrial Design at the TU/e. He has done a pre-master in Educational Science & Technology at UTwente, but decided to pursue a career in Industrial Design nonetheless. He is interested in designing with and for stakeholders in the area of education and business. Teun has affiliation with designing for learning innovation and reflection within education and likes to combine educational and behaviour change theories with design to create personal value for employees, students, and teachers.

Stefanie Zins

Stefanie Zins finished her bachelor's degree in Product (Industrial) Design at Maryland Institute College of Art. Her work focuses on tackling social issues with the intervention of design solutions and design research relating to how people interact with spaces and the objects around them. Her goal is to continue to combine themes of sociology, psychology, social issues, and politics into designs of furniture and objects, particularly ones that are created to be used and integrated into public spaces.

A.1.1 Contribution of researchers

All researchers contributed equally throughout the entirety of the project, often addressing one task together or dividing the different parts of the project during each step. In the beginning, all researchers contributed to understanding the theoretical background of the project, as well as the related works in order to have an equal understanding of the scope of the project. The entire team also contributed to formulating research questions, which then guided the following parts of the project.

The initial visit to TBK and study was conducted by Max Crutzen, Susan, Draaijer, Teun Veelenturf, and Stefanie Zins in collaboration with the initiators of TBK. The information gathered from this study was then used to create the research probe, which all researchers contributed to in regards to ideation. The stickers were designed by Rossana Henstra and Susan Draaijer. The insight and evaluation cards were designed by Susan Draaijer. The Bike Board was designed and produced by Max Crutzen. The printing of the stickers and adjustment of the files for printing was done by Rosanna Henstra, Max Crutzen, and Teun Veelenturf. The observation scheme, study setup, and interview questions were created by Teun Veelenturf and Stefanie Zins.

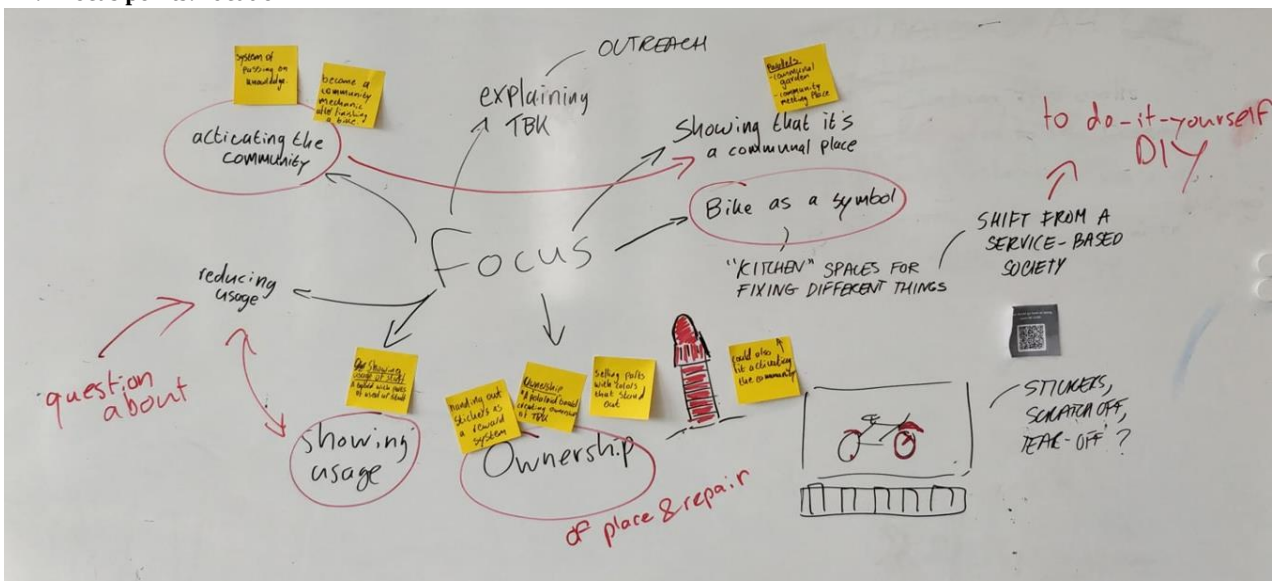
The field research at TBK on the UvA Campus in Amsterdam was contributed to equally by all researchers. Max Crutzen, Susan Draaijer, and Stefanie Zins conducted the observational research and the use of TBB for the first half of the participants, while Rosanna Henstra and Teun Veelenturf conducted the interviews for the same participants. Halfway through the research process, the researchers swapped roles, with Rosanna Henstra and Teun Veelenturf conducting the observational research and the use of TBB and Max Crutzen, Susan Draaijer, and Stefanie Zins conducting interviews with the second half of the participants and the mechanic. All interviews and observation schemes were transcribed by all researchers. The thematic analysis and interpretation of this data was completed as a team with the use of tools such as OneDrive and Miro.

