Encountering the inner face of products: computer repair practice and amateur computer repairers

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Encountering the Inner Face of Products: Computer Repair Practice and Amateur Computer Repairers

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Abstract: This study focuses on the interaction between user and product that is characteristic of the amateur computer repair practice, including maintenance, upgrade, part replacement, customization, and repair. Our discussion is based on data provided by semi-structured interviews and think-aloud sessions with participants with diverse levels of repair experience with computers. The data indicates key findings for sustainability studies that aim to contribute to current discussions on design for sustainable behaviour by providing a snapshot of the amateur repair behaviour. The study revealed three important findings. First, since repair is a practice that features particular elements such as skills, settings, implicit and explicit rules, amateur repairers are users who sustain and develop the practice. They have particular identities and a perspective that is characteristic to amateur computer repair practice. Second, repair practice helps to transform product characteristics, both materially and from the point of view of the practitioners, as largely independent from how the product is designed. Third, the implicit and explicit rules are distributed via online and offline networks. Through these networks, knowledge and tools are shared among the practitioners. In conclusion, a comprehensive understanding of amateur computer repair practice might contribute to the Design for Sustainable Behaviour (DfSB) studies and sustainable system design.

Introduction

According to van Hinte (1996, as cited in Verbeek 2005), many products are designed on two levels: Skin or cover, i.e. the surface of the products, and the interior (which we call “the inner face” of the product). Based on this territorial segregation, while the outer surface of the product is freely accessible for interaction, the products’ inner surface is accessible only for trained technicians, being complex, even unintelligible for users. That can be considered as black-boxing (Jordan & Lynch, 1992).

On the other hand, users do occasionally interact with the inner face of products, for instance during repair and maintenance. Accordingly, this study focuses on such interactions with the inner faces of products. Our aim is to outline the characteristics of repair practice from the point of view of amateur computer repairers. For this we draw on interviews and think-aloud sessions conducted with repairers, which then we analyze from the perspective of practice theory (Reckwitz, 2002; Shove, 2007). Extrapolating from our findings, we argue that design of sustainable product systems requires a comprehensive understanding of amateur repair as a practice.

Below we first briefly introduce practice theory, then review how repair is discussed in sustainable design literature. Following an overview of our methodology, we present our findings via representative quotes, then we elaborate on how this study might contribute to Design for Sustainable Behavior (DfSB) literature.

Literature review

Practice theory

Practice theory takes practices as the building blocks of social life, and studies them with emphasis on routine action and tacit knowledge. Reckwitz (2002) describes the notion of practice as routine behaviour patterns that include bodily activities, mental activities, objects, particular understandings and knowhow. Shove et al. (2012) assert that the practice involves materials, competences, and meanings. They define competences as that “which encompasses skill, know-how and technique” and meaning as “symbolic meanings, ideas, and aspiration” (Shove et al. 2012, p. 14). “Materials” refer to “things,

technologies, and tangible physical entities, and the stuff of which objects are made" (Shove et al. 2012, p. 14). The linkage between the materials, competences and meanings describe a practice such as cooking, walking or shopping.

Repair studies in design

Studies in sustainability have underlined the importance of designing the extended life cycle of the product. In this context, repairability of the products is considered as one of the critical aspects in designing a sustainable product system. Designing a repair-friendly system requires inquiry into repair activities with their social, cultural and material dimensions.

In the literature on sustainable design, open design and HCI, studies provide multifaceted insights about repair activities. Among these, two models declared the importance of repair activities. The circular economy model suggests an order of maintenance, repair, reuse first, and remanufacture and recycle later, rather than direct recycling of an object (Ellen MacArthur Foundation, 2012). The second model by Doğan and Walker (2008), called Integrated Scales of Design and Production for Sustainability (ISDPS), also adopts a holistic approach. It stresses the importance of post-use product services such as product caring, maintenance, repair, reuse, and recycling at local level. Designers thus become responsible for considering post-use processes.

Scholars have also indicated several strategies to facilitate a longer lifespan of the product. A common argument is that repairability of the products depend on the product design decision in terms of openness and transparency of the products. A simple example is that design decisions such as using glue or uncommon screw heads in products prevent repair and negatively impact product lifespan (Ahmed, Jackson & Rifat, 2015). Conversely, modular designs assign an active role to users or empower them for repair activities (Keyte, 2015; Gwilt, Leaver & Young, 2015).

