Anja-Lisa Hirscher

When Skillful Participation Becomes Design: Making clothes together

Aalto University

ANJA-LISA HIRSCHER is a designer-researcher interested in exploring design as a means for engaging, educating and skilling people in alternative, local and more sustainable modes of production and consumption of clothing. She holds a BA in Media Design and an MA in Creative Sustainability. In her doctoral research, she explores matters of skillful participation in relation to the designers' role, and the social and material changes which occur in alternative spaces of peer production when diverse people make clothes together.

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Thank you!

Anja-Lisa (Helsinki & Ulm, January 2020)

[A] Abstract

This dissertation investigates the intersection and fluidity of design, use and participation when participatory design (PD) extends its focus to new forms, spaces and community contexts. Whereas early PD aimed to enable user participation in the design of their workplaces, contemporary PD experiences new challenges by expanding to new contexts. These contexts are, for instance, “makerspaces” for “peer production”, dedicated to placing participants with varying knowledge and skill into dialogue while providing spaces, tools, materials, and guidance. When extending PD to such spaces, the roles of the designer/user become blurred, because over time they move along a spectrum of acts of design and use. I investigated this challenge by creating three exemplary sites for designing and making clothes together. By designing together I refer to enabling the garment user to participate in the design and production process through offering local spaces and means for shared making activities. I blend PD, do-it-yourself, and do-it-together activities with concepts from peer production, to explore how participants (designer and user) with different skills are “making clothes together”. Simultaneously, I sensitize the participants to sustainable alternatives to the global mass-production system in fashion, which is traditionally based on fast, cheap and high-volume production in low-labor-cost countries.

I carried out three “research through design” experiments, creating different kinds of peer production makerspace settings in Finland, Germany and Italy. These spaces were distinctive in the social diversity of their participants; themes and engagement methods, and in their focus on clothing. This focus offered the participants a familiar repertoire of technical equipment (e.g. household sewing machines) and was thus beneficial for observing the blurring of roles between designer and user. Each experiment consisted of a series of participatory making workshops, each lasting three to

six hours. During a total of about 60 workshops with hundreds of participants, I collected rich materials such as design diary notes, observations, photographs, and audio recordings of qualitative interviews. The experiments posed specific questions that led me to emergent conceptualizations of "stuff" (i.e. tools, materials, spaces) and "skills". These stuff and skills were analyzed in terms of their evolving interdependence and their relation to participation and the blurring of roles. The dissertation is structured as the presentation of the main findings of four peer-reviewed journal articles and an introductory chapter.

I outline five main contributions to extended PD research and practice. First, my research illustrated the fluid spectrum that spans design and use, through interrelating conceptions from literature with a substantial amount of materials documented through practice. Second, through systematic analysis of stuff and skills, the research explored the social and material considerations of design and "infrastructuring". Third, I documented how the participants' (designer and user) roles changed and how participation is a development process over time. The participants' roles changed from categories such as *beginner* to advanced *experts* and allowed associations between those with different kinds of material engagements from *operating* to *managing* to *designing*. This was seen, for instance, by participants taking over responsibilities and becoming workshop facilitators; or a local visitor who turned out to be a sewing machine repair expert. Fourth, I propose that in the given context, participation can be understood as skillful acts of use. This perspective helped me recognize and document changes in the participants' roles and types of participation when framed as acts of use, determined by skills. Finally, the developed categories documented the relation between participation and skill, by highlighting interesting dynamics emerging around skills development, materialized

through evolving and changing stuff (i.e. social and material infrastructuring). For example, skilled participants developed or brought their own tools for facilitation. This further elucidated how skills are not static but interrelated, and that specific skills are required and can be developed through different social, material and designerly aspects, attuned to such extended PD contexts.

The results, therefore, contribute to extended PD research by adding nuances extracted from practice, to highlight how skillful participation changes over time. This suggests a reconceptualization and broadening of traditional PD or co-design perspectives of roles. For practice, the perspective of framing participation as skillful acts of use allows designers to support participants' skills (development) during participation. Further, my research identified that a focus on user or designer roles is limiting in such contexts. It advocates designing spaces for infrastructuring, which allow changes in participation and anticipate unexpected use: spaces that nourish skills development and encourage the sharing of responsibilities among very different participants which can potentially be sustained over time.

Keywords

participatory design, participation, use, design, roles, infrastructuring, making, peer production, clothes

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The following original research papers are included in this dissertation:

Paper 1 [P1] → p.163

HIRSCHER, A.L.[I], NIINIMÄKI, K., ARMSTRONG, C. (2017).
Social Manufacturing in the Fashion sector:
New value creation through alternative design strategies?
Journal of Cleaner Production. Volume 172, 4544–4554.
https://doi.org/10.1016/j.jclepro.2017.11.020

I As the first author I was responsible for structuring, where I received comments from the co-authors and writing most parts of the theory such as developing the definition of social manufacturing and establishing the alternative value framework. Further, I contributed part of the data, the participatory sewing workshops. In addition, I conducted the analysis of my data and illustrated the possibilities for future application of the value framework in the discussion. Introduction, discussion and conclusion were collaboratively written with the co-authors.

Paper 2 [P2] → p.177

HIRSCHER, A.L.[II], MAZZARELLA, F., FUAD-LUKE, A. (2019).
Socializing Value Creation Through Practices of
Making Clothing Differently: A Case Study of a Makershop
With Diverse Locals, Fashion Practice, 11(1), 53–80.
https://doi.org/10.1080/17569370.2019.1565377

II This was a collaboratively written paper, testing the value framework from the first paper and an earlier developed tool (Value-Proposition Tool) in a different workshop setting. My role as first author included a first proposal on the structure, which was discussed and iterated with all 3 authors. Further, I was co-developing and supporting the workshop facilitation. The collection and analysis of the materials was also done by all 3 authors. I was writing the sections on socializing value creation, adapting the value framework from P1 and analyzing the materials according to it and therefore writing the first part of the results and findings. The second part on the value proposition (VP) tool, its application and findings were written by the third author. Introduction, discussion and conclusion were written together with both co-authors.

Paper 3 [P3] → p.203

HIRSCHER, A.L.[III], MAZÉ, R. (2019).
Stuff Matters in Participation: Infrastructuring a Co-Sewing Café.
Journal of Peer Production. Issue 13. Retrieved from:
http://peerproduction.net/issues/issue-13-open/peer-reviewed-papers/stuff-matters-in-participation/

III This paper is bringing together three areas or research, where my role as a first author was in collecting and analyzing the materials of the Co-sewing café case and writing a first manuscript and outline of the paper. The second author supported the structuring of the paper, sharpening the arguments and contributed to introduction, discussion & conclusion section and elaborations on some of the figures developed.

Paper 4 [P4] → p.223

HIRSCHER, A.L.[IV] "Hey, I can do that too!" —
Skillful acts of use thriving in a co-sewing café.
Under review.

IV Single authored

[P] Prologue

Clockwise from top left:
Mr. Kraft repairing our old sewing machines.
The Co-sewing café during a busy afternoon workshop.
Collaboration among differently skilled participants.
Participant cutting a pattern using tools and instructions provided at one of the cutting tables.
Results of different workshops: shirt and skirt and a child's pants jointly upcycled from old jeans.

You can hear the sounds of laughter, discussion and the constant rattle of old-fashioned sewing machines. It is around 5 pm, and I am making a pot of coffee while explaining the basics of the "*Co-sewing café*" to a first-time visitor. This space is neither a café nor a tailor's studio. *The Co-sewing café*, situated in the center of Dietenheim, a 6600-inhabitant town in the South of Germany, is a space open to anyone to learn, share, make, repair, and design their own clothing. If they are beginners, they are supported by myself, a trained designer, though not in fashion, and other skilled people. The participants who join are diverse in age, nationality, occupation, and sewing knowledge or experience. They all make their way through the door for different reasons. For example, there is 30-year old Anette, using a sewing machine for the first time in her life, and 16-year old Sophie who is a young advocate for sustainable consumption and loves to upcycle anything. There is Naser, a young refugee from Afghanistan, who used to work as a dressmaker before coming to Dietenheim. He can advise participants and facilitate his own workshops. Andrea and Theresia are both very skilled in sewing but had not made many clothes for themselves before regularly attending the *Co-sewing café* workshops. There are many more types and varieties of participants, creating a wide spectrum of possible types of use and their progression. The *Co-sewing café* allows every participant to freely choose textiles from the material stock, which is based solely on donated supplies. Everyone is invited to use one of our good, old household sewing machines, some of which are over 30 years old, repaired and maintained by our local expert Mr. Kraft, a 92-year-old late repatriate from Russia. At the end of the workshop, usually around 8 or 9 pm, we clean up the space together and I photograph the proud makers and owners of the garments with their newly designed and produced piece. These photos are added to our inspirational gallery, showing newcomers all that can be made here together.

"The great thing is, there is someone here who knows this stuff. Here, in live, you can also learn from others, especially if there are such great people like today."

The quotes on this and subsequent spreads between chapters are taken from interviews with participants.

[1] Introduction

The scenario presented in the prologue depicts a local, post-industrial[1] production space in which designers and users design and make clothes together. The scene is taken from one of the design experiments representing the research environment of this dissertation. The setting illustrates the diversity of the participants and their different roles based on varying skills. All these different participants and their diverse skills need to be accounted for when designing for and in such contexts. The diversity of participants requires a flexible context, attuning to the different, also unexpected, deep engagements of certain participants. As a result, the range of participation offered great potential for sharing and negotiating roles, skills and responsibilities. The described context was built on a close participant-designer relationship, which also poses certain questions and design challenges. It requires the designers and design researchers to be able to jointly create a space with the participants, which can attune to the social, material and spatial requirements occurring over time.

Similar spaces for all types of production scenarios, not only for garments, are emerging all over the world. From an industrialized, Fordist mass and assembly line production system, new movements and platforms are evolving. This development can be referred to as, for instance, the democratization of manufacturing (Mota, 2011), including peer and social production (Benkler, 2006), "personal fabrication" (Burns & Howison, 2001; Gershenfeld, 2008) and "social manufacturing" (Shang et al., 2013; Hämäläinen & Karjalainen, 2017). What unites these movements is their general aim to enhance innovation and local production driven by active consumers and local production spaces leading to what some would call a "third industrial revolution" (Troxler, 2013). These developments also pose new challenges, such as models of organization, including the division of roles and responsibilities based on skills and the knowledge of tools, materials and practices (Seravalli, Eriksen, & Hillgren, 2017; Toombs, 2016); values and ethics when sharing spaces and resources (Arvidsson, 2008; Foster, 2017); and socio-materially sustaining these spaces over time (Troxler, 2010).

In such environments, design can play an important role in successfully including users as participants in the design and production process. Design, according to its traditional definition, refers to the design and production of objects on an industrialized scale. The entire design process is played out before the end product reaches the hands of the final user. Unlike the traditional comprehension of design, an increasing number and variety of movements and platforms aim to open design to more people and parts of society. For example, in a human-centered and co-creation perspective, people are asked to participate in the design process at an early stage, to increase user-friendliness and product or service success (Sanders & Stappers, 2008). People's ability to design for themselves has been "radically and rapidly" changing, as discussed in discourses of open design and post-industrial design (Leadbeater & Miller, 2004; Mazé, 2007; Von Busch, 2008).

Movements and design strategies such as "open design", "craftivism" and the "maker movement", as well as do-it-yourself (DIY) and do-it-together (DIT) platforms are driven by groups of passionate people across the globe, supporting the creation of physical and digital spaces for "peer to peer" exchange (Seravalli, 2014; Mota, 2011). Online recipes, instructions, patterns and models are shared via digital platforms, to be produced locally, in what I from here on refer to as "alternative spaces of peer production", such as "Fab Labs", "hackerspaces" and "makerspaces" (Maxigas, 2012; Nascimento & Polvora, 2013; Troxler, 2014). These spaces share production facilities while placing individuals into dialogue to share expertise and

1 By post-industrial I refer to an economy that is not solely based on heavy industrial machines and mass-production systems, but recognizes an increase in local or service orientation (e.g. Allen, 1988).

produce artifacts. The role of design and the designer thus changes in these contexts. For instance, designers are asked to open up design and production processes in which everyone can participate (van Abel et al., 2010).

With the emergence of these new forms of design and production, the role and understanding of not only the designer, but also that of the user/consumer is changing. For example, marketing theorists refer to consumers as "prosumers" who produce and make the products they consume (Toffler, 1980), or "produsers" (Bruns, 2008), if situated in a digital context. "Pro-ams" (professional amateurs) is another term, indicating that passionate consumers become experts in producing, through "distributed manufacturing" such as decentralized production, coordinated via information technology and the internet (Leadbeater & Miller, 2004). Of course, varying degrees of user participation are embedded in these terms. For instance, the term prosumer emerged when companies started to put "consumers to work"; for example, filling their own gasoline tanks at service station (Ritzer & Jurgenson, 2010, p.18). However, nowadays the term also refers to users who add their own content to online platforms such as Wikipedia (Ritzer & Jurgenson, 2010) or support product development in co-creation processes (Xie, Bagozzi, & Troye, 2008). This development can be taken forward and thereby influences the degree and depth of actual user involvement in the design process. The depth of involvement is here swayed by the freedom and responsibility given to the user during the process, the tools available and the abilities (i.e. skills) of the users to influence or produce the final product (Wolf & McQuitty, 2011). When the user plays a more active role in the design and production process, this inevitably motivates new approaches, roles and responsibilities for the designer.

As the user interest in participating in the design and production process grows, the roles of designer and user can become blurred. Redström (2006; 2008) even goes a step further and describes the assigning of roles in such contexts as problematic. Users are involved not only in the design, but also in ideating the eventual or future use of artifacts – conceiving "use before use" (Redström 2008). During more open and participatory design processes, assigning the role of a "user" assumes "that there already are users of things not yet designed, thus obscuring the complexity of what actually happens as someone starts using a thing, as someone becomes a user" (Redström, 2008, p.410). From this position, ideating "use before use" can thus be seen as participating in the design, complicating the dichotomy of user and designer. This challenge becomes particularly evident in the aforementioned alternative spaces of peer production. While such spaces of peer production generally place "experts" and "laypeople" into dialogue and challenge conventional knowledge and power distributions, a prevalent focus on highly technical products might work against this aim. In contrast, the making and designing of clothes locally utilizes a more familiar repertoire of technical equipment among the participants (for instance sewing machines) and builds on their partly existing knowledge. Therefore this specific context is more conducive to changes and renegotiating the distinction between the roles of designer and user. The particular instance of making clothes together as a form of peer production offers less technical means of production, but also introduces new values, concepts and forms of application. Hence, in my research I will combine literature and discussions on PD, peer production and sustainable fashion to understand what the blurring of roles means when PD extends to peer production scenarios.

Like design, traditional fashion design and production has also expanded through establishing new relationships among designers with the participation of consumers/garment users. In the traditional fashion system, the user is assigned the role of a passive recipient who consumes the products available on the market (von Busch, 2008), similar to other industrial end-products of design. The designer is responsible for easy-to-use product design, playing by the rules of the industry. However, in sustainable fashion research, alternatives are emerging (e.g. Flechter & Grose, 2012). These alternative approaches explore, for example, opportunities to organize clothing production closer to the users themselves, who can then contribute to the future product. Participation in fashion design is a relatively new and slightly under-researched area. The relation of my work to this body of research will be further discussed in Section 1.4.

As indicated above, stronger participation in design and production processes changes the designers' role and informs new design approaches. For instance, design for community participation, social innovation, and sustainable transition question traditional designer and user roles (Fuad-Luke, Hirscher, & Moebus, 2015; Ericson & Mazé, 2011; Manzini, 2015). Depending on the area of design, the understanding of the user as a participant varies according to shared responsibilities, the input they can deliver and their level of participation. In fact, a whole new landscape is emerging in design (Sanders & Stappers, 2008). For example, in "co-design" the users generally provide input in workshop sessions and are seen as a subject of research, whereas in comparison, PD addresses the user as a "partner" (Sanders & Stappers 2008). The research on "design for social innovation", applies terms such as "diffuse design" (performed by anyone) vs. "expert" design (performed by professionally trained designers) to distinguish between the nuances of who is designing (Manzini, 2015). In contexts of "design activism" and beyond, terms such as "authorized" (professionally trained) and "non-authorized" designers (professional amateurs, other professionals and citizens) are used (Fuad-Luke, 2014). This selection of expressions applied by scholars to articulate contemporary design roles does not claim to be complete but helps illustrate the nuances and divergences dominating the emerging challenge when the roles of designers and users become blurred.

This development is exemplified in PD, which has a long tradition of involving users as participants and emphasizing the user as an equal partner (Ehn, 1988). Unlike the traditional perceptions of design, PD has a long legacy in considering the user as more than just an end-user of a product, involving them early on in the design process of their future workplace (Sanders & Stappers, 2008). Remarkably, co-design and participatory design (PD) are often used interchangeably, as both share a mindset that considers user involvement in the design process as crucial. For instance, Eriksen (2012) emphasizes that both PD and co-designing are considered an approach rather than a method, which underlines the shared mindset among these bodies of research. Both approaches also build their design strategy on similar tools and methods such as the facilitation of workshops. In these workshops, users and designers ideate, develop, envision and sketch together, to imagine future design objects or services and their uses (Mattelmäki & Sleeswijk Visser, 2011; Sanders & Stappers, 2014a; Sanders & Stappers, 2014b). Sanders and Stappers (2008) see co-design as the creative act of designers and non-designers sharing the work during a design process. Similarly, Ehn (2008) sees participants as being involved in the participatory design process as co-designers, building on his work with colleagues on co-operative design methodology which evolved in the UTOPIA project discussed below (Bødker, Ehn, Sjögren & Sundblad, 2000).

However, the origin and development of the approaches, the values they stand for, and to a certain degree, the areas of application with which they are associated, differ to some extent (Mattelmäki & Sleeswijk Visser, 2011). Co-design as an approach evolved in a US context, finding its way into the business world (Sanders & Stappers, 2008). It is more closely related to product innovation, as it sees the user as a subject of research who places input in co-design sessions (Sanders & Stappers 2008). These (open) innovation-oriented processes are thus to be considered processes that foster the "co-creation" of value in the form of (sellable) products or services (e.g. Björgvinsson, Ehn & Hillgren, 2010; Prahalad & Ramaswamy, 2004). Open innovation research and the related value

co-creation practices are discussed broadly in, for instance, management literature (e.g. Prahalad & Ramaswamy, 2004). However, practices of value co-creation are not uncontested in regards to (not truly) sharing the value generated through company-centric undertakings (Arvidsson, 2011).

In comparison, in the Scandinavian context, early PD endeavors are situated in the relatively strong worker unions, motivated by "the social and rational idea of democracy as a value" (Ehn, 2008, p.94). Hence, PD seems to have a slightly stronger political agenda, and emphasizes the sharing of decision-making power during the design process (Mattelmäki & Sleeswijk Visser, 2011). I further understand co-design as being more closely related to collectively ideating over a shorter period of time. Unlike PD, which in its early spirit, seemed to more strongly emphasize and support participants' skills in developing workplace contexts, fostering joint implementation and aiming to enhance these skills beyond the PD process. Given these slight differences, on which my positioning is also built, I chose PD as an approach and mindset, and therefore situated my dissertation in PD research. This is because I understand PD as aiming to find ways that consider designers and participants equally important during the design process. Besides, PD offers interesting perspectives on the division of roles and power when designing together. The value-oriented, social and democratic ambition of PD offered a beneficial design approach for exploring how exactly the role of the user as a participant plays out and is developed over longer periods.

PD is inspired by the basic idea of giving a voice to everyone affected by a change in their workplace design. It is rooted in the 1960s and 1970s political movements that arose in Western societies, in which people demanded greater participation in democratic processes (Robertson & Simonsen, 2012). These first PD endeavors were thus underpinned by ideologies of social democracy, which aimed towards "workplace democracy" with equal distribution of power in the multi-stakeholder design- and decision-making processes (Gregory, 2003; Ehn, 1993). This was a response to workers' fears of being replaced by machines and technology (Nygaard, 1979; Sandberg, 1979), because technological developments, such as the introduction of computer systems at workplaces, enforced changes in these environments (Ehn, 1988).

The first research on PD built on the pioneering work of Nygaard, who in 1972 took the first step away from the traditional research towards actively involving trade unions and workers in workplace design (Sundblad, 2010, Nygaard, 1979). He inspired further projects among Danish, Norwegian and Swedish computer and information science researchers (Sundblad, 2010). These researchers developed additional projects on the tools and methods of participatory workplace design. For instance, the *DEMOS*[2] project initiated by Ehn, and later the *UTOPIA*[3] project, in collaboration with Kyng.

The DEMOS project (1975–1979), investigated, through action research methodology, how workplace democracy could be implemented (Ehn, 1988). At "four different enterprises: a repair shop, a newspaper, a metal factory, and a department store", DEMOS explored the issues arising between employers and trades unions that impacted the use, design, and implementation of computers at workplaces (Ehn, 1988, p.10). At this time, workers were worried that their jobs would be replaced by computers, and this meant that the designers' task was not only to design the future workplaces with them but also to find ways in which the technology would enhance people's already existing skills and abilities and reduce unskilled and repetitive

2 DEMOS = Acronym for [DEMOkratisk planering och Styrning i arbetslivet] "Democratic Planning and Control in Working Life - on Computers, Industrial Democracy and Trade Unions"

3 UTOPIA = Acronym for [Utbildning, Teknik Och Produkt I Arbetskvalitetsperspektiv] "Training, Technology and Product In Quality of work perspective"

tasks that could be automated (e.g. Ehn, 1988; Sandberg, 1979). These ideas were further developed in the UTOPIA project (1981–1985), known for emphasizing the quality of work and products by involving skilled workers, through participation, in the design of workplace technology (Ehn, 1993; Ehn, 1988). Designers and workers collaboratively envisioned how computers would be embedded in and change the work environment, more specifically the tasks and requirements of graphics workers in a newspaper production facility (Ehn, 1988).

Since then, PD research and practice have developed into a well-established field of design research with multiple forums for exchange. Designers and researchers adopted and explored how the social and political ideas of the 1960s and 1970s could influence their practice in their first conference, themed "Design Participations" (Cross, 1972). Today, we have multiple conferences such as the *Participatory Design Conference* (PDC); the *Nordic Design Research Conference* (NORDES); and, if the research is closely related to technology and interaction design developments in PD, *CHI — Conference on Human Factors in Computing Systems.* In addition, established design journals, especially *Co-Design – The International Journal of CoCreation in Design and Arts* offer a platform for research exchange related to PD. The overall research still strongly focuses on exploring means for users to participate in the design process (Halskov & Hansen, 2015). However, the areas of contribution are changing and extending towards, for instance, communities and neighborhoods (Robertson & Simonsen, 2012).

Contemporary developments in PD, such as extending its focus to communities and politics, nonetheless primarily dedicate their attention to designing and researching tools and methods for various actors to participate in rather short-term PD projects. This focus neglects, for instance, the detailed analysis of the changes in participation over time (Pihkala & Karasti, 2016). Recognizing this, PD research has in recent years provided further studies and in-depth investigations into participation in IT development (e.g. Saad-Sulonen et al., 2018; Vines, Clarke, & Wright, 2013) and into matters of participation in public spaces (e.g. Hamers, Bueno de Mesquita, Vaneycken & Schoffelen, 2017). An interesting perspective on participation in public spaces is offered by the recently concluded research project *TRADERS*[4]. Here, five early-stage researchers explored different participatory approaches to propose a methodological framework for designers and design researchers to apply in larger scale PD projects and public contexts. They identified that small-scale initiatives can "grow from individual or collective interests, skills, or talents", which, when brought together, can enhance "dialogues that contribute to different forms of capacity building" on an extended scale, such as public or city contexts (Huybrechts & van der Sluys, 2017, p.44). The research project and resulting book deeply explore matters of participation in longer and larger PD contexts and investigate "what it means to participate when boundaries are blurred and new (power)positions, roles, and forms of agency have to be explored" (Hamers, 2017, p.12).

Except for these researchers, relatively little emphasis has been dedicated to how exactly users and designers work together on a local level, over longer periods of time (Kraff, 2018; Halskov & Hansen, 2015). Detailed accounts on the social and material negotiations emerging when PD goes beyond "project time"[5]

4 TRADERS = Acronym for "Training Art and Design Researchers in Participation for Public Space"

5 I use the terms "project time" and "use time" to refer to the duration of the research projects and the designer/participant involvement and participation. In close accordance with Telier (2011) and Huybrechts (2011), I understand "project time" as the timespan, during which designers work closely with the participants and assist them in shaping the project according to their needs and wants. "Use time" in contrast, refers to the time beyond the initial research or design phase, during which the project is further developed and sustained by the participants. This can be supported by the initiating designers, e.g. by a flexible infrastructure to be continued with.

are limited in number. Kraff (2018, p.60) claims that "relatively little focus is put on the reflection of how people are involved, the role that they play in projects, and how their participation is directed over time". This calls for further research on matters of participation over time, and researchers' responsibility to be more "precise about users' roles when planning design events, selecting methods, interpreting design materials, and making decisions" (Halskov & Hansen, 2015, p.90). Vines, Clarke and Wright identified the need to address questions such as the reasons for, how, when and why people participate, and how these are influenced by the designer and the social, material, spatial, and contextual design considerations.

When PD extends towards communities, organizations, neighborhoods or spaces of peer production, referred to as "extended PD" in this dissertation, new infrastructures need to be designed to address the diversity of the participants (e.g. Salazar, 2017; Hillgren, Seravalli, & Emilson, 2011). A growing set of participants is likely to provoke different types of participation over time and can potentially also complicate the dichotomy between the designer/user role. This can possibly result in specific power issues when the existing or increasing skills and contextual knowledge of the participants blur the designer roles and responsibilities. In PD research, a great effort has thus been dedicated to exploring what can be called "'genuine' participation in design", referring to the "fundamental transcendence of the users' role from being merely informants to being legitimate and acknowledged participants in the design process" (Simonsen & Robertson, 2012, p.5). However, the depth and nuanced variations in participation are less studied than, for instance, the development and application of tools. PD has emphasized that research on the development of tools and methods equalizes potential power imbalances and enables participants to express their voices during the design process, which facilitates participation (Simonsen & Robertson, 2012). With this research I thus aim to investigate the diverse types of participation in extended PD contexts, such as community-based PD, expanding in time and scope. As an exemplary context, I choose the aforementioned alternative spaces of peer production (and specific instances of making clothes together) which are designed for and with participants to enable local design and production activities.

[1.1]

When designers and users work together

When designers and users work together in PD, the user becomes a participant and the process is called participation, which is facilitated through tools and methods but is also situated in complex and different contexts (e.g. Light & Light, 2012; Pihkala & Karasti, 2016; Saad-Sulonen et al., 2018). By the term "participant" I refer in this dissertation to active users/consumers, who become involved and participate in the design and the making process of, for instance, a garment. This definition is set for the context of this dissertation, in which participation is played out by participants making, designing, producing and interacting with others in alternative spaces of peer production. Through this type of participation, the roles of the designer and user become fluid and meet, in a process that I refer to as "becoming" a participant. PD is considered especially sensitive towards the users' expertise and has a particular interest in the social aspect such as interaction among different actors and the people involved in design (Pihkala & Karasti, 2016). In PD, people or workers are referred to as users of designed objects or environments and are seen as experts of their experiences (Ehn, 2008). The appreciation of the user's knowledge also informs a change of roles and a negotiation of responsibilities and power during the process. This change mechanism is further driven by the complexity of the PD process, creating uncertainties in the outcomes as strong participation also questions the role and freedom of the designer as a "decider".

Appreciating users' expertise also changes the role and understanding of the user activities. To benefit from their expertise, early PD research explored tools and techniques to directly involve workers in joint decision-making regarding the design of their future workplaces (Ehn, 1988). These tools were, for instance, simplified mock-ups, such as "cardboard computers" (Ehn & Kyng, 1992) or "design games" built with easy-to-assemble materials such as post-it notes, play dough, etc. (Eriksen, Brandt, Mattelmäki, & Vaajakallio, 2014). With different means for expression, the workers or future users could envision and prototype their future work situation (Ehn & Kyng, 1992; Ehn, 1993). The design of these tools and methods aimed to enable collaboration and ideation between designers and skilled workers (Ehn, 1988). The intention was that with the help of these tools and methods, the user and designer would be able to communicate on equal levels (Ehn, 1993). Those tools and methods offered mediums for interaction and communication beyond specific technical knowledge and expertise among a diverse range of participants, enabling designers to tap into the users' expertise in their work practices (Ehn, 1988).

The development of tools and methods aimed to reduce strict role allocation during participation. In other words, the designer was granted the role of a leading facilitator of the collective design process, someone with technical expertise, creating tools and methods to facilitate the users' understanding of technicality. The user in turn was asked to participate in given workshop terms, with tools and methods designed by the designers to facilitate "mutual learning" and to tap into their tacit knowledge as "domain experts" (Robertson & Simonsen, 2012). Domain experts refers to the users as a source of knowledge regarding their everyday experiences of use practices in their area of work. Designers were regarded as knowing the technology to be implemented (Ehn, 1988). Mutual learning in PD was thus understood as being similar to a "master-apprentice relation in a double sense" (Ehn, 1988, p.377). The designers gained insights from the highly skilled users into their everyday work processes and vice versa (Ehn, 1988). To involve the diverse participants in ideating possible future designs, PD has over the years systematically developed techniques, tools and toolkits to harness the knowledge, expertise, and experience of future users, seen as experts of their everyday practices (e.g. Eriksen et al., 2014; Sanders & Stappers, 2014a).

However, this way of looking at participation illustrates even more clearly the strong division of roles related to knowledge and expertise, which is illustrated in Figure 1 at the end of this section. This division becomes more prominent especially in short-term PD workshop contexts, which are restricted in time and pre-defined by certain expectations. It is also still evident in the following definition by Robertson and Simonsen (2012) in their comprehensive and relatively contemporary compilation of the different strings of ongoing and emerging PD research today.

> *"Participatory Design can be defined as a process of investigating, understanding, reflecting upon, establishing, developing, and supporting mutual learning between multiple participants in collective 'reflection-in-action'. The participants typically undertake the two principal roles of users and designers where the designers strive to learn the realities of users' situations while the users strive to articulate their desired aims and learn appropriate technological means to obtain them."* (Simonsen & Robertson, 2012, p.2)

A division in roles was common in the traditional design perspective, which reflects a power imbalance. PD aimed to overcome this by giving every participant a voice through facilitation with designed tools. PD thus argued that people who would use or "be affected by a design" should have a voice in the design process (Ehn, 2008, p.94). This approach aims to enhance the quality of the end product (Bødker et al., 2000) and briefly illustrates PD's early

interest in "empowerment" as a central concept building on sharing skills and decision-making power (Ehn, 2008). In the perspective of Ehn and colleagues (Björgvinsson, Ehn, & Hillgren, 2010; Ehn & Badham, 2002) empowerment as an emancipatory concept can be understood as giving decision-making power to users in participatory processes. This understanding of the embedded power imbalance, when separating designers and users into distinct roles, is important for the later developments of PD. Awareness of this matter informed PD research and the development of tools that aimed to enhance participation. Besides all these efforts in PD tool and method development, the gap between facilitating designer and participating user still seems to exist in many instances, and thus requires further research into the depth and type of participation and sharing of decision-making processes.

In PD, the types of participation range from people merely attending a workshop or contributing to digital platforms to shared decision-making power through contributing ideas (Binder, Brandt & Gregory, 2008; Huybrechts, 2011). Consequently, participation can vary widely in depth and influence on the outcome (Andersen et al., 2015). In addition, the type and scale of participation in a given context changes over time (Saad-Sulonen et al., 2018). In early PD, participation was about including factory workers through design and decision-making processes (Ehn, 1988), but today we talk about a much broader range of people as PD participants outside the workplace (Halskov & Hansen, 2015). A wider variety of people, with different skills, representation, and power are to be included, depending on the context and scale (Keshavarz & Mazé, 2013). These contexts range from PD in communities and organizations to "publics" and spaces for peer production. Therefore participation also develops over time (Saad-Sulonen et al., 2018). For this reason, participation in PD frames a broad spectrum on which users do not only act as interviewees, but actively participate in the design process by, for example, drawing, ideating, sketching or prototyping with designers and other colleagues. They also share decision-making tasks and other responsibilities, especially when going beyond the workplace context (Simonsen & Robertson, 2012). Participation is thus also considered one of the main criteria for successfully and sustaining PD projects and their impact on communities (Saad-Sulonen et al., 2018).

However, according to Halskov and Hansen (2015), based on their ten-year literature review of PDC conference papers, a definition of participation and how it unfolds in each research project is still lacking. This is particularly relevant for PD projects, which evolve over time and rely on a sustainable level and depth of participation (Saad-Sulonen et al., 2018). Further critique is directed at PD research for focusing too strongly on methodological and tool development, which is supposedly too narrow and restrictive when designing environments in longer-term PD projects (Hyysalo & Hyysalo, 2018; Vines et al., 2013). For example, the tool focus neglects mundane activities that are important when organizing and strategically planning PD projects with an extended scale (Hyysalo & Hyysalo, 2018) and overlooks the analysis of the depth of participation in the PD processes (Gerrard & Sosa, 2014). These two critiques underline how, especially when PD extends in scope and time to new contexts, a new focus on research concerning matters of participation with very diverse participants is required to overcome the gap illustrated in Figure 1. Tools are important for facilitation, but especially in these new extended contexts, PD also requires approaches to share responsibilities with participants, and thereby enable pathways for sustaining PD projects over time.

In this regard an important aspect to consider is the fact that participation also always creates uncertain outcomes at the beginning of a project, thus challenging the designer and related stakeholders to be open to leaving the end result as undetermined. PD projects further cross over different domains and build complex systems of actors and contexts that influence each other, either knowingly or

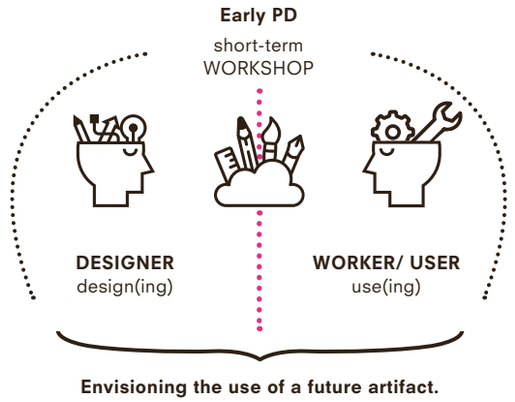


Figure 1
Early PD dealt with the design phase before users had access to the product/service and was built on a strongly role-based separation of domain experts: designer vs. user.

unknowingly contributing to uncertain outcomes (Huybrechts, 2011). For the most part, this uncertainty is created through the prior unknown input of the participants and by simultaneously reducing the decision-making power or control of the designer (Huybrechts, 2011). For instance, Huybrechts (2011, p.3) describes the PD process as negotiations with participants which include "(…) risky trade-offs, to stress that participation is a multidirectional process that is determined by the designers and artists as well as by the participants". The term "risky" is applied to underline the uncertainty resulting from unknown input and participation (Huybrechts, 2011). However, this term might be associated rather negatively, if stronger participation is understood as bearing greater risks of the designer or related stakeholders losing control/power over the process. This perspective might further underline the problems in dividing into roles and associating more power with certain roles. In an extended PD perspective, the aim should be to share control over the process and use the project time to enable participants to share this responsibility.

When truly sharing decision-making power, the roles of designers and users become blurred, and questions arise as to who is the expert in what area, and who takes which roles in the design process. In PD, separation into the roles of "designer" and "user" are not uncontested and "generally used with some unease" (Robertson & Simonsen, 2012, p.3). Especially when PD enters new territories such as communities, "the classical distinction between (professional) 'designers' and 'users' does not make sense anymore, neither does it make sense to view 'design' activities as separate from an ongoing practice (also of technology use)" (DiSalvo, Clement & Pipek, 2012, p.203). This poses new challenges to PD; for instance, negotiating power relations and reducing the division into strict roles (Kensing & Greenbaum, 2012). However, in PD, "power issues are often dealt with in very general terms" (Eriksen et al., 2014, p.101). Eriksen, Brandt, Mattelmäki and Vaajakallio (2014, p.101) elaborate in their paper that a new discussion on "situated power issues and relations and how these relate to participation and specific PD tools and techniques" should be started. They suggest that one approach to levelling out the power relations in PD would be to hand over ownership, confidence, and responsibilities to participants (Eriksen et al., 2014).

In summary, the arguments above point to selected areas in PD research which identify the need for further studies. For instance in the context of extended PD, the blurred roles of designer and user need clarification, also in respect to the depth and development of participation over time. Hence, the following sections will elaborate in more detail on what happens in extended PD, when users participate in communities, beyond short-term PD workshop settings. The explicit processes of designers and users working together in alternative spaces of peer production will further open opportunities to understand the changing of roles over time.

[1.2]

Participatory design extends into communities

Contemporary developments in PD include a variety of aspects that extend the focus beyond activities in workplace and labor contexts towards, for instance, communities and spaces of peer production. Further, they extend to larger and longer timeframes and towards the implementation and development of PD projects over the years. One area of PD research and practice relevant to consider is thus "community-based PD". As PD enters local communities and neighborhoods, new challenges and opportunities arise (Robertson & Simonsen, 2012). Community-based PD deals with the social constructs and relationships between local groups or neighborhoods (DiSalvo et al., 2012), going beyond the organizational structures and methods developed for the traditional workplace PD. They redefine and negotiate the design space, methods and tools appropriate for the local context and possible forms of participation (Sabiescu, David, van Zyl, & Cantoni, 2014). These contexts can be extremely diverse, ranging from varying communities and practitioner understandings of PD to different target groups. Examples of these are organizations, activist- and/or hobbyist communities, local neighborhoods, minority groups and different themes such as PD for public deliberation, community communications, and cultural productions (DiSalvo et al., 2012).

In their chapter entitled "Communities" in the "Routledge Handbook of Participatory Design", DiSalvo, Clement and Pipek (2012) provide a general overview of the multitude of community-based PD, categorizing communities on the basis of geography, identity, and interest/practice, or as a combination of these factors. In regard to geography, a community can refer to a neighborhood, but not only this, as a community could also be bound by identity and/or shared interests and practices. Its identity is informed by what constitutes this community as a specific group that is related by, for example, age, race, gender, sexuality, physical abilities, or ethnicity (DiSalvo et al., 2012). A community based on shared interest or practice is represented through the participants' involvement and shared practice around a specific topic of interest. For instance, activist- and/or hobbyist communities are organized around an issue or interest in practice but are not necessarily formally structured as an organization. They emerge and structure themselves organically, building on the competences inherent among their participants (DiSalvo et al., 2012).

One important aspect of community-based PD is that the participants' affiliation to a community, outside of the workplace, is most often voluntary, "driven more by intrinsic rewards than by extrinsic factors such as pay" (DiSalvo et al., 2012, p.183). Intrinsic rewards are understood as motivation through experience or acting to satisfying personal values. These personal motivations are increasing and broadening opportunities for community-based PD. One reason for participation is, for instance, the participant's motivation to contribute or share the values of a community or activist group, which can also be considered as the formation of publics (DiSalvo et al., 2012). The notion of publics is considered here because they are constructed as a type of community formed around a shared issue of concern (DiSalvo et al., 2012; DiSalvo, 2009). Due to the growth of digital networking, globalization, societal and sustainability challenges, the formation of activist groups to build a form of protest, or organize activities to change these issues, is on the rise (DiSalvo et al., 2012).

Extended PD contains different conceptualizations of publics, such as DiSalvo's work, situated in a US context, working with activist communities. In their case study, Neighborhood Networks, DiSalvo, Louw, Holstius, Nourbakhsh and Akin (2012, p.50) focus their efforts on designing means "by which the participants could discover and express connections between the capabilities of a given set of technologies and issues that were salient to them". The notion of publics has also been explored in the Scandinavian context in discussions on how publics might inform PD practice, looking at them from two perspectives: "participatory design (designing for use before use) and meta-design (designing for design after design)" (Ehn, 2008, p.1). This dissertation does not directly address the notion of publics but mentions it to illustrate sensitivity towards participants' values and motivations for participation in a community context. In summary, publics can further expand the contemporary applications of PD and allow a broader perspective of participants' motivation and reasons for participation, based on shared values and concerns.

For PD, the challenge in designing for and with communities is characterized by their heterogeneity. This diverseness requires the aforementioned sensitivity towards individuals' motivation, but also suitable infrastructures, such as platforms for coordination, communication and facilitation (Ehn, 2008). When communities deal with a shared issue of concern, they require a common infrastructure within which to act and communicate about the issue (Ehn, 2008; DiSalvo, 2009). Therefore, this infrastructure is identified as an aspect and a place for design contribution (DiSalvo, 2009). This design contribution could be a kind of "infrastructuring by design" or creating tools and methods to address these issues in a participatory manner (DiSalvo et al., 2012). Especially in the context of communities and participation, Le Dantec and DiSalvo (2013) consider infrastructuring as the social, material and spatial structures for sustaining a community of participants (Le Dantec & DiSalvo, 2013).

> *"The information and communication infrastructures that underpin everyday life, at the personal, organizational and societal scales, are undergoing historically rapid transformation as digital networking is increasingly woven into the fabric of our contemporary economic, social, political and cultural practices. Contributing to the development of information and communication infrastructures, especially in articulating and serving broad public interests, represents community-based PDs potentially most rewarding challenge."* (DiSalvo et al., 2012, p.201)

Extending the scope of PD to communities also extends the timespan from initial project design towards ongoing use, thereby tackling the challenge of sustaining PD projects and participation over time (Haskel & Graham, 2016; Iversen & Dindler, 2014). According to Iversen and Dindler (2014) extending temporality in PD is reasoned in the desire and need to investigate sustainability matters in, for instance, public and community-based PD projects. They argue that there are four key aspects for sustaining PD projects: "maintaining, scaling, replicating and evolving" (Iversen & Dindler, 2014, p.153), which strongly relate to social, organizational and participation matters. In this respect, several researchers have discussed the notion of "infrastructuring" as relevant when PD projects develop over time. For instance Agid (2016, p.81) discusses how the designer's position impacts relationship building and project development over time in regard to infrastructuring "as on-going work toward shared, if complex and difficult to imagine, social and political possibilities". Huybrechts and colleagues investigate the potential of infrastructuring to help participants develop capabilities for long-term

participation strategies (Huybrechts et al. 2018). And Seravalli and colleagues (2018; Seravalli, Eriksen, & Hillgren, 2017) use different instances of commons-based peer production to illustrate infrastructuring as relevant for enabling processes of long-term implementation over time.

In PD, infrastructuring refers to a particular understanding of process development over time in different communities of users and contexts, often, however, related to technology (Bødker, Dindler, & Iversen, 2017). Infrastructuring has rapidly expanded as a way of conceptualizing the structures of PD processes (Karasti, 2014; Karasti et al., 2018). In PD research, infrastructuring was first adopted and framed by Karasti and Baker (2004) and Karasti and Syrjänen (2004), followed by Ehn (2008). Karasti and Syrjänen (2004), who analyzed the emergence of interrelated processes and activities that build infrastructuring over time. In recent years, a growing body of research on infrastructuring has emerged in the PD literature and beyond, which will be discussed in relevant detail in Section 3.1.2. In summary, the extended scope and timeframe of PD in communities poses new challenges, such as sustaining projects over time and ensuring the long-term involvement of participants by negotiating roles and responsibilities. These challenges demand new approaches and means for designing in such extended PD contexts. Infrastructuring is therefore considered one possible approach.

[1.3]

Where designers and users work together

Since its early industrial contexts, PD's agenda has extended to more open and public settings, more diverse participants and larger or multi-sited, long and temporally-distributed contexts (e.g. Lindström & Ståhl, 2015). These contexts can look and operate similarly to the setup I introduced earlier as "alternative spaces of peer production" and thus also demonstrate an overlap of literature with peer production. These alternative spaces of peer production are, for example, Fab Labs, hackerspaces or makerspaces. They offer physical infrastructures for and/or by people using tools, equipment, and facilities to design and produce their own artifacts (Kohtala, 2016; Seravalli, 2012). These platforms or spaces mainly offer two things: the means of personal fabrication, for example, through access to tools and machines; and second, participation in a social, collaborative set up (Kohtala, 2016; Nascimento, 2014). This combination entails that users become embedded members of a community of peers, in which they may also learn and exchange knowledge (Nascimento, 2014). These alternative spaces of peer production, as communities, enable participants (designers and users) to make and produce together and are thus an important area for investigating the social and material aspects over a longer time span. These spaces are even comparable to the "shared machine workshops" explored in early PD research in the 1970s (Bannon & Ehn, 2012). Even the terminology in peer production literature allows this connection to be made. The term "shared machine shops" was themed in a special issue edited by Maxigas and Troxler (2014), describing and investigating "new spaces of citizen participation and alternative production". They used it as a sort of umbrella term for the different types of spaces that were emerging. As the aspect of designers and users working together over time also occurs in extended PD contexts, it becomes important to consult and learn from the discussions raised in peer production research, especially given the framing of this dissertation.

These types of peer production spaces vary according to local context, community logics, values, and organizational models. This results in a range of different types of spaces, which have in common the means for some type of production. For example, Fab Labs are a highly organized type of space, often exhibiting a clear identity and belonging to an international network (www.fablabs.io). The concept

was initially introduced at MIT (Massachusetts Institute of Technology) and aimed to foster innovation by offering a platform for personal fabrication and experimentation. Given its original innovation agenda, a certain bias toward consumerist product innovation (Maxigas & Troxler, 2014) rather than alternative values (such as environmental sustainability, see e.g. Kohtala, 2016) may distinguish Fab Labs from hackerspaces. Hackerspaces tend to emphasize a critical, (h)activist and anti-capitalist, do-it-yourself agenda (Maxigas, 2012), reproducing the peer-to-peer values and model (Seravalli, 2012). The Fab Lab agenda has been further criticized as over-emphasizing product-innovation (Maxigas & Troxler, 2014), requiring the purchasing of "a new set of products (from 3D printers to making kits)", and serving "corporate agendas and forms of profit making" (Vossoughi & Hooper 2016, p. 212). Both Fab Labs and hackerspaces tend to attract users from particular and sometimes narrow demographics (Carstensen, 2013; Fox, Ulgado, & Rosner, 2015). The expression makerspace is a sort of umbrella term, comprising a broad definition of a community workshop for personal fabrication, referring to any kind of collaborative workshop space (Kohtala, 2016). It does not necessarily emphasize innovation or technology. Makerspaces somewhat combine new fabrication technology and more traditional low-tech, craft and local production facilities, aiming for a broader audience (Seravalli, 2014).