The paper was written as a team, with different researchers focusing on different parts, while often meeting and commenting on each other's work to provide feedback and ensure a cohesive argument. The abstract, the introduction, and the related works were written by Rosanna Henstra and Susan Draaijer, with Rosanna Henstra focusing on the sustainable toolkits

design portion and Susan Draaijer focusing on TBK concept. The design and part of relevancy and future directions was written by Max Crutzen. The methods/study setup, findings and discussion, part of the abstract, and part of relevancy and future directions were written by Stefanie Zins. The theoretical background, limitations, part of the introduction, part of relevancy and future directions, and part of the conclusion were written by Teun Veelenturf.. The appendix was compiled by Max Crutzen, Teun Veelenturf, and Stefanie Zins. All researchers reviewed and edited each other's work as the paper was being written.

Throughout the duration of the project, Teun Veelenturf acted as the main point of contact between our team and experts, such as Dirk Ploos van Amstel, with whom the team met with every week to provide updates and receive feedback. The presentation format was created by Stefanie Zins, with each team member contributing equally to different portions of it. Due to unforeseen circumstances, the project was presented only by Teun Veelenturf and Stefanie Zins.

A.2 Focus points: Ideation



A.3 Observation Scheme

What to observe	Example	Notes
Values:		
Helping each other	One student helps another student. Include what is said.	
Recommending to others	-	
Competencies:		
Hands on learning	Observe that student do something that they could not do before	
Repair	Watch them repair (parts of) their bike	
Writing reflection on insight board	Look at the answers	
Writing on insight panel	Look at insights that might have been produced	
Learning from mechanic	Taking advice from mechanic into account	
Planning future repairs	Plan next bike repair with mechanic or online and discuss what is still wrong with bike	
Materials:		
Using tools	Usage of different tools. Mostly same, different?	
Engaging with TBB and stickers	How do they act? Seem happy, engaged or bored?	

Other notes:		

A.4 Interview Questions

A.4.1 Interview questions - participants (in repairs):

1. How would you describe your experience in The Bike Kitchen?
2. Could you reflect on your own behaviour regarding using and repairing your bike?
3. What elements of TBK do you enjoy? And what would you like to improve?
4. Would you tell your friends or family about having used TBK? Why or why not?
5. How do you feel about having fixed your bike? Was this experience positive or negative overall?
6. Do you think you are more skilled in repairing your bike after experiencing TBK? How does that make you feel?
7. Do you value your bike more after this? Why or why not?
8. How do you feel about the Bike -Board-Design that shows what has already been fixed?
    1. Do you feel any contribution to the community?
9. What were your initial expectations of TBK? Were your expectations met?
10. What did you notice in your interactions at TBK?
11. How do you think your experience with TBK might affect how you interact with your bike after the repair is done?

A.4.2 Interview questions (mechanic):