Other scholars, especially outside design literatures, focused on the nature of the repair and how it emerges in daily life. Rosner and Ames (2014, p.319) bring a novel approach to discussions on the openness by suggesting the concept of "negotiated endurance." According to the authors, the meaning and value of repair is defined in the social negotiations between a user and a repairer. As such, repair emerges in everyday practice, where the actors have great importance. Instead of being a single and independent phenomenon, repair activities are transformed by "material, infrastructural, gendered, political, and socioeconomic factors" (p.319).

Knowing the user is an inherent part of designing a product or experience, especially in relation to meaning-making and user experience (Bødker, 2015). Accordingly, some studies focused on the user's experience as entangled with repair activities. For example, Lindsay's (2003) study shows that users who engage with TRS-80 computers, adopted various roles as "developers, producers, retailers, advertisers, publishers, and technical support staff" (p.50). On the other hand, Kohtala et al. (2020) describe the people who deal with repair and maintenance activities, as "active users" (p.34). A third study by Lilley et al. (2013) focuses on sustainable behaviour change and it categorizes repairers into three as "fixers, sometimers and non-fixers" according to their repair frequency. Design for sustainable behaviour studies (DfSB) focus on user behaviour, and explore how design can help to make users adopt sustainable behaviours (Bhamra, Lilley & Tang, 2011), including repair.

In line with these arguments, whether and how users engage in repair, maintenance, and upgrading of the products should be viewed as a multi-faceted experience (see also Ackermann, 2018; Terzioğlu, 2021), determined by the social, economic, material contexts of the practice (Rosner and Ames, 2014; Houston, 2019). However, current literature has not been specifically interested in repair as an experience. Even though design for repair is investigated under Design for Sustainability, there is a limited focus on user behaviour (Daae, Chamberlin & Boks, 2019). Kuijer and Bakker (2015) discuss limitations of DfSB (see also Shin & Bull 2019), and highlights that adopting practice theory for a practice-oriented design approach presents a promising area for sustainable design. Overall, there is potential for further studies that focus on repair activities by paying attention especially to users, various actors, objects, and networks involved.

Method

This study aims to reveal experiences, practices, knowledge, and settings of amateur repairers. Accordingly, a qualitative,

interpretative approach is adopted during the data collection process. Research design involved semi-structured interviews and concurrent think-aloud methods (Hannington & Martin, 2012; van Someren, Barnard & Sandberg, 1994) in order to collect diversified data. Data triangulation was made by collecting data from different sources. All data was collected by the first author.

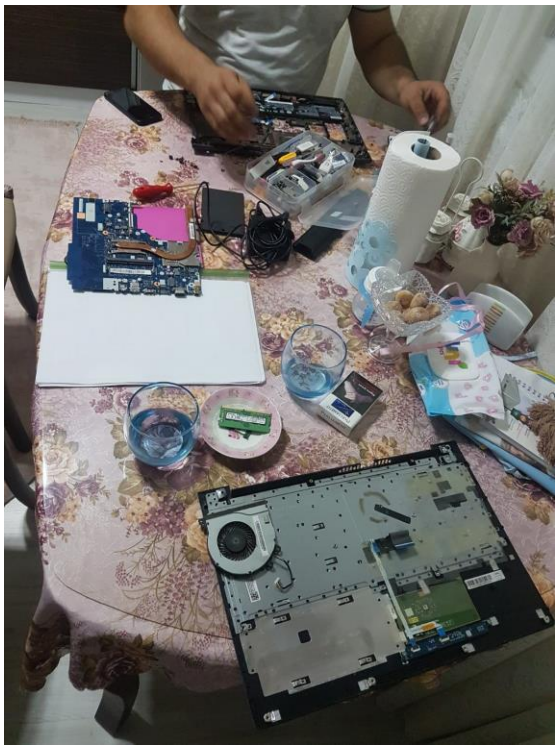

Figure1. Participant disassembles a laptop during think-aloud protocol. © Researcher' s archive.