Extending PD research to peer production presents an opportunity to investigate participation of participants (designers and users) in close collaboration. Peer production spaces provide an interesting overlap with early PD and its factory and production setting, as local peer production spaces simulate miniature manufacturing environments. Bringing these two bodies of research together offers new perspectives when exploring participants' motives for becoming deeply involved in the tangible design and production process. Both bodies of research are also marked by an ideological overlap, emphasizing the opening of design and potentially production to users as participants, stakeholders and makers, even as designers. They both stress democratic values and processes for developing the common good through open, participatory processes and aim to enable and empower participants to design and produce themselves.

Research on peer production provides insights into the change in roles among the different participants when collaborating in shared production spaces. Peer production research offers a contrast to PD through several long-term, ethnographic inspired studies (e.g. Kohtala, 2016; Toombs, 2016; Foster, 2017; Tanenbaum et al., 2013; Nascimento & Polvora, 2016), which allow deeper insights into patterns of participation, the types of participants and their skills, the spaces and organizational structures, and their driving values. These studies have mostly been conducted through researchers being involved as participant observers in different types of peer production spaces. Their involvement has enabled them to apply qualitative research methods such as ethnographic field notes including autoethnography, participant observations and interviews. Through these longer-term studies, they have gained a deeper insight into, for instance, patterns of technology use and tool development, collaboration and care practices, matters of empowerment, and the implementation of values such as equality and sustainability in particular chosen spaces. Learning from these offers relevant findings regarding the specific challenges discussed in extended PD. These studies helped develop a more focused, concise framing for my research, and also inspired my choice of research methods, as my study was situated in a similar context (discussed in more detail in Chapter 3).

Research on peer production, especially in the context of platforms and spaces, has increased rapidly, investigating several areas in communities of hackers and makers (Herrmann & Büching, 2013; Lindtner & Lin, 2017). Given the scope of this dissertation, only a specific area relevant for contextualizing the experiments

will be considered and briefly outlined. For instance, the research of Tanenbaum, Williams, Desjardins, and Tanenbaum (2013) overlaps with peer production and design literature, as it explores how the relationship between democratizing technological production informs practices of participation. These authors investigate the role of DIY, hacking and craft in regard to their potential for democratizing design and manufacturing, as well as its opportunities for design in the context of Human-Computer-Interaction (HCI) (Tanenbaum et al., 2013). Nascimento and Polvora (2013) also discuss the opening of technologies to the wider public for the means of enhancing participation. The literature representing a critical perspective on the rather narrow-focused participant groups of tech-aware, male-dominated, hacker communities (e.g. Carstensen 2013; Fox et al., 2015) was very interesting in relation to my experiences from practice.

When looking at the potential of skills development and learning through peer production practices, few researchers have considered hacking and Fab Labs as offering prospects for education, also over longer periods of time (Kolko et al., 2012; Smith & Iversen, 2018). Recent doctoral dissertations in the field include Foster's (2017) work on the inclusiveness and empowerment of making cultures, ranging from Fab Labs to feminist hackerspaces. Toombs' (2016) research and dissertation on care ethics is especially interesting in regards to sustaining hacker communities. Particularly relevant in the context of this dissertation is also his research on identity formation in these communities (Toombs, Bardzell, & Bardzell, 2013). I also refer to Kohtala's (2016) dissertation on how environmental sustainability is addressed in Fab Labs. These researchers supported my framing and narrowing of the focal points in peer production, such as examining matters of participation in regard to social and material aspects in my practices, provided by an alternative space of peer production. In addition, concepts such as identity formation through skills development can be traced in peers' production literature.

PD has been driven by designers' (researchers') values emphasizing a shared and democratic design process. In comparison, participants of peer production communities are often motivated by sharing a similar set of values and aims (Toombs et al., 2013). These communities are driven by different ambitions, for instance, technological innovation (Tanenbaum et al., 2013), an interest in hacking technologies (Maxigas, 2012), or repair (Baier, Hansing, Müller, & Werner, 2016; Houston et al., 2016). The people participating in communities dedicated to commons-based peer production are identified by Troxler (2010), referring to Benkler's (2006) work, as individuals "collaborating in producing cultural content, knowledge, and other information and indeed physical goods" (Troxler, 2010, p.2). Participation in such spaces and communities is anticipated to potentially enable a person to develop a "maker identity", as they become aware of and develop their agency and skills while becoming part of a community making artifacts (Toombs et al., 2013). Several aspects are important for sustaining such communities and the respective spaces, one of which is "care" (Toombs et al., 2013; Toombs, 2016). Another important reason is the feeling of becoming part of a community that is driven by shared aims and values (Toombs et al., 2013).

These forms of value-driven, community-based production spaces can be considered "social production" (Benkler, 2006). They comprise communities assembled under commons-based, peer production, as well as social entrepreneurship and alternative currencies (Arvidsson, 2008). They are united by the fact that they are all "self-organized, emergent, bottom-up" and "not primarily motivated by monetary concerns" (Arvidsson, 2008, p.326). Social production has a strong focus on "making" in a social setting sharing space and materials, where social interaction and "socially recognized self-expression" (Arvidsson, 2008, p.326) are the main motivators, enabling skills sharing and knowledge generation that is "ethical surplus". Ethical surplus refers to the ability to tie participants to a certain project or community to which they

contribute their time, skills and knowledge to generating meaning and purpose through supporting a shared goal based on shared values (Arvidsson, 2011, p. 270).

These shared values and interests relate to participants' motivations to participate and engage on a deeper level, over longer periods. However, in PD, the reasons for participation, and participants' interaction and exchanges with other participants over time, in particular in projects or spaces extending in time and scope, are far less studied and explored through practice. Therefore, peer production research, especially on alternative spaces for peer production, will be consulted, learned from and related to the literature and discussions raised in PD.

By opening the design processes through alternative spaces of peer production, the roles of designers and users become blurred, as the spectrum of what is considered the tasks of the designer are less clear. However, until today, little is known in PD about this explicit renegotiation of roles (designer/user) when both work, design and produce come together in similar settings. Further, PD research is yet to deploy a stronger emphasis on the social, material and spatial configurations that emerge when users become the designers and makers of their own products and share their knowledge with others. Peer production spaces almost enforce this negotiation of roles and responsibilities, based on skills and knowledge, especially over time. Therefore, PD can learn from discussions already raised in peer production research, but can also add to them with, for instance a "research through design" (RtD) perspective, as well as investigations of participant diversity and inclusiveness.

As elaborated above, peer production research mostly applies an ethnographic approach, whereas RtD is able to attend to more tacit knowledge related to materials and making from a designer perspective. In combination, these methods can attend to and provide insights into the interrelation of participants' experiences, also in terms of skills development and the designer's impact on enabling participants with facilitation and changes in the designed space. A notable example is Seravalli's dissertation from 2014, and her work and involvement in the makerspaces belonging to the Malmö Living Lab context. Her study uses an RtD approach to examine how production can be opened in the context of makerspace experiments. Her research is relatively closely related to mine, in regard to discourses, practice and research approach, crossing over literature from PD, peer production and the commons. She investigates the opening of production and how it can be facilitated, practiced and supported by design, but points out that she did not act as a facilitator. She explains her role as being "engaged in co- making stuff, co-organizing events and activities, and co-prototyping services" (Seravalli, 2014, p.200). Seravalli also acknowledges what I refer to as blurring and negotiating roles, and calls it the "shuffling of roles", and "beyond use value", which in my context is social interaction and learning from others: two of several other aspects influencing the opening of production (Seravalli, 2014, p.21). However, my work offers a more robust amount of collected materials, combining not only overlapping discourses but also research approaches, and aims to generate new insights through their combination.

My research applies an RtD approach to a longer-term study of designing, establishing and facilitating makerspaces, which is still rare in both peer production, and PD research, enabling me to learn from, but also contribute to both areas. In contrast to classic, ethnographic, inspired peer production studies, my RtD approach offers deeper insights into the role of the facilitator and designer in such spaces. Compared to, for instance, Seravalli's work, I can also provide detailed insights into material and designerly aspects through systematically collecting materials from practice, over an exceptionally long period of time. I relate these insights to participant observations and interviews, thereby documenting changes in participation informed through tools and space, but also participants' interactions and skills development.

[1.4]

What do they make together?

The phenomenon of users actively participating in design and production processes can be observed in many fields of production, including that of fashion and clothing. Ranging from the traditional end-product of design to technology and software development, users becoming interested in shaping their future use experiences (Ritzer & Jurgenson, 2010). In the context of sustainable fashion design, alternative design approaches explore local, small scale clothes production scenarios that foster active user involvement (Fletcher & Grose, 2012). However, relatively little research has been dedicated to deeply investigating what happens to the roles of designers, and how participation is facilitated when they make clothes together with the user. The traditional fashion industry is one of the most polluting and exploiting industries, mass-producing most of its products in distant locations, without input from the final user of the garment (Allwood et al., 2006). Based on a linear scheme, driven by fast, cheap and low-quality production, the "fast fashion" phenomenon feeds users' desire for novelty with ever-faster changing collections, copied from the catwalk and high-end brands, at affordable prices (Fletcher, 2010; Fletcher & Grose, 2012). This global mass-manufacturing system encourages overproduction and consumption via planned obsolescence (Burns, 2010), dramatically increasing the waste load by promoting easy replacement and disposal of clothes (Allwood et al., 2006). Both a driver and a consequence of this low-price scheme is the mindset of the user. This mindset has implications for the overall perceived value of clothing, which is arguably in decline.[6]

To achieve a sustainable fashion system we need to question the number of garments produced and consumed (Fletcher & Grose, 2012). This requires (re-)valuing and increasing the lifetime of garments already owned, and sharing responsibilities among designers, producers and consumers/ garment users (Fletcher & Grose, 2012). Various researchers have explored a multitude of different approaches to address different sustainability issues in the fashion design and production processes. These range from product-service system solutions (Armstrong et al., 2015) to slow fashion (Fletcher, 2010; Clark, 2008), low-care products (Fletcher, 2012), circular fashion design (Niinimäki, 2018; Moorhouse & Moorhouse, 2017), open fashion design strategies (Palmer, 2016) and user participation in design processes (von Busch, 2008; Cramer, 2011; Hirscher & Fuad-Luke, 2013). The latter is an area that is particularly relevant for contextualizing the type of makerspace that builds the cases for this research.

A change in user mindset opens the door to alternative design approaches (Fletcher & Grose, 2012). Increased media awareness and coverage of industry incidents in garment manufacturing has brought the disastrous working and environmental conditions to global attention. Incidents such as "Rana Plaza"[7] in Bangladesh in 2013, when a garment production site collapsed, killing over a thousand workers and leaving several thousand injured, lead to worldwide campaigns and initiatives. For example, the *Fashion Revolution* week by *Future Fashion Forward*[8] or the *Make something* week by *Greenpeace*[9] aim to address the problem of distant mass manufacturing by raising user awareness and showing alternatives to fast fashion production and consumption. The increase in online communities dedicated to crafting and garment making, such as "do-it-yourself" blogs, internet forums and inspirational platforms such as *Pinterest* ease the access to information and encourage self-making and experimentation (Wolf & McQuitty, 2011). The internet offers a clear benefit by being able to spread knowledge and information and provide the means of driving these practices (Palmer, 2016). It is a useful platform to raise awareness and share activism ideas and further offers direct contact and exchange between user/wearer and designer (Fletcher & Grose, 2012). Intertwining these with the emerging user interest and the progression of local and digital peer production spaces offers designers the opportunity to explore alternative ways of producing and consuming fashion with the user as a participant in the process.

These general trends build fertile ground for a change in user values towards being interested in where clothes are manufactured. This change, which raises questions about where and how things are manufactured offers an interesting arena for further exploration from a design perspective (Fletcher, 2012). Especially when designing with users, roles and users' abilities are uncertain, as they might not (yet) have the skillset to design and make a garment. These considerations illustrate the dilemma when designer and user roles become blurred, as it leaves unaddressed what exactly happens when they start working together and negotiate their roles. PD already has a history in developing tools and methods for participation in, for instance, work environments or service design. In contrast, in fashion design, participation is a relatively new area of research and practice. Research experiments with participation in clothing design and production are mostly driven by aspects of sustainability such as "person-product attachment" (Cramer, 2011; Hirscher, 2013) and the sharing of power and liberation in the case of "fashion hacking", as a tool to activate formerly passive consumers (von Busch, 2013). Further, some research projects have been conducted on participation in textile design, aiming to enhance emotional attachment through the personalization of clothing. Examples are the "people's print" project (Bowles, 2009) or Ballie's (2013) explorations in social and digital media to enable participatory experiences for fashion consumers. However, neither of these projects have looked at processes of making clothes together, in a space specifically designed for and dedicated to peer production.

Particularly interesting for participation in clothes-making processes are design strategies that engage the user as active participants in local, workshop-based upcycling or peer-to-peer production framings (e.g. Fletcher & Grose, 2012). In practice, these are, for instance, fashion designers who experiment with open patterns that can be downloaded, laser-cut, 3D-printed and as such produced in local Fab Labs such as the Dutch "Post-Couture Collective" (Post-Couture, 2017). Other examples are local workshops on, for example, upcycling, where users are supported by designers who ease involvement according to different skills and needs. Generally, in Fab Labs, the technology aspect drives the design in terms of what is

6 This paragraph is strongly based on the first paper included in this dissertation: Hirscher, A.L., Niinimäki, K., Armstrong, C. (2017). Social Manufacturing in the Fashion sector: New value creation through alternative design strategies? *Journal of Cleaner Production*. Volume 172.

7 On 23rd April 2019, 1136 factory workers were killed and over 2000 were injured when a garment factory building in the Rana Plaza, Bangladesh collapsed (Clean Clothes Campaign, 2013).

8 Fashion Revolution Week is a campaign organized in response to the Rana Plaza factory collapse. The yearly event is primarily organized by an association called Future Fashion Forward e.V. and is held worldwide through local ambassadors who organize events and information activities at the local level (Fashion Revolution, 2019).

9 MakeSmthng is a community that promotes activities to challenge consumerism. It was first organized by Greenpeace as a week-long campaign and in 2018 already had 400 individual events in 48 countries, all related to "making" activities encouraging do-it-yourself and do-it-together, repair and upcycling practices (MakeSmthng, 2018).

possible with the tools available, for example a dress that does not require sewing or an entirely 3D printed collection by "Danit Peleg" (Peleg, 2018). In low-tech, craft-based workshop spaces dedicated to upcycling and repair, however, the sustainability agenda is more prominent, and the manual sewing skills and abilities of the participant are important in shaping the final outcome.

These possibilities are changing the role of the designer into that of a collaborator and facilitator (Fletcher & Grose, 2012). The work of Fuad-Luke (2009) proposes, along similar lines, that "design activists" could act as a "non-aligned social broker and catalyst; a facilitator; an author; a creator; a coauthor; and a happener (someone who makes things happen)" (Fuad-Luke, 2009, p.xxi). Among other design activism strategies, Fuad-Luke (2009) proposes so-called "halfway products", objects that are intentionally left unfinished as a means of design activism. These halfway products aim to enable users to become designers of their final object and create meaning, while gaining an understanding of production processes (Fuad-Luke, 2009). A similar notion is discussed in PD and interaction design, termed "unfinished design", where the final use is "undetermined" (Redström, 2008). This means objects that engage in design as a process of designers or users alike, independent of whom they are, but emphasizing how they use an object beyond its originally defined design: "design-after-design" (Redström, 2008). User participation in the design and production process is therefore changing users' roles into actively influencing the final object of design. Researchers further propose that this active participation in the design process changes consumers' perception and the value they place on the product (garment) (Cramer, 2011; Mugge, 2007; Niinimäki, 2011).

A known advocate for experimenting with user participation in the context of sustainable fashion design is von Busch (2008). In his doctoral dissertation spanning different discourses related to this dissertation, he explored design strategies that enable the collaboration of designers and users in making garments, mostly in workshop format. Von Busch (2008, p.35) describes the potential of facilitating creative design and making sessions in which "pooled experience and skills that are brought together" enable people to make garments themselves. He takes inspiration from hacking and activism and claims that fashion designers can become activists by applying their skills for improving the industry to more transparent and sustainable practices.

> *"I have called this role a "hacktivist" designer role (...). This role is not the one of a classic unique genius of fashion. Instead it is in the form of orchestrator and facilitator, as an agent of collaborative change. It is not the divine creator of the original and new, but a negotiator, questioning and developing design as a skill and practical production utility."*
> (Von Busch, 2008, p.50)

In this spirit, I identified various design strategies that foster a stronger user participation, including a sharing of skills and knowledge among its participants. These are, for instance, in addition to DIY, DIT in peer-to-peer production spaces as well as open and participatory design (Hirscher, 2013). These design approaches advocate a process of designing and making together. For making clothes this means that users, for example, choose a pattern, fabric and style and eventually produce a garment. They might need help in technical details from pattern-making to assembling the pieces, but generally this shifts their role from using a garment to designing and making it. Therefore a whole spectrum, including design and production aspects, can be exemplified when making clothes together in alternative spaces of peer production. Garments are relatively simple to assemble, requiring little technical equipment, and thus offer a suitable context for exploring what happens when designers and users truly work together to make a product, from idea to final garment. The process of making clothes together provides an interesting case to study in extensive detail because it is situated at the

triangulation of three discourses. It provides an interesting area of exploration in extended PD, adding to a niche addressing research on participation in fashion, but also adding and learning from peer production and PD research. Making clothes together considers issues of technology (i.e. skills), diversity (i.e. different participants) and forms of production for sustainable fashion.

[1.5]

Research questions and objectives

The above introduction gave a brief overview of the background literature in which my dissertation is situated (see Figure 2). When PD extends in scope and time to new contexts, such as communities and alternative spaces of peer production, new challenges emerge, such as the blurring and change of roles over time. Different areas of design research advocate this new role of the designers as facilitators, enablers, catalysts, activists, and many others. However, they are also discordant on whether and how this change takes place. In addition, they are not agreed upon whether the distinction into roles is useful at all. Designers and design researchers are therefore asked to and do engage in research and practice in such contexts, including the design and development of suitable infrastructures. However, a clear, detailed elaboration on what this exactly entails in terms of designerly considerations, participation and social, material and spatial matters needs more research, especially over longer time spans.

PD literature is the starting point for investigating the development of participant roles, the values driving them and their activities when PD extends in scope and timeframe. This builds the basis for an explicit investigation on the designerly, material and contextual configurations influencing the negotiation of roles and participant's skills. Different, yet unknown elements can be identified across distinctive areas in design research and become explicitly prominent in PD when extending to alternative spaces of peer production. The emergence of alternative spaces of peer production fosters a growing trend in local making activities, but often leaves unquestioned the distribution of roles, responsibilities and sustainment in these spaces. Therefore, this dissertation draws in additional research conducted in peer production and builds a bridge to PD. These two areas of research, the ambiguity of how precisely designers and participants work together, and what motivates them to share and change roles and responsibilities, build the starting points for my research and experiments. Matters of participation, and how these are influenced by social and designerly considerations, are additional pillars that frame this research. Figure 2 on the following page illustrates how the different research areas interrelate and build together the research program "extended PD" within which my research is situated.

This dissertation examines what exactly happens in the context of extended PD when designers and participants work together. My original research question was articulated very broadly along the lines of "What are the emerging challenges, approaches and experiences identified in extended PD contexts in which participants design and produce locally?" In the process of tracing a theme of extended PD in terms of emergent practices across several areas of research, I found it necessary to frame more precise questions in order to investigate this in depth and focus on a specific area, instead of broad coverage. Furthermore, I was more interested in what happens in terms of designer-participant interactions (i.e. the local and human scale of design practice) than in the trends, issues or concepts of a general phenomenon. Therefore, I reformulated this broad question as a general aim to be investigated and articulated more specific questions in order to investigate the blurred spectrum of use and design in a specific, expanded PD context. I looked particularly at the nuances that influence changes in roles, such as participants' expressions,

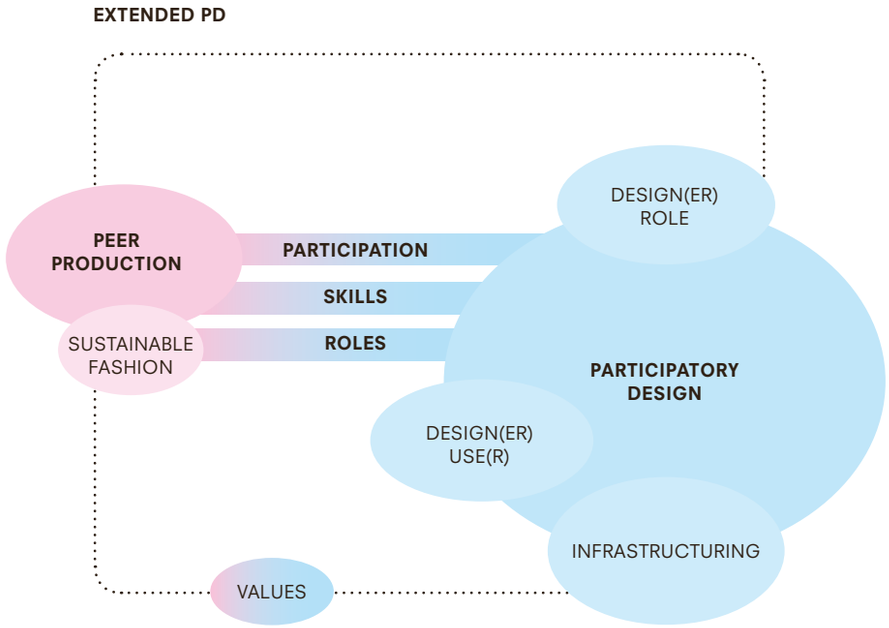


Figure 2
Visualization of the different research areas relevant for contextualizing "extended PD", and the positioning of my own work. My research spans aspects of participation, skill and the change in roles over time.

experiences and activities (acts of use). These I framed and investigated through three RtD experiments (Brandt, Redström, Eriksen, & Binder, 2011; Eriksen & Bang, 2013) to enable an in-depth account studying these acts of use and changes over time. The research questions that guide my research are the following:

[1] What happens when participants (designers and users) make together in extended participatory design (PD) contexts?

[1.1] How can we better understand extended PD contexts, including alternative spaces of peer production?

[1.2] In making clothes together, how are roles, use and participation experienced and changed over time?

[1.3] How can acts of use become "skillful" and be changed by (social and material) infrastructuring?

My objective was therefore to examine these questions through different lenses ("program frames"), using an RtD approach (Brandt et al. 2011, Koskinen et al. 2012), supplemented with qualitative research methods from social sciences. The research questions were motivated by certain gaps in the literature, as outlined in the sections above and in Chapter 3,

RQ: [1] What happens when participants (designers and users) make together in extended participatory design (PD) contexts?

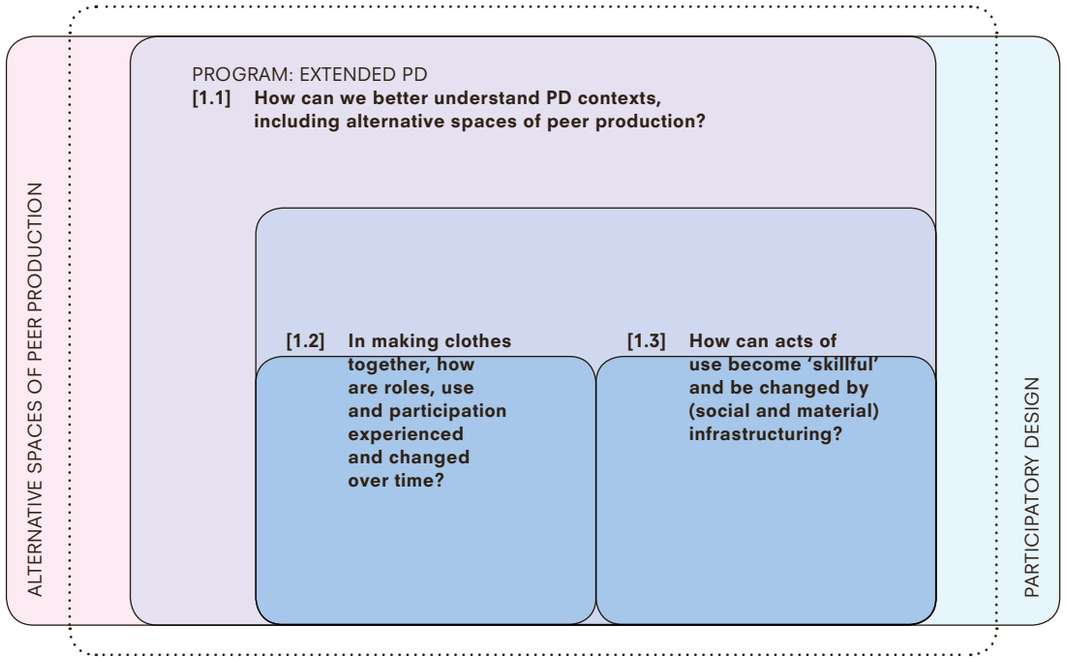


Figure 3
General research program. Two main bodies of research: participatory design (PD) (Section 1.2) and alternative spaces of peer production (Section 1.3) which form the bridging area defined here as "extended PD". In this program, the specific research questions aim to explore certain framings.

but also by societal challenges and conditions or project settings that emerged through practice. Practice, here, is comprised of three design experiments, which I constructed with the support of different colleagues in larger research environments. The experiments were different in scope, length, location, and focus. However, all investigated an extended PD context through local clothing production. I had the unique opportunity to explore, through these different experiments, how design and infrastructuring change over time. I was able to observe and document how participants and the designer involved worked together and thereby changed and developed the experiments. Giving justice to the different developments and issues that arose through practice required a research approach that allowed emerging questions to be investigated, and a certain "drift" (Krogh, Markussen, & Bang, 2015) in the program framing. The research questions are therefore derived from a literature and practice exchange, which enabled an in-depth investigation over time. I studied the interplay between the different participants, their activities, and the changes in tangible and spatial arrangements.

Figure 3 above illustrates the general research program, which will unfold and deepen over the next two chapters (2 and 3) to address the three overarching, but also specific research questions (1.1–1.3).

[1.6]

Dissertation structure

This dissertation is structured as four peer-reviewed journal articles (see summaries in Chapter 4, section 4.2 and the full articles at the end of this dissertation) that present the main findings, and the introductory chapters (1–6 as outlined in the table of contents) that summarize and deepen the literature and methodology. As common to this type of compilation dissertation, the articles build upon each other to a certain degree, and thus deepen and advance understandings over time. Some of the articles may be broader than the focus of the overall dissertation, which looks deeply at what happens to the roles of designer/user and the negotiation along a spectrum of acts of use and design when PD extends towards alternative spaces of peer production. The introductory chapters frame the articles and provide a detailed account of the theoretical background, research process, experiments, findings, and contributions.

This first introduction chapter starts by familiarizing the reader with the general theoretical background to describe the context, and in Chapter 1 identifies an emergent and as of yet under-studied challenge in PD research and beyond. This relatively broad first chapter is followed by the second chapter – Research Design, which explains the context, research environment, and the research program. The research was conducted through multiple projects and research engagements. By following an RtD approach, the design practice posed specific research questions which are explored through the literature and practice. The second chapter also presents the experiments I carried out. These are three different kinds of peer production makerspace settings focusing on making clothes, established in Finland, Germany and Italy. These spaces were distinctive in the social diversity of their participants; themes and engagement methods.

The third chapter then elaborates on the program frames through the contextual lenses that arose through the experiments, which constitutes *extended PD* and *infrastructuring and its social and material considerations*. These are further deepened through focusing on *changing participants' (designers' and users') roles in extended PD* and *when participation (as skillful acts of use) becomes design*. The interplay of the literature and practice sharpened but also slightly changed the program frames and research questions along the way. From the very broad initial starting point, which is also evident in the first two papers, the focus drifted and deepened towards looking at the negotiation of roles and participant activities and how this is influenced by the social and material considerations of infrastructuring.

Chapters four and five summarize the research articles and present the results. Chapter 5 answers the research questions and formulates the explicit contributions to PD research and practice. The concluding remarks and limitations of the study are voiced in Chapter 6. The epilogue at the end provides additional reflection from the practitioner perspective, including a step-by-step description of how the biggest experiment, the *Co-sewing café*, was established and maintained. A comprehensive account on the important issues to consider in terms of participants and context is also provided. Finally, I articulate which social and material considerations impacted the change in roles and the sustaining of the space to date.

"I see the sewing cafe as an extension to what I can do already, so in a way its broadening my skills and offers to exchange with others."

[2] Research design

This research is situated, informed and directed by different research positions and related research projects and funding. In these larger research projects, I conducted three different RtD experiments, which are situated in transdisciplinary "Mode 2" type of research settings and thus driven by societal and sustainability goals and challenges. In this chapter I thus present and justify my choice of research design, which combines RtD with certain aspects and methods from qualitative social science research. This research design is due to my involvement in different research environments that support different research traditions, such as qualitative social science represented at the University of Ulm. However, my quest is also to answer the research questions from a practicing designer perspective, which has involved facilitating participatory sewing workshops for many years and influenced my choice of methodology. Through my insider perspective, I wanted to deeply examine my role, impact and relation to the participants, and thus chose RtD and a programmatic approach, to allow knowledge production through an interplay of literature and practice. In contrast, the qualitative research environment helped me complement my subjective viewpoint with participant experiences and through conducting and analyzing qualitative, semi-structured interviews. The possibility to establish and explore design experiments in a transdisciplinary research context further enabled this overlapping of research approaches and methods.

This chapter elaborates on the different contexts and timeline of the different larger research projects, including the specific design experiments and resulting publications that comprise this compilation dissertation. In the first part, I explain the context and my positioning behind my general choice of research design. This is followed by a more detailed explanation of Mode 2 research. In the next section, I elaborate on the two different research approaches, RtD and qualitative research. I elucidate my understanding and position in RtD, also in regard to knowledge production and the role of theories in RtD. This leads to a detailed description of the different design experiments, the respective contexts and environments, and my positioning and role in each of them. With this uniquely rich account of practice, I present the systematic application of the different methods for collecting empirical materials and how the very detailed analysis was conducted. As a summary, a table illustrates the overview of the materials gathered in each of the experiments. The last section (2.4) describes the process of knowledge production by narrating the chronology of the experiments and the interplay of literature and practice, causing a "drift" in the focus of the research over time.

[2.1] Research contexts

This research and its findings build on learnings informed by design practice, combining insights from three different design experiments, each following their own research design. Systematic analyses through specific "lenses" enabled me to discover similarities and differences between them. The experiments addressed diverse but related objectives, each set in different contexts, scopes and timespans, and supported by different teams. They took place in Helsinki (Southern Finland), Dietenheim (Southern Germany), and Bolzano (Northern Italy) and are discussed in detail in Section 2.3. However, the experiment with the greatest scope, and depth of analysis is the "*Co-sewing café*" in Dietenheim, Germany. An enormous amount of empirical material and experiences were documented in all three experiments, over an exceptionally long period of time, which enabled the four publications comprising this dissertation.

The choice of locations were guided by my research positions and my German origin, affording me native language skills (also applicable in northern Italy – South Tyrol). The first experiment – *Make{able}* was a continuation of my master's thesis and was thus

situated in Helsinki. However, as I felt that my lack of Finnish language skills made it more difficult to follow the conversations between the participants, narrowing my perspective of their experiences, Experiment 2 and 3 were conducted in German-speaking areas. The second experiment – *Makershop* was located in Bolzano, as it offered an interesting context combining cultures and languages from Italy and Austria, as well as being in the complicated situation of hosting a great number of refugees trying to cross the border to Austria and Germany. The funding and local connection in Bolzano was enabled through collaboration with Professor Alastair Fuad-Luke, a former colleague and advisor from Aalto University. The third and longest experiment – the *Co-sewing café* – made the greatest use of my situated, local knowledge and language skills (even my dialect). The three sites and experiments thus each provide unique insights into the emergent topic of extended PD. However, they were also influenced by my social, personal and local experiences as well as my values, which I address in the next section.

[2.1.1] Positioning in a transdisciplinary context

During my PhD research, I had the opportunity to benefit from two different research contexts crossing over disciplines and departments: *Aalto University – School of Arts, Design and Architecture, Design Department* and the *University of Ulm, Department of Sustainable Management*. From 2013, I was a research assistant at Aalto's "Emerging Design Practices", exploring open and participatory fashion design strategies for alternative economies (Hirscher & Fuad-Luke, 2013), the role of co-design practices in city contexts (Fuad-Luke, Salokannel, & Keinänen, 2015), and design approaches for alternative futures (Fuad-Luke, Hirscher & Moebus, 2015) with Professor Alastair Fuad-Luke. During my research position in Helsinki, I was able to advance my master's thesis project: *Make{able}*, receiving a grant from the EU program "Youth in Action". This allowed me to experiment for one and a half years with the temporary workshop concept: *Make{able} – Valuable clothes designed together* and host 12 workshops across different locations in Helsinki. The grant allowed me to explore the designers' role in a temporary peer production workshop-setting, sharing with participants the basics of garment construction using, for instance, the concept of "half-way" clothing, as an object intentionally unfinished by the designer (Fuad-Luke, 2009; Hirscher, 2013). In *Make{able}*, I took the lead in designing the workshop concept, organization and facilitation, supported by a team of designers, photographers and others interested in the concept and its opportunities. The experiences gained from this experiment initiated my doctoral research in late 2014 and provided part of the materials discussed in Paper 1 (P1).

In 2016, I started as a (design) researcher in the University of Ulm's "Reallabor" [Real-World Laboratories (RWL)] project. RWLs take real-world problems, such as complex sustainability challenges, as starting points. This RWL aimed to explore and identify the opportunities for sustainable transformation of the textile industry in the city of Dietenheim in Southern Germany (Geiger, Hirscher & Müller, 2017). On a larger scale, the RWL contributed to bringing forward transdisciplinary research for sustainable transformation, explored in the German context (Wagner & Ertner, 2016). Transdisciplinarity is considered a core research mode for RWLs (Schäpke et al., 2018). Transdisciplinary research attempts to tackle real-world problems by facilitating collaboration across scientific disciplines, but also societal actors (Forty et al., 2006). Therefore, it goes beyond multi- and interdisciplinarity, as it combines knowledge from lay people and academic contexts and considers these on an equal level (Forty et al., 2006). This hybrid knowledge production aims to "foster socially robust knowledge" (Schäpke et al., 2018, p.87). In the context of RWLs, the transdisciplinary research approach aims to foster sustainable transformations and to transfer and implement actionable knowledge to society (Schäpke et al., 2018).

The Dietenheim RWL was part of a bigger group of RWLs, funded by the South German state Baden-Württemberg, contributing to the production of overarching knowledge on RWL methodology (e.g. Schäpke et al., 2018; Wagner, Schäpke, Stelzer, Bergmann, & Lang, 2016). A RWL is a research format set in a social context in which researchers carry out real-world interventions referred to as "Realexperimente" [real-world experiments] to learn about social dynamics and processes (Schneidewind, 2014; Gross et al., 2005). The co-designed experiments emphasize a participatory approach as a core strategy for involving citizens and various stakeholders in defining and co-deciding which experiments are prototyped, reiterated and implemented. The RWL methodology bears some similarities to the living lab approach, given the context of testing in a real-world context (Schäpke et al., 2018). However, RWLs emphasize sustainable transformation more prominently, and neglect the product innovation agenda to some extent. Learning is generated through interweaving findings in literature with execution and iteration of co-designed real-life experiments. It is a fairly new research methodology and is thus still being defined and discussed (Wanner et al., 2018). The RWL format promotes the exchange between science and practice partners such as public institutions, municipalities and NGOs, but also traditional companies, and can thus be identified as transdisciplinary research aiming towards sustainable change (Wanner et al., 2018).

In the Dietenheim RWL, I was, with the support of other colleagues, mainly responsible for designing, establishing, and facilitating real-world experiments enhancing sustainable fashion consumption and production. To address sustainable fashion consumption in a sharing economy, with a colleague – Carolin Becker-Leifhold – I established a clothing library at a local school, launching a one-year project course (c.f. Becker-Leifhold & Hirscher, 2019). Another real-world experiment was the *Co-sewing café* which offered alternatives for sustainable fashion production at the local level. This was initially implemented with two other colleagues – Britta Stegen and Samira Iran (c.f. Hirscher & Iran, 2016). I then continued the engagement, development, research and documentation over the entire time span.

The second experiment *Makershop* was facilitated in "BITZ" – University of Bolzano's Fab Lab in Bolzano (Italy), building upon the findings from the first two experiments, but especially investigating the social aspect of making together, overcoming cultural and generational barriers. The experiment analyzed socializing value creation as collaborative making of clothing in a *Makershop* (i.e. a makerspace combined with a pop-up shop in which diverse locals made clothes using discarded textiles and second-hand garments). The experiment was planned and built with Professor Alastair Fuad-Luke and framed and supported by the *Mode Uncut* network. From the network, Francesco Mazzarella especially supported the documentation on the final exhibition day and contributed to the seminar, as did Cecilia Palmer and Zoe Romano. My role in this experiment involved contributing to a first co-design planning workshop, and helping to conceptualize, facilitate and document the one-week *Makershop* activities, including contributing to a concluding seminar and organizing the final exhibition.

This section illustrates the complexity of intertwining different research engagements enabling different experiments that inform the overall research design. The knowledge production is situated in a transdisciplinary, Mode 2 research context. The different experiments were motivated by a bigger societal and sustainability challenge – testing approaches for sustainable fashion consumption and production. However, it was narrowed down to the interaction and participation of designers and users when they actually work and make clothes together. This broadly formulated aim informed the choice of literature: PD and peer

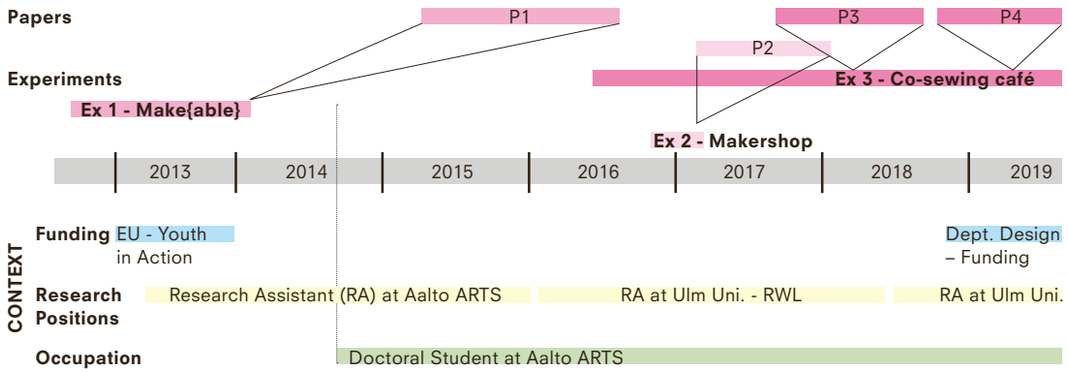


Figure 4
Timeline and overview of entire doctoral research process to illustrate interrelation of research positions, experiments and the resulting four papers.

production. In Figure 4 above, I document my research engagements with the resulting experiments, which constitute the different research papers compiling this dissertation. As funding sources and research employment situations I describe my position and the realization of the experiments, which are also documented in Figure 4.

[2.1.2] Mode 2 research and the introspective designer

On the basis of the transdisciplinary character of the RWL project described above, this entire doctoral research is understood as Mode 2. Like the RWL methodology, Mode 2 is a normative approach following a very specific intention, such as fostering social good and sustainability. Mode 2 research is often very value-laden and aims to address societal challenges (Dunin-Woyseth, 2011). It is based on transdisciplinarity and incorporates learning through experiments formed by diverse teams in transdisciplinary contexts. "In comparison with Mode 1, Mode 2 is more socially accountable and reflexive, it includes a wider, more temporary and heterogeneous set of practitioners, collaborating on a problem defined in a specific and localized context"(Gibbons et al., 1994, p.3). The term Mode 2 is derived from a change in research practices identified in the 1990s by Gibbons and colleagues (Gibbons et al., 1994). They observed changes in knowledge production in scientific research, and decided to call traditional academic means of knowledge production Mode 1 and emerging approaches Mode 2.

Mode 2 research describes the general process of knowledge production underlying this dissertation. Knowledge production is carried out in an applied context in which different actors contribute and apply this knowledge (Gibbons et al., 1994). My learnings were thus context specific, and further influenced by me being a researcher who embeds certain values in the design of experiments. To allow for accountability, different reflexive iterations, situated in the respective social setting and local context, were highly important. The reflections were facilitated through hosting several introspective workshops, interviews and feedback sessions with participants. Every experiment was formed around a group of participants and a mixed set of practitioners including designers, but also a consumer behavior researcher, dressmakers, repair experts, etc. My role was different in each of these projects and the resulting experiments, but always led and strongly impacted their development. Therefore, in the next section I acknowledge my subjectivity and describe my position. I will then explain each experiment in more detail at the end of this chapter (see Section 2.3), paying particular attention to how my activities have impacted them.

Mode 2 research emphasizes that knowledge is always grounded and relevant to specific circumstances and contexts. Therefore, I understand this as being consistent with a constructivist approach of inquiry, aiming to understand a phenomenon. In this respect, I recognize my own position in a constructivist paradigm, hence acknowledging and reflecting upon my own situated knowledge. This constructivist paradigm (Schwandt, 1998) is formed by a 'relativist' ontology, accepting that different realities exist (Gray & Malins, 2004). These are based on social, personal and local experiences, and as such I am aware of my situated knowledges, for example being a female, German speaker from a rural area similar to Dietenheim. The epistemology is subjectivist, because, as a researcher, I am deeply involved in the subject of research. The research methods explained in the next section are thus interpretative and dialectic, allowing me an involved position in a specific context (Gray & Malins, 2004).

Based on the above positioning, I take the standpoint of an "introspective designer", as Iversen, Halskov, and Leong, (2012, p.101) discuss in the context of PD and Values Sensitive Design (VSD), being especially attentive to values and the subjectivity of research in PD. The roles I took in each experiment differed, but I always acted as a practicing designer/design researcher/facilitator etc., thereby influencing the experiment's development. Explicit values underpinned the design decisions regarding the space, materials, tools, facilitation and management of each experiment. VSD arose in the context of Human-Computer-Interaction (HCI) and technology in order to embed considerations of values in the design of technology. It suggests a method for designers to reflect on the values and value conflicts created in the design process and use and introduces and defines 12 "human values of ethical import" (Friedman et al., 2006, p.364). Iversen Halskov, and Leong (2012) argue against limiting values to a set of 12, but suggest that all values are open for dialog, and that the "introspective designer" plays a major role in being aware of their values (Iversen et al., 2012, p.101). They elaborate on values as emerging and negotiated, articulating a kind of dialogue between a designer's initial position and participants in ongoing interactions with and through a design.

Iversen, Halskov and Leong propose we should "ground the values during the design process", and point out that "PD is about negotiating values", which are put into practice through participation (Iversen et al., 2012, p.88). I adopt this position to reflect upon and articulate the values which I embedded during the initial design process, but which I also continually interrogated, adapted and reflected upon in the negotiation of values with participants and other stakeholders. This further prompts me to acknowledge the responsibility and accountability of a participating person, as the values and opinions of a participant do not only represent their personal values; people are also accountable to their respective community (Robertson & Wagner, 2012) and this includes matters of inclusiveness of design processes and choice of methods (Leong & Robertson, 2016). Therefore, I adopt Iversen and colleagues' definition of personal values, as beliefs and drivers for attitudes and actions (Iversen et al., 2012).

I approach values as beliefs that guide attitudes and judgment according to social and cultural contexts (Iversen et al., 2012 referring to Rokeach, 1973). The term "reflective practitioner" by Schön (1983) is related, but I chose the description of the "introspective designer", which is rooted in PD literature. This description is especially attentive to values, which played an important role in my experiments. Like early

PD, VSD has been developed in a primarily industrial context, and later in an HCI framing of design. Therefore, I learned from this discussion and, rather than testing or building directly on this work, I selected some aspects to translate and explore here in another realm of design practice.

Different values affected my design approach and inspired me to create my own design methods, tools and techniques for the specific contexts. These were based on external factors such as my research context, my position and the research methodology. These values were, for instance, sustainability from a fashion design perspective, diversity experienced in extended PD and societal relevance from the Mode 2 research approach. By taking the role of a designer- (practitioner) researcher, I thus acknowledged these values and my subjective position, becoming deeply involved and thus also shaping the subject of research. For instance, the *Co-sewing café* is considered both an object of design and a subject of research. I designed the *Co-sewing café* being aware of the values I was embedding, such as those of social and environmental sustainability, diversity in ethnicity, age and gender, as well as shared ownership. These values were negotiated before and during the process with the participants, external actors, and in relation to changes in context and the wider infrastructures. As such, I aimed to attract a diversity of participants, underrepresented in traditional technology-driven hackerspaces and makerspaces (Fox, Ulgado, & Rosner 2015; Catersen, 2013), addressing different age groups, female participants and refugees. Therefore, the knowledge production and learnings were based on my experiences and reflections, offering deep and rich accounts, but were also limited by their subjectivity because they were so context specific.

As a great amount of this dissertation builds on my design activities, decisions and values, I argue that designers need to revisit their ability to articulate, negotiate and reflect upon values and critically consider how these impact on a design. Acknowledging the power position of the designer/researcher, I tried to be particularly sensitive to how the participants took part in the complex socio-cultural context in which my experiments were conducted. Ongoing negotiations of values, for example, in practice raise further questions relevant to power relations in design, such as how values are defined, interpreted and negotiated, by and for whom. This calls for more reflexive interrogation of values in design research and practice. Therefore, I chose methods that were especially sensitive to the embodied experiences of the researcher and had a history of use in normative qualitative research (attuned to values).