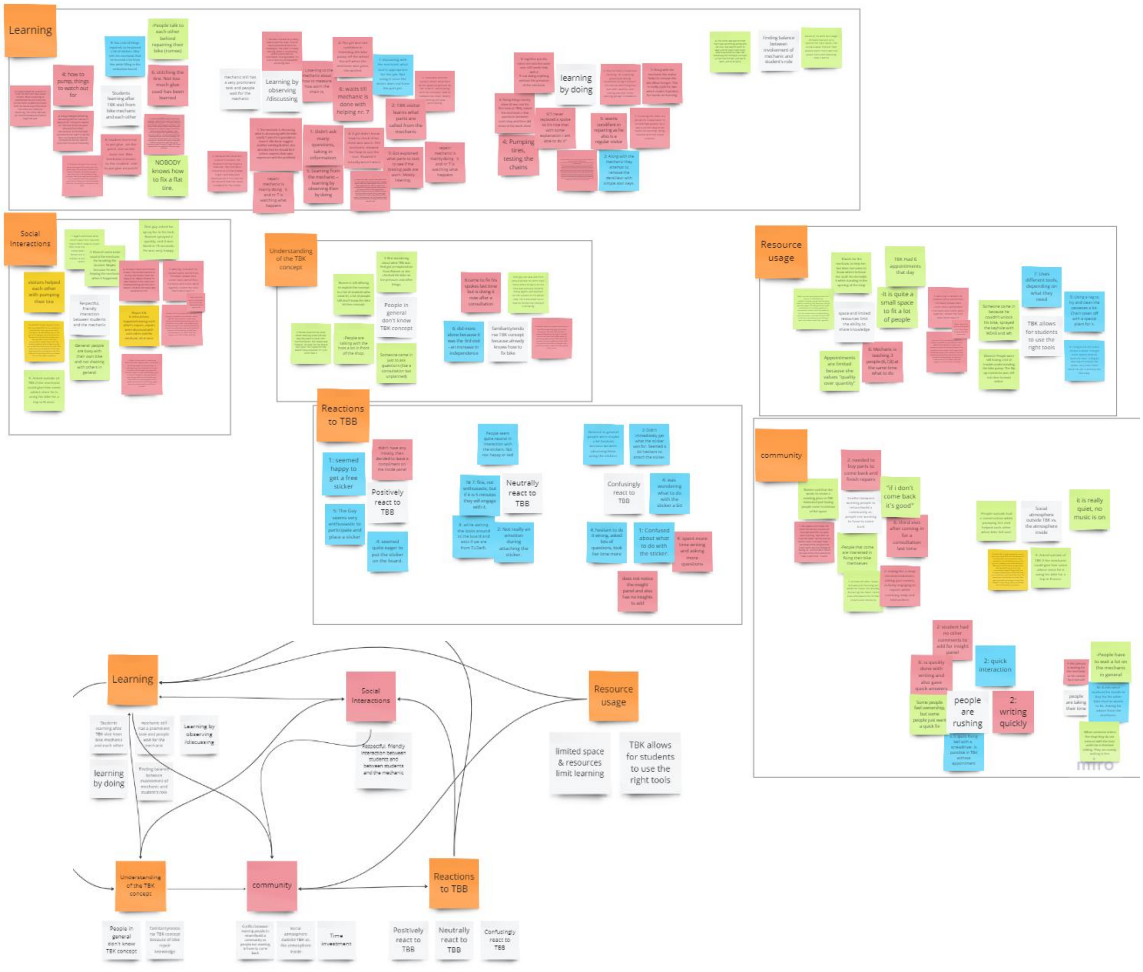
1. How would you describe your experience in The Bike Kitchen so far?
2. What elements of TBK do you enjoy? And what would you like to improve?
3. What do you think of your role as a teacher?
4. How do you feel about the board that shows what has already been fixed?
    1. Do you feel any contribution to the community? What have you noticed about how people use it?
5. How do you think TBK and these kind of hands-on learning experiences affects the students' relationship with their bikes? (ownership and awareness)

A.4.3 Interview questions first visit (initial study):

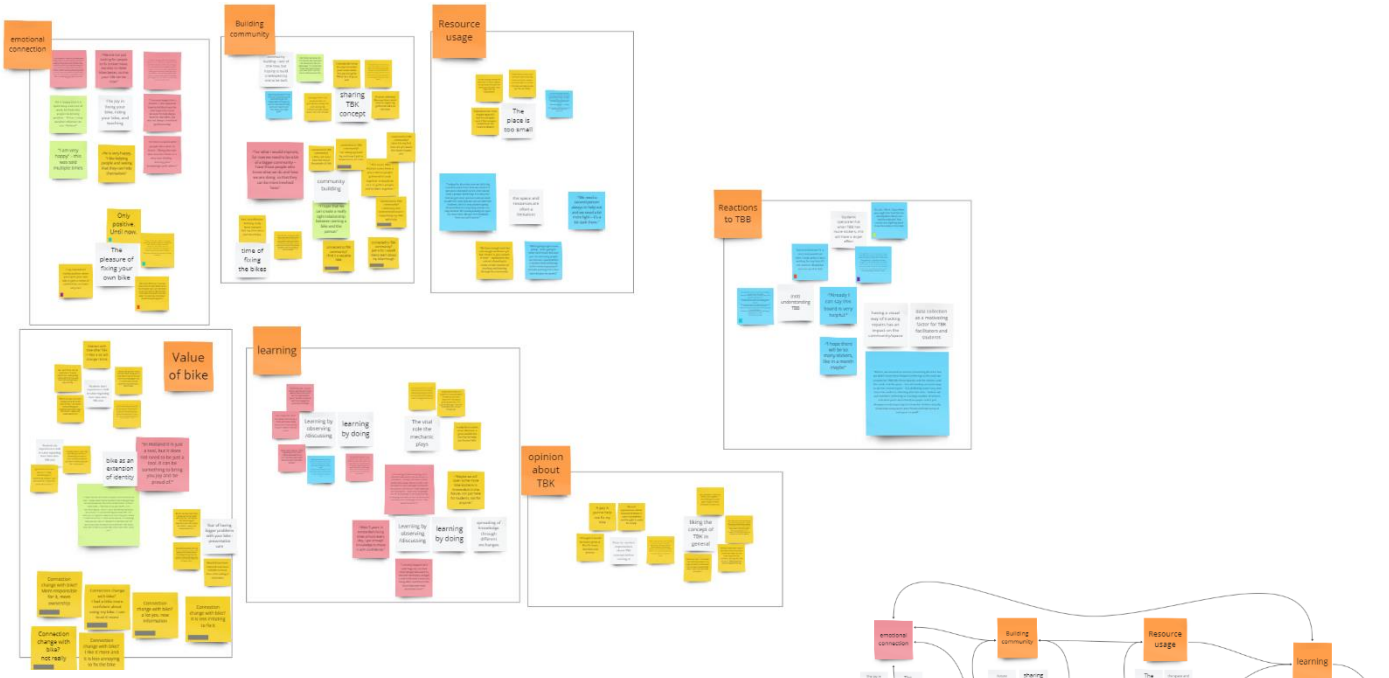
1. What kind of repairs do you see a lot?
2. Is TBK well known amongst students?
3. Are there a lot of people that come back for multiple repairs?
4. What are the proportions of new repairers vs regulars?
5. What do you think would help encourage socially responsible behaviors?
6. Do students talk about sustainability regarding repairing their bike?
7. What would a normal day at the bike kitchen consist of?
8. Do you see any behavioral change and different social practices throughout the process of TBK?
9. What have the outcomes of TBK been so far?
10. Do students provide feedback to you or to TBK?