20 amateur repairers were recruited via personal connections, social media announcements and snowballing. Participants were between 25 and 35 years old, from various professions. 18 participants live in 4 different cities in Turkey, and two participants abroad. Equal gender representation was sought in recruitment, with 7 women and 13 men participants. Furthermore, five concurrent think-aloud sessions are conducted to observe the participants' computer repair process. Out of 20, only 13 participants were found to have sufficient repair experience with computers. The 13 interviews were thematically analysed using MAXQDA. An inductive coding approach (Matthews & Ross, 2010; Thomas, 2006) was adopted, where the transcriptions of the interviews are used to derive codes and concepts.

Discussion

Hybrid identities distinct perspectives and technical skills

The field study revealed that amateur computer repairers are critical actors who sustain and shape the practice. When we examine the participants' discourses, we come across that amateur repairers are users who assume a particular identity, perspective, and skills through their involvement with amateur repair practice. Participants experience various breakdowns during the repair process. Accordingly, they can guide others with their accumulated know-how by offering possible solutions. One of the participants stated that he sees himself in the expert position, capable of guiding others:

When people mention that their computer has a problem, I ask them, as if I am a repairman: What exactly is your problem? Have you tried to do this or that? If he says, he has not tried [what I suggested], I go into detail. Something like this happens out of the blue. Then people ask: Why do you know that? How do you know that? (Kaan)

Participants in this study can be described as "active users" who deal with repair and maintenance activities (Kohtala et al., 2020). Yet, simultaneously, amateur repairers assume a particular identity as a repairperson (see also Lindsay 2003). In their social interactions, too, amateur repairers are perceived as persons with the competence and right to intervene in technical objects. Both participants' self-perception and their social circle's perceptions construct the identity of the amateur computer repairer. We found that amateur computer repairers combine the repairer identity and values related to being a user such as risk of damaging the computer, cost of the repair and loss of the stored data on the computer. The amateur repairers assume hybrid self-identities between being a user and having a technical professional's skill or expertise.

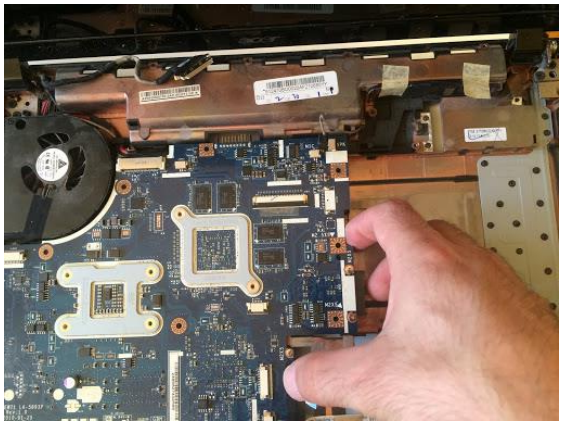

Figure2. Participant checks motherboard of the laptop. © Researcher' s archive

Figure3. Participant fixes the case of the laptop © Researcher' s archive

Interactions with the interior surface of the product play a part in this identity construction. Aligned with Houston's (2019) statement that repair provides a different way of knowing, we found that participants are knowledgeable about the various layers of the product, the background of the malfunctions, and even potentials for technical improvements and innovations. Their knowhow also enables them to repurpose existing components to reconfigure the objects, and even assemble new objects. It can, therefore, be seen that amateur computer repairers undertake creative activities beyond merely fixing the product. As such, knowing and interacting with the object's infrastructures broaden both the understandings and the practical capabilities of amateur repairers. Repair informs the practitioner on the material level that makes the product more transparent (Terzioğlu, 2017). The implication is that the apparent unity and mystery of the functions and components under the products' cover can be challenged through repair activities. As a result, repair re-establishes a bond between users and products that can dealienate the user.

The repairers are involved in both practical and analytical skills. Our study has shown that participants can repair and maintain tasks such as fixing broken parts, renewing thermal compounds, spare part replacements, and performance updates. They know how to use the required tools and how to interact with components through their implicit knowledge. They might use improvisational tactics in the implementation phase, to the extent that they experiment with the computer. Consequently, amateur computer repairers are a particular type of user who has a particular identity, perspective and skills. Accordingly, they can be defined as "enlightened users."

Overcoming the manufacturing and design decisions of the products

In addition to the identity of the repairer, the design of the product is a critical determinant of the repair practice. In the findings, material qualities such as snap-fit connections in laptops, non-standard screws and integrated parts block the repair show that computers are "blackboxed" (Jordan & Lynch, 1992). Other than the product's material qualities, the fear of damaging the computer, the difficulty of accessing tools and spare parts, and warranty limitations are other factors that black-box the computers. However, computer repair practice enables transformation of the products' characteristics, independent to some degree of how the product is designed. Repair practice enables interventions firstly at the material level that refer to make changes on material, form, and structure of the object. Secondly, perception levels that refer to products become transparent in users' minds, and users perceive the computer as a combination of different layers and components.