[2.2] Research approaches

[2.2.1] Research through design

In recent decades, the effort and discussions on "research through design" (RtD) have evolved strongly, aiming to define and establish it as a research methodology (see e.g. Gaver, 2012, Markussen, 2017, Koskinen et al., 2011). The research approach often commonly referred to as RtD can be traced back to a pamphlet by Frayling (1993) "Research in Art and Design" in which he offered a classification adapted from Read's (1943) work, "Education Through Art". Frayling (1993) defined three categories of knowledge production: "research *into* art and design", "research *through* art and design" and "research *for* art and design". Since these early categorizations, a variety of discussions and terminologies have developed to describe RtD. In some cases, they seem very different, such as, artistic and practice-led research (Hannula, Suoranta & Vadén, 2005; Mäkelä & Routarinne, 2006). But some terms are also used as almost interchangeable, such as "constructive design research" (Koskinen et al., 2011).

RtD can be understood as knowledge production through design practice. It emphasizes that practice is informed by theories but also produces new knowledge through practice, which means that these two reinforce each other (Gaver, 2012). The role, relation and hierarchy of theory to practice, and how new knowledge is produced through RtD, as a not yet fully formalized approach, are still under discussion (Gaver, 2012; Koskinen, Zimmerman, Binder, Redström, & Wensveen, 2012; Zimmerman & Forlizzi, 2008; Zimmerman, Stolterman, & Forlizzi, 2010). While surveying this RtD literature, the role and relation of theory to practice in RtD became very interesting to me, and I attempted to identify a position suitable for my own design research approach. Therefore, I found Markussen's (2017) account on how to construct theory through practice, and Gaver's (2012) perspective, especially interesting. Gaver (2012) offers an account on this subject in general design research, but also refers to sources rooted in HCI, which has a rich tradition in RtD. In the following section I thus explore Gaver's and Markussen's position in contrast to HCI-related sources (e.g. Zimmerman & Forlizzi, 2008; Zimmerman, Stolterman, & Forlizzi, 2010) to clarify the process of knowledge production and the relation of theories to practice in RtD.

Zimmerman, Stolterman, and Forlizzi (2010, p.313) describe RtD in the context of HCI as "the process of iteratively designing artifacts as a creative way of investigating what a potential future might be". They propose that design research does not aim to produce knowledge as a commercial product (Zimmerman et al., 2007), suggesting that with RtD, designers develop the "right thing", which will change the world for the better. This ambition suggests that RtD focuses on complex future challenges, in which designers embed their knowledge "as embodiments of theory" in producing an artifact (Zimmerman & Forlizzi, 2008, p.44). Defining and designing artifacts, systems or similar things with a future-oriented focus forces designers to materialize and define a "preferred state (…) to become more active and intentional constructors of the world they desire" (Zimmerman et al., 2010, p.310). By intentionally constructing the future through design practice, design researchers are, according to Zimmerman and Forlizzi (2008), doing imaginations that suggest certain solution-oriented takes on the future.

This idea of design as constructing is also relevant for "constructive design research" the often alternatively used term for RtD (Koskinen et al., 2011). Constructive design research proposes a research strategy in which questions are framed and potentially answered through the object designed (the construction). Koskinen et al. (2011) define it as "design research in which construction — be it product, system, space, or media — takes center place and becomes the key means in constructing knowledge". This definition however, and the aforementioned position of Zimmerman and colleagues (2008; 2010) proposes that design (as construction) is just as another method: a means for producing new knowledge and contributing to theories.

In my opinion, this position does not fully address where the challenge lies in understanding, practicing and defining RtD, because in RtD there is always the challenge of the object of design overlapping, as a subject of research, with the method of research. This was also the challenge in my research, and is rather common to RtD in general, as has been acknowledged and discussed by several researchers (e.g. Godin & Zahedi, 2014; Scrivener, 2009). The validity and theoretical contribution of doing research through design practice is thus subject to disagreement, also in the consulted literature. For instance, Zimmerman and Forlizzi (2008) point out that RtD lacks a formalized process for theory construction. Therefore, these scholars propose that RtD projects should be intentionally constructed to be tested and produce knowledge to contribute to theories for the discipline.

However, RtD has several ways of producing knowledge across discourses. This variety is recognized by, for instance, Markussen's (2017) article describing three different ways of building theory through design, based on the analysis of three doctoral dissertations written in Scandinavian contexts. Further, Godin and Zahedi (2014) conducted a literature review on

RtD papers focusing on methodology and the challenge of RtD being embedded in the design process. They concluded that the related literature does not yet have an agreed process or position for generating new knowledge through RtD. Instead it has a number of different perspectives (Godin & Zahedi, 2014), some of which are elaborated above. Given the nature of my design experiments, I support the position of Gaver (2012) and Markussen (2017) and see the potential of RtD to generate knowledge through the situated and evolving design practice, emerging through the exchange and relation of theory with practice. Hence, I further acknowledge the emerging and changing nature of a design, which depends on many external factors and not only on the designer's construction. The knowledge production occurs not only through my envisioning and embodiment in a design artifact, but through negotiating and changing the design on the basis of my learnings from the literature and practice. In addition, (unexpected) contextual factors inform changes, such as extremely skilled participants, or the type of material and equipment that is donated.

[2.2.2] Constructing theory with research through design

In terms of my research approach, I would like to further elaborate on knowledge production and theory building through design practice. Therefore, this section offers a deeper investigation into a more generative understanding of RtD (e.g. Gaver, 2012, Markussen, 2017). The transdisciplinary research setting and seeing a case of extended PD as the object of design as well as the subject of research requires further investigation into this aspect. In contrast to Zimmerman and colleagues, my position on RtD is therefore not compatible with their statement that knowledge in RtD is only constructed or embodied in an artifact. In my opinion, this does not account for the evolving nature of design and, for instance, infrastructuring. It further neglects the fact that the context in which we design will change according to design, but also by other means, and that practice and theory might mutually affect each other. For instance, the local contexts, the diverse participants, and my designerly doings affect the practice (i.e. the evolving design of the *Co-sewing café*) and thus change and add to the knowledge generated over time. Further, a constant reflection of practice with literature also affects how I potentially address certain challenges experienced in practice, and thus generate new, evolving knowledge. Therefore, I see my approach to RtD as more closely related to Gaver (2012), and Markussen's (2017) perspective, who propose that "theory should be allowed to emerge from situated design practice" (Gaver, 2012, p.942). In the following I thus elaborate on my understanding of knowledge production through RtD, and in which way this knowledge can contribute to relevant theories.

The positioning of the design practitioner as researcher allows the research strategy to be guided by using methods familiar to the practitioner (Gray, 1998). Following this perspective, the research will allow the practice (embedding the tacit knowledge of the practitioner) to guide the emerging problem formation, including changes in research questions and problem focus, until the completion of the practice (Gray, 1998). Gaver's (2012) account is here particularly interesting to me, as it acknowledges design as being generative and evolving, not only a standardized method. His account perceives it as limiting to see design as just another research method. It proposes valuing RtD for its explorative and eclectic nature, not seeing it as lacking standardization (Gaver, 2012). In design practice, we as design researchers act according to circumstances in a specific context, thus the (design) context or artefact is changed by its own activity (Gaver, 2012).

Therefore, theory alone can never fully encompass an ongoing activity such as design; it is intertwined and emerges through the exchange of design activity and theory. For this

reason, Gaver (2012, p.940) states that theory alone "by necessity underspecifies design activity". Gaver (2012, pp. 937–938) further proposes to "view theory as annotation of realized design examples (...)" and points out that "theories produced by RtD are not falsifiable in principle". Markussen (2017) also agrees with Gaver (2012) that in RtD, the goal of theory is different to that of traditional science:

> *"In most treatments of the topic design theory is looked on as something which is used to inform or inspire the design of new artifacts. Only rarely is attention paid to how resulting artefacts or design activities may refine or challenge theory – either by pushing it so as to reconfigure basic premises or by inventing novel concepts."* (Markussen, 2017, p. 91)

I see my research as being in line with that of these scholars, who characterize RtD as addressing multifaceted challenges invoked by practice or theoretical potential. In other words, RtD can investigate challenges posed through practice or literature and allows the design activities to inform or contest these theories. The challenges are framed and addressed by the designers, who embody the knowledge regarding the way in which to formulate solutions, and thereby aim to tackle the problems embedded in these situations (Gaver, 2012). Thus, I elaborate in the next paragraph on how learnings through literature and practice are closely intertwined, because my practice also changes the context and thus the knowledge produced. I try to elucidate how and where the knowledge emerged, and describe, for example, to what extent the theories informed my practice and vice versa.

In my case, the object of design was understood as, for instance, the whole *Co-sewing café* (as a designed infrastructure) evolving over time, embedded in the context of a real-world laboratory. The subject of research was the designed workshop concept or infrastructures (i.e. the *Co-sewing café*) and not a single artefact or design materials. Therefore, the subject of research was the setup and analysis, which I did very systematically to produce knowledge on the object of design (i.e. the *Co-sewing cafe*). As infrastructuring has no fully constructed artifact and evolves fluidly over time, I consider Gavers' notion on theory as emergent, and suitable for describing my way of knowledge production and contributing to theories. The methods through which I learned were thus the involved design and participatory design activities, and their setup and analysis. They produced emerging knowledge about participants' roles, for instance, which can contribute to extended PD and infrastructuring research. In particular, I was interested in what exactly happens when designers and users negotiate roles and responsibilities in infrastructuring processes, which evolve over time and are thus generative by nature. By this example, I illustrate the challenge of the overlapping object, subject and methods of research, requiring a systematic and detailed implementation and documentation and a clear positioning.

Through my deep involvement as a practicing designer, I was able to generate nuanced knowledge of design and the infrastructural impacts on the acts of use, roles, participation and skills development. My design practice included not only designing tools, methods and spaces, but also facilitating, experimenting and imagining with participants in a larger context, over a longer period of time. These designerly activities are explained in detail in the three experiments in Section 2.3. I also documented my design research activities and design decisions in great detail using methods derived from RtD. In addition, I relied on qualitative research methods from social sciences to enable a reflective analysis of the impacts and changes evolving over time in relation to the participants' social, experiential and interaction experiences (see details on the methods for documentation in Section 2.2.5). I thus conclude that even though my research process faced the same challenge, the systematic setup, analysis and thorough documentation supported clarification of what constitutes the object, the subject and the methods of research. This

enabled nuanced and detailed knowledge production through an introspective and deeply engaged position.

Thorough documentation and reflection on the research process from various angles was thus considered as crucial as in any other research tradition (Pedgley, 2007; Godin & Zahedi, 2014; Daalsgard & Hasklov, 2012). In addition, the researchers' positioning and critical reflection and awareness of the embedded and negotiated values were important to recognize as influencing the subject of design and the methods (Iversen, Halskov, & Leong 2012). As in qualitative research, the subjectivity of the researcher, due to her deep involvement in the research process, needs to be accounted for to ensure aspects of rigor and validity (Gray & Malins, 2014). Gray and Malins (2014), in accordance with Lincoln and Guba (1985), propose the use of the word "trustworthiness" instead of validity and rigor in RtD research:

> *"Trustworthiness still encompasses the term 'validity' but in a modified sense. Validity is concerned with whether the research findings make sense and are credible to the research context – its users, our peers, our readers. Trustworthiness also encompasses 'generalizability' – the extent to which the research findings are more generally applicable (transferable) to other contexts. In qualitative research, the development of criteria for evaluating research quality is a discursive task, involving inter-subjectivity and negotiation."* (Gray & Malins, 2014, p.130)

In my case, I aimed to ensure validity or trustworthiness through thorough documentation by complementing RtD with methods from traditional fields of social sciences. For instance, I documented all designerly and material considerations with detailed lists of "stuff" that emerged over time, to offer a deep insight into the design and development process of the *Co-sewing café* (further details can be found in P3). Hence, I see my way of generating new knowledge with RtD as a possibility to learn from different bodies of research (i.e. PD and peer production), to relate these to each other, and to test the findings through practice (i.e. the *Co-sewing café*). This practice took place over several years and was therefore iterated on the basis of designerly and practical learnings, but also new findings in the literature. For instance, the practice brought to light several surprising and unexpected challenges and opportunities, which I systematically documented and found to be partly neglected or discussed differently in the literature. My process of knowledge production can be situated in this evolving relation. It is based on different methods for documenting and analyzing to my own, but also participants' experiences and activities, thus allowing me to contribute to certain areas of PD and peer production literature by complementing but also questioning specific discussions. The detailed learning process, and how theory and practice are intertwined are further examined in Section 2.4.

[2.2.3] Following a programmatic approach

My research is embedded and shaped by the contexts and circumstances explained in Section 2.1. Therefore, I did not follow a linear approach. Instead the research focus evolved, changed and deepened over time. A relatively broad aim, namely what happens when PD extends to local peer production scenarios, was formulated as the starting point. In this framing, different RtD experiments were created, analyzed and iterated. For this reason, I chose a "programmatic" approach (Brandt et al., 2011; Redström, 2011; Eriksen & Bang, 2014) as one way of conducting RtD. I understand this approach as being more in line with my iterative research process. It also enabled me to relate to examples from contemporary, extended PD such as Seravalli's (2014) doctoral dissertation on "Making Commons". Seravalli (2014) has followed a similar strategy of using a programmatic approach, generating knowledge through an interplay between experiment and program,

RQ: What happens when participants (designers and users) make together in extended participatory design (PD) contexts?

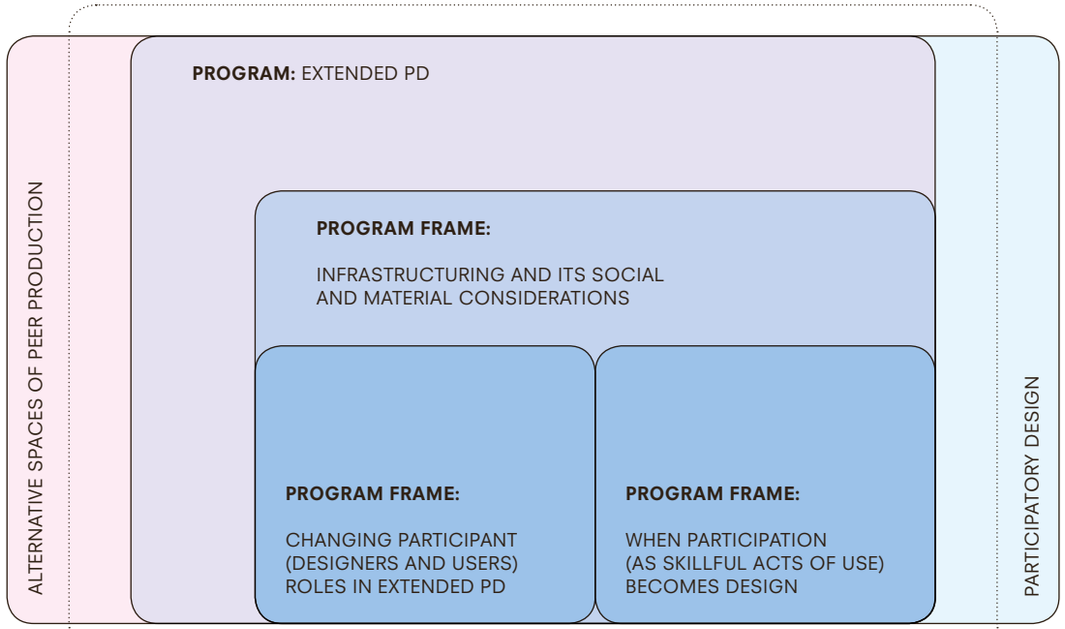


Figure 5
My research program, as inspired by Xlab's "working diagram" (Brandt et al., 2011). The figure illustrates how the "extended PD" program deepened in focus to explore the specific framings.

employing Schön's notions of "reflection-in-action" and "reflection-on-action". Seravalli (2014, p. 52) also frames her research approach in a series of experiments in the context of Malmö Living Labs, where she acknowledges that "experiments are not only determined by the program, but also by the materials of the design situation (being both human and non-human), as well as by their agendas". My research program, with its respective research question(s) and program frames is illustrated in Figure 5 above.

The programmatic approach emphasizes the interaction of theories and practice by framing a series of experiments (as practice). These experiments can be considered interpretations of the program and are guided by a question or objective (Brandt et al., 2011; Redström, 2011). The "question", or what Brandt and Binder (2007, p.4) call "research question" in their working diagram "has a larger scope than the program explored". Therefore, the question can also incorporate a "reality outside the program" (Eriksen & Bang, 2013, p.2). The program is materialized through the experiments as it "creates a frame for experimentation" (Redström, 2011, p.5), allowing for several experiments to be facilitated in one program. The program thus informs the design of the experiments, as they are considered to be an interpretation of what is important to be explored and tested, but not necessarily to be proofed or confirmed in terms

of the program (Brandt et al., 2011). The program is thus not "unquestionably presupposed"; it frames a specific position or worldview, which provides a relevant framing to be supported or challenged (Brandt et al., 2011, p.22).

It is important to underline that in this approach, neither the practice nor the program are set from the beginning; both emerge along the way. The program can, for instance, emerge by formulating a question and be framed by theories, but it can also be initiated by the interpretation of an experiment (Eriksen & Bang, 2013; Brandt & Binder 2007). This is important to note, as in this emerging way the research questions are continuously reformulated as noted by Eriksen and Bang (2013). In this respect, they challenge the term "question" as being misleading in experimental design research, as from their perspective it should be understood as the wider research context (Eriksen & Bang, 2013). In contrast, in Brandt and Binder (2007) the "question" also refers to as a research question with a wider scope. I find the argumentation of Eriksen and Bang (2013) very useful, as I see my overall (research) question as defining a wider context or an objective to be explored, whereas the more specific research questions were reformulated continuously until the finalization of this dissertation. These explicit research questions are more narrow, and interrelated with what I call 'program frames' in the overarching program of "extended PD" (see Figure 5). These frames are useful for articulating my focus areas in "extended PD", and for positioning my interpretations as experiments (see Figure 6).

In the programmatic approach, knowledge is produced through the interplay of practice and literature over time (Brandt et al., 2011). Knowledge is thus generated in the dialectic relation of program and experiments. Hence, program and experiment are mutually dependent, their aim being to materialize the program through experimental interpretations (Redström, 2011; Eriksen & Bang, 2013). In the program, the experiments change and build upon each other, informed by reflection on practice and theory (Eriksen & Bang, 2013). Being informed by the program, but also through practice, emphasizes that through the experiments, constant "reflection-in-action" and "on-action" (Schön, 1983) occurs. Schön (1983) described the role and the way in which the designers reflected on and in action while engaging in different experiments; each experiment having a different aim and generating different knowledge. This reflection builds the dialectic relation between program (theory) and experiment (practice) and is where knowledge is produced.

Another important aspect informing RtD is the evolving nature of design research, which may result in the research program "drifting" (Krogh, Markussen, & Bang, 2015). "In design, however, "drifting" is a quality measure as it tells the story of a designer capable of continuous learning from findings and of adjusting causes of action" (Krogh et al., 2015, p.39). In the evolving nature and interplay between theory and practice, a possible "drift" can occur through discoveries made during the research process (Krogh et al., 2015). Therefore, it is important that the program is robust but also flexible enough to allow for development through "drifting" while staying true to its main objective (Brandt et al., 2011).

There are several reasons for my choice of the programmatic approach. First, I was not following a linear research approach. The extended scope and timespan of my research, situated across different transdisciplinary research contexts, required an approach that allowed me to start at the broad end and deepen with time. The insights generated from different experiments in practice and bodies of research had to be brought together for answering to an overall objective. Moreover, the research questions did not stem from one body of research but resulted from crossing over different areas (i.e. PD and peer production) and challenges that emerged through practice. According to Brandt, Redström, Eriksen and Binder (2011, p.23) this "mutual interdependency of program and experiment" is not unique to the programmatic approach, but very common in transdisciplinary research, such as Mode 2. Hence, confirming a suitable choice of research approach, as identified in Section 2.1, my research is characterized as Mode 2 and framed by a transdisciplinary context.

I see the knowledge production situated in the evolvement of the research activities over time as being based on an interplay of literature and practice (further elaborated in Section 2.4 below). In this regard, it is important to underline that I was not studying the design of a single artifact and the knowledge that is embedded in that artifact. However, I acknowledge the negotiation, change and fluidity in the object of design and the research process over time. This object of design, which was also my subject of research, was influenced by my designerly activities. In this regard, I could also benefit from relating to Seravalli's (2014) work, conducting research in a similar context, while also following a programmatic approach. This approach recognized the designers' embeddedness and acknowledged that my activities, as well as those of others, would influence and change the context of the experiments and hence the subject of research (i.e. the design of for instance the *Co-sewing café*).

For these reasons, the programmatic approach was identified as being suitable for learning through practice and across different experiments and literatures. The context and my interest in participants roles, acts of use and participation in peer production spaces and how these can be enabled by design, influenced my study through different bodies of research. Therefore, the "program" was formed of literature assigned to PD but complemented by discussions raised in peer production literature. These areas of research, supported by inputs from earlier explorations in sustainable fashion, framed the activities and enabled the knowledge generated through the interplay of the program with the experiments (see Figure 6). Concretely, this means that the analysis of the materials from Experiment 1 and 2, led to not only two papers (P1 and P2), but also a drift in the program and the narrowing down of the focus towards looking at the social and material matters of participation in the long-term experiment of the *Co-sewing café* (i.e. P3 and P4).

In summary, my research started with the first experiment – *Make{able}* – which comprised a series of 12 workshops, informed by sustainable fashion (consumption and production) literature. The experiment left many questions open on the ways and means of local production and the value of participatory clothing workshops beyond the product outcome. Therefore it informed the initial program, and the research question exploring what happens when designers and participants work together in such alternative spaces of clothing production. Through two further experiments, Experiment 2 – *Makershop* – and Experiment 3 – the *Co-sewing café* – I started to investigate different aspects of participation, spatial arrangement and types of facilitation. Experiments 2 and 3 where thus combined with further theoretical explorations in PD and peer production literature. Experiment 2 – *Makershop* –was developed and run to test certain concepts and ideas from Experiments 1 and 3, elaborating further on the concept of value and local, alternative design strategies for sustainable fashion design and production. Experiment 3 – the *Co-sewing café* – provided the deepest insights into the role of skills and participation in infrastructuring and will be described and dealt with in the most detail in this dissertation, given its extended timespan and the depth of my involvement.

The *Co-sewing café* offered the opportunity to investigate aspects of participation over time, the role and influence of the facilitating designer/design researcher enabling me to better understand extended PD contexts by initiating and working in such a context. The reasons for participation, and how participation changed over time, also in relation to participants' skills, were particularly interesting to observe in practice. While experimenting with the *Co-sewing café* I also analyzed parts of the documented materials such as my diary notes, photographs or first interviews, and tried to find similar cases in the literature. This made

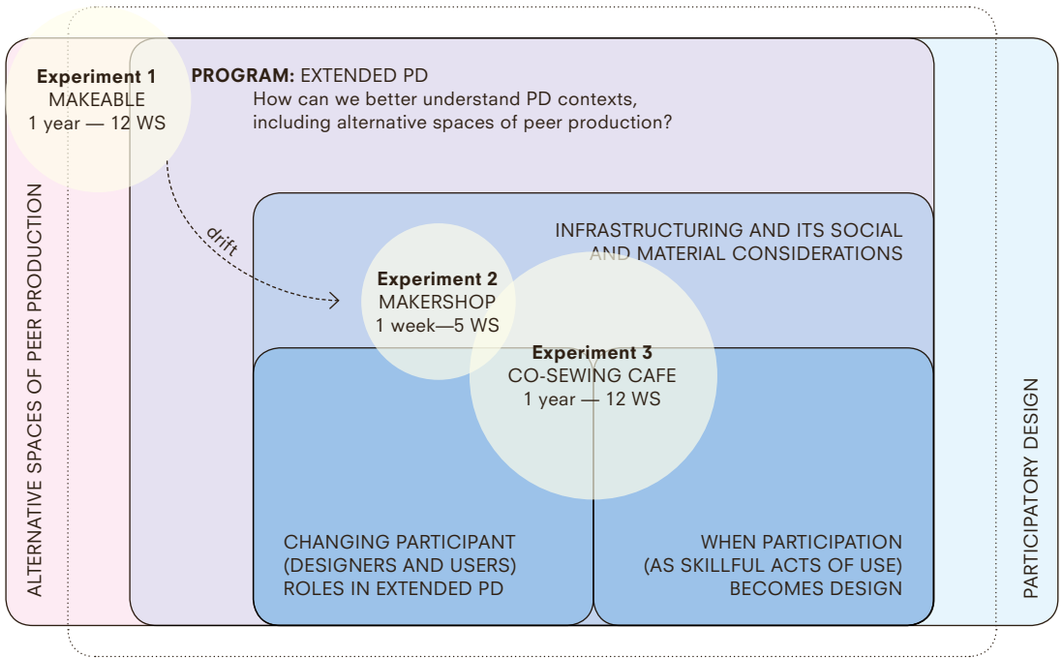


Figure 6
My research program, as inspired by Xlab's "working diagram" (Brandt et al., 2011). The figure illustrates how the experiments informed and were built upon each other. Tracing in literature what I observed in practice resulted in a drift and narrowing down of the program towards program frames that investigated changing participant roles and matters of use and participation.

me realize that little research had been conducted that looked as deeply and extensively at the social and material aspects of extended PD settings, as most research was either of an ethnographic nature or consisted of shorter-term, less detailed documented RtD experiments. In addition to observing participants, I could also add my own designerly activities and considerations to the analysis, which complemented the results. These discoveries led to the explicit program frames, which dealt with specific areas in extended PD contexts such as: "Changing participants' (designers' and users') roles in extended PD" and "When participation (as skillful acts of use) becomes design".

[2.2.4] A qualitative research approach

In order to better understand and provide a deep analysis of different perspectives to matters of participation and the change in roles in extended PD contexts, it was important to benefit from additional research approaches with a tradition in documentation and systematic data collection over longer timespans. Qualitative research has a long tradition, especially in the social sciences and psychology (Flick, 2014). It acknowledges the researcher's involvement in the field and considers this as valid knowledge. The subjectivity of the researcher and the study participants are both considered part of the research process (Flick, 2014). "Researchers' reflections on their actions and observations in the field, their impressions, irritation, feelings, and so on, become data in their own right, informing part of the interpretation (...)" (Flick, 2014, p.17). Qualitative research offers a variety of methods and approaches generally aiming to understand subjective viewpoints and the meaning in interactions and practices (Flick, 2014). In the context of my complex doctoral research environment, qualitative research methods complemented the methods derived from RtD. This combination of methods aimed to enable a deep and meaningful understanding of participants' experiences and interactions and the social context in regard to my own designerly activities.

As a longer and larger RtD project, the research methods included mixed methods drawn from RtD and from qualitative social science research. The specific methods drawn from qualitative research were qualitative, semi-structured interviews and participant observations (Creswell, 2007). This mix of methods had two reasons. On the one hand, well-established qualitative research methods enabled a more systematic and structured learning process. The qualitative approach permitted finding elaborate ways to investigate, for example, participants' motives for participation through interviews and to analyze the meanings found in the different types of materials collected (Flick, 2014). The qualitative data analysis methods further qualified an understanding of the subjective experiences of the participants through the conducted and analyzed interviews (Flick, 2014). As this research setting was very complex, combining different fields and projects and a vast majority of participants and different design experiments, I benefited from more established methods of handling this amount of information. As a researcher, I am deeply involved in the subject of research, and the methods chosen were thus interpretative and dialectic, allowing me an involved position in a specific context (Gray & Malins, 2004). These hermeneutic (interpretative) methods were "interested in analyzing structural causes of practices" (Flick, 2014, p.42) and recognized my situated knowledge as informing the interpretation of the interviews and observations.

Secondly, my research environment in Ulm commonly used research methods from the social sciences. In this context, RtD was not a typical or known research approach to documenting the activities in the real-world laboratory context. Therefore, qualitative research methods were useful for translating findings regarding the *Co-sewing café* to my colleagues and the larger RWL context. For these reasons, my choice of methods was also informed through my ambition to find a suitable approach to interpreting and translating the findings in a transdisciplinary research context of Mode 2 (Dunin-Woyseth, 2011).

The research environment in Ulm also enabled me to learn to code the interviews using the software program Atlas.Ti[10] from a colleague, with whom I co-authored a paper (Hirscher & Iran, 2016). By coding, I refer to a process of qualitative data analysis that creates categories from data segments of summaries, label and/or clusters of these (Schreier, 2012). In contrast to qualitative content analysis, in the chosen coding approach, the codes/categories emerged from the interview data, and were not derived from theory (Flick, 2014). This approach is defined as thematic analysis in the context of psychological research. It describes "a method for identifying, analyzing and reporting patterns (themes) in data. It minimally organizes and describes your data set in (rich) detail. However, frequently it goes further than this, and interprets various aspects of the

10 Atlas.Ti is a software program for qualitative content analysis, as it allows categorizing and coding of, e.g. transcribed interview materials.

research topic" (Braun & Clarke, 2006, p.79). These authors differentiate between inductive and theoretical thematic analysis: I followed an inductive approach, in which codes and themes emerge from the data. This analysis approach is most often applied to interview data, as in my case too, to analyze subjective viewpoints (Flick 2014).

[2.2.5] Combining two research approaches and different methods

Due to my involvement in the aforementioned transdisciplinary research context, I applied qualitative research methods from social science in addition to methods derived from RtD. Gray & Malins (2004, p.15) refer to this combination of different methods as a multi-method research strategy (Brewer & Hunter, 1989), in which more than two methods are played out as "triangulation" of methods. Triangulation aims to generate a deeper and more meaningful understanding of the given issue by combining several research methods. The different methods should enable different perspectives and help us understand complexity (Gray & Malins, 2004). In my position as an "introspective designer" (see Section 2.1.2) I had the advantage of experiencing and impacting the research process by being an insider, building on my sensitivity towards materials, machines and tools and the processes of making. This specific knowledge allowed me to recognize changes in regards to material but also immaterial aspects, such as matters of ownership and sharing responsibilities in the process. Adopting some of the more systematic, social science-based methods and triangulating these with findings from RtD opened new insights by combining an insider design perspective, with an observer viewpoint, to support trustworthiness.

The multi-method strategy should reduce bias resulting from a single-method approach, as different perspectives provide different information (Gray & Malins, 2004). In combining different methods, I tried to reduce my subjective bias as a researcher who was deeply involved in the subject of my research. In addition, the combination of different methods helped to identify specific areas to be looked at in more depth, and pointed to interrelations or surprising instances. For example, the findings from the interviews (i.e. reasons for participation), were placed in relation to my own observations or reflections on the design (i.e. changing the arrangement of the workstations to enhance skill-sharing among the participants). Moreover, I documented, through observing very skilled participants, how their participation affected the group dynamics, facilitation, material arrangement and sharing of responsibilities. The explicit choice of methods in each experiment are discussed in detail in Section 2.3.

Overall, the first and second experiments *Make{able}* and *Makershop* used similar methods for documentation, reflection and analysis, but were complemented by a questionnaire in the case of *Make{able}*. The third experiment, the *Co-sewing café*, offered the most in-depth documentation and amount of collected materials. Here, I drew upon the documentary methods developed in RtD and social science research. For the RtD methods, I kept and analyzed a "working diary" (Mäkelä, 2007, p.162) which could also be referred to as a "reflective journal" as described by Gray and Malins (2004, p.57) in reference to Schön's "reflection-in-action" and "reflection-on-action". In this reflective journal, I documented in a free format my own design activities and experiences from the first co-design workshop (June 2016) until January 2018 (end of documentation). These journal notes include documentation of the changes in the *Co-sewing café*, implemented, for example, upon request of certain participants, specific alterations in the context, but also the emerging and required materials and tools that appeared or were brought by participants or other actors. Further, a semi-standardized diary in the form of a table was used to compare the specific features of each workshop (Pedgley, 2007). This diary included details of dates, the number and types of participants, workshop themes, notable interactions among participants, and other descriptions noted throughout or after the facilitation of each workshop. This diary combined with the photographs was the means for documenting these observations.

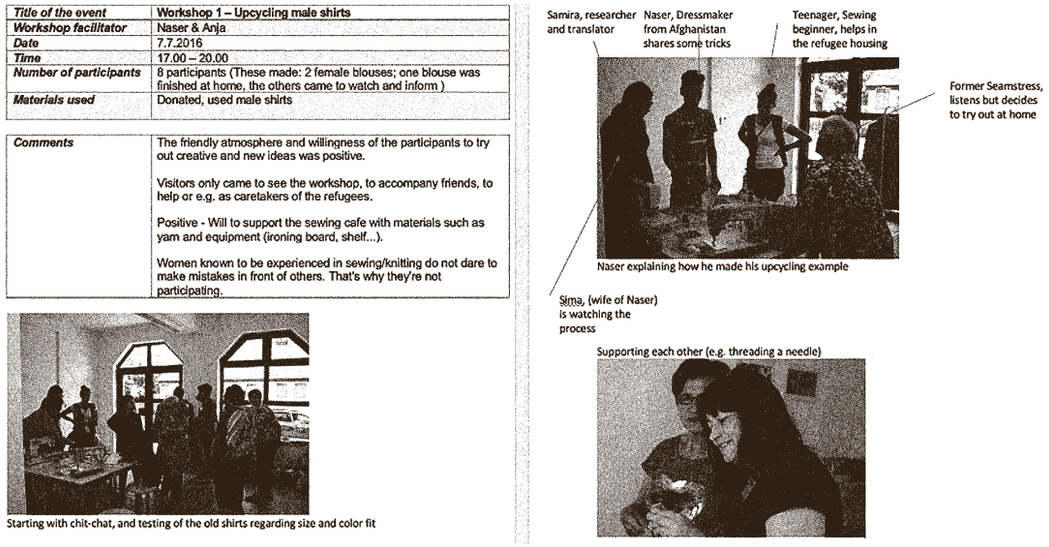


Figure 7
Screenshot from analysis of the workshop held on 7.7.2016. This illustrates the combination of photographic materials and the semi-standardized diary notes and my observations.

The qualitative research methods supported the collection of materials and the analysis of the *Co-sewing café* in terms of people's interaction with the space, its tools and members. In order to acknowledge the right of the participants to be included in this study, prior to participation I asked them to fill out a standardized agreement form about informed consent, on which they could also choose in which way (e.g. online or offline) I could use or publish the photographs taken during the workshops. I also asked for their consent before starting to record the interviews, explaining again the basic principles of the study. To ensure anonymity in my research in terms of the transcribed interviews or questionnaires, specific locations or names were anonymized in the transcriptions, if required. Participant lists of the 42 workshops, including names and times of participation, documented the routines of the 314 participants. Twenty-six short, semi-structured interviews were conducted with the average participants after their first or second participation. Extensive photographic documentation, comprising approximately 1200 photographs taken by the main author and other participants, as well as video recordings of two full workshops, provide additional material. The photos were especially useful as an additional source of data, as they allowed me to capture processes and interactions with people and artefacts, and are less selective than observations (Flick, 2014).

The analysis of written, qualitative content, such as the transcribed interviews and my notes, was conducted using an inductive approach. I analyzed the content of the interviews by building thematic codes or categories. The themes that emerged from my own journal notes were compared to the semi-standardized

diary entries to find potential correlations between the participants' activities and my designerly activities. Furthermore, I used excerpts from the textual analysis or the interviews with the photographs. The photographs were used as complementary material, supporting or contradicting certain assumptions I made on the basis of my notes. The combination of textual and visual materials and the methods of analysis resulted in several visual content maps, onto which, for example, interview quotes or themes were added to the photographs and notes from my journal (see as an example Figure 7). These maps contain and connect representative photographs of specific workshops, highlighting situations and interactions with tools and materials or among participants, supported by quotations or codes taken from the textual analysis. This method of analysis can be identified as "visual concept mapping" (Butler-Kisber & Poldma, 2010).

[2.3]

The experiments in short

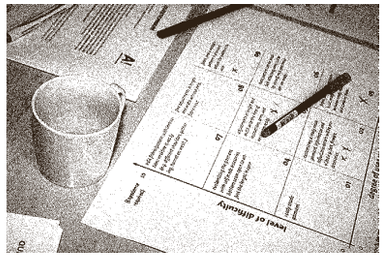
The following section describes the three experiments in more detail and provides a summarizing table to illustrate the methods and materials accumulated in the different experiments. The original research papers each deal with specific research questions and different literature, in reference to materials collected from different experiments. Therefore, the short descriptions of the experiments are to a certain extent directly collected from the original research papers and inserted here for a more comprehensive picture. Paper 1 uses insights generated through Experiment 1 and compares it to a broad area of literature related to sustainable fashion design, social manufacturing and value creation. It looks at the design experiment as a means to enhance sustainable fashion design and production. P2 in turn builds on the literature from the first paper, but adds insights from Experiment 2, looking more deeply at the social and interaction aspects occurring in these participatory sewing workshops. Therefore, both experiments and papers look at the design of the workshops from a broad, conceptual level. The papers specifically elaborate on the participants' interactions and the product, knowledge or social value of the design and research experiments. However, due to the shorter time and reduced scope, compared to the *Co-sewing café*, these two experiments only tested the underlying design concept. Papers 3 and 4 dive deep into the experiences and materials collected form the third experiment – the *Co-sewing café*. This third experiment was able to build on the learnings generated from the first two experiments and papers, in theory and design practice. Therefore, Papers 3 and 4 present a deeper examination of the RtD activities and materials generated in relation to the PD literature and peer production. These last two papers offer a deeper insight into the social and material as well as designerly considerations benefiting from the content analysis of RtD materials in relation to qualitative materials. This was presented, for example, in the visual content maps generated through interviews, journal notes and photographs.

Experiment 1: Make{able} – Valuable clothes designed together

Make{able} was a workshop concept and an RtD experiment originally developed as part of my master's thesis process, but which was iterated and continued over the span of one and a half years (2012–2013) into an open collaboration between different designers, as a mobile sewing café enabling citizens to design and make their own garments. It was based on the values of mutual learning and participation, to enable stronger user involvement in the design process and to explore whether it was possible to create a stronger "person-product attachment" (Chapman, 2005; Schifferstein & Zwartkruis-Pelgrim, 2008) through making an object (in this case a garment). Twelve participatory





Clockwise from top left:
Make{able} Workshop at "Made in Kallio" a Café and Co-working space (2013).
Make{able} Workshop at the Arkadia Bookstore in Helsinki (2013).
Half-way garments that I prepared (or pre-designed) for different levels of skill.
These ranged from *Stage 2* for beginners, in which only details could be adjusted, to providing the paper pattern for skilled makers.
Self-evaluation matrix used to illustrate participants' perceived skills development.
Make{able} Workshop at the Recycling Factory Fare in Cable Factory (2012).
Participant signing their label: Value{able}, the name of the maker, and the time it took to make the garment.

workshops under the theme or method of participatory or "half-way clothing" were facilitated, with approximately 120 participants, male and female. A "half-way" product or garment is intentionally unfinished by the designer, leaving an open space for the end user to customize and finalize the artefact (Fuad-Luke, 2009). Thereby easing the making of a garment for less experienced users but still inviting them to participate and create items according to their own needs or tastes (Hirscher, 2013). The workshops were conducted in different locations in Helsinki, Finland (see some examples above) between May 2012 and December 2013, each hosting between 8 to 15 participants, in total around 120. The workshops offered a ready-to-make sewing and design setting, including sewing machines, materials, design facilitation, patterns, or half-way products.

My role and other contributors

Since I initiated the project in 2012, I had many roles, from planning and facilitating workshop sessions and establishing collaborations with material suppliers and locations, to designing an identity for the project, including a logo, the website, garment labels to be filled out by the participants, communication materials, workshop themes with patterns for half-way garments, instructions as PDFs to download, and video tutorials. The workshop activities were run from 2013 and supported by a varying team of designers and other creatives (Tjasa Avsec, Harri Homi, Daniel Morales, Nina Cee, Teresa Mair, Vendula Johanová, Laura Reinikka, Bianca Byggmästar, Charlotte Remming) who co-facilitated or documented the workshops through photographs and videos.

Materials collected and analyzed

Observations and photographs were collected, including three video recordings of three workshop sessions. These delivered insights for later reflection upon the general activities, feelings, emotions, interactions, and atmosphere. Immediate experience and feedback was gathered through a series of questionnaires handed out to 18 female participants directly after the first two workshops. Online questionnaires were sent to the same 18 participants two months and one and a half years after their participation in the workshops to investigate possible attitude and behavior changes in personal consumption habits as well as potential emotional bonding towards the created garment. The analysis showed that the majority of participants felt happiness and satisfaction during the making process or afterwards when they saw their results. In addition, I developed a method, a self-evaluation matrix, to be filled out before and after workshop participation, to analyze participants' perceived learning experiences of their skills and knowledge about making a garment. The participants could choose a half-way garment based on their perceived skill-level, numbered 1–9, by crossing the respective number in the matrix. After the workshop, they could re-evaluate their choice using a different color, if they felt they wanted to choose a different number next time (i.e. higher level of difficulty and skill required).[11]

Experiment 2:
Makershop: Make yourself …

The *Makershop* experiment was initiated in November 2016 at the BITZ Unibz Fab Lab in Bolzano, Italy. The aim of the project was to engage locals and newly arrived citizens in making clothing together, and to investigate the potential of such a process to generate new design concepts and value propositions. The project entailed a fashion makerspace and pop-up shop to engage diverse locals in exploring how their skills and cultures could contribute to making clothing differently. The

11 Parts of this description have been published in Paper 1: Hirscher, A.L., Niinimäki, K., Armstrong, C. (2017). Social manufacturing in the fashion sector: New value creation through alternative design strategies? *Journal of Cleaner Production.* Volume 172.

Clockwise from top left:
Makershop Workshop in Bolzano, Italy (2016).
Garments created as collaborations between two participants (two former dressmakers).
The two women explored upcycling old garments by participating every day in the *Makershop* in Bolzano, Italy (2016).
At the end of a full-day workshop the participants gathered for a group picture.
After one week of "social making" in the *Makershop*, the results were exhibited with photos of the makers. These objects could also be acquired by visitors for a donation to the local "Associazione Voluntarius", which works with refugees and migrants.

Makershop was initiated during the festive time of December, when many artisanal products are sold at the local Christmas market. Bolzano, near the Dolomite mountains, attracts tourists and locals alike but is also the destination of newly arrived and displaced citizens (visitors, migrants and refugees), the latter from Northern and Western Africa, the Middle East, Eastern Europe and the Balkans. With this experiment we aimed to bring together the talents, skills and creativity of local designers, students and artisans with those of diverse citizens in order to generate different kinds of clothes and exchanges.

The *Makershop* project started with a kick-off co-design workshop, attracting staff from Associazione Voluntarius (an association helping migrants and refugees in Bolzano) as well as students and staff from the Free University of Bozen-Bolzano (Unibz). This was followed by a one-week *Makershop* setup, and two follow-up workshops to reflect on the activities and generate further collaboration and concepts. In the *Makershop*, sewing machines were provided free of charge by a local sewing equipment shop, and by participants who brought in their own machines. Other tools, materials and equipment were provided by the project organizers, a local haberdashery shop, and some engaged participants. All these tangible resources came to life through the individual resources, imagination and professional or semi-professional cutting and sewing skills of the diverse locals participating in the project. Newly produced garments were added every day to the large street-level shop window façade (i.e. the pop-up shop) of BITZ, the Unibz Fab Lab in the center of Bolzano.

My role and other contributors

This experiment built upon certain findings from Experiments 1 and 3, and earlier research work conducted with Professor Alastair Fuad-Luke at Aalto ARTS "Emerging Design Practices" (Hirscher & Fuad-Luke, 2013). However, the *Makershop* focused on socializing value creation, while working with different cultures and acknowledging their diverse skills. The core team for organization and facilitation thus included Professor Alastair Fuad-Luke and myself, supported by local experts, students and other researchers from the "Mode Uncut" network (Francesco Mazzarella, Cecilia Palmer and Zoe Romano). In this experiment, I acted as a workshop facilitator, advising on garment construction, guiding the planning and organization of the *Makershop* and the concluding exhibition, and as a participant observer and photographer.

Materials collected and analyzed

For this project, participant observations (Creswell, 2007) were conducted, consisting of the investigation and interpretation of the behavior of the project participants and their social interactions in the *Makershop*. Furthermore, photographic documentation provided insights into the interaction among peers, and the final garments created, as each maker was photographed with the ready-made piece. In addition, the facilitating design researchers wrote down their own reflections during and straight after the week-long workshop. Our observations and reflections were discussed and compared in a group consisting of the three authors of P2 (Hirscher, Mazzarella & Fuad-Luke, 2019), leading to a flexible, reflective process of learning by doing (Kemmis & McTaggart, 2003).[12]

Experiment 3: The Co-sewing café

Located in a small town in southern Germany with about 6600 inhabitants, the *Co-sewing café* was established in July 2016 as part of a bigger research project, a real-life laboratory, which investigated the sustainable transformation of a

12 Parts of this description have been published in Paper 2: Hirscher, A.L., Mazzarella, F., Fuad-Luke, A. (2019) Socializing value creation through practices of making clothing differently: A Case study of a *Makershop* with diverse locals, *Fashion Practice*, 11:1, pp.53-80.

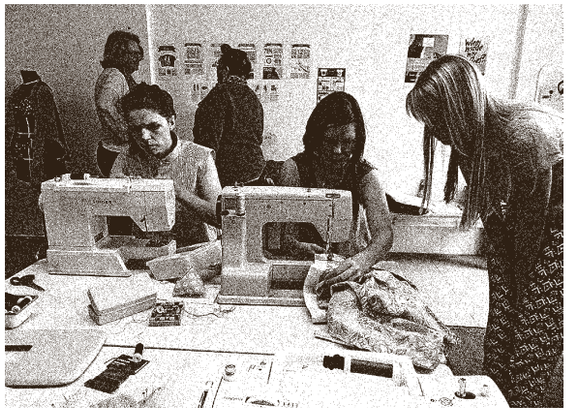
rural context (Geiger, Hirscher & Müller, 2017). This research project was framed as a "Real-labor" [Real-World Laboratories (RWL)] project, in which researchers carry out real-world interventions referred to as "Realexperimente". This format, driven by experiments set in a social context, enabled me to address the objectives of my doctoral research using an RtD approach. The *Co-sewing café* occupied a former 60 m2 shopfront. It was designed to host 10–12 workstations, which included refurbished domestic sewing machines and donated sewing materials and fabrics. The material for analysis was collected for 18 months, documenting 42 workshops, each three hours long, with approximately 314 participants in total. The workshops were conceptualized following participatory design principles. Participants were enabled to develop, share and practice skills and competencies for designing and making garments. Each workshop provided sewing suggestions, such as garment patterns and samples to try on, accessible for different skill levels. Workshop facilitators provided support, advice and ideas. Providing the infrastructure to start making a garment from the first visit aimed to reduce barriers such as lack of space, tools, skills, ideas, and materials. To ease the entry level, achievable goals were planned, which helped reduce the fear of mistakes or frustration.