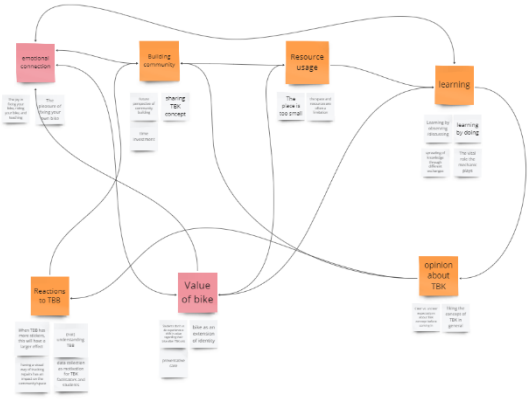
A.5 Thematic Analysis

A.5.1 Practices-as-Performance



A.5.2 Practices-as-entity





A.6 Findings (Continued): Practices-as-performance

A.6.1 *Resource Usage*

The observational research showed that although TBK allows for participants to use the right tools, the space itself and the limited resources limit the ability to share knowledge. During the appointments of participants 6,7, and 8, the mechanic was teaching all 3 people different tasks at the same time, causing participants to have to wait for instructions or tools to become available. This proved to slow down the efficiency of the space, while preventing a much slower acquisition of knowledge, therefore likely not slowing, narrowing, or closing resource use as much. This shows that not only the interactions, but also the tools and the space influence how participants learn in the space.

A.6.2 *Understanding TBK Concept*

Although there are some participants who had visited TBK multiple times, such as participant 6, many, such as participant 3, did not fully understand the concept until the time of their appointment. Other participants also come to TBK to ask questions about the space, which can often slow down the process of addressing the appointments. There is opportunity to spread knowledge about the concept of TBK in order to make the space more efficient and increase the impact that such a space has on the resource loop.

A.7 Findings (Continued): Practices-as-entity

A.7.1 *Resource Usage*

Similar data was collected from the interviews regarding resource usage with many participants stating that the space is very crowded (participant 3) or that it should be expanded (participant 4). The mechanic himself also stated 'we have enough tools but not enough mechanics yet, but I think it is just a matter of time (regarding wanting to create a chain reaction of teaching and learning)', showing that all parties are aware of the limitations regarding learning and repairing.

A.7.2 *Emotional Connection*

In the study, it was found that the purpose of repairs is not only to fix a bike out of necessity, but also for the joy of doing so. The mechanic noted that 'we are not just looking for people to fix broken bikes, but also to make bikes better, so that your ride can be nicer', showing that the emotional connection related to the repair, as well as the bike could have an effect on the resource loop and the perception that people have about their bikes.

A.7.3 *Community Building*

As seen in the observational research, the interviews also showed the explicit desire for participants and TBK initiators to actively create a community, although it was not something that was being seen yet. Participant 4 noted that 'I would say because it is my first time I don't feel part of a community yet, but maybe when time goes by, and the bike shop will stay open and I have to visit more often, this might grow', which shows that there is opportunity to foster community in a more intentional way, even though it may rely on other factors such as time invested into the TBK experience.

A.7.4 *Opinion About TBK*

Many participants had very different expectations before coming to TBK, some saying that they were expecting it to be less precise (participant 3) and others saying that they had no real expectations, but thought it could be useful (participant 2). Overall, the majority of participants also had a positive reaction to their experience at TBK, however, this shows that there is a gap between the understanding that participants have of the space as compared to their final experience. This indicates an opportunity to educate future possible participants about a space to create a more clear experience, as well as spread knowledge about the need to positively impact the resource loop.