The circuitry of the graphics card was probably burnt and the problem was caused by that. So I threw the graphics card in the oven. You heat it at 180C for five to ten minutes. Now, they have thin circuits. Very randomly, heated solders flowed and united, then the graphics card that I baked worked. (Oğuz)

As shown in the quote, amateur repairers can employ quick and cheap alternative methods that are different from formal repair practice. Lack of materials or budget might lead the user

to find creative solutions such as putting the processors in the oven, or using cream instead of a thermal compound. Such primary maintenance tasks as renewing thermal paste can also be considered as enhancing a product's capacity and performance and prolonging its lifespan. Additionally, amateur repairers are used to overclocking processors or upgrading parts in order to enhance the product's capacity and performance. Lastly, amateur repairers can repurpose leftover components from other, broken computers enables them to intervene in the function of the components. For example, re using the old phones instead of broken wifi adapters of the computer. As a result of such interventions, the product's form might differ from its initial version, or usage context might be transformed.

Through amateur repair practice, the black-boxed computer is transformed in the user's perception in the context of transparency. In line with Houston (2019), this study revealed that interaction between user-products characteristic to the amateur repair practice provides a different perspective to the user. Practitioners perceive the computer as multiple separate products, arranged in multiple technical layers – an assembled rather than an integral object – which then enables them to intervene in the products they repair. As such, amateur repair practice enables diverse ways of intervention to the products. By doing this, users might overcome the manufacturing and design decisions by transforming the objects' characteristics, including its performance, function, lifetime, or transparency. Therefore, authority is dispersed from manufacturers to the user through amateur computer repair.

Networks

A third aspect of repair practice that we emphasize here are the various networks in which repair takes place as a practice. Social and production networks are critical for expanding knowledge, accessing spare parts, and skill sharing.

Production networks comprise computer companies, subcomponent manufacturers, technology markets, wholesalers, and influencers. These often have the effect of regulating access and thus closing the practice. However, personal connections, global online shopping, and flea markets may help repairers find parts that are non-standard, or available only in wholesale.

More important are social networks that shape amateur repair practices. Offline networks consist of friends, neighborhood technicians, school teachers and family, who support one another by sharing knowledge, experimenting together, and exchanging tools or components. Online communities are crucial mediums for the distribution of knowledge and experience, especially via texts on forums or video tutorials. These communities not only create but also ensure the credibility of knowledge through debate and confirmation by peers. Knowledge and experience is generated by cumulative online labor that expands, maintains and enhances the practice.

Conclusion

This study presents a comprehensive understanding that takes into consideration various elements and actors regarding amateur computer repair practice. This approach contributes to sustainability study in three ways.

Firstly, the study identifies the characteristics of the practice and the practitioner. Since DfSB studies aim to facilitate the adoption of sustainable behavior by users, understanding amateur repairers' practice is important for identifying opportunities and limitations for transferring similar behavior to other user groups. Characteristics of the amateur repairers (their skills, knowledge, identity and perspectives) can be used by DfSB studies to propose a practice model that specifies the elements as well as the conditions of repair practice. Looking for ways to reproduce similar practice formations in other settings might be a strategy to actively involve other users in repair and maintenance activities.

Secondly, this study highlights the importance of the actors who are involved in repair practices, including users, their social networks and the larger production networks. It is critical to understand sustainable behavior from such an extended perspective that reveals the system's actors' roles. Since repair is a practice at the intersection of innumerable networks, understanding the actors and their relationships might contribute to designing products and systems that are either compatible with such networks, or provide alternatives.

Thirdly, the study provides an understanding by describing the nature of the user-product relationship through repair practice. Since the design of the product plays a part in the practice, it is important for product designers to take into consideration various user groups that interact with the inner face of products, and their social and material engagements. Since amateur repair practice goes beyond formal repair through improvisational tactics, this includes opening up a space for users' creativity. Accordingly, the product engagement experience of the users might contribute to manufacturers and designers in terms of extending the lifespan of the objects.

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