The café concept was designed by myself, on the basis of what I learned from *Make{able}* and prior co-design sessions with citizens and inspiration from literature. It was implemented with support from two colleagues (Britta Stegen and Samira Iran, c.f. Hirscher and Iran 2016). The café was established at a time when in Germany, cities and villages were struggling to find suitable accommodation and means for integrating recently arrived refugees. Given the context and my learnings from the first experiment, the idea arose to include locals as well as newly arrived refugees. Through multi-lingual flyers and posters, we invited locals and refugees to a joint co-design session at the town hall. As we aimed to engage a diverse group of people, we also visited the local refugee café. I also presented the idea at two public events in Dietenheim and used local media and newspaper channels.

The café can be understood as a makerspace that offers an open, collaborative workshop environment shaped by its individual participants and purpose (Kohtala & Bosque, 2014). The purpose of the café surpasses that of producing garments; it also enables learning and exchanging knowledge and skills, interaction and community-building among peers and various people with common interests. Thereby it supports the values of peer production and PD, engaging a wide range of participants with different skills, representation and power (Keshavarz & Mazé, 2013). It was designed to attract a diversity of participants – those underrepresented in traditional technology-driven hackerspaces and makerspaces (Fox, Ulgado, & Rosner, 2015; Catersen, 2013) and to address different age groups, female participants and refugees. Furthermore it used only refurbished materials, distinguishing the café from the general Fab Lab agenda of generating product innovation (Maxigas & Troxler, 2014), and requiring the purchasing of "a new set of products (from 3D printers to making kits)" serving "corporate agendas and forms of profit making" (Vossoughi, Hooper, & Escude, 2016, p.212). I designed the *Co-sewing café* fully aware of the values I was to embed in it, such as those of environmental sustainability; diversity in ethnicity, age and gender; and an emphasis on a common ownership. These values were negotiated with the participants and external actors before and during the process, as were the changes in context and wider structures (Hirscher & Mazé, 2017).

My role and other contributors

I initiated and ran the *Co-sewing café* myself with the support of some aforementioned colleagues. Like other doctoral projects following the contemporary PD tradition (e.g. Seravalli, 2014), I set up, ran and developed the café myself as a trained designer, attending specifically to the practical, material and 'designerly' aspects of infrastructuring. As regards my



Clockwise from top left:
The *Co-sewing café* in Dietenheim, Germany (Workshop 14.10.2016).
Visiting designer Cecilia Palmer helps a participant design her own garment on the basis of a provided sample piece and pattern.
The *Co-sewing café* in Dietenheim, Germany (Workshop 21.07.2016). A former dressmaker teaches another participant how to sew a skirt, based on a pattern he had prepared.
The *Co-sewing café* in Dietenheim, Germany (Workshop 23.11.2016).
My colleague and co-facilitator Britta and another experienced participant help a sewing beginner guide the fabric on the sewing machine.
The *Co-sewing café* in Dietenheim, Germany (Workshop 22.05.2017).
Myself assisting a participant with a difficult sewing task for a beginner. I help her by starting the seam and allowing her to continue.

positioning, I played many roles, from planning and facilitating co-design sessions for conceptualizing the *Co-sewing café*, to designing the space, tools, workshop themes and infrastructures with my colleagues at the University of Ulm. However, I not only took, but also shared many of these roles and activities with the participants, such as that of a workshop facilitator, participant observer and photographer. I also documented activities while simultaneously explaining the assembly of garments from paper patterns to wearable dresses. I repaired sewing machines (which I learned over time from a local expert participant), designed posters, labels and programs, and of course made coffee for everyone. This also illustrates how a skill often allowed me to take certain roles, similarly identified by Seravalli (2014), offering an interesting link to the focus of this dissertation on skills and doings over roles and identities. The list of activities I ran, can of course be extended, illustrating the situatedness and my subjective position from which the reflections are made.

Materials collected and analyzed

Over 18 months, I documented my own design activities and experiences in a reflective journal. I also collected 42 semi-standardized dairy notes with details of dates, participants, interactions and other descriptions noted throughout or after each workshop. The participant lists of each workshop, including names and times of participation, documented the routines of the participants. Twenty-six short, semi-structured interviews of average participants were conducted after their first or second participation. Extensive photographic documentation comprising approximately 1200 photographs taken by the main author and other participants, as well as video recordings of two full workshops, provide additional material.

The structured interviews, which used 15 open questions, collected in-depth information about the reasons for participation; the experiences of the workshop in regard to learning, interaction and outcome, and general feedback on the *Co-sewing café*. Twenty-six interviews were recorded, transcribed and coded, following an open, thematic coding strategy using the program Atlas.Ti. The majority of the participants were female, their age ranging from 16 to 80, although most were between 30 and 60 years old. Each workshop had a varying number of participants, ranging from 4 to 25, but the average number (which fit comfortably in the space) was 6–8 participants. Of the average number of participants in a group, typically about half were regulars; the others were first-timers or occasional participants.[13]

[2.4]

The interplay of theory and practice

In this section I demonstrate how and where knowledge was produced through my programmatic approach to RtD. I see that RtD has the potential to generate knowledge through situated and evolving design practice that is not only about envisioning and embodiment in a design artifact, but through negotiating and changing the design based on learnings from the literature and practice, also in regards to (unexpected) contextual factors. Therefore the conceptualizations and facilitation of each experiment enabled deep insights into the participants' activities, the negotiation of roles and changes emerging in the different contexts, as well as created a certain drift of the program, generating new insights. In addition to my reflections on the design activities and the qualitative documentation of the participants' experiences, answering the guiding research questions required a closer examination of new areas of the literature.

13 Parts of this description have been published in Paper 3: Hirscher, A.L., Mazé, R. (2019). Stuff matters in participation: Infrastructuring a Co-Sewing Café. *Journal of Peer Production.* Issue 13.

Experiments	EX 1 – Make{able}	EX 2 – Makershop	EX 3 – Co-sewing cafe
Context	Several temporary workshops, facilitated in Helsinki, Finland in different locations.	Temporary workshop context in a Fab Lab from Unibz - Bolzano, Italy for one week, with additional preparation and follow-up workshops.	Fixed location, 60m2 Shop, established as part of a "real-world laboratory" at University of Ulm, in Dietenheim, Germany.
Timespan	12 workshops in May 2012–Dec. 2013	2 Co-design workshops (Nov. ad Feb.), 5-day Makershop and 1-day exhibition and seminar. Nov. 2016–Feb. 2017	Still open and ongoing, documentation includes 42 workshops held in June 2016–January 2018.
Documentation methods & materials collected	Participant observations Photographs (250) Videos (3) 2 different types of feedback Questionnaires (18 in total)	Participant observations Photographs (100)	Participant observations Photographs (1200) Interviews (with 26 participants) Reflective Journal Semi-standardized diary
My role	Initiator, designer, facilitator, (design) researcher, organizer, photographer	Co-initiating and framing of the concept and activities. During the experiment: designer, facilitator, (design) researcher, photographer	Initiator, designer, facilitator, (design) researcher, photographer, organizer…
Papers	P1	P2	P3 & P4

Table 1
Overview of methods, materials collected and respective experiments.

The first experiment, *Make{able}*, was created and facilitated with a rather general understanding of PD and sustainable fashion and related values, aiming to enhance participants' clothes-making skills. As a result of the qualitative analysis conducted for the first paper, I became aware that the phenomenon of social interaction was the main driver for people to participate in the *Make{able}* workshops. This discovery initiated a first outlining of the program, thus illustrating the dialectic relation between program and experiment (Brandt et al. 2011, Eriksen & Bang, 2013). Hence, I started to explore similar observations in the literature and came across the concept of social production, social manufacturing, and the ethical economy. Relating this literature to PD made me turn towards peer production sources to better understand what happens in such workshop settings. This broad exploration is formulated in the first two papers, P1 and P2, of this compilation dissertation.

The first paper established a basic understanding of the participants' experiences and what could be generated through participatory sewing workshops. A drift in focus was observed through the diversity of the "intangible" value identified, and the experiences discovered through the content analysis. The focus turned to what truly happens in the interaction when making together in such alternative spaces for clothes production. This resulted in the formulation of the broad program in which PD overlapped with peer production and certain aspects of sustainable fashion. In order to better understand what happens when PD extends in scope and timespan, I initiated two more experiments, the short-term *Makershop* in Bolzano, Italy, and the long-term *Co-sewing café* in Dietenheim, Germany. Chronologically the *Co-sewing café* was established first, in a fixed environment, aiming to deeply explore participation, social interaction and the acts of use over time through literature and practice.

Research design

The explicit naming of the program as "extended PD", came later on in the research process. It emerged with the first analysis of the long-term experiment of the *Co-sewing café* and the write-up of the third paper, formulating the research question in regards to what happens when participants and designers produce together in extended PD contexts. With the *Co-sewing café*, I intended to investigate over a longer period of time how social interaction and participation are influenced by space and context and vice versa. The contextual aspect became particularly relevant, as, during the refugee crisis in 2015, around one million refugees came to Germany. This enabled a broad variety of participants to collectively conceptualize the *Co-sewing café*. The diverseness of the participants brought an immense, unexpected skill set to the table; for instance participants who were trained dressmakers. The participants varied in cultural backgrounds, profession, age, and skill sets. This mix of people led to interesting social interactions and exchanges of skills.

In order to acknowledge my position and values in such a complex environment, I thoroughly documented my designerly activities, the values I embedded and the roles I played in enhancing active user participation when designers and users made clothes together. I analyzed my role as a designer shaping the context and activities of the *Co-sewing café*, in an exploratory paper for NORDES doctoral consortium in 2017. This paper looked at the negotiation of values in PD practice, using the example of the establishment and development of the *Co-sewing café*.

Documenting the design activities in a reflective journal and conducting interviews with the participants enabled the first analysis after about six months of running the *Co-sewing café*, and through thematic coding of the transcribed interviews I identified that the learning of new skills and the exchange with others over a shared topic of interest (sewing and upcycling) was behind the participation of the diverse people in the *Co-sewing café*. These findings were compared to specific designerly, material and contextual aspects influencing the *Co-sewing café's* spatial and thematic arrangement. An interesting relation was the overlaying of photographic documentation with, for instance, quotes from the participant interviews and notes from my reflections. This triangulation of material illustrated that the physical arrangement of the space (grouped workstations) can encourage participants to naturally help each other if required (e.g. if the facilitator is busy) and their skill levels permit. It also brought to light the relation of "tools" (e.g. sewing machine, key to the space) with the roles and responsibilities assigned to it. For instance, a very skilled participant asked for a key to the space to offer their own workshops. These findings made it useful to deepen the focus of the program towards the social and material considerations of infrastructuring, especially in terms of understanding reasons for participation and their relation to skills and skills development over time.

The extended scope and timespan of the *Co-sewing café* enabled research on participation, relationship building, and the exchange of knowledge and skills development emerging in one such makerspace. It offered a deep exploration, analysis and description of the different types of participants and enabled me to observe a change in participation over time. In particular, two aspects continuously caught my attention, as to a certain degree, these occurred in all the experiments and shaped the way in which the people participated. First, the great diversity in the types of participants and the way in which their skills and participation shaped each experiment was highly interesting. This led me to analyze my observations, photographs and notes with the aim of understanding the participants' types of use and how they attune to certain roles and responsibilities over time. Second, my designerly and material considerations further influenced development in material matters, shaping the spaces but also affecting participation in a specific way. Hence, I chose to allow for this drift in program and focused on exploring participation and use through theory

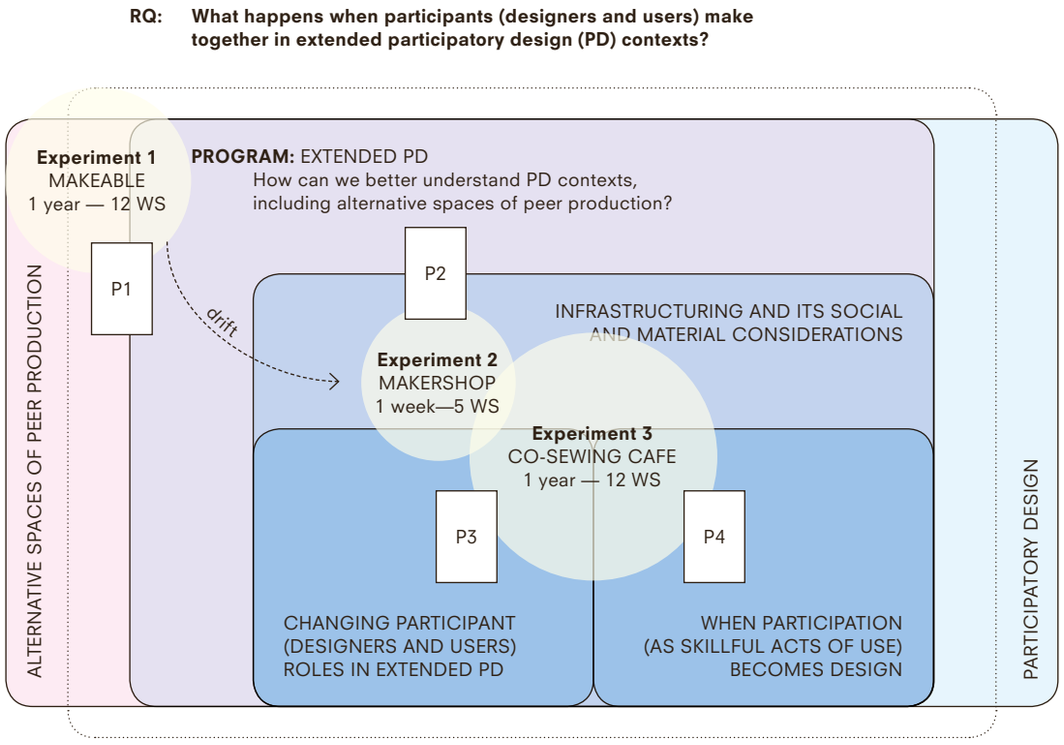


Figure 8
Research program with the interlinked program frames which are deepened in relation to the experiments, addressing specific areas and research questions in the program.

and practice behind the two deeper program frames, looking through the lenses of "stuff" at design possibilities by "changing participants' (designers' and users') roles in extended PD" and "skills" (i.e. "when participation (as skillful acts of use) becomes design").

These two lenses emerged when I examined the literature on other examples dealing with the two matters described above. I came across Shove and colleagues' (e.g. Shove & Pantzar 2005, Shove et al. 2012) work in the context of social practice theories, which was also adopted by other design researchers (e.g. Scott et al., 2009, Kuijer, 2014). In P3 I thus adopted the terminology as analytic categories: "stuff" (materials), "skills" (competences) and "images" (meanings). Practice theory was useful for expanding the unit of analysis in design research to include larger and longer practices of participation (de Jong & Mazé, 2017), including multiple, varied and changing practices of using space (i.e. *Co-sewing café*); spatial arrangements including furniture, materials, tools (sewing machines and equipment); interaction with materials (fabrics, threads, etc.); and participants' skills development. Following this detailed analysis of types of use and the resulting participation, I concluded that in this context, participation is better understood as "skillful acts of use".

A more detailed elaboration on skills in the literature and their development in practice was thus inevitable, which led to the last paper (P4) and the subsequent research question: How can acts of use become "skillful" and be changed by (social and material) infrastructuring? Tracing notions of skills in the PD and peer production literature elucidated that both lack nuanced descriptions and deep research on skills development and its impact on participation in alternative spaces of peer production. In contrast, the practice showed that different types of skills played a major role in shaping the *Co-sewing café* over time. Based on this discovery through practice, I not only identified a neglected area in the literature, but also contributed and challenged discussions related to skills development and the distinctions of the roles assigned to skills in both discourses (i.e. PD and peer production). The above paragraphs should illustrate how the program and its research questions emerged over time, as each experiment posed new questions and resulted in a certain drift and deepening of the program. In this evolvement over time, different highlights and discoveries were discussed, to elucidate my learning process. The interplay of program and experiment and which paper roughly addresses the respective framing is illustrated in Figure 8 on the previous page.

"I bought myself a sewing machine, but you don't start with learning sewing on your own, it's much nicer together in a group."

[3] Program

This section investigates what happens when participants and designers make and produce together in extended PD contexts. The program will gradually deepen into what I call "program frames" to elaborate the terminology and literature relevant for exploring the specific research questions that emerged through the literature and practice exchange. The program frames aim to contextualize the setting for the experiment, constituting a specific research perspective (Brandt et al.2011). With this approach to framing my experiments, I refer to my programmatic approach as discussed above, which emphasizes the interaction of theory and practice by creating a series of experiments (as practice) in a program, guided by a research question or objective (Brandt et al., 2011; Redström, 2011). The knowledge in this approach is generated in the relation between program and experiment, while constant reflection on the experiment in reference to the program is ensured.

The overarching program is called *Extended PD*, which is an overlap between PD and peer production research, as introduced in Chapter 1. This has been gradually narrowed down to more precise program framings, looking at specific areas of extended PD, which are interpreted through different parts of the experiments, but also guided by specific research questions. Section 2.4 illustrated the interplay of theory and practice, providing specific examples of the process of knowledge production and how this influenced a "drift" in the program. Chapter 3 now expands on the process of the mutually dependent relationship and interaction of the literature and experiments. The learnings generated thereby deepen the focus and support the articulations of the program frames and the contributions to these. The program frames thus inform practice by offering a particular area for contribution. The findings do not aim to verify the program but to generate new knowledge in regard to the framing of the program, or the specific areas within it. Therefore, this section unfolds and deepens the "extended PD" program to enable an elaboration of the results and contributions in Chapters 4 and 5.

The first section of this chapter builds on the first introductory chapter. It elaborates the broad overall design dilemma, of blurring designer/user roles, activities, and responsibilities when working in extended PD contexts. This challenge becomes particularly evident in alternative spaces of peer production, where designers and participants design, make and produce side by side. These spaces can also be considered instances of extended PD and infrastructuring (Seravalli, 2012). For this reason, research on alternative spaces of peer production and extended PD contexts, including infrastructuring, will be deepened to broadly frame the overarching program. The overlapping of these two bodies of research (PD and peer production) in exchange with the different experiments, should support answering the following general research question: How can we better understand extended PD contexts, including alternative spaces of peer production?

Once the context of extended PD is articulated, I deepen my study into two aspects: on the one hand the social and experiential aspects of participation, and on the other hand, the material and designerly characteristics of infrastructuring. In combination with my practice and the materials collected over years of documentation, these two theoretical elaborations contribute to answering the questions in the results section: In making clothes together, how are roles, use and participation experienced and changed over time? And how can acts of use become "skillful" and be changed by (social and material) infrastructuring? In the second part of this chapter (3.2) I summarize the findings from the literature and relate them to the experiments.

[3.1] Extended participatory design

In the following section, I dive deeply into what I defined as "extended PD" in the introduction. The first chapter illustrated the ideologies

and key principles underpinning PD, and also elaborated on PD's distinction into roles of designer/worker due to the traditional allocation of labor in industrial production processes. PD aims to address this not uncontested separation by emphasizing the development of tools and methods; to connect the roles of the designer and user by enabling a sharing of knowledge, skills and potentially, decision-making power. The sharing of this kind of power also implies that the roles of designer/user/participant become blurred and lead to unknown grounds and potential new design dilemmas. Therefore, Chapter 3 provides an in-depth investigation of matters of participation in design and explores the related spectrum of participation spanning design and use. By the term spectrum, I conceptualize the fluidity or blurriness of the relation between the dichotomies of design and use.

I identify "infrastructuring" as an emerging area in PD practice and research and as being highly relevant in the discussion on the unclear, fluid spectrum of use and design in extended PD research. I thus study literature dedicated to the social and organizational aspects of infrastructuring in regard to designerly and material dimensions, and what exactly happens in these extended PD contexts, by examining in the PD and peer production literature how and under what circumstances the designer/user roles become more fluid. As a result, I establish terminology for a more nuanced articulation in regard to design, use, participation, and skills. The following sections expand on each other to better understand and deepen what happens when users and designers work together. The sections are further constructed in reference to questions and findings from the experiments and are thus considered an interplay of theory and practice, as elaborated in Section 2.4.

[3.1.1]
The blurred spectrum spanning design and use in extended PD

The focus and field of practice in PD is shifting from workplace democracy to more open, public and community-based settings, including infrastructuring as consisting of participatory processes. This development requires a shift in scope and point of reference in PD (Bannon & Ehn, 2012). For instance, the shift from design "objects" to design "things", was investigated by the "Atelier" research project (Telier, 2011), with collaborative research on the development of educational media environments. The project traced the word "thing'" back to ancient Nordic and Germanic societies and further refers to Latour and Weibel (2005) calling for a "thing philosophy" and to make things "public" (Bannon & Ehn, 2012; Ehn, 2008; Telier, 2011). In this framing, "Atelier" explored differing types of use, such as configurability, representing "a quality which allows for interventions of users in a physical space" (Telier, 2011, p.178) or "patterns of use and appropriation of an environment" (Telier, 2011, p.177). These patterns of use and appropriation can also be interpreted as social practices, as they refer to the act of change (Telier, 2011). Through use, change is enacted, and meaning is created by the user through active involvement (acts of use and activities).

> *"(...) it may be constructive to think of Participatory Design assemblies as things, especially if aspects of democratization are at stake. This helps to explore these design environments as socio-material frames for 'matters of concern' and the alignment of controversies, ready for unexpected use, opening up new ways of thinking and behaving. This perspective may also inform designers as to how they may act in a public space where a heterogeneity of perspectives are in evidence among the actors, in finding alignments of their conflicting matters of concern.*
> (Bannon & Ehn, 2012, p.57)

The relation of design(er) and use(r), are of course discussed in great depth and breadth by different strings of research in design theory. For example, related studies from end-user development, in particular, meta-design (Fischer & Scharff, 2000) have also explored the blurring of designer/user roles. The work of Botero (2013) connects PD with research on end-user participation, looking at the development of competencies and interactions in expanding design spaces. Although the area of end-user development and meta-design would have potentially provided additional terminologies or insights, this would have meant the program opening or drifting in yet another direction, which predominantly deals with technology development. However, my research requires articulations for what happens on the human scale, in day-to-day activities, dealing with tangible means of production. Therefore, although I acknowledge these strings of research, given the objective of this dissertation, I did not explicitly refer to them when framing the program.

A key theoretical as well as practical issue for PD is that of "use" or extended use. "While much emphasis in PD has been on methods and process, there has also been interest in means for tailoring and reconfiguring systems in use" (Mazé, 2007, p.143). Several PD and interaction design researchers, such as Redström (2006, 2008), Ehn and colleagues (Björgvinsson, Ehn, & Hillgren, 2012; Ehn, 2008), and in this regards also the Atelier project, explore and define a range of terms, such as "design-before-use" or "design for use before use" to illustrate a relation that is strongly driven by the designer's perspective to determine use before actual use, referring to, for instance, the traditional idea of PD in relation to the design of workspaces (Redström, 2006). Further, Seravalli (2012) uses the term "design-for-design" introduced in the Atelier project (Telier, 2011) to describe the activities during which designers aim to enable users to design for themselves. The term refers to design activities that aim to provide environments or artifacts that encourage users to start designing.

Another way to conceptualize use is in terms of acts of participation, by following Redström's "RE:Definitions of Use" (2008, p.410) from an act-based perspective, that is, "what it is we do rather than who we are". Through his argumentation, acts of using, designing or appropriating need not be understood as mutually exclusive; more nuanced and active relations between design and use can be formulated. I will further investigate this notion, as different acts of use become evident when skilled participants negotiate with designers about roles and responsibilities.

This negotiation and fluidity are described by the proposition, that design-for-design aims to result in design-after-design, in which a user becomes the designer during a project when facilitating designers are involved (Telier, 2011). "Design-after-design" leaves open the possibility for involved stakeholders to initiate their own activities by performing design actions after the design of a given structure is concluded (Telier, 2011; Redström, 2008). The last notion elaborated in this context, which also seems to blur design and use the most, is "design-in-use" which first arose in 1991 (Henderson & Kyng, 1991). These authors looked at designed systems and how these evolve through use (Henderson & Kyng, 1991). They concluded that a system design that allows for tailoring or modifying is important for the successful use and implementation of a system in work environments (Henderson & Kyng, 1991). The term has become rather generally used in PD to highlight the incompleteness of the designed object or space (Ehn, 2008; Dittrich, Eriksén, & Hansson 2002). As these activities may not be fully controlled and, indeed, may be left more or less open, the concept of design-in-use underlines the users' creative input that is embedded while using something over a longer period (Dittrich et al., 2002).

The concepts above have been introduced and used in various and sometimes inconsistent ways in PD. Therefore, I have tried to articulate and conceptualize the terminology in a more consistent and connected way, in order to clarify the fluidity building the spectrum spanning design and use. As a result, after tracing these terms in literature, and to illustrate the difficult to distinguish fluidity when trying to define who takes which role in the design process, I defined this as a spectrum. This spectrum related these descriptive terms to each other and positions them as shown in Figure 9. The spectrum

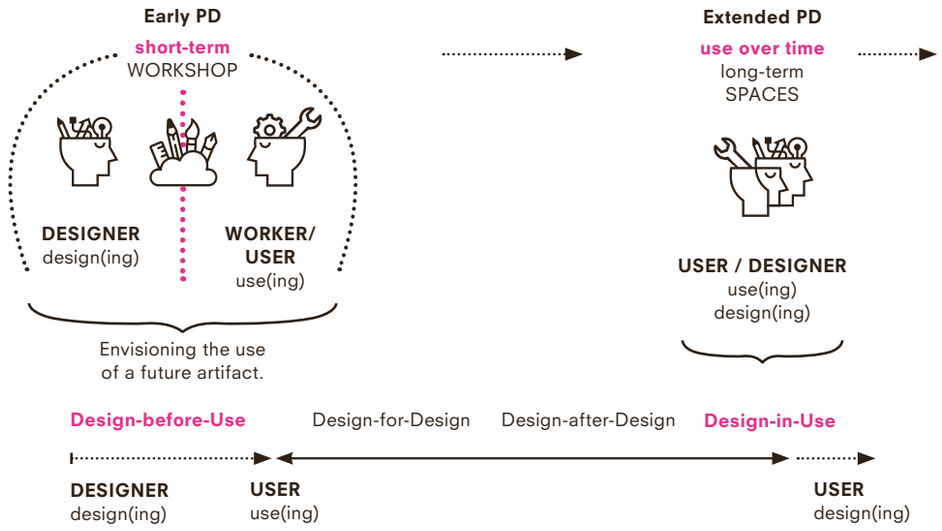


Figure 9
The fluid spectrum spanning design and use in participatory design (PD) contexts, built on an interpretation of my analysis of the above described terminology.

starts with what was traditionally defined as design by a designer and moves towards intensifying user participation and their influence on the design outcome from left to right, where at the very right of the spectrum the user is considered as designing. The terminology described above should help illustrate the step-by-step involvement of the user in the design process. It also shows that the problem of blurring the role of designer and user has been acknowledge and discussed in PD and design research in general but that it is not yet clarified. In addition, Figure 9, which is an illustration based on my analysis, adds to the spectrum the early and extended understanding of PD: from envisioning use before use, or in other words, designing with the user before actual use, towards extended PD, where use becomes similar to design over time.

As mentioned above, in traditional PD, the design process is about envisioning "use before use" (Redström, 2008), but use is interpreted differently by the user and by the designer, especially when considering use and appropriation over time. Use can therefore also entail taking responsibility for a space, its management and appropriation. The acts of use then go beyond merely using an object or a space; use can also include becoming active participants, caring for a common space, supporting associated activities and values. Therefore, below, I describe the definitions of different types of use in the related literature.

These extended or differentiated descriptions of use, are often lumped together. For example, use can require different skills and depth of involvement. These additional terms describing use include, for instance, knowledge about how to "operate" a machine. Users increase their competence by learning how to operate or are already knowledgeable in how to operate a tool. The term "maintenance" entails keeping an existing artifact/service/space in good condition. Further descriptions of use practices are derived from Carroll (2004, p.3), and include "adaptation", "modification", "tailoring" and "redesign". All these terms relate to closing the gap between the intentions of the designer and the actual use. For example, a user may alter, adapt or redesign the appearance or function of an original design to better fit their needs. An advanced extension of this is when participants can practice "appropriation", characterizing the act of taking possession of a thing by making it one's own, "appropriation involves mutual adaptation" (Carroll, 2004, p.3), during which users may not only redesign but take ownership of a design.

Design-in-use emphasizes the role of the user as completing a design, adding their creativity while in use and as a continued redesign. This argues for a deep level of engagement and taking over responsibility on the part of the user/participant. Applying this terminology to extended PD contexts, such as alternative spaces of peer production, design-in-use refers to a continuation of the design and making activities as well as facilitation and running of the space beyond the involvement of the initiating designer. This handing over of responsibilities requires a development of relevant skills, knowledge and motivation among the participants. Enabling these can be supported with, for instance, designerly approaches. In their paper, Huybrechts, Hendriks, Yndigegn, and Malmborg (2018) discuss how to design for participation over time, with a design approach named "scripting". They dedicate special attention to handing over the facilitator role to other actors to ensure continued participation in community-based projects (Huybrechts et al., 2018). The negotiations of these roles are thus to be enabled by the designer, for instance, but also require motivation and skills on the part of the participants.

The enabling of participants to become equal partners, eventually taking over the role of a facilitator, requires the design (i.e. makerspace) to be open and adaptable. However, the initiating designer also has to "step back" and hand over their decision-making power to participants. What this means for designers has been expressed by Mazé (2007, p.147) in the context of interaction design, building on a "Design for Hackability" panel (Galloway et al., 2004, p.3): "It is not a matter of 'ease of use' but of seeing if, when things were left open, users would step in and take over – for the designers, it was "an experiment in loss of control". The not knowing what will happen to a designed object has always been there, but the more open a design is, the more it can change over time. This change is influenced in the context of makerspaces by the participating actors and the context such as external funding, spatial arrangements, materials and tools emerging and disappearing and the coming, going and interactions of the participants (i.e. social and material infrastructuring). All these unknown factors impact and change a design and the way in which designers and participants work together. Therefore, the following section deeply explores the social and material aspects of infrastructuring, to better observe and describe the nuanced changes in practice.

[3.1.2]
Infrastructuring and its social and material considerations

This blurring of roles through design-in-use is particularly evident in infrastructuring, including an expansion of what is considered as "use". In extended PD, the concept of infrastructuring rapidly developed as a way to conceptualize the structures of PD processes (Karasti, 2014; Karasti, Pipek, & Bowker, 2018). Infrastructuring can be understood as a fluid and dynamic structure enabling participation, in which people and their actions cannot be reduced to terms such as "user" and "use". Therefore, infrastructuring exemplifies the challenge of blurring roles and types of use. In PD, a body of research has been dedicated to the different perspectives when users are involved in design. In early PD, the user is seen as ideating the eventual use of artifacts – conceiving "use before use" (Redström, 2008), whereas in contemporary PD, especially infrastructuring, "design for future use" (Redström, 2008) or design-in-use (Ehn, 2008) extend the act of "use" towards a broader spectrum (see Figure 10 below). Infrastructuring blurs the

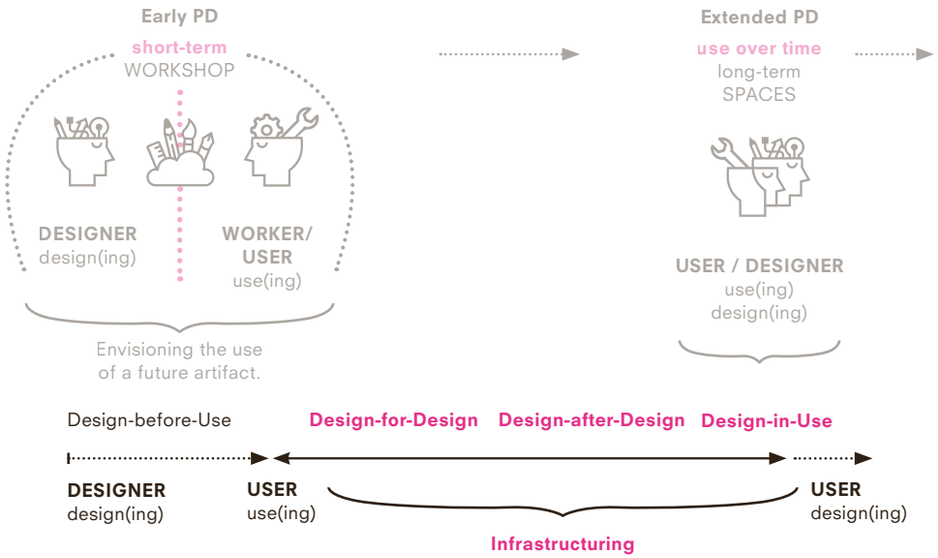


Figure 10
My interpretation of the spectrum spanning design and use in relation to infrastructuring.

boundaries between "use, design, implementation, modification, maintenance, and redesign" (Karasti, 2014, p.143). For really understanding what happens in this spectrum bridging design and use in infrastructuring, nuanced differences in understanding users and use practices need to be distinguished for a more detailed description of what happens in practice.

Infrastructuring in PD is characterized as an ongoing activity with a fluid and dynamic structure (Karasti & Baker, 2004; Karasti & Syrjänen, 2004). It enables and intertwines activities in a process of ongoing development through design and use phases including adaption, re-design, and appropriation (Björgvinsson et al., 2010). In PD, infrastructuring focuses on action, for instance, the learning and shaping of infrastructure by, for example, a community of people (Simonson & Robertson, 2012). Thus, the term infrastructuring is useful when exploring the extended scale of PD activities involving designers and users alike. Le Dantec and DiSalvo (2013) state that "infrastructuring is a particular mode or practice of PD that develops and provides socio-material resources and experiences" (Le Dantec & DiSalvo, 2013. p.247). Infrastructuring is particularly useful for characterizing the flexibility, openness, and adaptability necessary when designing for uncertain outcomes and future use (Hillgren, Seravalli & Emilson 2011) and is for this reason considered in greater depth in this dissertation.

The roots of infrastructuring lay in the field of Science and Technology Studies (STS) (Star & Ruhleder, 1996), which shifts the focus from designing for fixed environments, products or technologies towards a dynamic infrastructure that relates to different contexts (Star & Ruhleder, 1996). Infrastructuring relates back to Star and Ruhleder's (1996) characteristics describing the *what* and *when* that constitute an infrastructure. They found that infrastructures are embedded in other social and technical structures, building relations with people and objects. Furthermore, infrastructures are learned through regular practices by, for example, members of a community. Infrastructures are transparent to use; as such they naturally support activities. Therefore, they only become visible upon breakdown. This is later exemplified by Pipek and Wulf (2009) who expanded the characteristics of infrastructures and the concept of infrastructuring in the context of STS. They used a case study of implementing an IT infrastructure into an organization, a German state government, to illustrate design, implementation, use and appropriation over time. With these empirics they describe a methodological approach to infrastructuring and explore how information systems evolve over time with a growing number of different users and types of use.

In contemporary PD, infrastructuring is adopted and applied in various ways and identified as being highly relevant in several contexts. In her paper "Infrastructuring in Participatory Design," Karasti (2014) offers an overview of the developments in PD to that date. She distinguishes these areas as infrastructuring in communities, the commons, publics, design for social innovation and politics of participation. Research on infrastructuring in communities and in relation to the commons of peer production are especially relevant for this dissertation and will be addressed in more detail below.

Infrastructuring in communities has contributed to PD research by supporting the objective of designing means of sustaining communities of participants (DiSalvo et al., 2012). Further, Karasti (2014, p.2) states that "infrastructuring emerged as a way to advance the overarching community interests". An example of this is the study by Karasti and Syrjänen (2004). In their research on two different communities of practice, they discovered that infrastructuring emerged almost naturally. It was integrated and evolved in ongoing activities and in relevant community contexts over a longer period of time. In community-based PD, infrastructuring is most often practiced in contexts extending in scope and timeframe, such as in "design for social innovation". This is exemplified in the work undertaken in the Malmö Living Lab context (e.g. Hillgren, Seravalli, & Emilson, 2011; Seravalli, Eriksen, & Hillgren 2017) or OpenLab:Athens, a solidarity organization that explores the concept of "guerilla infrastructuring" (Vlachokyriakos et al., 2018). Through "guerilla infrastructuring" and their work with solidarity movements, Vlachokyriakos et al. (2018, p.481) investigate a design and infrastructuring strategy that fosters "active participation in the group's decision-making practices".

Another significant aspect in this regard is that of community formation, such as forming a group of committed participants who share a similar set of values and concerns. Forming a community of interested participants can be supported through infrastructuring by enabling the sharing of responsibilities, skills and knowledge (Le Dantec & DiSalvo, 2013; Huybrechts et al., 2018). These authors emphasize a design-in-use perspective as elaborated above, building on Ehn's (2008) conceptualization of infrastructuring. Ehn (2008) proposes infrastructuring as a means of sustaining a community of committed participants. In this respect, infrastructuring is understood in relation to use: as the people's abilities to change an infrastructure by adaptation, redesign or appropriation (Ehn, 2008).

The research on infrastructuring and the "commons" for the opening of production was conducted by Seravalli (2012; 2014; 2018) and colleagues in the context of the Malmö Living Labs. She defines the opening of production as "creating the conditions for the emergence and development of production activities carried on by users" (Seravalli, 2012, p.53). According to Seravalli (2012), this is implemented by the design of infrastructures that enable design-in-use or design-after-design. Participation in such spaces is often dependent on the space's ability and framing, and whether these support design activities during use (Seravalli, 2012) to sustain a community of committed participants. Seravalli (2012) hence proposes that:

> *"(...) a promising approach could be to shift the understanding of makerspaces from infrastructures, as defined structures addressing specific uses and communities of practice (Telier, 2011), to spaces for infrastructuring, which entails the creation of underdefined structure,*

that can be continuously restructured at use time for supporting emerging activities." (Seravalli, 2012, p.54)

In other words, FabLabs, hackerspaces and makerspaces can be understood as instances of infrastructuring that foster the commons in peer production. Infrastructuring in relation to "cultural commons" has been explored in Marttila's doctoral dissertation (2018). In her work, Marttila refers to her cases as "infrastructural initiatives" that aim to enable "wider public access to, and appropriation of the European digital cultural heritage" and help different people and communities contribute to "cultural commons" (Marttila & Botero, 2017, p.97).

The above illustrates that infrastructuring becomes useful as a bridging concept between short-term PD projects and spaces and communities of peer production such as Fab Labs, hackerspaces and makerspaces, set-up by and for participants over extended periods of time (Kohtala 2016). However, conceptions and research on infrastructuring for such alternative spaces of design production are, according to Karasti (2014), as yet under-developed. A notable exception is found in the work of Seravalli (2012; 2014; 2017), who has explored infrastructuring as a process in a makerspace called "Fabriken". Describing the co-designing, establishment and running of the setting, she analyzes tactics for participant involvement in the space as well as the "participatory making of the space" as a form of infrastructuring. From this perspective, she identifies a shift that proposes to no longer understand makerspaces as fixed infrastructures for a defined use and community but as spaces for infrastructuring (Seravalli et al., 2017). Infrastructuring therefore not only addresses contemporary challenges of PD such as extended scope and timeframes, but also the blurring of roles and the fluidity of design and use.

Infrastructuring involves a constant renegotiation of roles and relations with diverse actors including stakeholders and community members, as well as environments and *things*, framed in flexible timespans and the given resources (Hillgren, Seravalli & Emilson, 2011). The renegotiation of roles and relations has been further explored by Agid (2016, p.81) in the context of "relational practice", underlining that the designer's situatedness is "critical for how we approach infrastructuring" and potentially complicates creating the relationships necessary for "building and engaging with various infrastructures". In this perspective, the important role, but also the corresponding responsibilities of the designer to design for infrastructures that enable social and material engagements among the participants, gain attention.

Infrastructuring in itself can be understood as fluid and dynamic structure enabling participation, in which people and their actions cannot be reduced to terms such as 'user' and 'use' (Jegou & Manzini, 2008; Hillgren, Seravalli & Emilson, 2011). In order to enable unexpected use and participation, Allen, Agrest and Ostrow (2000, in Telier, 2011, p.173) argue that, "an infrastructuring strategy must not only pay attention to how existing infrastructures condition use, but in doing so, at the same time also deliberately design indeterminacy and incompleteness into the infrastructure with unoccupied slots and space left free for unanticipated events and performances yet to be". A challenge for the designer(s) is thus to critically consider one's own position and in addition keep a future concept or space open, particularly if the future user is unknown, to enable infrastructuring as design-in-use.

In this context, it is important to distinguish the temporal difference in "project time" vs. "infrastructure time" (Karasti, Baker, & Millerand 2010) in reference to the concept of "continuing design in use" (Henderson & Kyng, 1991).). "Continuing design accounts for the continuity of functionality of the infrastructure, to ensure that a working system is in place all the time" (Karasti et al., 2010, p.406). In a similar matter, Pipek and Wulf (2009) consider infrastructuring in a technology development context as the process in which a design is appropriated in use, and thus neglect a strict separation between the two. Therefore, a strict separation between design and use is not useful when aiming to sustain participatory infrastructuring because it "is not only a matter of how the design is appropriated in use" but also of how it enables the relevant actors to continue their activities and enhance their skills and knowledge (Bødker, Dindler, & Iversen, 2017, p.267). The continuation of user activities based on skills is particularly interesting when comparing early PD, in which skilled users contributed to the future design of artifacts, with contemporary PD, especially infrastructuring, in which gaining skills through participation is emphasized more strongly (Huybrechts et al., 2018). This underlines the importance and role of skills in developing and designing for successful processes of infrastructuring in PD.

In summary, this conceptualization of infrastructuring illustrates the important role of the designer while being situated in the context, as being reflective about their designerly activities, which influence infrastructuring as a process. Further, the social and contextual aspects, such as the different types of participants and their participation, as well as material considerations and external aspects, also inform infrastructuring. The elaboration above therefore demands further research into instances of (social and material) infrastructuring, such as alternative spaces of peer production, which will be examined in the following.

[3.1.3] Changing participants' (designers' and users') roles in extended PD

In infrastructuring, the diverse spectrum of participation is particularly obvious, as designer/user roles become blurred and change over time. The wide variety of participation is impacted by, for instance, different social, material, infrastructural and personal aspects. Likewise, infrastructuring is shaped by designerly, social, material and spatial aspects. Some of these aspects can be addressed by design, for example, by designing tools, methods and processes that acknowledge the diversity of people with differences in skill, representation and power (Keshavarz & Mazé, 2013). However, if we aim to design for long-term participation, two main aspects need to be considered. First, participants' social experiences, which inform infrastructuring, need to be accounted for, as do their skills development, informing possible continuation beyond project time. Second, the material or designerly aspects have to offer a dynamically adaptable structure, to be redefined as "use time for supporting emerging activities" (Seravalli, 2012, p.54) and thereby sustained as "infrastructure time" or design-in-use. Infrastructuring is still also a constantly emerging area of research, and aspects of temporality influencing participation in particular are proposed as a field for future research (Botero et al., 2019).

As noted above, PD tools, methods and processes aim to enable a sharing of knowledge and to equalize the influence on the design outcome among all participants. Therefore, skills and knowledge can be understood as strength to allow for informed and reasoned decision-making, and influence participation by using (or refusing to use) an object in a specific way (Bratteteig & Wagner, 2014). According to Robertson and Simonsen (2012, p.5) "participation" in PD means to "investigate, reflect upon, understand, establish, develop, and support mutual learning processes as they unfold between participants in collective 'reflection-in-action' during the design process". Similarly, Ehn (1993, p.62) underlines the importance of shared understanding in informing creativity and design: "the origin of design is in involved practical use and understanding, not detached reflection, and design is seen as an interaction between understanding and creativity". Therefore, mutual learning and a shared understanding and reflection among designer and user is an essential key criterion for participation, and subsequent PD processes (Robertson & Simonsen, 2012). However, participants' skills

also need to be considered, as these play a different role in extended PD contexts and in regard to participation over time.

For this reason, designers need to identify and develop suitable means for facilitating successful, long-term participation, enabling skilled participants. The broad spectrum of participation illustrated above thus requires new means of facilitation, and a new openness towards what the object of design can be (Brodersen, Dindler & Iversen, 2008). A great amount of PD research hence focuses on the means for doing design, including methods, tools and toolkits (Brandt, Binder & Sanders, 2012), as well as other socio-material factors conceived of as designed and, indeed, considered the primary object or product of PD (Björgvinsson et al., 2010). PD research and practice has thus focused on supporting participants in "making, telling and enacting aspects in future design" (Brandt et al., 2012, p.145) with different processes, including design games to stage participation (Brandt, Messeter, & Binder, 2008; Eriksen et al., 2014). "PD relies on accessible and shared methods, reducing the boundaries to participation posed by differences in skill, expertise, and ownership" (Mazé, 2007, p.151). The focus of PD has thus shifted from the traditional end-product of design to the means of fully involving participants in participatory processes, taking into account their skills and abilities.

Early PD explorations of participation and skill, especially related to technology development and computer systems at the workplace, have emphasized skills as being essential for participation (Ehn, 1988), and hence, to date, skills have played an important role in PD (Smith & Iversen, 2018; Galliers et al., 2012). When describing skills, Ehn (1988) distinguishes between the different types of tacit knowledge as a sensual experience, meaning knowledge by familiarity, and formalized or automated tacit knowledge, represented by the social competence of making judgments learned through, for example, experience or guidance from someone more skilled. The research on skills in PD, in particular how skilled workers participate in traditional PD workshop settings (e.g. Ehn, 1989; 1993), has evolved towards developing a great variety of tools and methods for successful facilitation with a wide variety of participants. Ehn (1988, p.369) points out that "designing for skill should be a fundamental aspect of work-oriented design of computer artifacts", concluding that computer artifacts should support and further develop workers' skills. He refers to highly skilled workers, comparable to craftsmen, and the different types of skills required for achieving professional expertise, such as "instrumental work skills and social interaction competence" (Ehn, 1988, p.454).

Therefore, designers have to reconsider how design processes, especially in PD, enable participants to become skilled actors, encouraging them to develop and deploy their skills within and beyond the PD process. Recent research in infrastructuring contributes to this perspective, advocating designing for skills and focusing on the "intangible outcomes of design, such as new skills, insights and a reflective stance towards technology" (Smith & Iversen, 2018, p.14). One way in which infrastructuring can potentially enable users with skills as an outcome of their participation is elaborated by Huybrechts, Dreessen, and Hagenaars (2018). They discuss how skills, knowledge and participants' abilities can be developed in infrastructuring processes and the related challenges. Birk (2017, p.777) has further elaborated on "infrastructuring the social" in Danish marginalized communities, concluding that "the potentials for subjective transformation—the acquisition of new skills, new knowledge, and new ways of being in the world" lie there. These authors all propose the potential of designing and infrastructuring for enabling participants with skills and abilities to obtain greater agency and involvement in PD contexts that extend the expectations of short-term workshops.

Infrastructuring has been acknowledged as an especially suitable approach for enabling participatory processes and participation over time. For example, in their case paper on a recycling station in Malmö, Seravalli, Eriksen, and Hillgren (2017) describe infrastructuring as a suitable "open-ended and iterative approach" to be introduced by the design team, but adopted by the core team to address the complexity and context-dependency of this public service space. Infrastructuring can further be considered a process fostering the "long-term involvement of participants" (Huybrechts, Dreessen, Hagenaars, Brynskov, & Carvajal, 2018, p.80). Scholars acknowledge that participation constantly develops according to changes situated in the context and its actors. Hence, they further identify the challenge that designers in such long-term infrastructuring contexts are asked to address in issues of future self-organization beyond providing designed tools and processes: that of enabling participants with capabilities to continue independently (Huybrechts et al., 2018). However, the "many dimensions of the tools, roles, dialogues, and capabilities" are still addressed less in long-term participation endeavors and PD infrastructuring processes (Huybrechts et al. 2018, p.95). This further underlines the importance of deeply examining the designerly aspects impacting participation over time, and the skills and nuanced differences in use, impacting participants' interaction with tools, materials and the other people involved.

When aiming to enable long-term participation, a designed space needs to address the skills development of the participants and be open to these skills being applied during design-in-use. For enabling design-in-use, the designer has to be open to the object of design or "thing" to be determined by the user while in use. "One way of conceiving of objects as 'open' to participation is to think of them as easy or hard to access. Certainly, such a skill-based account is evident in attempts to make objects more accessible through low-tech or open source materials" (Mazé, 2007, p.146). The designer can thus, for example, support these skill-based openings of objects and enhance participation by following design approaches such as "open design", "half-way" products, DIY, DIT, peer production or hacker, activist and craftivist movements (von Busch, 2007; Hirscher, 2013). Mazé (2007) even considers hacktivism as a way of illustrating power, by enforcing openness through the activity of hacking an object. However, alternative spaces of peer production are not equal to a single artifact; they cover an entire space with a community of participants, which change over time. Therefore, infrastructuring as a process that encompasses the whole context, including the social, material and spatial considerations, is a suitable means to design for long-term participation in makerspaces. If makerspaces are designed as instances of infrastructuring, they can be redesigned by participants and designers alike, and changed by the skills, knowledges, tools and materials brought in.

[3.1.4]
Participation
(as skillful acts of use)
becoming design

As identified above, a key aspect to deep (and long-term) participation are participants' existing skills and knowledge. In early PD, these are often referred to in the context of mutual learning as key criteria during the collaborative process. This can be exemplified by enabling a "master-apprentice relation in a double sense", in which designers gain insights from highly skilled users and vice versa (Ehn, 1988, p.377). Roles (designer and user) are assigned by associating specific skills with them. However, this clear role distinction becomes blurred when PD contexts extend to new environments in which the participants might be more skilled than the designers. This underlines the importance of recognizing participants' existing skills, their skills development and how this informs participation and acts of use, as well as extended PD processes and beyond. Therefore, I seek to elaborate in this dissertation the types of participation in relation to the different types of skills required for such extended PD contexts. In other words, when PD extends beyond short-term workshops, participants' interaction with

tools and materials, but also with other participants, requires different types of skills, as well as confidence.

In expanding the activities of users towards extended forms of use, and opening designs, environments and processes for participation, designers also share responsibilities with users. This is especially evident in alternative spaces of peer production, as these spaces claim to offer skills-based use and design activities, which reach beyond making and designing objects towards facilitating spaces for peer production (Seravalli, 2014). Framing participation as skillful acts of use embeds the premise that participation is based on skills informing use. Participation as skillful acts of use can therefore include caring for a common space and supporting associated activities and values by sharing skills (Toombs, 2016; Toombs, Bardzell, & Bardzell, 2015). Consequently, it was important to distinguish in Section 3.1.1 the different types and extended forms of use that are often grouped together. While performing an act of use, a user is to a certain degree shaping and influencing the final design (Dittrich et al., 2002). Dittrich et al. (2002, p.124) point out that this is an important issue for PD, as it highlights design for change and "brings into focus issues of coordination between use, design in use and adaptation and development". This is particularly interesting when comparing early PD, in which skilled users contributed to the future design of artifacts, with extended PD, especially infrastructuring, which aims for long-term participation.

In this respect, not only the object of design is changing in PD, but also the roles and processes of the designer, and how they can enable skillful participation. For instance, Lee (2008, p.31) describes this with examples from practice, defining challenges in the PD process that need to be addressed by reconsidering "the roles of designers (design developer, facilitator and generator) in order to achieve user participation in design". Pihkala and Karasti (2016) further articulate a necessary reflexive engagement from the designer's perspective in participatory design and technology development contexts. This means being aware of the negotiation of roles, goals and technology in contexts in which "the customary roles of designer and user are sometimes questioned, and participation does not conform to the familiar understandings, methods, tools, and techniques" (Pihkala & Karasti, 2016, p.21). Pihkala and Karasti (2016) conclude in their study that participation should be understood as being "always-in-negotiation" among all the actors involved. They acknowledge a limitation in relating participation to predefined roles, as in their perspective, participation is about becoming a participant through negotiating relationships and fostering a "variety of participations beyond preset roles" (Pihkala & Karasti, 2016, p.28). These scholars discuss a perspective in which users host a more active role as co-designers and pro-active participants, merging roles and tasks with those of the designers.

In the next step, this skillful participation can become closer to design, to potentially support sustaining PD projects. For instance, Iversen and Dindler, (2014) who look at ways of sustaining PD initiatives, propose that "it becomes important to consider not only what happens during the project, but also what happens after the project has ended". In other words, enabling participants to change their role and participation from passively enacting a pre-designed use towards actively designing, when changing an object or "thing" and its use to better fit their current need, is relevant for project sustainment (Iversen & Dindler, 2014). For this change in role and participation to happen, participants require specific skills and confidence to create "meanings that are so original that they become similar to designing" (Bredies et al., 2010, p.159). These skills help participants move beyond preset roles towards skillful participation and impact on their agency and confidence in what they are able to do.

When participants (designers and users) make, design and produce together over a longer period of time, the traditional distinction into roles of "designer" and "user" is questioned. This creates certain design dilemmas, such as the blurring of the terms design and use, as well as the blurring and negotiation of roles (user/participant/designer), depending on the users' abilities. Particularly evident are the negotiations in alternative spaces of peer production that require new tools, methods and approaches to address and support users in their changing role towards becoming designers and/or producers. These peer production spaces also require more specialized skills and knowledge for operating tools and machines. Unlike short-term PD workshops, in which materials include easy-access tools such as play-dough or cardboard prototypes, extended PD contexts require different skills. Therefore, participation as skillful acts of use becomes more important and needs to be addressed differently.

The literature dealing with extended PD explores processes for designing in groups of people ranging from communities to publics and spaces for peer production, which broadens the scale and temporality beyond the original workplace context (Robertson & Simonsen, 2012). However, for these extended PD contexts, new and different participant skills are required, which enable them to take more responsibilities, possibly beyond the research project's duration. Therefore, PD requires further research on the designerly approaches enhancing the development of different types of skills during the PD process. For this reason, the next section explores selected studies from peer production research to investigate and learn from them how matters of participation, skills development and changes in roles in such spaces are discussed and approached.

[3.1.5]
Skillful participation in alternative spaces of peer production

Participation in alternative spaces of peer production is often discussed as being directly related to the acquisition of practical skills to empower participants/makers towards greater independence (Lindtner & Lin, 2017) from market dictated consumption patterns (von Busch, 2007; Kohtala, 2016). Through "making" products, skills are practiced and enhanced by learning through the process and by making with others (Toombs, 2016). Therefore, these spaces are also considered learning environments for technical skills development (Kolko et al., 2012). However, sustaining them in social (community participation and skill-sharing) and material (financial, tools and spatial) matters (Toombs, 2016; Foster, 2017) depends on the community members and their skillsets.

One important claim driving the "maker culture" is whether what they refer to as "making" is considered as benefiting people by enhancing their manual skills in building, disassembly and repair (Mellis & Buechley, 2014; Kohtala, 2016). Making is about creating material products, as opposed to DIY activities, which can encompass making but also amateur practices that include nontangible results such as repair. "DIY is commonly used to describe the act of creating, producing, modifying or repairing something that lies outside of one's professional expertise. It's based on a notion of self- reliance and self-improvement through the acquisition of new knowledge and skills" (Mota, 2011, p.283). In summary, both descriptions embrace skills to realize the desired result, be it a new product or repairing /redesigning an existing one. The development and application of skills are thus an essential ingredient, motivating making and repair practices.

Skills in communities of peer production are further considered highly important for developing a "maker identity" and participants' agency, which helps participants feel connected to the respective community and thus contribute to its sustainment (Toombs, Bardzell & Bardzell, 2015). When members have special skills, they can develop an identity related to these skills but also care for others by transferring them (Toombs, 2016). Similarly, in spaces emphasizing only practices of repair, the sharing and learning of skills are crucial for becoming a member of the community. "Skills

and knowledges of repair are assembled and shared between fixers and participants, in ways driven by shared motivations and affective connection" (Houston et al., 2016, p.1409). Hence, different types of participant skills are crucial in fostering and developing making activities, including the participants' agency in being able to contribute to the community by sharing their skills with others.

For this reason, alternative spaces of peer production can be considered learning environments for "making" skills. For instance Tanenbaum et al. (2013, p.2609) note that makerspaces provide physical infrastructures for "practitioners to learn from one another, collaborate, and share projects". In this respect, Kolko, Hope, Sattler, Maccorkle, and Sirjani (2012) conducted a study on informal learning and technical skills development in their PD- and maker-/hacker-inspired "Hackademia" project. Through their research, they aimed to address the lack of interplay between skills, emphasized through the predominant model of higher education being strictly discipline oriented, claiming that "this narrow sense of expertise is ultimately tied more to identity than aptitude" (Kolko et al., 2012, p.129). Their study offers insights into learning in an environment similar to makerspaces and describes how learning occurs through discovery and exploration, motivating "learners to develop self-directed, creative problem-solving skills" (Kolko et al., 2012, p. 131). In essence, alternative spaces of peer production offer means for developing and sharing making skills in a social environment.

In addition to learning new skills, participants' values and the interest in contributing to a community and sharing skills are motivating reasons for participating in making activities. This has been investigated by Grimme and Bardzell (2014) under the notion of empowerment, through an interview study in the US. They discovered three themes: the first, the empowering of *oneself* as allowing "the maker to reject a passive consumerist subject position"; the second, the empowering of *others* by teaching and inspiring peers; and the third, the empowering of the *making communities,* contributing by "sharing tools, resources, networking, and collaboration" (Grimme & Bardzell, 2014, p.4). These three themes also offer certain conclusions regarding the reasons for participation. Examples of these are personal values, contributing and being a member of a community, and sharing and gaining skills and knowledge. The listed reasons are yet to be researched in depth, as depending on the type of space and the promoted activities, participants differ, ranging from technological affine hackers to craft-interested DIYers. Therefore, the roles, responsibilities and participant groups and their motivations vary.

This also indicates that it is challenging to generalize the reasons for participation in terms of sustaining such communities, because most research is:

> *"(...) only focusing primarily on documenting the practices of individual hackers rather than the emergence and sustainment of the communities in which these practices take shape. Because of this individualized focus, the extant body of research lacks the explanatory power to investigate how these communities succeed and thrive (...)."*
> (Toombs, 2016, p.1)

This results in a challenge and the question of sustaining such peer production spaces, financially as well as participant-wise (Seravalli, 2012; Toxler, 2010). Hence, there is a call for further research beyond specific communities, exploring the contextualizing factors that drive and sustain such communities (Toombs, 2016). Maintaining and sustaining such a community requires labor, skills, knowledge, and sociality, in order to care for others and the space (Toombs, 2016). In addition to skills and knowledge, Toombs, Bardzell, and Bardzell (2015, p.8) highlight that the "member's abilities to care for one another" are essential for the "continued success of these communities." One major aspect of care is identified as sharing skills among members, hence illustrating the link between developing and sharing skills, and the social and material considerations of sustaining the space.

Nevertheless, each of these spaces is different and fosters distinct "making" activities, situated in local contexts. Therefore, Toombs (2016) pointed out the need to research beyond individual hacker identities and single spaces. In the multitude of possible makerspaces, we need to start looking at the different types of and reasons for participation, such as developing and sharing skills, and how these are acted out. Then we can address the unanswered question of how to sustain such spaces and participatory design initiatives that are struggling with similar matters (Iversen & Dindler, 2014). Further, little research has yet been dedicated to specifically exploring and articulating types of skills informing the "mechanisms of skill-sharing and educational practices in these spaces and their impact on questions of access, inclusion, and empowerment" (Foster, 2017, p.9). Different types of participant skills are considered a crucial element for enabling such makerspaces to function. By sharing these skills the abilities of other participants also expand. For this reason, my research will investigate in detail the types of skills practiced and shared in a makerspace and connect these to the social and material consideration, shaping participation and the spatial infrastructure.

[3.2]

Summarizing the program frames

This dissertation explores matters of skillful participation and infrastructuring in terms of designer and user roles in the context of extended participatory design (PD). This focus also identified a neglected area in the literature, which motivated a crossing over of PD and peer production discourses, to discover new learnings. I thereby identify infrastructuring as a bridge between these two bodies of research and examine the fluidity of roles (designer/user), exemplified by infrastructuring in alternative spaces of peer production. These extended PD contexts thus benefit from infrastructuring and designerly considerations that acknowledge the important role of skills, and for which participants require different types of skills compared to short-term PD workshops. In contrast to a workplace PD context, the roles and responsibilities of the participants in extended PD are different, as communities driven by personal motivations and values have a different power distribution. This outline provides the program for my dissertation in which the three experiments are facilitated.

Through the interplay of theory and practice I discovered that the PD literature lacks detail on relevant types of skills and their impact on the depth of participation. Consequently, I consulted the literature on peer production research to investigate the role of skills in such spaces. As both strings of research provide rather little detail in this matter, I began to study how they deal with the motivations and reasons for participation, the different strategies and values with which the spaces or projects were built, and how these guided participants towards meaningful participation. In this literature analysis, I especially considered the different aims and understandings of the terms "design" and "use" in PD discourse, which evolved from design for future use, towards design-in-use. I contrasted this with the general idea of personal fabrication in which the product is entirely designed and made by a single user fulfilling their personal needs. In the following paragraphs I thus summarize the literature above and present my interpretation of it in relation to the experiments.

My three experiments (i.e. M*ake{able}*, *Makershop* and the *Co-sewing café*, (which are presented in Section 2.3) can be defined as makerspaces offering an open, collaborative workshop space formed by its individual participants and purpose (Kohtala & Bosque, 2014). They were intentionally designed to attract a diversity of participants, underrepresented in traditional technology-driven hackerspaces

and makerspaces (Carstensen, 2013; Fox et al., 2015), addressing different age groups, female participants and refugees. I chose to refer to the term makerspace as any kind of collaborative workshop space (Kohtala, 2016) not necessarily emphasizing technology and innovation but bridging different means of craft production. I further consider them community-based PD, because the participant communities are bound by a shared interest and practices around the specific topic of sewing, upcycling and clothes making. These spaces are less informed by traditional workplace hierarchies, which I think further influences people's motivation to participate and the general perspectives on use. Furthermore, questions of identity and skill influence hierarchies and the distinction into roles, creating a rather unclear spectrum which needs to be better understood in order to address the overarching research question.

PD projects that expand in scope and timeframe require a deeper level of participation and participants' skills to take over, for example, the responsibilities of the former design researchers who initiated the project. This is especially evident in instances of infrastructuring, such as Fab Labs, hackerspaces and makerspaces, which indicate that use is open to be determined by the participants. As a consequence, the role of the participant is also open. As an example, a participant may visit once, create an artifact, or visit several times and thereby appropriate a space and its infrastructure. Furthermore, the participant could even commit to taking responsibility for sustaining the space. These unknown types of participation enabled in spaces for infrastructuring are thus further blurring and complicating the dichotomy of designer and user, illustrating the problem of reducing the design and use spectrum to two fixed categories and roles.

As a result, from my study of PD literature in comparison to the experiments, I propose looking beyond roles, otherwise research tends to remain preoccupied with individual identities, occupation, and demographics when designing within extended PD. As mentioned above, in traditional PD, the design process is about envisioning "use before use" (Redström, 2008). However, use is interpreted differently by the user and by the designer, especially when considering use and appropriation over time. This is particularly evident in alternative spaces of production, in which a participant may act as a user but also as a designer. Therefore, I consulted selected literature on peer production and further deepened my understanding of infrastructuring. This informed the premise here, in which infrastructuring is considered as designed, not dissimilar to an unfinished object of which the final use is "undetermined" (Redström, 2008). Makerspaces as infrastructuring can be treated as "objects" of design, in the sense evoked above, as dynamically structured processes that engage designers and users alike, regardless of who they are, and in terms of how they use the object (in this case, the makerspace) beyond its original form (design-after-design). This premise expands the understanding of users and use, as infrastructuring enables extended forms of use, beyond making and designing objects or *things,* towards different types of participation, such as facilitating makerspaces.

"For myself, I find sewing pretty difficult. But today that was very motivating, that's important for me. Especially, when it comes to the little tricks you learn here, like the rubber waistband I would have probably done it wrong without instructions."

[4] Results

RQ: [1] What happens when participants (designers and users) make together in extended participatory design (PD) contexts?

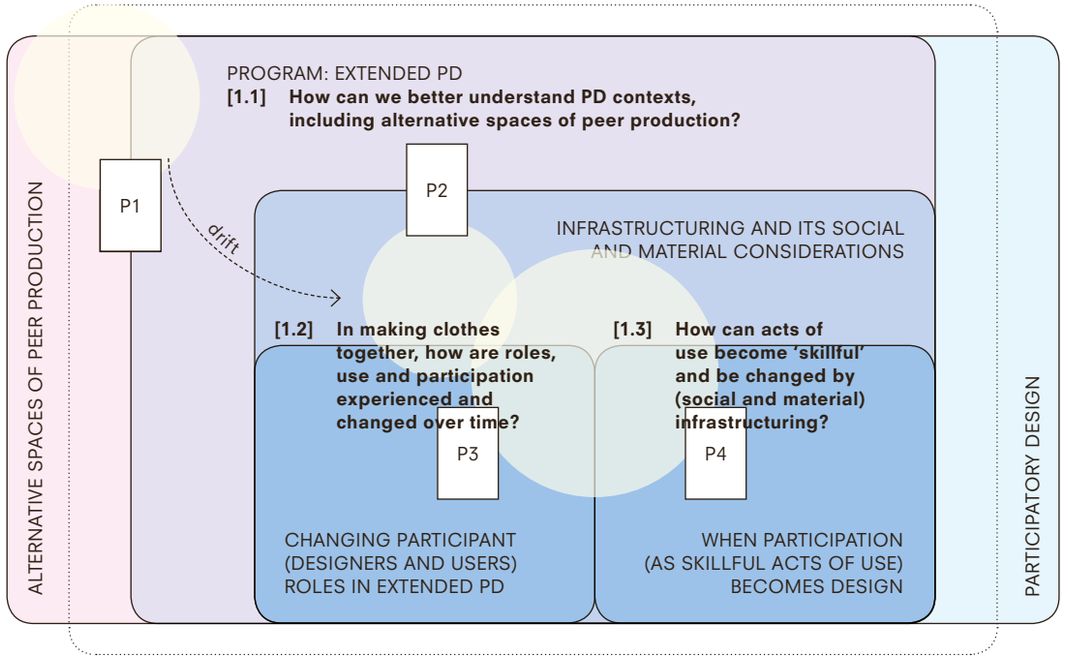


Figure 11
Relation of the research questions to the program frames, visualizing which articles best answer which research question.

This chapter presents the overall results, starting from the research questions, and ending with the summaries of my papers. The results of the papers will address the research questions articulated in Section 1.5, to enable formulating five overarching contributions, which provide insights into the processes and learnings that informed the articulation and main contribution: *when skillful participation becomes design*.

[4.1] Research questions

In order to recap the research program of this dissertation, in the following section I first elaborate on the research questions and their relation to the program frames. Through the interplay of theory and the three practical experiments, supported through the methodology described in Chapter 2, I have illustrated how and where the knowledge was produced. In this section I thus demonstrate in detail the discoveries made through the research and specifically acknowledge which results in the papers answer the research questions formulated below. Figure 11 hence illustrates the overall research program, comprising the relation of program frame to the experiment and the respective research questions, which are addressed by different papers. Each paper has individually formulated research questions, and consults the literature, and might be broader in scope than that of this dissertation.

P	Article	Authors	Context	EX	RQs
1	Social Manufacturing in the Fashion sector: New value creation through alternative design strategies? *Journal of Cleaner Production.* Volume 172.	Hirscher, A.L., Niinimäki, K., Armstrong, C.,	Sustainable Fashion Design Sustainable Production and Consumption Social Manufacturing Do-it-yourself & Do-it-together Participatory Design User participation in design activities Value creation	EX 1 Make{able}	RQ 1 RQ 1.2
2	Socializing Value Creation Through Practices of Making Clothing Differently: A Case Study of a Makershop With Diverse Locals. (2019). *Fashion Practice,* Volume 11 Issue 1.	Hirscher, A.L., Mazzarella, F., Luke, A.	Sustainable Fashion Design Sustainable Production Makerspaces Designer / User Roles Social aspects in making Value creation	EX 3 Makershop	RQ 1 RQ 1.1 RQ 1.2
3	Stuff Matters in Participation: Infrastructuring a Co-Sewing Café. (2019). *Journal of Peer Production.* Issue 13.	Hirscher, A.L., Mazé, R.	Participatory Design Infrastructuring Peer Production Alternative spaces of peer production Use and Participation Stuff (Tools, Materials, Space)	EX 2 Co-sewing café	RQ 1 RQ 1.1 RQ 1.2 RQ 1.3
4	"Hey, I can do that too!" – Skillful participation thriving in a Co-sewing café. Under review.	Hirscher, A.L.	Participatory Design Infrastructuring Peer Production Alternative spaces of peer production Participation Skills	EX 2 Co-sewing café	RQ 1 RQ 1.1 RQ 1.2 RQ 1.3

Table 2
Overview of original research articles and their context in relation to experiment and research question.

Therefore, the research questions formulated in Section 1.5 specifically address the objectives of this dissertation and tie the findings of the four papers together.

[4.2]

Summary and results of the papers

This dissertation consists of four original research papers, which offer individual results and together form its contribution. These papers vary in their relevant audience (i.e. Sustainable Production, Fashion Design, Peer Production and the Co-Design community), type, context and depth of focus. Each paper is partly wider in focus and points in different directions and towards different audiences than the dissertation itself as a whole. This is because the research focus developed over four years of doctoral research and collaboration with different co-authors. The papers are listed in chronological order, and illustrate the deepening of focus over the course of this research. P1 and 2 are rather broad exploratory papers, investigating the designer-user relationship in the context of sustainable fashion making. P3 and 4 dive deeper into the PD literature with inputs from selected areas of peer production,

elaborating user participation with the lenses of stuff and skills. To provide an overview, this chapter begins with Table 2, which summarizes the papers by listing their titles, co-authors, contexts and experiments and discussing the research questions. This is followed by four brief summaries and the compiled results of each paper, which are attached in full length at the end of this dissertation.

[4.2.1]

Paper 1: Summary and results
Social manufacturing in the fashion sector: New value creation through alternative design strategies?

Paper 1 is a broad, exploratory paper that studies, in the context of design and sustainable fashion literature, the consumer's role and opportunities to become more active in the design and production process of garments, and to generate value for themselves and others beyond the product. Through this perspective, the paper aims to tackle certain problems of the linear fashion scheme, which is currently driven by fast, cheap and low-quality production that fosters easy disposal or replacement, due to low product value for the consumer/user. The concept of social manufacturing is defined as reflecting on the user role in production processes. Social manufacturing is understood as a democratic approach that opens up the design and manufacturing phases for everyone (Shang, Liu, Xiong, Cheng, Ma & Nyberg, 2013) to investigate new user roles and proposes new perspectives on value creation in an "ethical economy". Through the analysis of literature and two sets of data, the paper expands on the types of value that are created in social manufacturing through opening the design and manufacturing processes with alternative design strategies.

This paper thus contributes to the dissertation by exploring the new roles of designer and user and the value created when users design and make clothes together. It further identifies possible design approaches allowing user involvement in the design process. These alternative design strategies in fashion are identified as DIY, DIT and participatory design (PD). The paper is based on two sets of data from two different sources. One source of empirical data consisted of focus group interviews conducted in Finland and the US provided by my co-authors. My part of the data utilized Experiment 1 - *Make{able}*, which is explained in further detail in Section 2.3 on page 66.

With the insights generated through the literature and data analysis, the paper looks at value and value creation through the lens of the social production phenomena (Benkler, 2006), in an ethical economy. Social production refers to concepts that are "self-organized, emergent, bottom-up" and "not primarily motivated by monetary concerns" (Arvidsson, 2008, p. 326), similar to the values and motives driving, for example, DIY and DIT makers. The value generated through such initiatives is referred to as intangible (not measurable in monetary terms) and thus difficult to share equally (Arvidsson, 2011). For identifying and analyzing the data regarding such types of value, the paper proposes an alternative value framework for social manufacturing which comprises six types of value chosen and defined for the analysis on diffuse social manufacturing practices. These are namely: social, knowledge, experiential, emotional, environmental, and economic value.

As a result, P1 demonstrated that alternative design strategies such as PD, DYI and DIT offer the designers a new role, in a post-industrial design and production context. Designers are asked to rethink design processes and to move towards activating and co-designing with users to collectively generate diverse types of value, beyond the product. This offers wide potential and diverse roles for the designer to organize local peer production spaces for collaboratively making clothing with the end users. Experiment 1 –*Make{able}* – illustrated how designing a workshop concept with "halfway" garments opens up the design phase to users by involving them prior to the wearing of the garment. The user actively co-designs and

co-creates value while learning how to design and make garments themselves, supported by the designed workshop context and the "halfway" product design.

Further, the paper concluded that these alternative design strategies offer an opportunity to create different types of value such as social, knowledge, experiential, emotional, environmental, and economic value. The value is created through creative social experiences shared with others, creating knowledge and new skills in garment production or a deeper emotional attachment to the garment, because it was made with one's own creativity, skills and time. Economic value and business model generation were not analyzed in depth, as the paper aimed to contribute on a conceptual level. The paper emphasized the role of design strategies and encouraging designers to find new ways to combine DIY and DIT approaches to foster new creativity and collectivity among the participants, creating strong, deep learning experiences.

[4.2.2]
Paper 2: Summary and results
Socializing value creation through practices of making clothing differently: a case study of a makershop with diverse locals.

Paper 2 is also a widely framed conceptual paper, which starts with an introduction to the problem of the current fashion industry and offers a new perspective through elaborating on the concept of value in regard to diverse exchange economies of fashion (Hirscher & Fuad-Luke, 2013). These alternative exchange economies put people — not only designers and other professionals but also amateurs and citizens — at the center of new modes of money exchange and intangible forms of value such as time, skills, knowledge, and other types of resources (Arvidsson, Bauwens, & Peitersen, 2008). The paper further emphasizes, like P1, a new and active role for the consumer/ garment user. We stress in this paper that alternative practices of clothes-making activate people to get involved in the making of their own clothes, contributing to increased awareness of the authorship, origins and processes behind garments, while overcoming the need and desire to consume with more creative, personal and social experiences (Chapman, 2005). This perspective highlights the potential of disrupting the traditional passive role of the user (using a ready-made garment), and replacing it with an open, collaborative and active role as value creator (von Busch, 2007; Niinimäki, 2011).

Building on the literature elaborating on the movements in the broader context of sustainable fashion and the "maker culture", complemented by the alternative value framework from P1, this paper (P2) explores the socializing aspect of collaborative value creation. For this reason, it further distinguishes the types of value into individual, community and societal value. These distinctions were defined and elaborated in Experiment 2 — *Makershop* (see 2.3 page 66) with diverse locals in Bolzano, Italy. In the paper, we define diverse locals as citizens living locally for a long time in a locality, or economic migrants and refugees who have recently arrived. Experiment 2 focused on practices of making clothing differently, as alternative forms of exchange, in and beyond the market, offering a counter-narrative to how clothes are predominantly made and simultaneously generating intangible value beyond the product. The experiment further emphasized artisanship as a skillful method for more meaningful and sustainable design, production and consumption. By introducing the term "social making", the paper describes such practices as being grounded on new forms of multicultural and multigenerational exchange and value creation among "diverse locals", who design and produce unique clothes while sharing (traditional) skills, ideas and patterns. The expression "social making" emphasized the "social" aspect of collaboration and production at a local level. The types of value identified were adding and differentiating the proposed alternative value framework from P1 by looking at value from an individual, community and societal perspective, emphasizing the social and well-being aspect of co-creating value through social making.

As a result, the paper discusses in detail the different types of value generated in the experiment, addressing distinctive scales from the individual level towards societal dimensions. These types of value highlighted new relationships between existing actors and new stakeholders, many based on sharing resources, time, skills, and open-source patterns. The individual value in this paper was seen as comprising, for example, the knowledge value of gaining skills, and certain aspects of social value, such as building new friendships. The variety of value created gave expression to the potentiality of alternative exchange models, adding value to otherwise non-remunerated forms of exchange in a society. The paper further showed participants' appreciation of these newly developed relationships as societal value. With this result, the study proposed "social making" as a means to experiment with matters of social cohesion and integration, by valuing people for their diversity of skills and knowledges and unexpected contributions to a community. The framing of the experiment showed that diverse locals were willing and primed to become active users, designing and making clothing, while blending and hybridizing their skills and cultural knowledge among locals and newly arrived people.

In Experiment 2 — *Makershop* — we demonstrated, as design researchers, the multiple roles (i.e., entrepreneur, facilitator, enabler, innovator, and activist) that are relevant for enabling participants to co-create value beyond garments. We thus conceptualized opportunities for independent designers to develop their own networks in local communities, working as catalysts for new enterprises and creating alternative forms of value and exchange. However, in-depth elaboration on the potential for business model generation or making this a viable reality in the contemporary economic system was beyond the scope of the paper and of this dissertation.

[4.2.3]
Paper 3: Summary and results
Stuff matters in participation: Infrastructuring a Co- Sewing Café.

This paper (P3) closely examines theories from three different areas of research, namely PD in particular infrastructuring, peer production and social practice theories. This is supplemented with a very detailed analysis of tools, materials and spatial considerations from the third experiment — the *Co-sewing café*. The paper starts by acknowledging that people's ability to design for themselves is increasing, supported by a growing number of alternative spaces of peer production. These spaces are considered the object of inquiry, where the ways in which people participate and use these spaces, and the emerging roles of designers and participants, can be investigated.

The paper combines the different literature to build a conceptual framework that is used to analyze extensive empirical material gathered while initiating, running and researching Experiment 3, over 18 months. This allowed exploration and definitions of concepts important for understanding how acts of use and participation can be articulated in relation to the social, material and spatial aspects of "infrastructuring". The concept of infrastructuring is traced in literature and framed to investigate the social activities and skills as well as the materials, tools and space that are integral to alternative spaces of peer production.

For the analysis of the empirical materials collected, Shove and colleagues' (e.g. Shove & Pantzar 2005, Shove et al. 2007) analytic categories derived from social practice theory were useful. The categories of "stuff" (materials), "skills" (competences) and "images" (meanings) expanded the unit of analysis in design research to include larger and longer practices of participation (de Jong & Mazé, 2017). Participation included multiple, varied and changing practices of using space (*Co-sewing café*), spatial arrangements including furniture, materials, tools (sewing machines and equipment), interaction

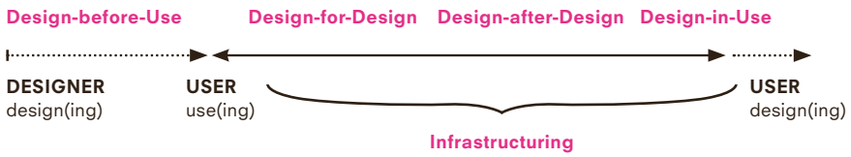


Figure 12
My interpretation of concepts referring to acts of designing and using, in which nuanced and active relations articulate a spectrum between the polarities of design and use.

with materials (fabrics, threads, etc.) and participants' skills development. These categories were set in relation to the spectrum of use and design, forming a conceptual framework to articulate and analyze use and participation in the *Co-sewing café*. The framework enabled us to present the evolving interaction between skills and stuff to better understand the composition of as well as the changes in use. The tables and figures throughout the paper illustrate and combine findings from the literature and the experiment, for example in Table 2, and the types of use activities and competencies that can develop over time and with practice (i.e. learning). Table 3 offers a comprehensive inventory of the stuff, in relation to skills and acts of use, supported by several rich accounts and insights into key events or activities documented in the *Co-sewing café*.

To better understand the renegotiation of roles in infrastructuring, in this paper I established a nuanced description of different types of use and possible changes in use over time. I analyzed different terms (see Section 3.1.1 page) and clarified, related, interpreted and elaborated their relations conceptually and visually and towards one another and over time. This resulted in a demonstration of changing, emergent and unexpected use over time, and how this generates new relations to existing stuff and even the introduction or creation of new stuff (i.e. infrastructuring) by designers or participants. This interrelation demonstrates in detail what happens when use moves towards design, along a spectrum spanning design and use (see Figure 12). Figure 12 combines my interpretation of the terms reviewed in the literature with my results from the analysis, informing my understanding of participation as "acts of use" following Redström's "RE:Definitions of Use" (2008). Through Redström's argumentation, acts of using can be understood as more nuanced and active relations spanning the polarities of design and use.

This paper shows that in the context of peer production spaces, participants' roles are influenced by acts of use, understood as participation along a spectrum with two polarities: design and use. Extending PD's formulations of design and use, the *Co-sewing café* explored use and using in depth and in relation to larger and longer social practices, thereby elucidating nuanced and varied types of use and participation beyond the dichotomies of "designer" and "user".

This further supports the finding that focusing on user roles tends to remain preoccupied with individual identities and demographics. Instead, I propose framing participation in terms of acts of use to enable articulations of more nuanced types and changes (including learning) along a more fluid design and use spectrum of activity. Through the literature, the paper defined evident types of use such as *operation, maintenance, adaptation, appropriation,* and *management.* These were elucidated through the *Co-sewing café* materials, manifested through participants' use practices and the frequency of participation. These types of use were articulated in relation to the way in which people use or interact with the space, its tools and materials, making the *Co-sewing café* their personalized

own. The types of use, in reference to the type of stuff, provided an insight into the level of skills and engagement of the participant and the roles (*beginner, regular, expert, facilitator*) they attune to or change over time. Through the analysis of detailed reflections on key-events, interrelated change mechanisms building on learning over time, were illustrated.

The role of the designer was seen as designing and enabling a flexible space (i.e. the *Co-sewing café*) – designing for infrastructuring that attunes to a spectrum of possible participations. Infrastructuring is argued to be a bridging concept, connecting research fields to address use and participation at different scales. The different types of participation are changing the *Co-sewing café's* social, material and spatial conditions, through skillfully using or interacting with the café. For instance, if someone brings additional tools, supports others in their sewing activities, or asks for their own key to take responsibility for facilitating workshops, this is considered infrastructuring or design-in-use.

[4.2.4]
Paper 4: Summary and results
"Hey, I can do that too!": Skillful participation thriving in a Co-sewing café

The fourth paper (P4) builds on the findings from P3 and deepens the understanding of participation as "skillful acts of use" by tracing notions of skills and skills development in the PD and peer production literature. The findings from the literature are complemented with results from analyzing the materials generated in Experiment 3 — the *Co-sewing café*. The paper looks in detail at the role and development of skills in extended PD contexts: for instance in community-based PD or peer production settings, growing in scope and timespan. Based on the PD literature, the paper states that skills are highly important for a democratic design process, enabling everyone to participate and skillfully use tools and methods. PD has dedicated a considerable number of studies to exploring tools and methods to facilitate PD processes. However, relatively little focus has been devoted to the different notions of participants' skills and their development. This gap has been identified not only in PD, but also in the literature discussing extended PD settings, such as alternative spaces of peer production.

This paper hence explores types of participants' skills and skills development by identifying the notions of skills discussed in in early PD studies, which looked at workers practicing the skillful use of tools. The existing notions of skill found in this literature build the context to examine and iterate these through practice in an extended PD setting: Experiment 3 – the *Co-sewing café*. The café is considered a successful PD experiment, continuing beyond the project time. By combining the findings from the literature with practice, a nuanced understanding is developed, emphasizing the important role of skills in sustaining participation. These findings aim to contribute to the understanding of participation as "skillful acts of use", which could address the challenge of sustaining participation in extended PD contexts such as peer production spaces.

As a result, my proposed understanding of participation was iterated towards "skillful acts of use", to explicitly acknowledge the users' abilities in the description. These skillful acts of use underline the importance of articulating nuanced differences in skills, to shed light on the blurred design and use spectrum in infrastructuring. Understanding participation as skillful acts of use, and not emphasizing a role perspective or who the participants are, allows a more in-depth view of their skills development, and how different types of skills are interrelated with the way in which people participate. Therefore, the paper (P4) concludes that skillful acts of use are not only enabled through the designers providing tools or methods for participants to "perform experience beyond words," (Telier, 2011, p.163); they are also informed by highly skilled users. This underlines the fact that research on extended PD

and infrastructuring in particular should understand participation as skillful acts of use, and address the emerging and unexpected use over time. This is reasoned because the identified types of skills need to be understood in relation to each other, interlinked through a process of constant learning over time.

The relevant notions of skills found in literature (*manual* or *technical skills*, *social skills*, *creative problem-solving*) were explored through the *Co-sewing café* to elucidate explicit nuances relevant for this specific context. Notions such as *facilitation skills* and *upcycling* as a *design skill* were acknowledged as important for running and maintaining the *Co-sewing café* over such a long period of time. The study showed that the identified types of skills need to be understood in relation to each other, interlinked through a process of constant learning over time, which was identified through in-depth accounts of practice. These additional types of skills and their interrelation offer possible perspectives to address particular challenges of extended PD and infrastructuring today, such as emphasizing skills development during participation. The explicit types of skills, such as *upcycling* as a design skill, are of course context specific. Upcycling also illustrates a bridging element and a motivation for participants to continue developing this skill. In this particular case, the concept of upcycling could be seen as triggering a shared interest or issue reasoning sustained participation.

The paper demonstrated that differentiating among types of skills can elucidate the ways in which participants actively engage with a space and its activities, but also offers insight into the process of specific skills development. The materials collected suggest that terms are missing in the related literature. They further propose possible perspectives that could be adopted to address the particular challenges of extended PD and infrastructuring today, such as emphasizing skills development during participation. In the *Co-sewing café*, participants started by following proposed procedures, but quickly developed manual skills towards more independent working and started changing the infrastructure by bringing additional tools, changing the arrangement of the space, or requesting access via their own key, to better fit their current needs. The opportunity to personalize the *Co-sewing café* and share responsibilities such as facilitating workshops with skilled participants enabled sustaining participation and the café beyond the project's duration. In this case, fostering skills development as part of infrastructuring enabled participants to make changes to the space and its way of working towards design-in-use.

"Before, I tried to learn sewing by video tutorials, but in real life, this is a completely new experience. One can learn from the others and their experience."

[5] Contributions

This study contributes to PD research and beyond by elucidating the interactions among designers and participants in extended PD environments. The changing roles of designer and participant and the spectrum of use, participation and design were explored through several RtD experiments and the literature reviewed above. In order to offer concise answers to the research questions, this chapter reveals the key findings in relation to the overall research question with three specific sub-questions. At the end of this section I summarize and discuss the main contributions and their impact on specific research fields and practice.

[5.1] Answering the research questions

[1]
What happens when participants (designers and users) make together in extended participatory design (PD) contexts?

When PD extends beyond workplace environments to communities, the scope and timeframe also extends. In the dissertation, this development is defined as extended PD and illustrated by local, peer production spaces. These spaces open design and production processes to everyone, thus posing new challenges for design, as they question the traditional allocation of roles such as designer and user. This creates certain design dilemmas, which were identified in literature and practice as blurring the roles of designer and user, becoming more fluid. This means that the roles people attune to can change over time, making it more difficult to distinguish between use(r) and design(er). Instead of separate and distinct categories, I understand design and use as acts of use along a spectrum of participation in design and production processes. This spectrum spans a variety of types of use, based on different levels of participation, influence or decision-making power in the design process. This dissertation clarifies and develops this spectrum based on terms identified in the PD literature, which I relate to each other and to practice. Through my experiments, I was able to test and distinguish nuanced differences between the different user-designer relations and complete and iterate these along a design and use spectrum. The definition of this spectrum, spanning the polarities of design and use, is illustrated by the blurring of roles. Through examples from practice, it shows how types of use become closer to design when participation is understood as skillful acts of use. Hence, the phrase: *when skillful participation becomes design* refers to the observed process and changes in participant roles and skills over time, moving along the spectrum spanning design and use in extended PD contexts. The spectrum clarifies this fluidity by illustrating nuances through practical examples and provides means for articulating what happens when users and designers make and produce together.

[1.1]
How can we better understand extended PD contexts, including alternative spaces of peer production?

Since the early industrial PD contexts, PD's agenda has extended to more open and public settings, including more diverse participants and larger or multi-sited, long and temporally distributed contexts, which can look like and operate similarly to the setup of alternative spaces of peer production. This dissertation therefore defines extended PD as a specific area of research that implies a change in focus and context of application towards communities, organizations and neighborhoods or alternative spaces of peer production. In such contexts, design and production are opened to people not trained in design, and thus have to enable and allow for specific types of design, such as design-for-design and design-after-design. These terms emphasize that in extended

PD, not only designers do design, but through the context and the social and material aspects combined, users start to participate in ways that are skillful and closer to what could be considered design-in-use.

In practice, this means that in extended PD contexts, design should allow for stuff (i.e. tools, materials and space) to emerge, change and materialize over time through changes in context or participants' types of use. This conception requires designers to rethink design processes as they affect use and participation by designing spaces that are flexible, open to unexpected and skillful acts of use. Through the literature, this conception was identified as infrastructuring in PD. Infrastructuring is particularly useful in bridging short-term participatory workshop conceptions with larger and temporally extended PD contexts, such as alternative spaces of peer production.

One of the experiments presented in the dissertation is exceptionally longer than the majority of PD projects, and thus provided a great amount of systematically collected materials for analysis. These materials enabled contributions to research on extended PD, from a practice perspective, as they offered long-term documentation and robust evidence of such instances. The results provided insights into the many different types of social, material and designerly considerations impacting such extended PD contexts, and allowed for articulations to better describe the detailed matters of participation. For instance, the comprehensive documentation of stuff in the third paper (P3) in relation to the abstractions from literature (i.e. the spectrum spanning design and use) established categories that provide terminology to describe participants' development processes. These include the participants' value of skills development, and the sharing of roles and responsibilities among all participating actors. This further enhanced the participants' experiences of taking responsibility, for instance facilitating their own workshops, and taking ownership of the *Co-sewing café*.

[1.2]
In making clothes together,
how are roles, use and participation
experienced and changed over time?

I investigated through literature and experiments how people participate in spaces for making clothes together. These spaces aimed to activate users to take part in designing and producing their own clothes, thereby offering new experiences that can change use and participation in such contexts over time. Design can inform use and participation by designing spaces that are flexible and open to unexpected and skillful acts of use. This can be called designing for infrastructuring, for example, creating environments that attune to a spectrum of possible participations over time. However, infrastructuring also further blurs the roles of the designers and opens a spectrum on which design and use become more fluid and can change over time.

This dissertation thus provides evidence of the changes in participants' roles and experiences through the exceptionally long third experiment, the *Co-sewing café*. By extracting notions from the literature and elaborating on these in reference to my materials from practice, I showed how use and participation are changing, emergent and unexpected, and develop over time. This phenomenon documents the blurring and fluidity that occurs when designers and users make and produce together. The participants' experiences and motives for participation were greatly diverse, resulting in unexpected types of participation and different types of value generated and gained. Their experiences were mainly identified as value in terms of gaining skills and knowledge and by establishing and defining the term "social making" in the second paper (P2). Therefore, I recognized social and knowledge value as the main motives for participation. However, certain experts such as experienced dressmakers, or a local sewing machine repair expert came for different reasons, and thus changed the *Co-sewing café* in unexpected ways.

Participants' roles changed and developed from *beginner* to advanced *experts*, allowing the association of these with different kinds of material and tool engagements, ranging from *operating* to *managing* to *designing*. This was seen in, for instance, the participants who took over responsibilities and became workshop facilitators, taking ownership of the space. In other words, I conclude that focusing on user or designer roles tends to remain preoccupied with individual identities and demographics. In such extended PD contexts, this hinders the change and development process of the participant, if we only design for fixed roles. Instead, the results advocate designing for skillful acts of use, acknowledging unexpected use through skills and knowledge brought in and developed by the participants.

To articulate and analyze use and participation in an alternative space of production, in the third paper (P3), a conceptual framework was developed. This was complemented by establishing descriptive and nuanced categories as acts of use (i.e. *operation, maintenance, adaptation, appropriation, management*) which were set in relation to design. This framework allowed me to present the evolving interaction between skills and stuff and to better understand the composition of, as well as the changes in, acts of use over time. These changes in acts of use also impacted participants and made them take different roles based on their skills development. The participants' skills development is documented in the fluidity that enables them to move between the nuanced categories, which are articulated along the design and use spectrum. The skills acquired and practiced in these kinds of spaces need to be understood in relation to each other and interlinked through a process of constant learning over time. For instance, a *beginner* first has to learn *manual* sewing skills (i.e. to *operate* a sewing machine), then potentially improve and practice their *social, facilitation* or *upcycling* skills. Through the context of making clothes together, skills development could be documented by relating different types of skills to certain tools and techniques. In comparison to complex technology-based hackerspaces or Fab Labs, participants could make clothes with a more familiar repertoire of technical equipment. Further, I, as a facilitating designer who experienced and learned the materials and processes as well, could observe, identify and compare types of participation and skills development in relation to familiar materials (e.g. fabrics, threads, zipper etc.), tools (sewing machines, scissors, iron etc.), workshop concepts and facilitation techniques. The participants relatively quickly became familiar with the overall workshop concept and process, as making clothes together using household sewing machines and other basic tools built on potential former knowledge, nevertheless situated and simplified in a social setting.

As the participants changed their participation through, for instance, learning new skills over time, the *Co-sewing café* also changed. The changes took place through the new roles that these participants took, and their skillful acts of use, which were infrastructuring the space and its processes. This occurred through for example, the participants' own way of facilitating workshops, or requesting additional tools or instructions for more independent work, or adding new equipment and materials to the café, which they considered beneficial for the space, themselves and others. The interrelation of skills and participation as a change process over time is illustrated in Figure 13 below. It shows how skills and acts of use are interrelated and develop through learning over time. In addition to stuff matters, and design impacting infrastructuring, this interrelation develops many unexpected, skillful types of participation that constitute certain aspects of social and material infrastructuring.

This dissertation showed that a sole focus on user or designer roles tends to remain preoccupied with individual identities and demographics. Through detailed documentation in practice, various types, patterns and exceptions to describing types of use were articulated in relation to the rather general formulations found in the literature. These descriptive terms

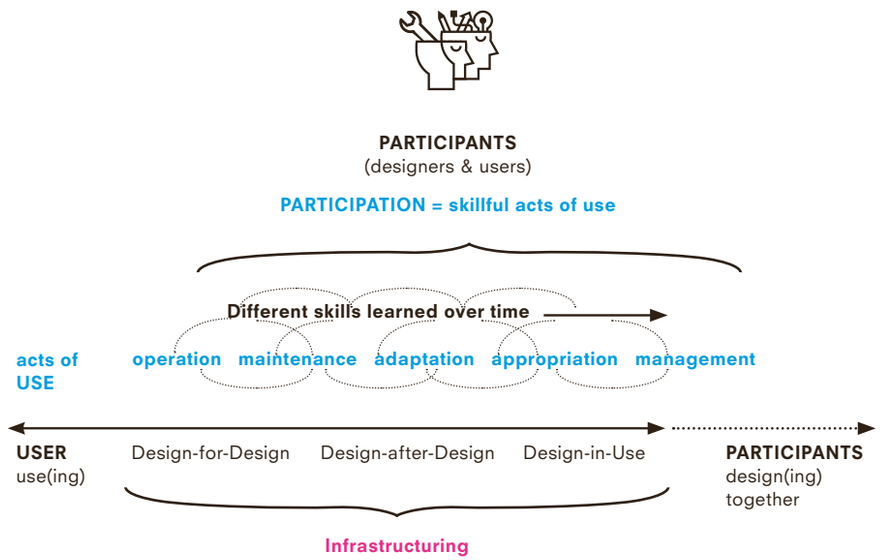


Figure 13
Progression of skills learned over time, interrelated with acts of use, constituting participation as skillful acts of use. This interrelation develops over time and thereby informs infrastructuring.

allowed documenting participants' activities beyond identity and roles (designer/user) and analyzing their participation on the basis of what they are able to do. In other words, an act-based perspective that understands participation as skillful acts of use opens the negotiation of roles and the attached responsibilities to every participant. Participation is in this case considered a development process that influences the many different roles participants attune to or change over time. Participation is therefore understood as "skillful acts of use" depending on the users' level of competences and skills, and these skills impact stronger or weaker types of participation.

[1.3]
How can acts of use become "skillful" and be changed by (social and material) infrastructuring?

Participation is framed as skillful acts of use, to enable articulation of more nuanced types and changes (including learning skills) along a more fluid spectrum of activity spanning design and use. In order to better articulate the nuances influencing participants' agency to move between the polarities of design and use, I developed, in the absence of existing literature and terminology for PD and peer production, different notions of the skills relevant for this specific context. Framing participation as skillful acts of use allowed me to understand these nuances in relation to the way in which people participate, depending on their skills and abilities. The different types of users changed or developed their roles towards stronger or weaker types of participation, based on their skills (including learning). This also impacted the social, material and spatial conditions of the alternative space of peer production (i.e. infrastructuring). Looking at my design practice and infrastructuring through the lenses of stuff and skills illustrated how these aspects are interrelated in terms of participation (i.e. skills inform types of use). From an "introspective design" position, my particular sensitivity to materials allowed a deep focus on the role of materials, but also a shift of focus towards spatial and immaterial aspects such as ownership and access (i.e. a key providing access). The explicit differentiation among types of skills elucidated the ways in which participants actively engaged with a space and its activities, but also offered insight into the process of specific skills development. Combining an "insider" design perspective through RtD experiments, with systematically collected and analyzed materials, enabled a more nuanced and deeper understanding of different types and reasons for participation (i.e. motivation and skills development over time), contributing to current discussions raised in extended PD.

Tracing terminology in literature, but also testing and clarifying it with the detailed materials collected through the experiments, enabled documentation of the interrelation of stuff use, and the introduction or creation of new stuff (i.e. material aspects of infrastructuring). Infrastructuring was thus identified, to describe the evolving process and nature of designing in such contexts and with very diverse participants. Infrastructuring bridged two research fields both facing challenges when roles and the spectrum of design and use become blurred. These contexts deal with use and participation at different levels, and therefore require designs and design processes that offer flexibility to participants' different and unexpected acts of use. The role and interrelation of skills and stuff in infrastructuring became very important from a design perspective, including a shifting of focus towards spatial aspects and flexibility. I aimed to foster skills development through designing a flexible infrastructure, to enable participants to make changes to the spatial and material aspects towards design-in-use. This means that the different types of participation (i.e. skillful acts of use) documented in the *Co-sewing café* were infrastructuring the *Co-sewing café's* social, material and spatial conditions. These skillful acts of use included participants sharing knowledge about tools (e.g. sewing machines) and processes (e.g. cutting fabric based on a pattern) with others. Such participation enabled design-in-use, resembling workshop facilitation and continuation of the *Co-sewing café* beyond the project's duration. These types of skillful participation also became increasingly closer to my activities as a facilitating designer, thus also changing the context in unexpected ways (i.e. social aspects of infrastructuring).

For practice, this underlines that designing for such extended PD contexts means designing for skillful acts of use, when users might have more, or different skills to those of the facilitating designer. In other words, the designer has to recognize the variety of skills practiced and developed by the participants and nourish these skills through an infrastructure designed to allow for changes in participation over time. This is exemplified in the case of Naser, the young dressmaker, who was very skilled in clothes-making, and was thus very soon able to host his own workshops. He however also required additional tools, such as multi-lingual posters or a key to access the space. Another example is Mr. Kraft (a 92-year-old late repatriate from Russia) who brought skills and tools to maintain and repair the sewing machines, constantly increasing our collection of sewing machines and workstations (i.e. material aspects of infrastructuring). These examples illustrate that designing for social and

material infrastructuring presented opportunities for participants' skills development, but also made the *Co-sewing café* their own personalized space. This flexibility can enable a sharing of responsibilities such as facilitating and hosting workshops by skilled participants towards design-in-use.

For the designer, this implies a change in their role over time, as they have to adjust to the skills required in the setting and aim to share and teach these to the participants. This could be, for example, starting to recognize reoccurring patterns in the workshops that enhance independent working of the participants, and then support these with designerly adjustments (e.g. adding labels to the materials or providing a shared key to very skilled and engaged participants). These brought to light material aspects of infrastructuring, which are not that clearly articulated in literature, such as the aspect of the key, highlighting the physical space and the regulations and responsibilities assigned to it as greatly impacting infrastructuring.

These designerly considerations aim to nourish skills development and encourage a sharing of responsibilities among very different participants to potentially endure over time. Nevertheless, this also provides the designer with a learning process, in learning to let go and to develop means for handing over responsibilities. This requires openly sharing and negotiating the values that informed the design of the peer production space, and potentially adjusting these to the given circumstances, participants' ideas and requirements, and local opportunities.

[5.2] Summarizing the contributions

The different experiments, in particular Experiment 3 – the *Co-sewing café* – explored and confirmed that in new forms of local peer production, the role and practices of design are also changing. The three experiments provided a great amount of systematically collected materials. The long-term study of the *Co-sewing café* in particular offered grounds for closely examining and documenting practice to relate the findings to concepts from the literature. Hence, this dissertation offers unique insights into changes in roles and skills over time (documented through the interrelation of stuff and skills), contributing to selected areas of design research and practice and illustrating the formulation: *when skillful participation becomes design*.

Elucidating the fluid spectrum spanning design and use

Interrelating the conceptions of design and use identified in the PD literature with a considerable amount of material documented through practice offers a contribution to PD research and beyond. The descriptions and instances formulated from practice elucidated the fluid spectrum spanning design and use. The described fluidity became especially evident in the context of designing for and in new forms of local peer production. Developing categories and nuanced typologies, based on combining findings from the literature with insights from practice, enabled the development of the spectrum spanning design and use. Based on the materials collected, I was able to systematically articulate what happens between the different phases and the participants moving in this spectrum. In other words, I revealed its fluidity by documenting fine differences in participation, and changes in roles over time. When relating the spectrum to infrastructuring, I further presented what this fluidity means for infrastructuring processes. I documented what happens when participants develop skills, attune to new roles and thereby impact the designed infrastructure. These changes influenced the participants' types of use and roles, but also showed the social, material and designerly considerations as infrastructuring.

Social and material considerations of design and infrastructuring

Developing categories and typologies through literature with practice exchange established more nuanced articulations regarding the fluid design and use spectrum in infrastructuring processes. These articulations did not only confirm the notions of infrastructuring found in the literature, using detailed analysis from the experiments; they also developed and revealed finer differences, adding more detail to existing notions of infrastructuring. For instance, the very systematic analysis of stuff provided, designed and emerged, elucidating details not yet recognized. Stuff emerged and changed, not only by design but also by participants' engagements, bringing to light stuff that I was not aware of, but that showed change mechanisms. For instance, a very skilled participant asking for a key to the *Co-sewing café* brought into focus the important aspect of the space and responsibility for it, as part of infrastructuring. These discoveries emerged through the detailed categorization of stuff and skills, enabling deep insights into the social, material and designerly aspects informing and constituting infrastructuring in such extended PD contexts.

Changing participants' (designers' and users') roles over time

In practice, this proposes that designing for and within peer production spaces demands being open and flexible to many types of participation and neglects designing for predefined identities and roles. The types of participants and their participation was recognized in this research as a development process, which influences the roles they attune to or change over time. As an example, I articulated categories of participants in terms of stuff and skills, which allowed me to illustrate in a diagram how participants' roles changed from, for example *beginner* to *regular* to *facilitator*. This categorization was the result of my evidence from the experiments, which I related to different kinds of material engagements called extended forms of use, such as *operating*, *managing* and *designing*. The experiments, especially the long-term *Co-sewing café*, allowed me to trace this over time, with hundreds of different participants. In addition to participants who were regulars or workshop facilitators, we also had surprising, unexpected participants, such as a local sewing machine repair expert from the neighborhood, and an experienced dressmaker asking for a key to the space to offer his own opening hours. Being aware of these different types of participants and their very different skills required means of design for all the participants to acquire, perform, share and learn different types of skills. This included the designers learning to let go and encourage the sharing of responsibilities over time.

Participation as skillful acts of use

This dissertation provides evidence from practice that an act-based perspective helps us understand changes in participants' roles and types of participation when framed as acts of use, determined by skills. This result contributes to extended PD research and suggests a reconceptualization and broadening of traditional PD or co-design perspectives on roles. I propose understanding participation as skillful acts of use, to enable and emphasize a more differentiated perspective and reflection on participants' skill (development and practice) during participation. This viewpoint is further elaborated by connecting the scarcely articulated concepts of skill found in the PD literature with evidence from practice to better understand participants' skills development processes. Tracing notions of skills in PD literature and beyond enabled the articulation of different types of skills (i.e. *manual*, *social*, *facilitation* or *design* skills) which were formulated in relation to the analysis from the experiments. These categories highlighted the development and becoming of

participants. This means that not all participants start as *beginners*, but that there are different types of participants, and that these types can change on the basis of the different types of skills they practice or develop over time. Of course, not all participants become *facilitators*, but the spectrum spanning design and use helps to document nuances in participation, such as participants moving between the interrelated categories. Nonetheless, generally, the frequency of participation increases manual skills and an independent making process. In the absence of existing literature, this detailed investigation into how participants' skills impacted their participation and the development of the *Co-sewing café*, is elaborated in the fourth paper, which aims to contribute to this neglected area of research on extended PD and proposes further strings of investigation.

When skillful participation becomes design

The above described spectrum and the categories of types of skills and types of participants enabled documentation of the change mechanisms along the spectrum, revealing the way in which people participate. The findings elucidated through the investigation of stuff and skills that the interrelation of these affect users' skills development and the resulting types of participation. With these established categories, I was even able to document how certain change processes took place in relation to infrastructuring and the stuff provided. This offered surprising insights into the specific types of skills relevant for the given context but also confirmed that skills are not static; that they are interrelated and develop through different social, material and designerly aspects. Analyzing participant categories in regard to their skills highlighted a certain underestimated reasoning for participation, which impacts design processes and infrastructuring for and within alternative spaces of peer production. This discovery was expressed by participation being understood as skillful acts of use, which over time can potentially become design. Skillful participation is hence informed and changed by infrastructuring processes and vice versa. Therefore, the expression "*when skillful participation becomes design*" illustrates the interrelatedness and changes over time which impact participation along the fluid design and use spectrum, when *making clothes together*.

"...from materials that you would otherwise throw away, or that perhaps wouldn't otherwise be used, to create something new, something really new, something really like a designer. Well, that's really more than upcycling I think its like setting a new trend."

[6] Conclusions

In the context of post-industrial design and production, I set out to closely examine what happens when designers and users are jointly engaged in making clothes together in alternative spaces of peer production. The diversity of participants attracted to such spaces reflects the diversity — and unexpectedness — of the types of participation. The diverse range of participants offers great potential for investigating how participants and designers work together and negotiate aspects of design and use and the roles they attune to, and how they develop skills and share responsibilities over time. However, a close user-designer relationship, as emerged in what I term "alternative spaces of peer production", also poses certain questions and design challenges.

These challenges are, for example, the blurring of roles in the intersection and renegotiation of design, use, and participation. For further investigation into this matter, I chose PD as my principal point of reference, explicitly looking at literature that deals with the extension of PD towards new forms, spaces and community contexts. Selected literature from peer production also supported this investigation when PD lacked detail. This was the case, for instance, when describing the types of spaces or the development of skills through participatory activities. In order to investigate these challenges, the research set out to examine what happens when participants (designers and users) make together, and thereby blur predefined roles. The blurring of roles creates a spectrum of change and diversity in participation, which I elucidated through the lenses of stuff and skills. This spectrum enabled me to further study infrastructuring and the interplay between the social, material and designerly aspects proceeding over time and their impact on types of participation.

I researched this broadly set objective using a programmatic approach, in which the main research program was defined as "extended PD", bridging the literature and discourse on PD and peer production. In this program, specific frames deepened the focus and explored, with three research through design experiments, the processes of designing and making clothes together. By designing and making together, I refer to the garment user opening up the design and production process to participation and offering local spaces and means for jointly engaged making. I identified the design approaches and movements that emphasized user participation, such as PD, DIY, and DIT.

When I began this research, it was situated in the scope of traditional PD and sustainable fashion research. However, thanks to the unique opportunity to execute three different design experiments, the study deepened and drifted towards finding new methods, established new articulations and explored the aforementioned emerging challenges faced by extended PD. Especially through the third, long-term study of the *Co-sewing café*, I was able to contribute to extended PD discourse. My study is different from traditional PD experiments, which are often confined in space and time, host only a selected group of people, and are arranged under specific expectations. Through this relatively fixed situation, the challenges in extended PD are less likely to be addressed, whereas my systematic study across three different experiments documented what happens if these pre-conditions are more open to development guided by unexpected social, material and contextual aspects.

Through these three systematically established, documented and analyzed experiments I developed categories, typologies, and even nuanced articulations to provide a new, detailed understanding of fluidity when participants and designers negotiate roles and responsibilities. Of course, on a day-to-day basis, the experiments seem to offer the same activities as any other traditional PD research context, but the extensive amount of time and materials collected provided evidence for the identification of robust patterns and categories that started to emerge over time. Through a total of about 60 workshops with hundreds of participants, I collected rich materials such as design diary notes, observations, photographs, and audio

recordings of qualitative interviews. The structured analysis of these posed specific questions led me to emergent conceptualizations of stuff (i.e. tools, materials, spaces) and skills. The evolving interdependence of the emerging stuff and skills guided my understanding that participation in such contexts is better understood as acts of use informed by skills.

This dissertation identifies five main contributions, which are listed in Chapter 5. These contributions offer substantially documented insights and descriptions elucidating the fluid spectrum spanning design and use. This spectrum can also be adapted and iterated for further investigation in related contexts. It illustrates that participants perform acts of use, which change over time. This change is to a great extent impacted by skills, and therefore I propose understanding participation as skillful acts of use. In addition, I showed that in practice, designing in alternative spaces of peer production should emphasize design for skillful acts of use, and not participant roles (i.e. designer/user). Hence, infrastructuring was considered a relevant notion that explores and recognizes nuances and changes in design, participation and context over time. In such instances of extended PD, I propose that skillful participation is a development process that can approach designing. Over time, participation, as skillful acts of use, is changing along the spectrum spanning design and use, towards design-in-use.

These findings suggest that, in extended PD contexts, the roles and acts of use and design become more fluid, moving along this spectrum spanning the two terms design and use, which were formerly seen as polarities. In the spaces in which designers and users work, design and make together, these polarities no longer accurately label the roles designer/user. Instead, the spectrum aligns a variety of descriptions such as design-for-design, design-after-design and design-in-use, which aim to describe the relation between design and use in the evolving use practices in different contexts (e.g. Ehn, 2008; Telier, 2011; Dittrich, Eriksén, & Hansson, 2002). I used this terminology, adapted from PD discourse, and applied it to the analysis of my experiments. This enabled a serious exchange of what have previously been rather theoretically entrenched terms, applying them to practice. As a result, I developed nuanced descriptions of the participant development along this spectrum. Figure 10 presents the spectrum, which was further related to my analysis of emergent stuff and skills. In consequence, P3 developed a conceptual framework supporting research that contributes to both multidisciplinary theory-building and the practices of designers and others working with alternative spaces of peer production.

The results of the analysis on stuff and skills developed a better understanding of the change mechanisms influencing participation as acts of use, understood as being skillful. This identification complements other research on PD, infrastructuring and interaction design, proposing an act-based perspective (Redström, 2008; Telier, 2011). My results agree with what Redström (2008, p.410) calls an "act-based account" that focuses on "what it is people do rather than who they are with respect to a design process". Moreover, a definition of roles (i.e. user/designer) neglects changes over time, as illustrated in this research. Therefore, this study further supports Redström's position (2008, p.411) that "describing such complex processes that take place over time on basis of terms such as 'designer' and 'user' might not only be difficult but potentially also misleading for design methodology". Whereas Redström's work is rather philosophical, my research contributes by providing evidence from practice and adding further nuances and specifications to the general formulations. My study also underlines unexpected and emergent occurrences, such as highly skilled participants who would be undervalued and mislead the participatory process if not recognized for their abilities.

Other researchers of PD and infrastructuring have come to similar conclusions, also supported by insights from their practice. As one example, Pihkala and Karasti (2016, p.28) state that "the comfort of roles, such as user, designer, or researcher, was problematized as they acted to hide, restrict, and neglect the dynamics of participation in practice". These authors see participation as "becoming", through a constant negotiation of relationships among those involved in the process (Pihkala & Karasti, 2016). Participation as becoming offers a similar description to my finding and main contribution; that participation in extended PD contexts is a development process over time and can proceed towards facilitating or continuing design activities.

The systematic analysis of the long-term *Co-sewing café* experiment contributes to extended PD research, entering new contexts such as peer production. My findings add to Seravalli's (2014) work, not only in regard to methodology but also by elaborating and providing details on notions of participant-designer interaction in similar, long-term infrastructuring processes. She formulated aspects for designers to consider when engaging in participatory processes for the opening of production. In regard to her programmatic approach, she proposes that design researchers look before and beyond their design interventions, towards moving from short-term experiments to longer lasting engagements (Seravalli, 2014). This extension of timeframe is crucial for further developing how experiments are influenced and taken up by others involved (Seravalli, 2014). In this respect, the long-term study of the *Co-sewing café* provided an experiment that was conducted over an exceptionally long period of time.

My results from practice further support the recognition of participation as becoming and developing over time. This becomes particularly evident in alternative spaces of peer production and thus widens the perspective from a technology and interaction design-situated PD context towards community-based PD. The research contributes to this discussion by describing in detail how the roles of the different participants were negotiated and changed fluidly. Consequently, I agree with DiSalvo, Clement and Pipek (2012, p. 203), who state that in community-based PD contexts "the classical distinction between (professional) 'designers' and 'users' does not make sense anymore, neither does it make sense to view 'design' activities as separate from an ongoing practice". My contributions thus support this string of research through detailed documentation of the evolving process in which roles were negotiated and participation changed during practice. These discoveries answered the identified gap in literature, providing detailed descriptions of participants' skills development relevant for participation in extended PD contexts. For instance, the documentation on the interrelation of different skills and how these impact participation contributed to elucidating ongoing practice with nuanced descriptions of the different types of skills and participants.

The findings highlight the important role of skills and stuff in developing types of participation and changes in roles, and also emphasize that PD should renew its focus on skills and skills development. Through my "introspective" design perspective, I illustrated that the changes in roles and participation as skillful acts of use are influenced by social, material and designerly considerations (see e.g. Figure 10 and Figure 12). Therefore, the changes in roles can also be placed along this spectrum and illustrate the fluidity of these roles when, for instance participants start bringing their stuff, such as pincushions or providing examples (i.e. exemplary garments) as themes for workshops which they feel competent in facilitating. Participating *beginners* can become *regulars, participants, facilitators, local experts* and *designers*: I defined these distinctions myself but based them on a robust analysis that describes the acts of use in relation to stuff and skills. Therefore, I understand these terms and articulations as summarizing depictions, which offer a more nuanced variety and understanding, built on the participant's interactions with skills and stuff. I further want to underline that these terms are by no means fixed categories; they are intended to be fluidly taken, changed and developed by the different participants, thus not restricting them in their development process.

Further, this research offers significant implications for extended PD research, in particular infrastructuring. In infrastructuring, the blurring of roles is particularly evident and developing skills through participation gains stronger attention, especially in regard to sustaining PD initiatives beyond the "project time" (Huybrechts et al., 2018). Moreover, Huybrechts and colleagues (2018, p.95) have pointed out that still "many dimensions of the tools, roles, dialogues, and capabilities" are still understudied in long-term PD and infrastructuring processes (Huybrechts et al. 2018, p.95). Therefore, this dissertation contributes further to the social, material and designerly aspects of infrastructuring, which are still an emerging field (Bødker et al., 2017; Botero et al., 2019; Karasti, 2014; Seravalli et al., 2017). The detailed elaboration on the social and material considerations of infrastructuring, such as detailing the emerging stuff, and how different types of skills were developed, shared and practiced, are thus considered another contribution to these discussions.

Finally, this dissertation, through its experiments, illustrated the interrelatedness of designerly, material and participation matters. Bringing together the findings from the literature and the introspective design perspective and the systematically documented materials from different experiments allowed this research to analyze and articulate changes in participants' roles. As a result, what happens *when skillful participation becomes design* was articulated and illustrated using examples from practice.

[6.1]

Limitations

I am aware this research has certain limitations. The scope of this dissertation did not allow in-depth accounts of all the concepts addressed within and across multiple fields and disciplines. This is due to my attempt to cover two broad areas of research and to relate these to the substantially documented experiments. This might result in a slightly less detailed elaboration of the literature and a limited description of the experiments, but it nevertheless offers new insights into both practice and literature.

The validity and generalizability of the results are further subject to certain limitations. In RtD, the findings are not generalizable, as each designer and each research context are unique. However, they do allow for learning and adapting to other contexts (Gray & Malins 2014). In addition, the chosen methods are, as explained in Chapter 2, very context specific and subjective, which is common to RtD. Therefore, they take aspects of validity into account. Validity describes the credibility of the research findings in the given research context. I acknowledge that the mixing of RtD with qualitative research methods in particular might be subject to disagreement, as both methods belong to different strings of research. However, I believe this also offers certain openings. For instance, the systematically collected materials and the supplementary qualitative methods aiming to support aspects of validity. The two approaches complement the results by offering insights from different perspectives. Further, Gray and Malins (2014), following Lincoln and Guba (1985), propose using the term "trustworthiness" instead of validity and rigor in the context of RtD research. I agree with them, as they describe trustworthiness as entailing validity but also generalizability. I aim to enable trustworthiness in my results through transparency in documentation and by applying a systematic analysis process to the large amount of materials collected.

In qualitative research in general, the quality of research involves inter-subjectivity and negotiation (Gray & Malins, 2014). Therefore, there are always certain limits in the methods chosen. For instance, my observations are always circumscribed by my position and my researcher bias. Thus, as this research is so strongly influenced by the practicing design researcher, I have to acknowledge my researcher

bias. I recognized how my values and intentions have shaped the experiments and took the position of an "introspective designer" (see Section 2.1.2). I acknowledge that my values, aiming to address diversity, sustainability and shared ownership have influenced the design of the space and the workshop conceptualization. For instance, the environmental sustainability agenda limited the workshop themes to donated materials and to a certain degree imposed these values on the participants. Therefore, people uninterested in this subject would not participate and thus be excluded from the analysis.

I also admit to being influenced by my personal and professional background, and specific theoretical perspectives. For instance, in the long-term study of the *Co-sewing café*, my local language skills, including my regional dialect, seemed to create an immediate feeling of closeness with the local participants. Language barriers with the newly arrived refugees were partly overcome by using English and my colleagues' support, but also by jointly ideating designs and upcycling processes together with Naser, a dressmaker from Afghanistan. This collective ideation process, also used with other participants, truly reduced and made roles fluid, as I could see and negotiate individually with the participants on a personal level. This of course also meant that I brought my designerly knowledge and facilitation skills into close contact with the participants, but that I also just assisted them in making. I always pointed out to the participants that my clothes-making skills derived from being an experienced self-taught maker, aiming to reduce my expert/designer position. Furthermore, I had collected a great amount of workshop facilitation skills over the years and could thus easily see and assist people when needed, which was especially evident in comparison to the less experienced facilitators. Hence, this made it important to thoroughly document and account everything required and influenced by my facilitation. This included great personal learning experiences: for instance how much or little assistance to give participants to support them in developing their skills. Documenting these aspects from the perspective of an introspective designer enabled transparency and supported the rigor of the process in terms of researcher bias.

Other, general limitations in this research were the group of participants analyzed, the majority of whom were female, with the exception of the *Makershop* in Bolzano. In general, qualitative research is always limited by the people that do not participate and thus cannot be interviewed or observed, especially if they have opposing reasons or perspectives. Furthermore, the different locations of the experiments were acknowledged, but not deeply investigated as influential contexts (e.g. rural vs. city context). The scope and context of the experiments therefore allows contributions and conclusions in only a specific context, which should be broadened in future research.

[6.2]

Future research

This research raised several questions that require further investigation. For instance, recognizing the rather limited discussion on the role and development of different skills in PD and peer production research calls for further study, also in relation to the literature found in pedagogical learning theories. Therefore, I propose further iteration, testing and developing of the conceptual framework and exploring the spectrum in other contexts. Another issue is infrastructuring in PD, an evolving and emerging field, which exemplifies the fluidity of use and design informed by social, material and designerly considerations. Infrastructuring changes an infrastructure by skillful acts of use, and changes in user roles, but it is also impacted by the situated context. These aspects constituting infrastructuring are also evident but slightly different in related contexts, and thus offer a potential subject for future studies.

The amount of empirical material collected, and the continuation of the *Co-sewing café* beyond documentation time offers the

possibility for further, deeper analysis of temporal and sustaining aspects. I am therefore particularly interested in further investigating, based on already existing materials, how the *Co-sewing café* is sustained today, almost two years after the research project. I have continued to observe the *Co-sewing café* development and will use these materials in future studies, as this focus was beyond the scope of this dissertation. I am further interested to see whether the concept can be implemented equally successful in other cities and contexts. Hence, I share in the last chapter an epilogue: a reflection of my design process. This aims to provide insights into the development of the *Co-sewing café*, from ideation to implementation, and show the measures that I consider particularly important for handing over the concept to participants who become facilitators and workshop designers.

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[E] Epilogue: Reflections on implementing a Co-sewing café

I share in this epilogue the detailed steps of implementing the Co-sewing café to follow my own proposal of opening design to be adapted, changed and reinterpreted by participants and others involved. These insights are based on my learnings from realizing short-term as well as long-term co-sewing workshop environments. In addition to the three experiments elaborated in this dissertation, I have further shared my facilitation and workshop design experience in different contexts. Using the example of the *Co-sewing café*, I therefore list the detailed considerations, activities, contextual factors, and resulting design decisions taken, which were shared and negotiated during the process with the different people involved. These reflections on the process of implementing the Co-sewing café aim to potentially enable others, realizing similar types of spaces for sharing skills, knowledge, tools, materials and social interaction, to create valuable, social, learning experiences as well as unique garments.

The Co-sewing café was established in the context of a Real-World Laboratory (RWL) project, at the University of Ulm. Like other real-world experiments, the Co-sewing café tested sustainable production and consumption models in close collaboration with local citizens. From the beginning, the Co-sewing café was intended to continue beyond the research project. Therefore, several measures were taken to share ownership and responsibilities with local actors and participants. I will explain the detailed steps in this section, to open up the design and infrastructuring processes to interested others and to enable transferability to other locations and contexts.

In general, the café aimed to enable citizens to directly participate in the design and production of their garments. This objective shifted the role of the passive consumer/user towards that of an active producer/maker/designer. The concept was based on the assumption that if people get involved in the design and production process, they potentially take more responsibility for their actions as a consumer. This can then open up new opportunities for more sustainable clothing production and consumption (Fletcher & Grose, 2012). Hence, the design of the workshops aimed to enable participants to regain a better understanding of product quality and materials through learning new skills to enable them to design, modify or repair garments themselves (Fletcher & Grose, 2012). Design researcher and fashion (hack-)activist von Busch (2008, p.65) follows a similar line of argumentation; he sees participatory design (PD) workshops as an opportunity for collective enablement, as these workshops promote the exchange of experience, skills and knowledge. He sees this as a liberating experience for the consumer, as new skills are learned and shared together (von Busch, 2008).

Local context and conditions

Against this general background and motivation, the Co-sewing café was initially created as a real-world experiment emphasizing participation of local actors, such as citizens, local organizations and the municipality. The location of implementation – Dietenheim – is a rural context, in southern Germany, with a population of 6600. For contextualizing, it is relevant that the two initial housings for refugees were enlarged at the same time as we began the Co-sewing café. The municipality, like the whole region, is generally wealthy, with low unemployment rates. The city of Dietenheim is known for its textile history, but the majority of industry has moved abroad, and the inner-city has been left with several empty shopfronts. Furthermore, the city has a slightly higher migrant population than the surrounding average. In the course of research in the greater real-life laboratory project, a representative, quantitative survey of 1014 participants was conducted, evaluating the existing attitude and behavior of the inhabitants. In terms of peoples' educational levels, incomes, environmental awareness and monthly expenses for clothing, the results were comparable to the overall German population, thus allowing transferability to certain degree (Geiger, Iran & Müller, 2017).

Designing the Co-sewing café space

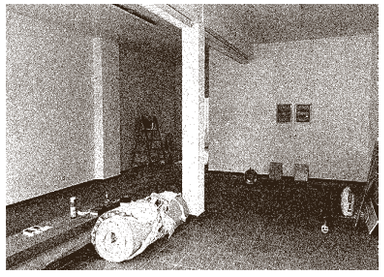
The kick-off for the Co-sewing café was a co-design workshop held in the city's town hall. Long-term residents were informed of this workshop by the local newspaper, a short lecture at the citizens' forum and a flyer. The municipality also contacted the local refugee support circle, with which close cooperation was established. In a team of three colleagues (Samira Iran, Britta Stegen and myself), we organized a visit to the weekly refugee café with a lecture and flyers in four languages (English, German, Persian and Arabic). The language skills of my colleague Samira Iran allowed us to present our very vague idea of a crafting/sewing community to a diversity of people. Through personal contacts and presentations, we managed to gather around 30 interested citizens and refugees for this first co-design workshop at the town hall. With this group of people we ideated and worked out a rough concept and topics for the future real-world experiment, which later became the Co-sewing café (Figure 14). Very quickly, sewing and handicrafts, and especially upcycling, emerged as areas of interest. For example, a young refugee from Afghanistan presented ideas he had found online for the upcycling of men's shirts. The local knitting circle also presented some of their bags and cushions crocheted from old t-shirts (Figure 15). Suggestions for premises, equipment, materials and opening hours were collected and a first list of possible workshop topics and their organizers were drawn up. As we aimed to share ownership of the concept with the local citizens, we tried very hard to incorporate the majority of the ideas and wishes into the concept design.

After this co-design workshop, we searched for a suitable space in Dietenheim, which was centrally accessible and offered shop windows. At the opening event on the 19th July 2016, the mayor gave a short speech, and everyone was invited to see the premises and ask questions, while having coffee and cake (Figures 16-18). Representatives of the local newspapers were invited, to spread the word. The space that our budget allowed us to rent for the real-world experiments was a 60m² former vegetable shop area, which we equipped with second-hand tables from the stock of the University of Ulm and simple shelves and stools, for a flexible room layout.

Based on the ideas collected during the first co-design workshop, I developed the Co-sewing café concept with the support of my two aforementioned colleagues. We placed a strong focus on seeing this space as part of the community and on offering room for creative

↑ Figure 14
Co-design workshop in the town hall

← Figure 15
Presentation of crocheted bags and cushions by member of the local knitting circle.

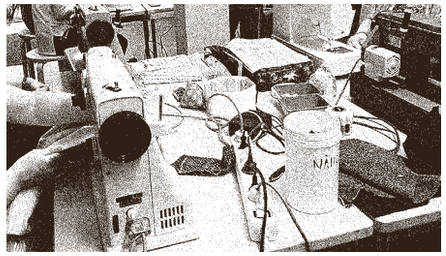


↙ Figure 16
Co-sewing café space before we equipped it.

↓ Figure 17
The first upcycling designs created by Naser, a very skilled dressmaker from Afghanistan. With his samples, we introduced the concept of upcycling, and aimed to entice people to the workshops.

↑ Figure 18
Opening of the Co-sewing café attracts many interested visitors and the press.

↗ Figure 19
Visiting Mr. Kraft in his “repair shop” for the first time, which is located in the basement storage facility of his elderly housing.



→ Figure 20
Workstation with sewing machines, and supply buckets for threads, additional tools and instructions for sewing machines.

↘ Figure 21
Co-sewing café with basic arrangements for sewing around grouped tables.

↓ Figure 22
Participants working together, offering advice and supporting each other.

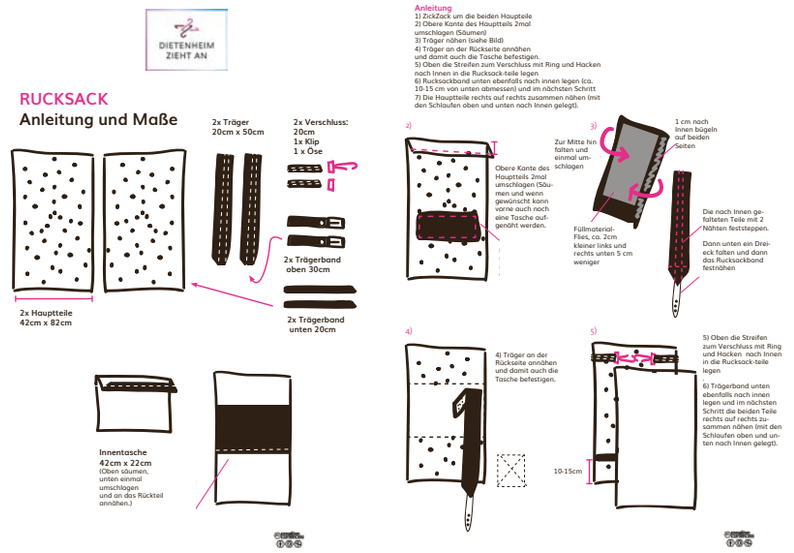


Figure 23
Example instructions created for more independent work in the assembly and construction process.

participant exchange. We emphasized the possibility of continuity right from the start by involving existing local groups such as the knitting circle or the refugee support circle. The aim was to provide a space for joint creativity and information on sustainable clothing production and consumption that could be used by a wide range of participants.

In order to enrich the design of the interior, and provide a greater variety of material, tools and machines, we placed an ad in the local newspaper asking for donations of different materials and equipment (fabrics, yarn, ironing boards, sewing machines, etc.). Further, the municipality arranged contact with a local sewing machine expert – Mr. Kraft, a 92-year-old late repatriate from Russia, who lived in elderly housing around the corner. He was known for repairing discarded sewing machines from the local recycling center. After calling him, I visited him in his “repair-shop” at his storage room, where he offered me several machines to use at the café (Figure 19). He then started to maintain and repair our sewing machines at regular intervals, bringing new tools, machines, or cookies for the participants.

The donated materials we received via the newspaper ad or by word of mouth were sorted and labelled on shelves according to their intended use, so that the participants could work with them independently. For instance, textiles were categorized by materiality and texture such as stretchy, silky, cotton, wool, felt and so on. However, I realized that this free supply and accessibility also posed certain challenges. Some things disappeared, some materials and tools were incorrectly placed and there was an overall, disorganized feeling, which created additional work for the workshop facilitator. Therefore, I chose to create basic supply “buckets” at each workstation, which contained different colored threads, needles, scissors, chalk, bobbins, seam cutters, measuring tapes and so on (Figure 20). These enabled basic materials to be easily at hand and helped keep the stock of supplies in relative order. The materials (textiles, lace, old garments…) suitable for the respective workshop theme were

pre-selected and displayed on a separate shelf or bench, thus reducing the mess created when fabric was pulled out from the shelf.

Eight to ten workstations with sewing machines, tables and stools were created for the regular sewing workshops, which were arranged for groups of four or five (Figure 21). The grouped workstations also facilitated getting to know each other and supporting each other. There were three cutting tables, an ironing board, two mirrors and changing facilities. Already during the first workshop I observed that small teams of two to three participants had formed to helped each other. Participants took each other's measurements, worked out ideas and designs together or helped with technical questions such as the correct threading of the sewing machine (Figure 22).

After a while, I observed that the technicality of threading and working with different, rather old sewing machines posed a challenge for the majority of people. Therefore, I added instructions (see an example in Figure 23) and labels for the different sewing machines, so that they could be used by participants without the facilitator (Figure 23). The usage of the sewing machines was generally one of the biggest challenges to the participants and the different facilitators, especially when I was not present. I was in the lucky position of having collected skills and experience by facilitating a number of sewing and upcycling workshops over the years, thus being used to working with different sewing machine models. I also obtained advice and support in the repair of the sewing machines from Mr. Kraft.

The workshop design

Based on a PD approach, the workshops were attuned to different levels of participants skills, providing tools and advice, to ensure that everyone was able to participate and make something based on their tastes and skills. Each workshop was dedicated to a different theme aiming to enable the participants to develop their skills and knowledge over time and to help and exchange ideas with each other. The participants were supported by workshop facilitators (designers, dressmakers and hobbyist dressmakers) in manual, technical and design matters. The workshops were conceptualized around the available materials and in relation to themes that would attract diverse participants. In the space, a basic stack of materials (textiles and old clothes) as well as sewing machines, cutting tables and other sewing accessories were always provided. The space and workshop concept aimed to reduced barriers (e.g. little manual skills, lack of time, or access to a sewing machine) for less experienced participants. The workshops in the Co-sewing café took place approximately three times a month, each lasting around three hours.

For each workshop the facilitators prepared patterns in different sizes and sample pieces, with different levels of difficulty, which were presented at the beginning of each workshop and served as inspiration and basis for the individual designs. The participants could thus choose, depending on their taste and abilities, a respective "sewing project". I call these "sewing projects", as the artefacts produced in the Co-sewing café are, in addition to garments, also accessories, such as bags and backpacks, and occasional repaired or crocheted cushions from old t-shirts. Workshop topics were also suggested by participants and later guided by those with more experience. Depending on their previous knowledge, the workshop facilitators give instructions on how to operate the sewing machines, how to cut and construct the garment, as well as advice on fabric selection, color combination and fit. Providing only as much guidance as needed aims to offer the participants a positive experience of making a garment by themselves, and to avoid frustrating mistakes by overly difficult sewing projects. The workshop facilitators therefore take over the sometimes less popular or more demanding do-it-yourself tasks, such as creating patterns, coordinating work processes, or maintaining sewing machines. The choice of

↑ Figure 24
Instructions and labels were provided to enable the participants to work more independently.

← Figure 25
The garment gallery and its different forms of use.

Deutsch	Farsi	Englisch	Fotos
Die Stoffe	پارچه Parche	Fabric	
Die Schere	قیچی Ghaychi	Scissors	
Die Nadel	سوزن Suzan	Needle	
Das Nähgarn	نخ Nakh	Thread	
Der Nahttrenner	بخیه‌کن Bekhiaf	Seam ripper	
Das Nadelkissen	بالشتک سوزن balesh'akhe suzan	Pincushion	
Das Maßband	متر Metr	Measuring tape	
Die Schneiderkreide	صابون Sabun	Tailor's chalk	
Die Nähmaschine	چرخ خیاطی Charkhe khayati	Sewing machine	

↗ Figure 26
Language posters created to ease communication.

↖ Figure 27
Prepared Bobbins and thread, sorted for generally busy workshop situations.

↙ Figure 28
Flyers printed in four different languages.

← Figure 29
Mobile Co-sewing café visiting the local refugee housing.

↓ Figure 30
Multicultural and multigenerational cooperation in the Co-sewing café.

workshop theme (i.e. sewing project) is another important task, as it requires thoughtful knowledge regarding the average participant skills, in choosing respective patterns. The theme should be attractive to a variety of participants, but it also has to make use of the textiles and materials available (as everything is based on donations) and should be manageable in the timeframe of one workshop. The patterns for the individual sewing projects were either prepared and designed by me, adapted from open source patterns, or bought through sewing magazines such as Burda Style, a known advocate for do-it-yourself fashion in Germany, established in 1949.

In order to enable others than myself to facilitate the workshops, I created certain tools and instructions for the sewing machines. A garment showcase, with a "Made in Dietenheim" label was assembled, illustrating the variety of garments produced, and supported by a gallery of participants wearing their self-made garments (Figure 25). The labels helped foster the local production aspect, and to nurture emotional attachment to the garment, as it was a visual reminder of the place, time and circumstances in which the garment was made. Further, the garment showcase helped explain and show newcomers what the Co-sewing café offered. For Naser, my colleague Samira Iran and I also created language posters, translating basic sewing terminology from German into English and Farsi (Figure 26). A range of tools and materials emerged over time, such as a wooden board for bobbins, which I could adjust when workshops were less busy (Figure 27).

These small details are all part of what is described in this dissertation as infrastructuring. These emerging tools and materials thrived in the Co-sewing café and changed it over time. Likewise, the way in which we facilitated the workshops was finetuned according to the circumstances, and allowed me to share with new facilitators the insights I learned, such as the types of workshop themes, the duration of the workshops, how much help to give, and how to best arrange the space.

Participants and communication

In order to engage a diverse group of participants, I tried to create a variety of themes to appeal to different age groups, genders and nationalities. Further, I designed a visual identity for the whole real-world laboratory, which benefited the design of flyers, a website and other means of communication. The Co-sewing café flyers were printed and distributed in four languages (English, German, Farsi and Arabic) (see Figure 28). Based on our visit to the refugee café, Naser participated actively in the planning and moderation of several workshops and the design of the different models. He was highly motivated and also wanted to offer a weekly repair lesson for the locals. Unfortunately, there is only one first housing for refugees in Dietenheim, which means that many of the first active international participants could not take part in the workshops after a few months as they were moved to another place. The same also happened to Naser and his wife. Therefore, we also continuously re-visited the local refugee housing and occasionally brought a mobile sewing café version to their community space (Figure 29). This was very well appreciated and encouraged participants to visit us in our central location. Although there were some language barriers at the beginning, the communication about the materiality and the joint creation worked well. We also benefited from the language skills of one of our staff members, who partly translated or provided multilingual posters with the basic concepts of sewing during the workshops.

The sewing café demonstrates positive cooperation between different generations. Often, the "older generation" still has extensive sewing skills which they share with other participants in the workshops. In some cases, projects were sewn together, or some visitors came for a coffee and to help (Figure 30). In general, there was a great variety of

↑ Figure 31
Local models gathering for a photo after the fashion show, wearing their self-made outfits.

↘ Figure 32
Upcycling with the knitting circle, crochet method.

participants; however, the majority were female, even though we tried to encourage male participants using specific themes. Given the context of a rural German village, the general population seemed to relate to the traditional understanding that sewing is practiced by women and did not even attend or visit the Co-sewing café. This was rather different in, for instance the urban context in Helsinki, where male and female young adults (aged 20–30) participated; or in the Bolzano experiment, where many of the participants were male and had formerly worked as dressmakers (originating from Afghanistan, Pakistan or Iraq).

In terms of communication and attracting new participants, from the beginning I created a participant list, in which everyone interested in being informed about the workshop themes could sign up for an email. Over time this email list grew, and now every month receives a new program with 3–4 workshop topics and their respective level of difficulty. The program was further published on our website, Facebook page and the local newspaper. We also shared the outcomes of all the workshops on social media. In addition, around 40–50 bigger press articles covered the Real-World Laboratory (RWL) in general, and about half of these were specifically dedicated to the Co-sewing café. We arranged activities such as a fashion show with the local school (Figure 31) at a sustainable fashion fare, also organized in the context of RWL. Furthermore, we had stands at the local Christmas fare, specific city events and local exhibitions, and offered sewing workshops for children during the summer holidays. All these activities helped spread the word, and continuously brought new participants, tools and materials.

Sustainability and transferability

As mentioned above, the sewing café concept was planned with the idea of gradually handing it over to committed participants. Therefore, the participants were involved from the beginning in decisions on the choice of workshop topics, and the search for materials and equipment was also partly taken over by the participants: for example an ironing board and a gas heater for the winter were donated by a committed participant. After some time, various workshops were also led by local people, following the example of the workshops we held (examples and instructions). I gave the local workshop leaders basic instructions for the possible duration, degree of difficulty and available materials. For example, the upcycling of old T-shirts to crocheted seat cushions or universal bags was initiated by the local knitting circle.

In this workshop, the workstations were organized into a large group, allowing all the participants to crochet and discuss together. The guidance was given by an experienced member of the knitting circle (Figure 32), who had prepared samples and then showed the method of implementation to the participants. Old T-shirts were cut into strips and then crocheted into colorful seat cushions. Furthermore, workshops on the subject of sports bags and cosmetic bags were held by two regular visitors to the sewing café, with our support. The theme and construction of the objects were discussed in advance and the necessary materials were obtained, if they were not already available in the sewing café. In a similar manner, I continued to encourage regular participants to facilitate their own workshops on themes with which they felt confident.

I will illustrate how participants change the way they participate, using the articulations extracted and defined in Chapter 3 above. I present two examples from the Co-sewing café, which I situate on the two ends of the fluid spectrum spanning design and use. In the context of this research, I understand the concept of “design-for-design” as designers aiming to enable users to design objects for themselves (Seravalli, 2012). In practice, this means that as a design, I recognize the garment not only as a product (i.e. the design of a jeans jacket), but

Figure 33
Illustrating with an example from practice of what I consider a nuance of "design-for-design".

also as the pattern, and thus the basis for inspiration and instructions to facilitate and enable someone who has never made a garment before, to design and produce their own version of it. Therefore, if a participant, a sewing beginner, uses the original design (jeans jacket and pattern) to design and produce their own version with the tools and advice offered in the café, and making it suits their taste, skills (e.g. material, color combination and leaving out the zipper) and body shape, their participation moves from a user "using" an object towards "designing" it, supported by a designer. This is illustrated in Figure 33, the spectrum of use and design occurring in the Co-sewing café, facilitated by a designer (i.e. design-for-design). Of course, the term design-for-design comprises many more nuances and could be illustrated by a variety of instances from the Co-sewing café. The example above thus tries to demonstrate the abstract terminology and the fluid spectrum with one narrative from practice.

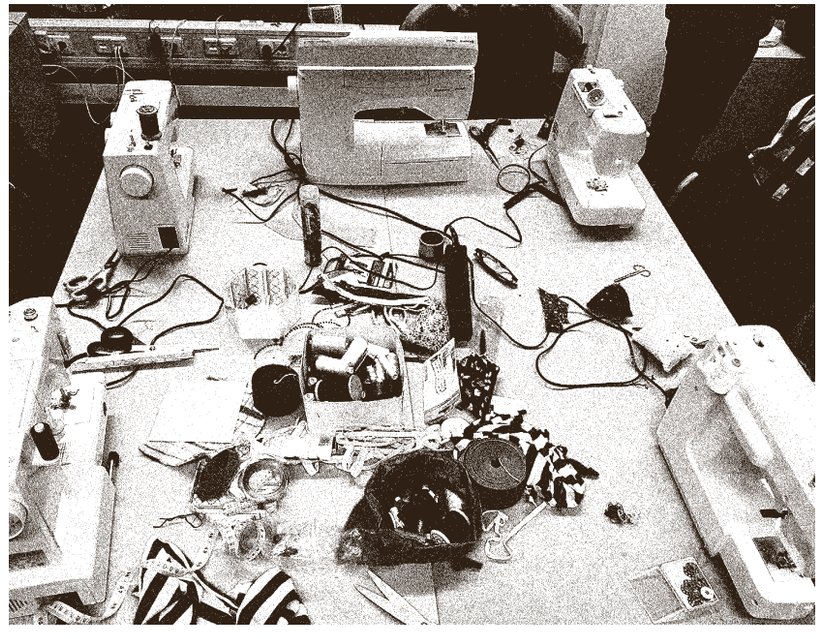
The other end of the spectrum, "design-in-use" illustrates how infrastructuring takes place in the Co-sewing café (Figure 34). Figure 34 presents on the left the initial design of the Co-sewing café, intended mainly for sewing. However, in-use, new forms, tools and methods changed this, in this case temporarily, for one crochet workshop.

Figure 34
Illustrating the whole design and use spectrum using examples.
The above depicts an example that I consider design-in-use.

The workshop and spatial arrangements have also been tested in other contexts, such as the local Fab Lab in Ulm. The concept of the Co-sewing café was introduced through four workshops which I facilitated, supported by a local group of sustainability students (Figures 35–38). I shared the basics of facilitation with the students, and provided them with patterns, left-over materials and four refurbished sewing machines, so that they could host their own workshops. I also showed them how to design a basic program, advertise the event and suggested people with whom they could collaborate, such as a local dressmaker. The workshops were well appreciated and hosted many participants. Therefore, the students continued to facilitate them, supported by the local dressmaker. The concept of a Co-sewing café is not new, as repair cafés, for instance, work in a very similar way. With this epilogue, I thus intend to only facilitate the implementation of other, similar types of spaces through practical insights and reflections on the "stuff" that has worked and emerged, and the skills and learnings that enable smooth facilitation.

↑↑ Figure 35
The first Co-sewing workshop at Ulm's Fab Lab: Verschwörhaus

↑ Figure 36
The same spatial arrangement with sewing machines grouped around the tables.



↑↑ Figure 37
Upcycling design samples created in the Co-sewing cafe in Dietenheim used as inspiration.

↑ Figure 38
Like in the Co-sewing café, basic supplies are provided at the tables.

[p1] Paper 1

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Social manufacturing in the fashion sector: New value creation through alternative design strategies?

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ABSTRACT

This paper proposes new perspectives and systemic changes to the linear fashion scheme, which is currently driven by fast, cheap and low quality production that fosters easy disposal or replacement, due to the low product value for the customer/user. The authors seek to open a discussion on new value creation through social manufacturing, specifically facilitated by do-it-yourself (DIY), do-it-together (DIT) and participatory design strategies. Social manufacturing can be seen as a more open and democratic approach to manufacturing, prompting different levels of user participation in the production process. The authors will illustrate how these alternative design strategies, build within the context of social manufacturing, can offer system-level changes by activating and empowering the end user to become value creators, while forming new, more sustainable innovations in design and manufacturing of fashion. The specific questions asked in this paper are: What types of value are created in social manufacturing through opening the design and manufacturing processes with alternative design strategies? Further, can social manufacturing enable sustainable solutions by transitioning the users to manufacturers of their own garments, prompting a new value system and range of business models in the fashion industry? An alternative value framework, developed within this paper, will enable the analysis of empirical data collected in Finland and the U.S. In the discussion, the authors demonstrate strategies to create wider change in the fashion system through social manufacturing, starting at a local level through empowered consumers.

1. Introduction

The fashion industry has traversed a decades-long race to the bottom in the name of cheap clothing, and the crusade for low prices is nearing its end. Based on a linear scheme, driven by fast, cheap and low quality production, the fast fashion phenomenon feeds consumers desire for novelty with ever faster changing collections, copied from the catwalk and high-end brands, at affordable prices (Fletcher, 2010; Fletcher and Grose, 2012). This global mass-manufacturing system encourages overconsumption via planned obsolescence (Burns, 2010), dramatically increasing the waste load of the planet by promoting easy replacement and disposal of clothing goods (Allwood et al., 2006).

The externalities of the low-price game are becoming more costly, with the manufacturing sector shouldering the latest brunt. Some of the most common headlines implicating the clothing manufacturing industry today are human rights violations (e.g. Donaldson, August 11, 2016a), toxic waste disposal (Cousteua, June 9, 2016), and dramatic price fluctuations for high-demand materials, such as cotton (e.g. Donaldson, July 15, 2016b). This system is facilitated mostly in countries with low labor costs, poor working conditions, low human rights standards and limited environmental laws (Allwood et al., 2006).

Both a driver and a consequence of this low-price scheme is the consumer mindset. For example, 75% of clothing sales in the U.S. are now derived from off-price retailers, indicative of a bargain paradigm among consumers (McGregor, 2016 July 14). This mindset has implications for the overall perceived value of clothing, which is arguably in decline. Initiatives such as re-shoring garment manufacturing and technological initiatives like automation or lean manufacturing pepper the landscape of this sector that seeks to respond to consumer demand.

The predominant business strategy in the fashion sector, based on globalized production with low price competition in production and manufacturing, is not sustainable in the long run. An oft-neglected perspective in the aim for alternatives is the possibility of introducing another model of clothing manufacturing while concurrently prompting the consumer to recognize and value good quality production (Niinimäki and Hassi, 2011).

In this paper we propose new perspectives to this linear fashion scheme. The authors seek to illustrate alternative ways of producing and consuming fashion, exploring alternative design strategies, such as do-it-yourself (DIY), do-it-together (DIT) and participatory design, in the context of social manufacturing. These alternative design strategies offer possibilities to organize the fashion design and manufacturing system more locally, closer to end users who become more active consumers, potentially disrupting the current mass and fast fashion industry from a local level. Furthermore, the paper offers alternative views for value creation in a social manufacturing context, by establishing an alternative value framework. On this basis, the researchers analyze empirical data collected in Finland and U.S. about DIY, DIT and other participatory consumer experiences in fashion that create a new understanding for social manufacturing. Building on two different data-sets, collected through focus groups in the U.S. and Finland, as well as the observation, participation and follow-up with the attendees in participatory clothing design workshops, the authors provide insight into consumer attitudes and perceptions regarding alternative modes of fashion consumption. Thereafter, authors explore what types of value are created in social manufacturing through opening the design and manufacturing processes with alternative design strategies? And further question, whether social manufacturing can enable sustainable solutions by transitioning the users to manufacturers of their own garments, prompting a new value system and range of business models in the fashion industry? In the discussion, we demonstrate strategies to create wider change in the fashion sector through enabling social manufacturing with empowered consumers, starting as potential business models at a local level.

2. Value creation

Traditionally, the consumer has been a value user (user of the product) in the fashion system, purchasing ready-made garments where value is created by wearing the garments. However, as new, more open design strategies offer the consumer an increasingly active role, the consumer becomes a value creator in the system, by contributing to the design or manufacturing processes (Niinimäki, 2011). Mohajeri et al. (2014) argue that in a new, more open system, consumers are value co-creators in the entire value-chain. By inviting people to design and make (produce) their own garments, consumers co-create meaning by making a garment with their own skills, time and effort. Effort and the success of doing something yourself provides deep emotional satisfaction (Niinimäki, 2010). Research has shown that user-involvement in the design and making process of a product will increase the emotional attachment to this product (e.g. Mugge, 2007) and naturally increase its personal value, making it less likely to be disposed (Niinimäki, 2011). There is potential that this activity may invite greater responsibility among consumers, valuing their goods longer, and thus, slowing down of the consumption cycles. Offering opportunities to learn new skills, empowers consumers to challenge their fashion consumption habits, such as low quality purchases and impulse shopping, producing more stable values in regards to fashion choices. The fashion industry is in need of alternative models of clothing manufacturing and value creation while concurrently prompting the consumer to recognize and value good quality production. Therefore, the next section builds an understanding of values in the context of social manufacturing.

Value is a multifaceted concept, with diverse meanings that are very specific to context. Generally, value can be “defined as a 'socially recognized importance': the weight that a society gives to an object or an issue” (Arvidsson, 2009, p.16). This means that there is a range of different understandings of value in relation to the sociocultural setting and the theoretical approaches these are grounded in (Karababa and Kjeldgaard, 2014). In this paper the authors relate their definitions on a sociocultural perspective as addressed in Karababa and Kjeldgaard (2014), who emphasize the “interrelatedness of value and value creation processes.” Marketing theory, such as consumer culture theory or service-dominant logic as a basis for our defintions of value is not as relevant here because these lack a consistent understanding of value and value co-creation (Grönroos and Voima, 2013). The authors are particularly interested in value co-creation of meaning enabled through collaborative experiences and the importance of ethics in value creation towards the common good and sustainable ways of living.

3. Social manufacturing

Social manufacturing can be seen as a democratic approach that opens the design and manufacturing phases to everyone (Shang, Liu, Xiong, Cheng, Ma and Nyberg, 2013). Yet, social manufacturing is a new concept, and a definition is still emerging. It can be understood as a way to manufacture physical products by enabling individuals to contribute to different phases of the production process like ideation, design and/or production. According to Jiang, Leng, Ding, Gu and Koren (2016) social manufacturing extends the idea of crowdsourcing, to the area of manufacturing, including a possible paradigm shift towards more decentralized and socialized ways for mass individualization of products. Individuals can operate by themselves, in a network or within an organization (Hämäläinen & Karjalainen, 2017). Hämäläinen & Karjalainen, 2017, (p.1) define “two forms of firm-individual collaboration in manufacturing industries: (1) social cloud manufacturing in which firms outsource manufacturing to individuals, and (2) social platform manufacturing in which a firm provides manufacturing services to individuals“.

Social manufacturing in fashion can be seen as an umbrella for large- and small-scale manufacturing with an emphasis on enabling consumers to play a more active role at different stages of the production process while creating new innovations in the design and manufacturing of fashion. In the context of this paper the authors define the term “active consumers” as interested and aware individuals who are actively and physically participating in the design or production phase of a product, thereby influencing the end product. This specific consumer group is referred to as more conscious and demanding, interested in experiences beyond the single object, such as learning through do-it-yourself activities. The alternative design strategies presented in this paper are mainly based on collaboration in small-scale physical garment production, with very active user participation, to some degree comparable to the concept prosumer, a term coined by Alvin Toffler (1980). A prosumer is an individual who produces/makes the products they consume (Toffler (1980)), and this group is relevant to social manufacturing, as suggested by Jiang, Leng, Ding, Gu and Koren (2016). The prosumer discussion, however, comprises differing levels of user-participation, whereas some require little participation, such as “pumping one's own gasoline at the filling station” (Ritzer and Jurgenson, 2010, p.18). Depending on the freedom given to the consumer to become a producer (Ritzer and Jurgenson, 2010), the “active consumer” is seen as taking a more responsible role in contributing to the final product outcome on a physical, do-it-yourself level.

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The focus of this paper is on the neglected concepts in the discussion around social manufacturing, which are based on analogue means of production that emphasize the "social" aspect through collaboration and interaction at a local level. So far, the framing of the term social manufacturing has mainly been focused on digitally enabled personal fabrication, or on a larger scale, mass-customization and distributed manufacturing (e.g. Jiang, Leng, Ding, Gu and Koren, 2016). Social manufacturing has been discussed as a "kind of service-oriented intelligent system, which is driven by specialized production", using social networks with their communities of prosumers to outsource the manufacturing activities in a more self-organized manner between individuals and firms (Zhou, Xiong, Nyberg, Mohajeri and Bao, 2016, p.8). This view, however, is referring to the term "social" as appropriating social networks (Facebook, Linkedin etc.) to facilitate interaction and communication with users (Zhou et al., 2016), which neglects the potential of localized, social interaction occurring in small-scale person-to-person manufacturing. Therefore, this paper has a stronger focus on illustrating how alternative design strategies, based on analogue, small-scale manufacturing systems, can inform the discussion on the "social" aspect of social manufacturing and showcase new value creation through active participation of the individual consumer.

3.1. Alternative design strategies for "diffuse social manufacturing"

This paper is particularly interested in the highly user-driven means of material production, seen within do-it-yourself (DIY), do-it-together (DIT) fashion as well as participatory clothing design workshops. These alternative design approaches all aim to activate the individual to get involved in the making of their own objects, and thereby, potentially supplanting the need and desire to consume with creative and social experiences (e.g. Chapman, 2005). These approaches may be more aptly identified as strategies for enabling "diffuse social manufacturing", a more radical and innovative method of production that is driven by user-entrepreneurs and peer-to-peer networks. (Hämäläinen & Karjalainen, 2017, p.3) talk about a distinction between "institutional" social manufacturing which is more firm-centric and "diffuse" social manufacturing driven by a "diffuse individual agency" with a greater importance of the consumer as producer. The term "diffuse" social manufacturing can in this context also be related to Ezio Manzini's (2015) differentiation on "diffuse" design (performed by anyone) vs. "expert" design (performed by professionally trained designers). This term provides an opportunity to illustrate a new way of producing fashion by integrating the end user as a co-creator of value via alternative design strategies enabling diverse types of value creation, beyond monetary benefits. Also Kohtala's (2015) work on "distributed production" is elucidating a distinction between the more firm-centric concepts that are based on lower individual participation (distributed manufacturing, mass customization, personalization) and an individual-centric approach, which is strongly building on the individual input such as peer-to-peer production, fabbing and personal fabrication. This distinction suggests different degrees of individual participation in the production process. In this regard, the paper investigates alternative design strategies with a strong degree of individual/user participation, which can be seen explicitly linked to the aspect of diffuse social manufacturing, as end-products created by consumers who are not trained in design.

With this preliminary definition of social manufacturing, one could question if diffuse social manufacturing could to some degree be referred to what Benkler (2006) described as the social production phenomena? Social production includes concepts such as digitally supported commons based peer-to-peer production as well as social entrepreneurship, alternative currencies but also physical forms of production, such as community supported agriculture (Arvidsson, 2008, p.326). The common ground for these concepts is the fact that they are all "self-organized, emergent, bottom-up" and "not primarily motivated by monetary concerns" (Arvidsson, 2008, p. 326), similar to the values and motivating factors driving e.g. DIY and DIT makers.

3.2. Half way/participatory design

Participatory design has its roots in the 1970s in Scandinavia, based on the idea to empower the workers to influence the environment they work in (e.g., Ehn, 2008). Until today, participatory design is connected with the word "empowerment" and driven by a stronger political agenda than, for example, co-design (Mattelmäki and Sleeswijk Visser, 2011). Participatory design is about involving the user in the design process with "a special focus on people participating in the design process as co-designers" (Ehn, 2008, p. 93). In the participatory design workshops with half-way products, the authors aimed to enable what Chapman (2005) calls the creation of a narrative experience for the user. Half-way products are design objects that are intentionally unfinished, offering the end-user involvement in the final product outcome and its design, to enable a unique product, which can capture the experience of joint making (Fuad-Luke, 2009). Through making and shaping a product outcome, the end-user can create a unique, wearable product and experience a strong learning curve in less time and with less skill. This aspect can reduce frustration and negative experiences due to lack of time, tools or skills, which allows for positive memories and emotions to be captured within the piece (Hirscher, 2015). Participatory sewing workshops with half-way garments offer enabling solutions to the user to regain capabilities and decision power in the final result (e.g., von Busch, 2010; Manzini, 2009).

3.3. Do-it-yourself (DIY) and do-it-together (DIT)

DIY in fashion can enable the consumer to fully produce a garment with their own skills, supported through so called DIY kits that contain materials and instructions. When DIYers create an object, they fulfill two roles: they are designers defining functionality and other specifications, but also, they are the builder or maker of the object (Wolf and McQuitty, 2011, p.154). In the fashion context, Otto von Busch (2008) has explored several DIY and DIT activities within his doctoral dissertation: *FASHION-able*. He uses DIT techniques such as workshops and DIY kits or instruction manuals to enable consumers to gain skills, providing tools and spaces for action to enable users to break free from the fashion dictate (Busch, 2008).

DIY and DIT, therefore, provide additional opportunities to offer positive creative experiences for the consumer, and opportunities to learn new skills. As shopping provides only short-term emotional satisfaction (Richins, 2009), DIY and DIT scenarios are perceived to provide longer-lasting emotional experiences with less material consumption. It aims to increase product longevity through custom fit/style and person-product attachment through personal effort (Niinimäki, 2011). DIY activities are strongly motivated by certain values and aspirations such as "identity enhancement: fulfillment of craftsmanship, empowerment, community seeking, need for uniqueness" (Wolf and McQuitty, 2011, p. 155). A strong argument for participation in DIT activities is also the social feature of making things with others; learning together and creating together (Hirscher, 2015).

In the current paper, the researchers aim to analyze where and how alternative design approaches (DIY DIT, half-way products, and participatory design) create value by opening the design and manufacturing processes to activate consumers to take a more responsible role in the fashion system. The authors explore how these alternative strategies may broaden the view of the term social manufacturing in regards to fashion. Furthermore, the authors will illustrate in the following section how diffuse social manufacturing in fashion can create value through more active user participation by enabling different types of fashion design and manufacturing processes outside the current fashion system. The researchers analyze the types of value created through these processes on the basis of a value framework, extending the discussion of value creation in a social manufacturing context.

4. Data and methods

The empirical data used in this study were generated from two different sources. The first part of this study utilizes an action research approach in which twelve participatory workshops under the theme of participatory or half-way clothing were facilitated with approximately 120 participants, male and female. The workshops were conducted in different locations in Helsinki, Finland between May 2012 and December 2013. The participants were provided with a ready-to-make sewing and design setting, including sewing machines, materials, design facilitation, patterns or half-way products. Observations and photographs were collected by the researcher and other facilitators. These delivered insights for later reflection upon the general activities, feelings, emotions, interactions and atmosphere. Through a series of questionnaires handed out to 18 female participants directly after the first two workshops, the immediate experience and feedback were gathered. Online questionnaires were sent to the same 18 participants two months and one and a half years after the workshop to investigate attitude and behavior changes regarding personal consumption habits as well as potential emotional bonding towards the created garment.

The second source of empirical data for the current study consisted of focus group interviews conducted in Finland and the U.S. The primary research objective of this study was to understand how fashion-oriented females in two different countries evaluated different Product Service System (PSS) concepts, including DIY concepts (Armstrong et al., 2015). The study was conducted during October 2012 to January 2013. A total of 101 women from the two countries participated in one of 17 focus groups. Eight focus groups were conducted in Finland with 52 participants, ages 24–66 (24 age 24–39; 28 age 40+). Approximately 70% of the sample had a college degree and a little over 40% reported earning more than 40,000€ annually. Nine focus groups were conducted in the U.S. with 49 participants, ages 25 to 87 (27 age 24–39; 22 age 40+). Approximately 84% of the sample groups had a college degree or higher and 65% reported earning more than $40,000US annually.

Focus group interview method is an effective way to collect consumers' opinions through open ended questions and through encouraging group interaction (Cozby, Bates, 2012). Large and rich data can be collected through focus group interview method and the aim is to identify themes and areas of group consensus and disagreement (Cozby, Bates, 2012). In the focus group interview sessions the concept for DIY was presented as a scenario, described as a narrative in which an online retailer sold fashion "kits" that included easy-to-follow instructions to create their own garment. After the scenario was read, the participants were asked to respond with their reactions and critique. The focus group sessions were audiotaped and later transcribed and analyzed. Content analysis was used to identify categories of enablers and barriers to acceptance of the DIY retail concept.

In both of the above cases, a qualitative and interpretative approach guided the inquiry while constructing themes on the phenomena of interest (Flick, 2014.) The data analysis occurred in two phases. First, the data from participatory workshops and focus group interviews were separately analyzed. In second stage, a triangulation method was used to combine the results and further to analyze the results through a value creation perspective to deepen the understanding of this value phenomena and to strengthen the grounding and quality of the analyses (Flick, 2014). Theory triangulation (Denzin, 1989) was used to approach data from different angles, multiple perspectives and with different research questions. Here, some specific research questions guided the analysis: what types of value can be created through opening the fashion manufacturing system through alternative design strategies? And further, can social manufacturing enable sustainable solutions by transitioning users to manufacturers of their own garments, prompting a new value system and range of business models in the fashion industry? Several iterative analyses were used to conclude a coherent outcome in the form of a value framework, which is presented in section 7.

5. Results

Next, the preliminary findings from these data are described before placing them in the value discussion.

5.1. Participatory design workshops

Based on questionnaires, handed over directly after the workshop to 18 female participants, it was discovered that the majority of participants agreed to gains in feelings of happiness and satisfaction during the making process or afterwards when the results were achieved. About half of the participants also agreed that their attitude about fashion and clothes shopping had changed, and they were interested in learning more about the production of clothes. 15 out of the 18 participants also ranked the expected value of their garment as 'high' or 'very high'; the main reasons given for this valuation was self-effort which they stated that they accomplished the piece themselves, which gave it a unique touch.

To illustrate the learning experience, a self-evaluation matrix was used in the first two workshops with 18 female participants, age 20–35 years to evaluate levels of skill and knowledge before and after the workshop (Fig. 1). The matrix was inspired by a matrix used in Fuad-Luke's (2009, p. 99) book *Design Activism*, which sets 'Making by the user' vs. 'manufactured' in correlation to 'self-

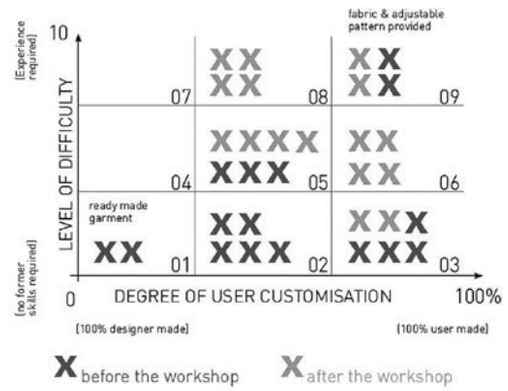

Fig. 1. Participants self-evaluation before and after a workshop (Hirscher, 2013, p.123).

design' vs. 'professional design'. The matrix was created to evaluate the level of difficulty vs. the freedom to design or customize a half-way garment. The half-way garments prepared for these two workshops had varying levels of "readiness" that referred to a number in the matrix. This means, that some garments were prepared by the designer, nearly as ready-made objects, offering small details for adjustment or customization by beginners. Other half-way garments could be combined with ready cut pieces, offering more freedom to design but also required greater level of sewing skills. Participants marked the number at the beginning of the workshop; "02" referring to a half-way garment that was easy to finish, but offered some possibilities to customize while "08" referred to a piece that could be individually combined with ready-cut pieces but required sewing and adjusting everything by the user themselves. At the end of the workshop, the participants were asked to re-evaluate, whether they would feel enabled to choose a more open/unfinished version after completing this garment. Sixteen participants filled out the matrix. The figure illustrates a clear increase in the participant's skill level, moving the prior (red) crosses that were marked before the workshop towards the upper left corner. This illustrates that after the workshop (green), they felt empowered to work with pieces which required more skills. The chart also documents a great variety of prior knowledge amongst the participants. This development was interpreted as a possibility to increase individual's self-confidence and skills, growing capabilities for more active user participation or prosumer activities (Fig. 2).

A follow-up questionnaire was sent by email to the same 18 participants after two months of participation, receiving 14 responses. The questionnaire comprised 10 questions, dedicated to evaluating the perceived value of and emotional attachment to the half-way garment in comparison to a purchased product. Furthermore, participants were asked about memories on the process of making and the achievement of creating a wearable garment as well as the feeling of gaining new skills and possible obstacles or restricting factors for continuing to make clothes. The response of the participants reflected positive feelings towards their garments, even though the expected value level with regards to the garment was partly re-evaluated to be 'high' rather than 'very high'. However, all of the participants agreed that they either 'love' or 'somewhat value' their self-made piece more in comparison to purchased garments. For example, one of the participants stated: "The cloth (tunic) has more value in my eyes, because I was also making it. It has a story now." The results indicated they were proud of their work and this encouraged them also to join the workshops again. Everyone also agreed that they appreciated the participatory workshop setting and would welcome similar sewing opportunities on a regular basis.

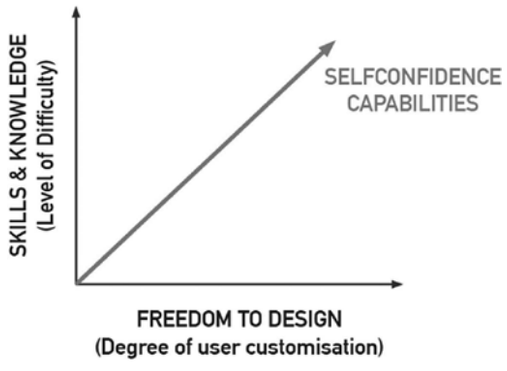

Fig. 2. Increased skill-level results in greater self-confidence and capabilities.

After one and a half years of running the workshops, another online questionnaire was sent out and was answered by six former participants. The participants agreed that they still felt a special attachment to the created piece because they made it themselves. One respondent pointed out that the piece represented "enormous value – memory, friends and skill for life." Also, five out of six agreed that they still owned and used the pieces while being generally happy with the results. They also appreciated the collaborative work with the designers and the learning aspect. The feedback was very positive regarding the workshop setting, providing tools, advice and design support. In particular, the collaborative making process, the assistance by the designers and the open atmosphere for learning and exploring together was consistently mentioned. In particular, the collaborative spirit developed within the workshop, represented through social interaction between the participants was a key-feature that encouraged repetitive participation. By helping each other with practicalities such as threading a sewing machine or collaborative design decision-making, the participants were enabled through the physical objects to discuss and connect with others, which is in line with previous research by Gauntlett (2011). The participants were encouraged by one another to become active and moved from being a learner to being a teacher/adviser/designer themselves (Hirscher, 2015). Within the 120 participants over twelve workshops, about one-third were regular participants, joining at least three to four times. Participant: "It was easier than I thought, good instructions made it really fun!"

Building on the feedback from the participants and the observations of workshop facilitators, the workshop setting was perceived to offer great potential to overcome restricting factors such as lack of time, skills, tools and motivation. Through an open and adaptive concept, the exchange of skills and knowledge was enabled, as the threshold for involvement was low, and motivation to become more active was supported through making and interacting with others. This illustrates key aspects of enabling solutions for the activation of the user through helping participants grow their capabilities, making participation more attractive (Manzini, 2009, p. 54). The project analysis illustrates that through collaborative ready-to-make workshops social interaction can be encouraged through making, empowering the makers towards an awareness of their own skills and design ability, resulting in joyful experiences. A sensible interaction between facilitating designers, the workshop infrastructure and the participants, builds the potential of this strategy to activate consumers to become designers, makers and producers of their own garments by sharing their knowledge with others.

5.2. Focus group interviews on DIY

The results from focus group sessions show that the DIY concept divides strongly the consumers' reaction and feedback. The DIY approach in fashion requires basic skills of sewing and understanding about garments patterns, pattern cutting, fabric cutting, different seam structures and sewing machine techniques, which is not familiar to all consumers. DIY aroused strong expressions of being funny, tempting, a positive experience, satisfying, a future trend, and potential innovation among study participants. Some participants felt that DIY would be an easy way to start making your own garments because it could minimize difficult stages (e.g., pattern making, cutting the fabric):

> "This could rather well be the answer for the call, that many people want to do themselves stuff, but nowadays they do not have the skills. Yes, this would be the garment area's IKEA, which offers the answer for the need to do tinkering and then you could say, 'I have done this myself.'"

On the other hand, nearly half of the participants commented, that this would be "my worst nightmare" because of a lack of sewing skills. Some participants were hesitant about how this service would actually work in practice, and especially, their ability to select a project that was amenable to their personality: "I am not sure of my own style and what fits me." There was also hesitation about the lack of guarantee of a successful end result if they made the garment themselves. Other participants were concerned about technical requirements, the time required, and other practical issues in the service (e.g., renting a sewing machine). Some participants perceived they are too impatient to wait for the end results, postponing their fashion fulfillment. Purchasing fashion, especially fast fashion items, is so easy and for some consumers this behavior offers a desirable emotional high. However, participants also offered to develop the service aspect further:

> "… if you could order it in that way that the difficult parts could be made already and you can do only those easy and funny straight seams."

> "There should be a web link included where you could find a helping video-clips. And a peer-group chat! Shared stuff always work. It should be a good interactive fashion kit."

> "There should exist a helpdesk and teaching videos."

Experiential and social aspects related to this PSS scenario were discussed most frequently among participants, such as the possibility to link the DIY concept to other services such as sewing clubs, courses and other more face-to-face interaction around DIY making. The need to gain peer-to-peer help and support was strongly present in this discussion, laying the groundwork for do-it-together concepts.

Do-it-together (DIT) is one way to empower people to experience shared learning processes. The social dimension in learning creates a deeper learning experience. Moebus (2015), p. 99 explains based on her empirical experience that this kind of shared learning experience is possible "by combining the knowledge and experience of different people who found themselves through the simple support of an online platform." The online platform could enable users to create a functional social network of people who plan an action through combining others' knowledge and then take the action together to implement the plan. Also, in the participatory half-way-clothing workshop participants experienced both the new creativity though a DIY approach and also DIT experiences while sharing the learning process with experts and peers (workshop facilitators and co-makers). The positive outcome, success in garment creation and construction, is considered most important, and the social aspect can help the process to ensure this positive result.

Even though DIY or DIT is suitable only for some consumers, an earlier study (Armstrong et al., 2015) has indicated that the social dimension in fashion Product Service Systems is perceived as more important for younger consumers, and therefore, the DIT approach might be more suitable for young, experimental consumers. This may be an opportunity to develop services for young, fashion-loving female consumers offering an emotional social experience instead of emotional experience created by fashion purchases.

For instance, "Wool and The Gang" illustrates a Product Service System model offering DIY Fashion kits and instructions via online video tutorials to their customers instead of ready-to-buy products (www.woolandthegang.com). An additional example is the online platform "Makerist", which offers DIY kits and online tutorials from experts in different fields, ranging from clothes making to pattern construction, knitting, crochet and other textile related crafting activities, and in addition offers an online community to showcase and share the results and experiences with other makers (www.makerist.de). Both PSS models, illustrate the combination of DIY/DIT with a service model that offers an alternative means of fashion consumption. They combine the PSS sustainability approach by disconnecting the link between the ready-to-buy product as being the only source of value, offering alternative options of use and value creation (Briceno and Stagl, 2006; Mont, 2002). These models facilitate different types of value creation to the customer beyond the use-value of the product, such as the creative making experience and participation in the community, offering a combination of products; for example, DIY packages and services such as sewing workshops to satisfy consumer's desires differently (Manzini et al., 2001; Mont, 2002; Tukker and Tischner, 2006).

6. Value creation in diffuse social manufacturing via social production

The following section places previously presented results from the empirical data into a value discussion. Here, the authors define the types of value created in social manufacturing in the context of clothing via the opening of the design and production process with alternative design strategies. Further, the authors ask whether social manufacturing can enable sustainable solutions by transitioning the users to manufacturers of their own garments, prompting a new value system and range of business models in the fashion industry.

When comparing the description of diffuse social manufacturing to alternative design approaches we can argue that they fit well under the umbrella term of diffuse social manufacturing, emphasizing a strong degree of user involvement. However, while looking at the values these alternative means of material production are built on, one could question if diffuse social manufacturing, motivated by a strong sense of communality, could be referred to as the social production phenomena? As described above, social production includes diverse concepts all sharing the fact that they are "self-organized, emergent, bottom-up" and "not primarily motivated by monetary concerns" (Arvidsson, 2008, p. 326). In social production, the value is not resulting from the directly owned resources of the company, but based on "collaborative forms of wealth production" (Arvidsson, 2011, p. 262). This means that by attracting and appropriating contributions from diverse stakeholders, such as consumers who are creating value through their input, creativity and tacit knowledge, intangible value is created (Arvidsson, 2011, p. 262). The question should be raised about how this value generated through consumer's active participation in production or innovation processes is distributed and measured? Arvidsson discusses in several papers (Arvidsson, Bauwens and Peitersen, 2008; Arvidsson, 2011, Arvidsson, 2009; Arvidsson, 2008) the issue on this intangible value, such as social value - generated through social production, within the "ethical economy". He argues that the outputs of social production are not "free" or beyond value, he argues that they follow another value logic, an 'ethical economy' (Arvidsson, 2009, p. 13). The ethical economy follows a "common, particular, and identifiable value logic: an ethical economy where socially recognized self-expression is the main motivation and community contribution is the main measure of value" (Arvidsson, 2008, p. 326). This means, that the main source to create value in social production is ethics or

"ethical surplus," which refers to the ability to tie participants to a certain project or community where they contribute their time, skills and knowledge to generate meaining and purpose through supporting a shared goal based on shared values (Arvidsson, 2011, p. 270). According to Arvidsson (2011), this way of creating value is particiularly true in projects found outside corporate boundaries, fully based on a shared vision and a set of values.

Therefore, there is a need to elaborate whether diffuse social manufacturing can also be seen as social production, as this will influence the value framework and the resulting analysis. In particular, the practices described as active user-participation in design and production processes, are "more socialized processes of value creation …" (Arvidsson, 2011, p. 262) and thus it is proposed here to consider them also as social production. In the examples of workshops and the participation in a DIY community, participants are strongly motivated by personal values. In addition they have an interest in sharing and increasing their skills and knowledge with likeminded people, gain social recognition through showing their skills in making, plus the aspirations for more influnce on the processes of garment manufacturing. It is argued here that especially diffuse social manufacturing could be seen as a form of social production, particularly the alternative design strategies referred to in the aformentioned examples. These have a strong focus on collaborative making, where the social interaction and "socially recognized self-expression (Arvidsson, 2008, p. 326)" are the main motivators, enabling skill sharing and knowledge generation that is valued more in this context than monetary concerns.

7. An alternative value framework for social manufacturing

The different types of value created through creative making processes in collaboration with others as well as indiviudally is emphasized. How and what type of value is created during such processes has been analyzed in the current study. For example, through the collaborative design process in participatory design workshops or DIT sessions, value is co-created through acts of collective creativity – defined as co-creation by Sanders and Stappers (2008). Co-creation is a very broad term, but in this paper the authors base their interpreation on the definition of Sanders and Stappers (2008, p. 6) who define co-creation as "any act of collective creativity, i.e., creativity that is shared by two or more people." The value framework does not comprise a complete list and definition of the great diversity of different types of value; however, we aim to choose and emphasize a selection appropropriate for this analysis on diffuse social manufacturing practices (see Table 1). Notably, there are other types of value very relevant to clothing such as symbolic and aesthetic value, which can even positively influence e.g. emotional attachment through symbolism of the self and "what is me" and "what is mine". Furthermore, these values can extend to what the authors define as experiential value, through the experience of pleasure in the creation of something beautiful. However, these types of value did not arise within the discussion with the participants, thus the authors propose them to be a matter of investigation for the future.

The current study focuses in particular on the types of value important to bring forward sustainable practices and influential factors for consumer behavior but also considers future business model generation for social manufacturing, such as a combination of PSS with DIY/DIT or other forms of active user participation in small-scale, local design and manufacturing processes.

7.1. Social value

Social value is defined by Sanders and Simons (2009, p. 1) as being the type of value "fueled by aspirations for longer term, humanistic, and more sustainable ways of living." Sanders and Simons (2009, p. 1) believe that social value has a strong potential for change towards more sustainable ways of living, but point out that its also very challenging to engage people in this type of value co-creation, as the "participation must be face-to-face to allow for real-time interaction". Social value can be reflected, for example, in exploring open-ended questions towards improving quality of life for some marginal group of people (Sanders and Simons, 2009). Therefore, we see that, for example, aspects such as social interaction, integration, and empowerment are key words for analyzing social value creation in collaborative design process. In this case, the social value can be constructed through DIT approaches. Social value should reflect the common good, and in this case, this could mean social well-being through social interaction (e.g., working in a group, shared experiences, shared learning) facilitated through face-to-face workshops where people are "making together."

7.2. Knowledge value

Knowledge can also be considered as one of the "intangibles"; a value to a firm through patents and intellectual property rights, but also as "tacit knowledge embodied in social processes" (Ardvidsson, 2009, p. 17). The latter refers to the ability of a firm to generate value based on user-led communities. Furthermore, knowledge is referred to as value as the individual's ability to gain skills through collaborative learning experiences. The ability, knowledge and existing skills in crafting and material production will influence strongly the motivation towards DIY/DIT activities, but also enable the person to distinguish the quality of manufactured products (Wolf and McQuitty, 2011). In the current case, the value of knowledge in relation to gaining new skills, or understanding the quality value of a product can be reached through participatory, DIY and DIT approaches. In DIY, for example, knowledge links directly to gaining new skills for garment construction. Overall, these activities can raise consumers' awareness towards a garment's quality (which is important in sustainable consumption and longer lasting products). Furthermore, within DIT and participatory approaches the knowledge building is co-created and shared amongst the participants, thus linking the knowledge building to social value generation.

7.3. Experiential value

The greatest source of value in social production is the ability to create relations between peers – the experience of a community who share similar values (Arvidsson, 2011). This experience of community, and being able to give input for a common goal creates positive experiential value by feeling appreciated for one's contribution that is recognized by their peers. In the area of fashion and DIY, von Busch (2008) describes the potential of facilitating creative working sessions where "pooled experience and skills that are brought together" (von Busch, 2008, p. 35) enable the individual to experience collective empowerment, learning through skill-sharing and self-enhancement. Especially self-enhancement or identity value is often increased via shopping, similar to the feelings of fun, fantasy, escapism, and freedom (Babin et al., 1994 in Karababa and Kjeldgaard, 2014, p. 121). Previously mentioned values can be (at least to some degree) reached through DIT and participatory approaches, emphasizing collective empowerment and satisfying consumer needs through alternative experiences, replacing the desire to consume more. Participants experience the feeling of "joy" and "fun" by being enabled to create a garment with their own skills but also by changing their role to teacher and advisor for others as they increase their skills over time.

7.4. Emotional value

Walker and Chaplin (1997) identify one value aspect in artifacts to be emotional value, which they define as personal or sentimental value. In the current throwaway culture, it is challenging to build stronger person-product relationships and keep the emotional value linked to some object. It can be said that it is extremely difficult to sustain the value of a product in a temporary context (Walker and Chaplin (1997)). Personal memories can increase the value of a product. Results from the participatory workshops show that it is possible to some extent to reach deeper person-product attachment through making the garment by oneself and through shared experiences, building a story captured within the made garment.

Table 1
Summary of value definitions.

Type of Value	Definition	Activity	Created in the cases
Social Value	… offering a strong potential for change towards more sustainable ways of living (Sanders and Simons, 2009)	social wellbeing through social interaction (e.g., working in a group, shared experiences, shared learning)	Yes
Economic Value	Generated through different types of exchange, creating monetary value.	Possible participation fee, donations, selling of DIY kits …	Potentially in the future
Environmental Value	The core values in environmentalism are the protection of biodiversity and ecological systems, consideration of negative impacts on human health and the sustainable use of resources. (Paehike, 2000)	Upcyling, reducing unnecessary consumption and giving value to undervalued materials, tools and skills, by enabling local production models	Yes
Knowledge Value	• "tacit knowledge embodied in social processes" (Ardvidsson, 2009, p.17) • individual's ability to gain skills	collaborative learning experiences in workshops, through blogs or DIY	Yes
Emotional Value	personal or sentimental value (Walker and Chaplin, 1997)	build stronger person-product relationships through personal memories – DIY/DIT helps building a story captured within the made garment	Yes
Experiential Value	"pooled experience and skills that are brought together" (von Busch, 2008, p. 35) to enable the individual to experience collective empowerment, learning through skill-sharing and self-enhancement.	create relations between peers – the experience of a community who share similar values (Arvidsson, 2011)	Yes

7.5. Environmental value

Paehike (2000) has listed the core values in environmentalism: first, the protection of biodiversity and ecological systems; second, consideration of negative impacts on human health; and finally, the sustainable use of resources. But these values are not sufficient, thus we must challenge our whole way of living if we consider sustainable development: how societies are organized and how we live our lives, including new challenges in purchasing patterns and disposal behavior (Paehike (2000)). In the current study one important motivation has been trying to understand how to change fashion consumption habits towards more sustainable practices. The current case examples show that there might be a possibility to increase the ethical awareness among participants. By constructing the garment him/herself, the participant can understand the effort needed to produce one garment (time and skills needed). Furthermore, the problematic and often low quality of current fast fashion items can be raised into discussion and through the process of making, increasing participants understanding of quality garment construction. These aspects open possibilities to challenge individuals' clothing consumption practices and possibly reduce the fast disposal of textile waste.

7.6. Economic value

Leiserowitz, Kates and Parris (2006) argue that the most important value in sustainable development is environmental protection. This includes many different values and approaches. Moreover, in sustainable development there are three key 'stakeholders': people, the economy and society. Therefore, the economic value needs to be addressed in sustainable development if we are aiming to change the current fashion system. The business logic in social manufacturing can be (or should be) different than in the traditional fashion system. The focus group workshops illustrate that DIY and DIT can create new business opportunities where a network of people create new business logic or some active consumers begin to build new business models based on different kind of actions in a network. Also, the interest of the workshop participants in joining collaborative sewing sessions on a regular basis opens potential for further exploring social manufacturing business models (e.g., based on a fixed participation fee or hourly rates). Therefore, DIT, for example, in combination with product-service-system approaches can potentially open new economic value creation.

With these definitions, the diversity of value is illustrated, generated through these alternative design strategies, which are incorporating active users in their business models. Through a more balanced way of addressing different types of value beyond economic value, we address sustainability and sustainable business model thinking. For new value creation, there is strong potential in co-creating value with the users but sharing this value more equally by opening the design and production phases. With a diffuse social manufacturing approach, we are generating experiential, knowledge and emotional value directly for the user, but also binding them to the described PSS or DIT model, which adds value to the service provider. Furthermore, social and environmental value for the individual and the community are co-created in addition to economic benefits for the individual owners or the community.

In Table 2 below, we summarize the findings generated through the data. The framework illustrates the level of participation and the sphere of activity in relation to the definitions of value. The context for this value framework is social production and diffuse social manufacturing through DIY and DIT strategies.

8. Discussion

This study demonstrates that alternative design strategies, like DIY, DIT and participatory design in fashion offer an opportunity to create different types of value reaching from creative experiences, gaining knowledge and new skills for empowerment to deeper person-product attachment to the garment, because it is manufactured with one's own creativity, skills and time. Thereby, the

Table 2
Value framework for social manufacturing.

Alternative Design Strategy	Collaborative/Individual	Objective	Type of Value
Do-it-yourself (at home)	Individual	Creative activity, Learning new skills	Knowledge Environmental
DIY kits	Individual	Creative activity, Learning new skills New business opportunity	Knowlegde Environmental
Do-it-together (amateurs working/meeting to make together)	Collaborative	Creative activity, Skill sharing & learning, New business opportunity	Knowledge Social Economic Environmental
Participatory Design Workshops (supported by expert designers)	Collaborative	Empowerment, Skill sharing & learning, Creating person-product attachment, Easy entry level	Knoweldge, Social Experience Emotional Environmental

resulting garment is made more precious and less likely to be disposed. As one of the participants in the focus group workshop explained: "You always value self-made more, so maybe you appreciate those garments deeper." On the other hand, this kind of deep and active participation is not for every consumer. The study results also illustrated that DIY/DIT is experienced differently, depending on the type of consumer, thus the results also have certain limitations. For example, people participating in a DIT workshop, already have a certain interest in the subject, like learning new skills, and thus represent only a specific consumer group.

As shopping provides some short-term emotional satisfaction (Richins, 2009), these more social fashion acts (DIY, DIT and participatory design) are perceived to provide similar emotional experiences with less material consumption. Own efforts and success of doing something yourself provides deep emotional satisfaction (Niinimäki, 2010). This is one opportunity for sustainable business models, to develop product-service-systems in combination with DIY/DIT approaches for more sustainable fashion consumption. By co-creating value with the customer in diverse forms, slower cycles of production and consumption are possible by offering opportunities to learn new skills while empowering consumers to challenge their fashion consumption habits. This offers only one of many alternative strategies that can empower consumers to break free from the current fast fashion cycle, low quality and impulse shopping to more stable values, and longer-lasting fashion choices.

The consumers' active role is most important while developing a new fashion system for social manufacturing. The new value in this system is that consumers can develop their skills and simultaneously create deeper understanding of the garment construction process, which offers them the freedom to redesign or repair and in addition develop stronger appreciation towards garments. A similar aspect is discussed by Sennett (2008) in his book the *Craftsman* where a feeling of empowerment through crafting skills is described. This author argues that the majority of consumers do not have to be working as a craftsman but need the ability to see and understand the quality of products and production to be able to make informed and conscious purchasing decisions. Therefore, if this approach can make consumers appreciate their garments more through creating deeper person-product attachment, it can support sustainable development. The garments that represent high emotional value are potentially worn longer, repaired or handed-over to relatives or friends and thus create less waste and reduce new replacement purchases. Therefore, DIY combined with DIT actions in fashion are one possibility to incorporate sustainable PSS thinking, towards a new fashion system which is more democratic, sustainable and open. This new system can activate consumers into new empowering roles, even offering new business potential. Even though there are obstacles to develop this system for all consumers, the authors see potential to attract young fashion lovers, who are ready to challenge themselves to learn new skills and share their knowledge in a social context. They have a tendency to represent strong consumers of fast fashion goods, offering financial capital to be invested in alternative means to satisfy their needs with experiential and emotional value generated through social manufacturing business models. Instead of offering them linear fashion consumption, diffuse social manufacturing would potentially lead them to new, sustainable pathways of fashion production and consumption.

There is an opportunity for change in the fashion system by activating consumers. Through their own action, consumers become value creators in the fashion system, not only value users. Alternative design strategies offer possibilities to organize fashion design and manufacturing systems more locally, closer to end users, reducing costs and environmental impact through less transport and transparent supply chains. Therefore, alternative design strategies supporting active consumers can potentially disrupt the current fast fashion industry from a local level. Social manufacturing, with a focus on "social" interaction and collaborative activity, facilitated through DIT and participatory approaches and shared values, can potentially enable new collaborative business models and service offerings for a change in the fashion system.

While DIY creates new creativity and DIT fosters new collectivity, these aspects create strong and deep learning experiences for participants. Combining these approaches in the fashion field, it is possible to shift the power structures of the fashion system and offer a new, more active role for the consumer in the context of social manufacturing. Consumers can begin to create their own system, designers can help them in this change process as shown through the half-way-clothing workshop examples. The developed value framework illustrates the diversity of value that can be generated through these forms of collaborative fashion making with the consumer. There is great potential for traditional as well as new, sustainable business model generation by looking at these values and exploring how many of these and in what ratio are addressed in their business model offering. For a more sustainable fashion system, consumers as well as retail brands with large-scale mass manufacturing are asked to change their ways of acting, to produce more equally distributed value, beyond monetary benefits.

This paper has focused strongly on the consumer-side, how he/she can start creating a fashion systems from the perspective of their own needs and values (e.g., need for new garments, new skills, new experiences or social interaction). Therefore, activating end users through new value creation, offers an opportunity to

implement an alternative fashion system, not linear, but more complex which strongly involves the user as co-creator of value. While transitioning the user to a manufacturer of their own garments, local networks are enabled, reducing long-distance transport and making supply chains transparent and simultaneously enabling users with new skills, knowledge and experiences. We see that the diverse value which is co-created, is shared more equally amongst different actors, challenging the linear system of fast fashion by offering alternative experiences and more sustainable means of producing and consuming fashion slower and more locally. There is the possibility to create fashion networks that are comprised of several small local units, linked to each other through global networks (e.g., though sharing platforms or open-design strategies). The network can provide a conduit for shared learning and an economy on a local scale.

9. Conclusion

This paper aimed at illustrating the diverse types of value created through alternative fashion design strategies. Emphasizing the agency of the individual consumer, becoming empowered with skills, knowledge, and capabilities to make informed consumption decisions or become more actively involved in local production circles. We highlighted the importance of the social aspect in social manufacturing, the great value in designing and making objects together, with one's own skills and abilities. Through the empirical data, the authors were able to showcase the diverse potential for alternative design strategies, which bring strong arguments for individual and collective participation in the physical making of an object.

Based on the value framework, and the suggestions found through the empirical data, the authors believe that these more radical means of social manufacturing are suitable for small-scale business, which are facilitated at a local level. Possible business models, incorporating these design strategies, are not aiming to become the next mass-market fashion business, but to encourage a new role for consumers, and perhaps, even lead to finding a new business logic, based on meaning making, shared learning, new value creation, and business in collaborative, participatory and peer-to-peer settings.

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[p2]Paper 2

Hirscher, A.L., Mazzarella, F., Fuad-Luke, A. (2019). Socializing Value Creation Through Practices of Making Clothing Differently: A Case Study of a Makershop With Diverse Locals

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HIRSCHER, A.L. MAZZARELLA, F., FUAD-LUKE, A. (2019). Socialising Value Creation through Practices of Making Clothing Differently: A Case Study of a Makershop with Diverse Locals

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To counter the unsustainability of the current mainstream fashion system, an increasing number of designers are activating practices of social making aimed at empowering people through shared learning experiences. Within this context, the collaborative network *Mode Uncut* initiated *Make Yourself...*, a project focused on socialising value creation through making clothing differently. This article presents the project which took place in BITZ Unibz FabLab in Bolzano (Italy), as a case of social making of clothing in a 'makershop' (i.e. a makerspace combined with a pop-up shop where diverse locals make clothes using discarded textiles and second-hand garments). Through this participatory action research project, it emerged that the process of bringing together diverse locals in a makerspace can help generating different clothing concepts, and that these concepts can bring about different value propositions for local clothes production. As an outcome of the project, a framework for socialising value creation was corroborated and enriched; the framework is conceived for other designers to use and generate value for individuals, communities, societies, the environment and local economies. In conclusion, this article discusses how social making contributes to shaping alternative exchange economies of fashion.

Keywords
fashion makerspace;
social making; value proposition;
alternative exchange economies

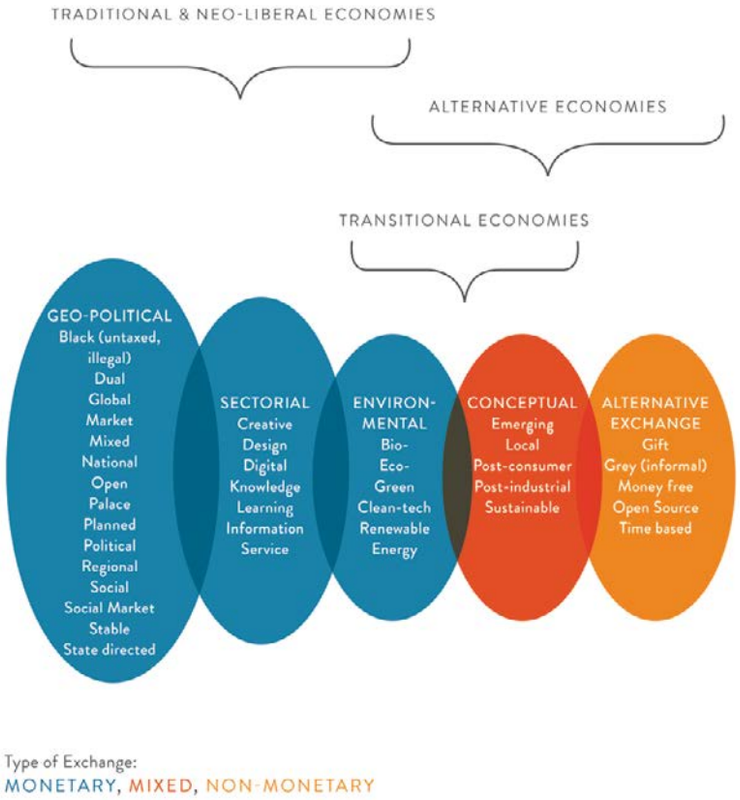

Figure 1
Traditional and Neo-Liberal, Transitional and Alternative Economies
(Source: Hirscher and Fuad-Luke, 2013).

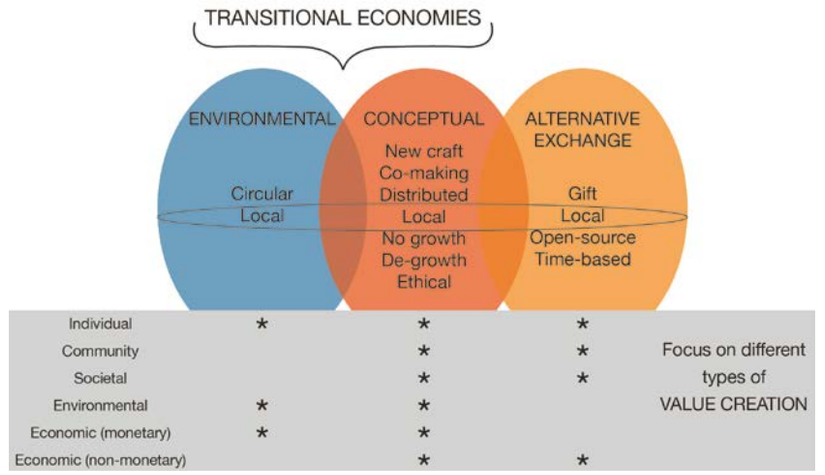

Figure 2
Potential transitional and alternative exchange economies for the fashion industry focused on different types of value creation in relation to the *Make Yourself...* project.

1.

Introduction: Alternative/Diverse Exchange Economies of Fashion

We are living in an age of positive disruptions of the clothing industry, currently dominated by cheap and low-quality production of fast-changing collections (Fletcher, 2010; Fletcher and Grose, 2012), increasing consumption via planned obsolescence (Burns, 2010) and disposal of garments (Allwood et al., 2006). A reaction to mass production and economic growth, which does not lead to socio-economic equity emerged in the 1970s, shaping a nobler vision of economics inspired by cooperation, education and the ambition to elevate people. The theory proposed by economist Schumacher (1975) around the concept that 'small is beautiful' in relation to 'economics as if people mattered' showed the importance of retaining circulation of flows (in terms of people, resources, money) in a local economy. This was followed in the mid-1980s by an optimistic narrative on 'new economics' (Ekins, 1986). It was the global economic crisis in 2008 that revived the debate on what can be identified as 'transitional and alternative exchange economies' (Hirscher and Fuad-Luke, 2013), meaning alternatives to traditional or neo-liberal global economies, alongside the emergence of the 'no growth' economy (Jackson, 2009) and the 'de-growth' economy (Latouche, 2011). These alternative – or diverse – economies, put people – not only design and other professionals but also amateurs and citizens – at the centre of new modes of exchange of money, but also of intangible forms of value, such as time, skills, knowledge, and other types of resources (Arvidsson, Bauwens, and Peitersen, 2008). This is opening the horizon to an 'ethical economy' (Arvidsson, 2009), in which outputs are not 'free' or beyond value, but they follow another value logic, where 'socially recognized self-expression is the main motivation and community contribution is the main measure of value" (Arvidsson, 2008, p. 326).

Among these transitional and alternative exchange economies – identified by Hirscher and Fuad-Luke (2013) and expanded upon below – there are conceptual economies which present, potentially, strong links to sustainable fashion (Figure 1).

These conceptual economies include the circular economy (Ellen MacArthur Foundation, 2014), which is focused on closing the loop of resources through practices of waste minimisation, modular design, repair, reuse, upcycling, transparency and traceability throughout the supply chain. Besides many multinational companies approaching the circular economy with a technological focus on eco-efficiency, we are also witnessing an overall increased interest in artisanship as a more meaningful and sustainable approach to design, production and consumption. From this perspective, a new craft economy is rising (Micelli, 2011), perceived not as a nostalgic return to anachronistic craftsmanship, but as a timely opportunity to set up resilient and redistributed micro-productions, for instance reinterpreting heritage textiles into slow fashion practices addressed to mindful consumers with increased appreciation for

the quality and origin of clothes (Vuletich, 2009; Neuberg, 2010). Artisanship is also linked to the shaping of a distributed economy (Stewart and Tooze, 2015), which is re-localising production thanks to the emergence of small, networked and less hierarchical micro-factories (Maffei, 2011). From a social standpoint, the maker's movement (Anderson, 2012) has activated an on-going revolution of the manufacturing sector. Within this context, the co-making economy (Gauntlett, 2011) is driven by the pleasure of making things by hand (Sennett, 2008), and is enabled by democratised access to interactive and digital fabrication technologies, while enhancing individual and community wellbeing (Thomas et al., 2011).

Overall, we can characterise the above-mentioned different types of transitional and alternative exchange economies as an overlapping landscape of potentiality where different combinations of value creation are implicit and may involve monetary, non-monetary or both kinds of exchanges (Figure 2).

1.1. Alternative/diverse fashion practices of exchange and value creation

Sustainable fashion designers and researchers have dealt extensively with making and using clothes in more sustainable ways (Fletcher, 2008; Gwilt and Rissanen, 2011), and have explored making as a joyful and convivial activity (Gauntlett, 2011; Hirscher, 2015). Worldwide movements such as craftivism – operating at the intersection between craft and activism (Greer, 2014; Corbett, 2017) – and Do-It-Yourself (DIY) are marking a shift from passive consumption to a participatory democracy made by interventionists, makers, hackers and tinkerers (Ratto and Boler, 2014). We are also witnessing an increased number of practices of open and collaborative design taking place in FabLabs, makerspaces and through individual projects (Fuad-Luke, Hirscher, and Moebus, 2015). Fab Labs (i.e. fabrication laboratories) and makerspaces are alternative sites of production, set up *by* and *for* participants to use tools, equipment and facilities in order to design and produce their own artefacts. They offer means of *personal fabrication* in a social and collaborative set-up (Kohtala, 2016). Fab Labs are considered the most organized type of such sites, as they have a rather clear identity, held together by an international network (www.fablabs.io) fostering also production innovation and closer collaboration with business-partners. Makerspaces, in comparison, refer to any kind of collaborative workshop space (Kohtala, 2016), not necessarily emphasizing technology and innovation. Henceforth, the term makerspace is preferred in this article, as it implies the possibility for a more diversified program of making activities.

In particular, here we focus on practices of *making clothing differently*, as alternative forms of exchange, within and beyond the market, offering a counter narrative to how clothes are predominantly made in the neo-liberal economy. These practices can be pursued, for instance in makerspaces, which enable community members to design, prototype and make clothes that might not be possible to create with the resources available to individuals working alone. We consider such practices as forms of *social making*, grounded on new forms of multicultural and multigenerational exchange and value creation among diverse locals who design and produce unique clothes based on sharing patterns. In this article, we define *diverse locals* as citizens living locally for a long time, or economic migrants and refugees recently arrived in a locale. This article is concerned with the re-combination of existing actors with new ones as a way to contribute different kinds of human (social and cultural) capital to making processes, using local resources and skills wisely and shortening the value chain (Fuad-Luke, 2011). Moreover, the term *social manufacturing* is referred to as a democratic approach to opening the design and manufacturing phase to everyone (Shang et al., 2013) and it has mainly been used so far in relation to digitally-enabled personal fabrication, or mass customisation and distributed manufacturing (Leng, Ding, Gu, and Koren, 2016; Hämäläinen and Karjalainen, 2017). Instead, in this article we prefer using the term *social making* to emphasise the 'social' aspect of collaboration and interaction at a local level, through alternative design strategies based on analogical, small-scale and local production systems. This way of making enables the joy of doing and learning together, creating value in terms of happiness and wellbeing beyond the physical object (Gauntlett, 2011). Such alternative practices activate people to get involved in the making of their own clothes, contributing to increased awareness of the authorship, origins and processes behind the garments, while overcoming the need and desire to consume with more creative personal and social experiences (Chapman, 2005). Such an approach disrupts the traditional passive role of the user (using a ready-made garment), with an open, collaborative and active role as value creator (Niinimäki, 2011). In this regard, research has shown that user involvement in the process of designing and making clothing will increase emotional attachment through embedding a story in the resulting garment (Mugge, 2007) and consequently enhances personal and emotional value and satisfaction (Niinimäki, 2010, 2011; Twigger-Holroyd, 2017). Nevertheless, it seems that most of the current sustainable fashion approaches do not question the current system radically enough. As a consequence, the age of the *prosumer* (Toffler, 1970), *Pro-Am* (Leadbetter and Miller, 2004), *user-maker* or *fashion maker-designer* seems not to have emerged yet.

Taking up these challenges, *Mode Uncut* (www.modeuncut.com) was created as a collaborative network and platform for exploring and disrupting fashion practices, by reconfiguring the *designer-producer-consumer* (DPC) relationship (Hirscher and Fuad-Luke, 2013; Mode Uncut, 2017). With this in mind, members of *Mode Uncut* have facilitated over twenty participatory design and sewing workshops in Finland, Germany, Italy and the UK, challenging the way in which we make our clothes, individually and together.

2. Socialising Value Creation

Within this context, we encourage a reflection on the contributors and beneficiaries of alternative fashion practices and new ways of making, in relation to different types of value created beyond monetary benefits. In general, value can be 'defined as a 'socially recognized importance': the weight that a society gives to an object or an issue" (Arvidsson, 2009, p. 16). In the economic system, value is mostly referred to as being measurable in monetary terms. However, when looking beyond this context, there are a range of different understandings of value in relation to, for instance, the socio-cultural setting and the theoretical approaches these are grounded in (Karababa and Kjeldgaard, 2014). In regard to the fashion sector, the consumer has been considered as a 'value user' (user of the product), purchasing ready-made garments where value is created by wearing garments. However, in the context of this article we emphasise that through social making the consumer is enabled to take an increasingly active role in the design and manufacturing processes and becomes a 'value creator' in the system (Niinimäki, 2011 & Hirscher, Niinimäki, Armstrong, 2018).

2.1
Types of value generated through practices of social making

A key issue taken into consideration in this article is the fact that the three pillars of sustainability (economic, environmental and social) are underpinned by different value theories for economics, sustainable development and the social sciences. For the purpose of this article, we reframed *social making* by looking at these theories in light of the piece of clothing and the process beyond the object, as well as the individual, the community, the society, the environment and the economics that enable clothes production.

We analysed the concept of *social making* in relation to intrinsic, instrumental and extrinsic types of value. According to Plato, intrinsic value is worth having for itself, not as a means to something else; instead, instrumental value is worth having as a means to get something else that is good. Furthermore, we propose that the concept of value is a social construct, and as such is defined by the culture adopting the concept. In line with axiological theory (which studies the notion of value and value judgements), clothes embed intrinsic properties (properties that an item has in itself, independently of other things) and extrinsic (relational) properties (which depend upon a piece's relationship with other things). The *social making* practices discussed in this article emphasise a strong degree of user involvement in clothes making activities. Thus, the type of value generated is co-created between users, designers and other actors involved in the process. The types of value co-created through *social making* practices will be analysed in the next section.

Within this context, it is important to note that practices of *social making* seem to be driven by personal values and beliefs (i.e. people's judgements of what is important in life) based on a strong sense of communality. This could possibly also be referred to what Benkler (2006) describes as the social production phenomenon, yet at a small-scale and local level. Such practices share a similar values-led approach, driven by people's beliefs being 'self-organized, emergent, bottom-up" and 'not primarily motivated by monetary concerns" (Arvidsson, 2008, p. 329). In social production, the types of value generated are not resulting from the directly owned resources of the company, but more grounded on 'collaborative forms of wealth production' based on attracting and appropriating contributions from diverse stakeholders such as consumers who create intangible value through their creative input and tacit knowledge (Arvidsson, 2011). Here, we question whether the type of value thereby generated is also shared among all actors. This way of creating different types of value is, according to Arvidsson (2011), particularly true in projects found outside corporate boundaries, where community members receive meaning and purpose through a shared vision (and hence shared values) and a set of personal values, beliefs or principles of behaviour. In fact, *social making* encourages user participation and exchange between cultures, and thus is able to offer 'more socialised processes of value creation" (Arvidsson, 2011, p. 262) beyond monetary benefits. Following a similar value logic as that of the 'ethical economy' (Ardvidsson, 2011), we refer to *socialising value creation* as an open, creative and collaborative process, which aims at socialising value creation through the process of making together.

2.2.
Value framework

In this article we consider how local and social practices of making clothing enable the creation of alternative types of value, such as: individual, community, societal, environmental and economic. For this purpose, we propose a conceptual framework of 'value',

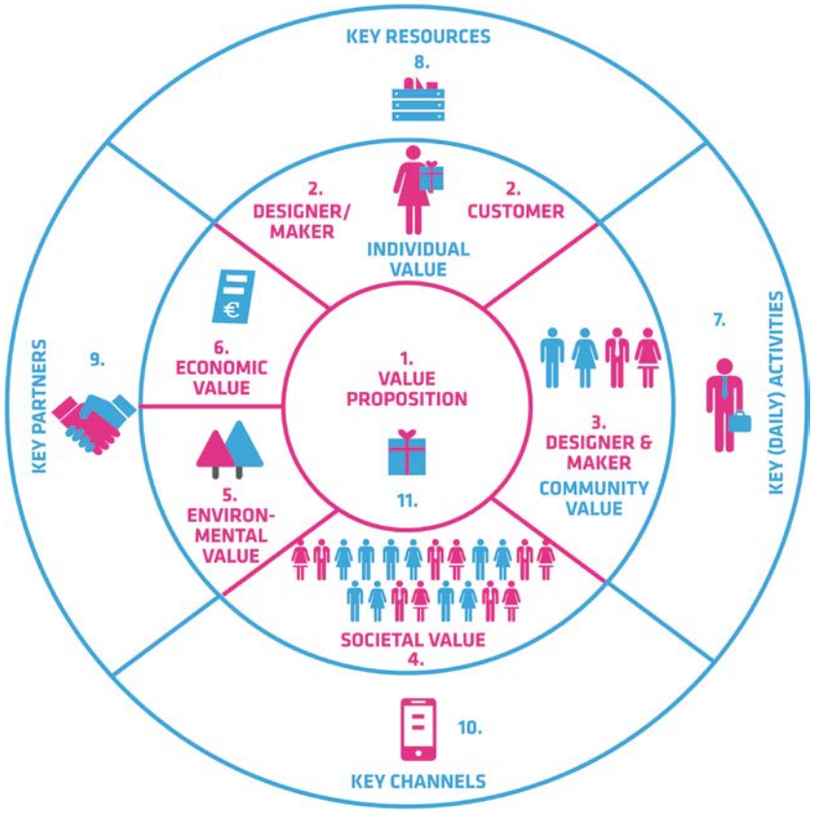

Figure 3
Value Proposition (VP) tool.

built upon previous research on different types of value (Hirscher, Niinimäki, and Armstrong, 2018) and which informed the development of a value proposition (VP) tool that was then applied in this project (Figure 3). The following sections explain the different types of value which the conceptual framework for *socialising value creation* entails, integrating Value, Sustainability and Needs theories around wellbeing.

2.2.1. *Individual Value*

With individual value, we refer to the value gained by a single person to increase his/her personal wellbeing, or the individual's ability to develop skills and knowledge through collaborative learning experiences. The knowledge and skills acquired through making enable a person to distinguish the quality of manufactured clothes (Wolf and McQuitty, 2011), but also add emotional value to the garments created, as these inherit the story of making (Mugge, 2009; Niinimäki, 2011).

2.2.2. *Community Value*

This category refers to the added value, which is generated by members of a community to benefit the community itself, for instance, by strengthening community cohesion while embracing a joint vision. In social production, for example, the greatest

source of value is the ability to create relations between peers and the experience of a community who share similar beliefs (Arvidsson, 2011). Being able to contribute to achieving a common goal creates positive experiential value for the individual, who feels appreciated for his/her contribution, recognized by his/her peers, but also generates exchange of knowledge and skills among like-minded people. This type of value is created through the collective tacit knowledge embodied in social processes (Ardvidsson, 2009).

2.2.3. *Societal Value*

Within this framework, societal value refers to the type of value, which contributes to society as a whole. Judge and Kammeyer-Mueller (2011) discuss the added value of individual and collective happiness and wellbeing to a well-functioning society. Societal value creation in the context of this article is found in enabling individual and collective wellbeing through social interaction and integration (e.g. shared experiences and learning, as well as getting to know diverse locals) facilitated through face-to-face workshops where people make clothes together.

2.2.4. *Environmental Value*

According to Paehike (2000), the core principles in environmentalism are the protection of biodiversity and ecological systems, consideration of negative impacts on human health and the sustainable use of resources. With this in mind, we consider environmental value as the contribution to reducing unnecessary consumption and giving value to underestimated materials, tools and skills, by enabling local production models.

2.2.5. *Economic Value*

Here we refer to economic value as the value generated through diverse forms of exchange (e.g. time, skill, knowledge), which may or may not be measured in monetary terms. In this context, economic value is framed within the 'ethical economy' (Arvidsson, 2009) and the transitional and alternative exchange economies defined in Figure 1.

3.

Make Yourself…: A Fashion Makershop with Diverse Locals

The *Make Yourself…* project was initiated in November 2016 at the BITZ Unibz FabLab in Bolzano, Italy. The aim of the project was to engage locals and newly arrived locals in making clothing together, and to investigate the potential of such a process to generate new design concepts and value propositions. The project entailed a fashion makerspace and pop-up shop (hereafter referred as *makershop*) engaging diverse locals to explore how their skills and cultures could contribute to *making clothing differently* to satisfying their needs. *Make Yourself…* was initiated during the festive time of December, when many artisanal products are sold at the local Christmas market. Bolzano, near the Dolomites mountains, attracts tourists and locals alike but is also the destination of newly arrived and displaced citizens (visitors, migrants and refugees), the latter from Northern and Western Africa, the Middle East, Eastern Europe and the Balkans, as well as many tourists. We aimed at bringing together the talents, skills and creativity of local designers, students and artisans with those of the citizens in order to generate different kinds of clothes and exchanges. With this in mind, the branding of the project was a word pun around *Make Yourself…* a hat, a gift, a scarf, a new look… warm, happy, busy, a friend.

Through this project we intended to answer the following research questions regarding practices of *making clothing differently* as a means for *socialising value creation*:

— To what extent does the process of bringing together diverse locals in a *makershop* help generating different clothing concepts?
— In what ways do these concepts generate different value propositions (VPs) for local clothes production?

The *Make yourself…* project started with a kick-off co-design workshop, attracting staff from Associazione Voluntarius (an association helping migrants and refugees in Bolzano) as well as students and staff from the Free University of Bozen-Bolzano (Unibz). This was followed by the *makershop* set up, and two follow-up workshops to reflect on the activities and generate further concepts and value propositions, as illustrated in the timeline in Figure 4.

At the scoping workshop the collective decision was to have a particular clothing theme (i.e. bags, socks and mittens, shirts, dresses and ponchos, toys and kids' clothing, hats and accessories) every day and a free making time at the end of each day, while the last day was set aside for an exhibition. Local sewing machines were provided free of charge by J. Mohr, a local sewing equipment shop, and by participants who brought in their own machines. A local haberdashery shop donated accessories and equipment for setting up the exhibition. The project organisers provided local resources, including sewing machines and equipment, pre-consumer textile waste and second-hand clothes. Some of the *makershop* participants brought in an ironing board and a desktop handloom later in the week. All these tangible resources came to life though the individual resources, imagination and professional or semi-professional cutting and sewing skills of the diverse locals participating in the project. Newly produced garments were added every day to the large street level shop window façade (i.e. the pop-up shop) of BITZ the Unibz FabLab in the centre of Bolzano.

3.1.

Methodology: Participatory action research

For this project, we adopted Participatory Action Research (PAR) as a qualitative methodology linking theory to practice and involving *in situ* collection of socially and culturally rich data, leading to a flexible and reflective process of learning by doing (Kemmis and McTaggart, 2003). PAR consists of the close collaboration between the researcher and the individuals who are the

Figure 4
Timeline of the different activities comprising the *Make Yourself…* project and the methods used.

focus of the investigation (i.e. co-researchers) to influence or change an aspect of the intervention, innovation, policy, practice or service that is the focus of research (ibid.). Throughout the timeline of the project, we acted as organisers of events, conducted co-design workshops, and facilitated participatory design processes giving those affected by a design a say in the final outcome (Ehn, 2008; Björgvisson et al., 2012). We encouraged the participants – who learned, designed and created together through 'mutual learning' – to gain a sense of ownership of the project. We involved participants in scoping and directing the *makershop* activities; however, as design researchers, we did set the research questions reflecting on the participants' interests, but not directly involving them.

Under the overarching PAR methodology, we conducted participant observations (Creswell, 2007) consisting in the investigation and interpretation into the behaviour of the project participants and their social interactions within the *makershop*. Finally, for the purpose of the co-creation workshops that we conducted as an act of collective creativity (Sanders and Stappers, 2008; Stickdorn and Schneider, 2011), we adopted a value proposition (VP) tool with the aim to facilitate the participants in developing propositions for local clothes production, as explained further in the following sub-section.

3.1.1. *Value Proposition (VP) Tool*

Given the disruptive fashion practices emerging within the alternative/diverse exchange economies landscape, it is crucial to understand how to generate a Value Proposition (VP), which enables the development of sustainable business models based on participation and openness among the stakeholders. Building on a former simplified version (Pekkola, Hirscher, and Fuad-Luke, 2013) of the original Business Model Canvas (Osterwalder and Pigeur, 2010) based around a central 'value proposition', a new version was created for the purpose of this project (Figure 3). The tool was conceived as a 'canvas', a visual and textual representation of a business model, unpacking all the elements, which are required to bring a business to life and to sustain it. It can be used both in a diagnostic and reflective way (to assess an existing project), or in a speculative way (to generate new concepts, i.e. new ideas that need further prototyping to become actual designs of clothes).

The VP tool was used in a reflective mode in the *Make Yourself…* workshops following up on the *makershop* held in December 2016. The aim was to collectively explore how different design concepts made by diverse locals generated value for different components of the proposition. The participants were asked to define their value proposition, that is to say a product, a service, or an experience that could be offered to customers in order to satisfy their needs, create satisfaction and generate value. The middle circle was used to map out the value (as outlined in the conceptual framework in Section 2.2) generated to individuals (both the maker-designer and the customer), the community, society, the environment and local economy. In the outer circle, clockwise, the participants were asked to brainstorm around the key resources required (in terms of physical, intellectual, human, financial or other assets), the key daily activities required to sustain an enterprise, the key channels to reach out to customers and the key partners to collaborate with in order to deliver the proposition. The workshop facilitator provided an example to enable the participants to understand the use of the tool. Hence, using a filled VP model as a guide, the participants were asked to collectively sketch out the VP for a particular item of clothing they made during the *makershop*. Starting from the centre and progressively filling out all the parts, the actual types of value created, the resources, activities, partners and channels were added to an A2 blank template hung on the workshop wall.

4.

Results and Findings

Throughout the *Make Yourself…* project, all the participants took ownership of the makerspace and contributed to the organization of the pop-up shop and its activities, which were conducted with a prevailing spirit of conviviality. The event received a full-page coverage in one of the key local newspapers, the *Dolomitten*, which generated a sense of pride among the participants. The upcycled clothes were often highly customised and aesthetically creative, although some improvements were needed in terms of fitting (e.g. size) and finishing. Furthermore, we saw potential in developing some design concepts to further test their viability in the market.

4.1.

Types of value generated through making differently

Based on our observations during the *Make Yourself…* project and on further reflections, we were able to draw insights on the overall feelings, atmosphere and types of value generated in the process of making clothes together, differently, as discussed in the following sections, structured according to the types of value defined in the framework introduced before.

4.1.1. *Individual Value*

Through the working environment which we set up for the *makershop*, the *social making* activities generated personal value providing the participants with opportunities to work individually, in pairs or collectively. When problems arose, people helped each other or turned to more skilful participants for advice, generating individual value through gaining new skills and knowledge as well as making new friendships. Migrants from Afghanistan and Pakistan with tailoring experience brought traditional detailing and know-how for conventional garments such as shirts and trousers; their design solutions for the various themes – bags, hats, shirts etc. – were made with pragmatism and executed with pride (Figure 5). Design and making happened side-by-side, leading to interesting outputs. For instance, when one participant cut her own pattern, it triggered others to adopt the concept but also to subtly change or evolve it. This was evident when four women decided to upcycle woollen jumpers into multiple new garments, i.e. hat, stole, and gloves (Figure 6). Nobody worked with paper patterns but chalked or folded and cut the second-hand clothes or fabrics directly.

Throughout the week, we documented everything that was made by photographing the maker with her/his garment or accessory. This concept proved very popular and led to the photographs of the makers being displayed with the actual garment or accessory in a final exhibition coinciding with the last day of the pop-up shop, as an act of empowerment through recognition of the maker (Figure 7).

4.1.2. *Community Value*

The *social making* activities led to a positive atmosphere through mutual engagement in the process, evidencing the community value generated for the group of makers. Although every day a different group of participants was making garments, a strong sense of community was established already during the first day, as shown by the group photo in Figure 8, which captures the majority of the participants. There was a core group of six to eight people (locals and refugees) visiting the *makershop* almost every day full-time,

Figure 5
Traditional shirt made by a refugee from the Afghanistan/Pakistan border showcasing his tailoring skills.

Figure 6
Upcycled woollen accessories generated through collaboration between four participants.

Figure 7
Garments made and showcased at the exhibition.

Figure 8
The core group of participants photographed at the makershop.

enjoying each other's company while creating garments together or individually.

Adopting the Human Scale Development matrix (Max-Neefd, Helizade, and Hopenhayn, 1991) as a framework to analyse the interactions and environment of the *makershop* as contributing to meeting basic human needs, we observed a qualitative increase in the participants' capabilities, such as:

— *Senses, imagination and thought*: the participants were able to use their senses to imagine, think, and reason, in a 'truly human' way in order to produce garments and events of their own choice.
— *Affiliation*: the participants showed concern for others, engaged in various forms of social interaction, without discrimination on the basis of national origin, ethnicity, sexual orientation, and religion.
— *Emotions*: the participants were able to have attachments to clothes and people outside of themselves.
— *Play*: they were able to laugh, play, and have pleasurable experiences with others.

4.1.3. *Societal Value*

The creation of societal value was identified in the social interactions and integrations occurring among the participants. Although language and cultural barriers did exist, they were easily circumnavigated by finding ways of collaborating or demonstrating how to do things by hand. Strong social interaction was very visible in the acts of helping each other to measure or cut fabric, repairing machines and simply chatting while making. Those with higher practical skills clearly enjoyed sharing their knowledge with other participants (Figure 9). Some of the female migrants teamed up with other women from ethnic backgrounds who were partnered with locals and had been living in the area for some time. The participant observations highlighted new relationships between existing actors and new stakeholders, many based upon sharing resources, time, skills, and open-source patterns, thus giving expression to the potentiality of alternative exchange models, adding value to otherwise non-valued forms of exchange within a society.

Figure 9
A local citizen explaining the use of a sewing machine to a group of recently migrated refugees.

4.1.4. *Environmental Value*

The garments were often made by using existing features of old clothing or waste textiles, such as cuffs, seams etc., enhancing the environmental value generated through upcycling. By using and repurposing undervalued materials (i.e. donated pre- and post-consumer waste), new clothes were made. Furthermore, the participants gained insights and skills for future practices of creative upcycling of old garments, potentially reducing unnecessary consumption and disposal.

4.1.5. *Economic Value*

The participants donated all the clothing they had made to the pop-up shop to raise money for Associazione Voluntarius. As soon as each garment was finished, the participants put the maker's name, the number of hours worked and suggested price on a suitably printed label. This meant that the makers had to self-assess their creations and define the monetary value of their products. None of the customers who bought the clothes contested the prices which were set up; in fact, some people donated even more money. The *Make Yourself…* event confirmed that diverse locals could be brought together to co-create upcycled clothing for sale to the public, raising money for Associazione Voluntarius, which was later redistributed between the refugees and migrants.

Overall, it emerged that the activities of the *makershop* generated different kinds of value, more typical of alternative exchange economies than of environmental transitional economies. This is, perhaps, to be expected since individual and monetary exchange are a necessary feature of environmental transitional economies, but non-monetary and other exchanges feature strongly within alternative exchange economies.

4.2. Value propositions generated through the reflective and speculative workshops

One month after the week-long *makershop*, a co-design workshop was facilitated with some of the original project participants. The VP tool described in Section 3.1.1 was used to reflect on the *Make Yourself…* project with the aim to collectively discuss and investigate possible VPs emerging from the clothes concepts generated through *social making*. Two VPs were chosen by the group to expand the concept and complete a value proposition canvas, as described below:

— Upcycled collection of woollen accessories (Figure 10), whose core design concept was to create zero-waste new garments from old jumpers;

— Specialized, customized gloves (Figure 11), whose core design concept was to measure people's hands and create bespoke gloves, e.g. a glove with an opposed thumb and forefinger with 3-finger mitten for using digital touchpads and mobile phones in cold temperatures.

A few weeks later, another workshop was held with a new group of refugees and migrants who were joined by several participants from the original *makershop*. New speculative clothing design concepts were generated by the participants at this workshop. After several concepts were generated, the group chose to further elaborate the following one:

— History brought to life through new clothes (Figure 12). This is a speculative concept for using the original clothing of Ötzi (i.e. the 5000 year old mummy of the Iceman found in the Italian/Austrian Alps and preserved in the South Tyrol Museum of Archaeology in Bolzano) to stimulate new design concepts for the contemporary fashion market.

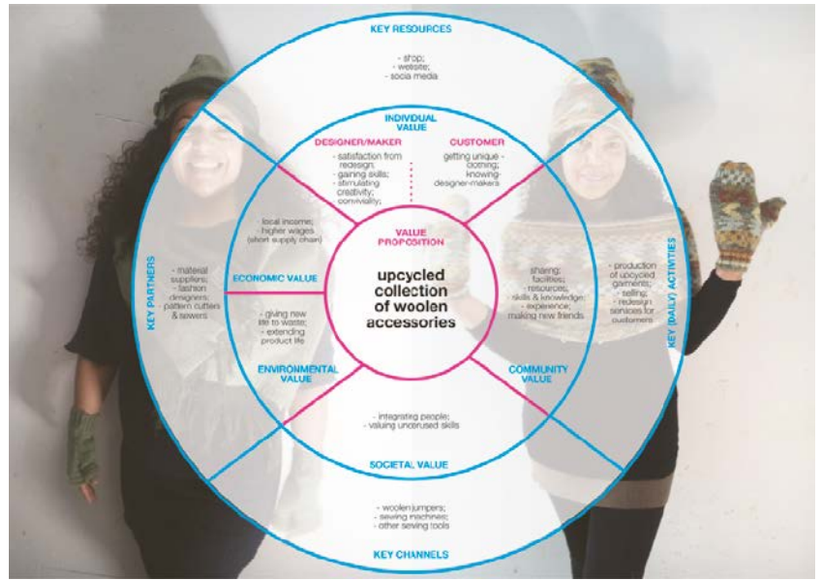

Figure 10
Reflective Value Proposition for upcycled collection of woollen accessories.

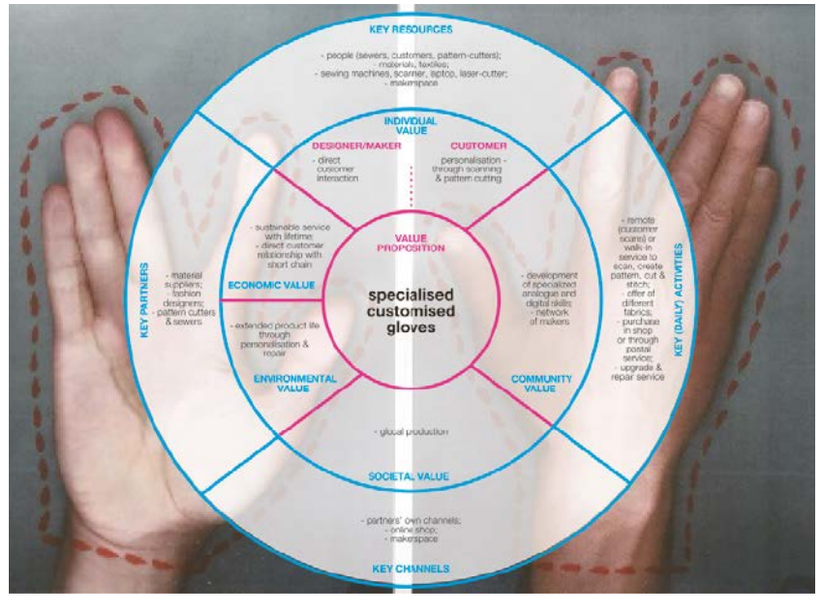

Figure 11
Reflective Value Proposition for specialised and customised gloves.

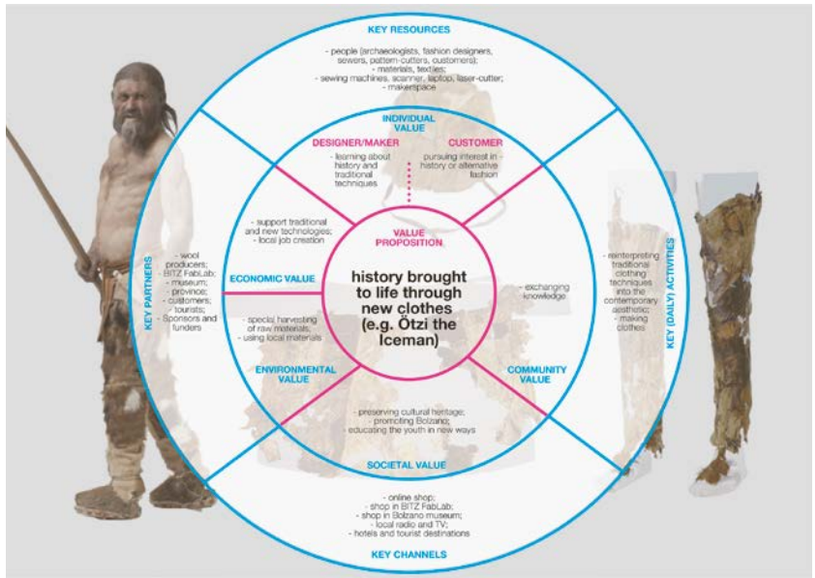

Figure 12
Speculative Value Proposition for history brought to life through new clothes.

Through the reflective VPs, it was clear that multivalent outputs were achieved for individual maker-designers and their customers, the *makershop* community, the wider society, the environment and the local economy. For example, individual maker-designers gained satisfaction from learning new skills and knowledge, through the joyful experience of making clothes together. Customers had the opportunity to purchase unique pieces of clothing, gained a different perspective on fashion and helped others (migrants and refugees) through their money donations. For the *makershop* community the interaction amongst makers allowed not only strengthening community cohesion but also providing the basis for a different practice of generating clothing concepts. For the wider society, the *makershop* was also identified as a place to help integrate locals and new arrivals, while valuing cultural diversities. Moreover, the participants of the co-design workshops recognised that the *makershop* and the concepts it generated offered an alternative model of local clothes production and upcycling, contributing to achieving environmental sustainability. They were also capable of understanding what kind of resources, activities, channels and partners could be needed to transform their design concepts into viable enterprise propositions. Finally, the participants understood that the *makershop* opened up opportunities for alternative economic exchanges, both monetary and non-monetary.

5. Discussion

The *Make Yourself…* project showed the potential of bringing diverse locals in a *makershop* to create different clothing concepts through *social making* and to generate different value propositions, challenging the fashion system to be more open, social and sustainable. It emerged that such collaborative practices of *making clothing differently* would require a shift in the production model (entailing participatory design processes of *social making*), business models (with the potential emergence of new social enterprises recombining existing and new actors), the design process (opening it up to professionals but also diverse locals as enthusiastic co-designers) and the role of consumers (becoming *prosumers* of their own clothes). The following paragraphs discuss how the findings from the *Make Yourself…* project addressed the research questions, contributing knowledge to the discourse on alternative exchange economies focused on sustainable fashion.

5.1. Bringing together diverse locals in a makershop to generate different clothing concepts

Through the project, the practice of bringing diverse locals in a *makershop* was framed as a social approach to the circular economy, aligned with the notion of 'collaborative consumption' (Botsam and Rogers, 2011), but also co-design centred on soft system methodologies (Fuad-Luke, 2007). The need to build new and compelling synergies between design, production and consumption emerged as a way to support sustainable practices of *social making*. In order to activate new relationships and forms of exchange among existing and new actors in the fashion system (Hirscher and Fuad-Luke, 2013), a mindset shift was deemed necessary. In this regard, *Make Yourself…* showed that diverse locals were willing and primed to become maker-designers and *prosumers*, mixing their skills and traditional know-how. Moreover, locals and newly arrived locals (i.e. migrants, refugees and others, here termed as *diverse locals*), aptly demonstrated that they blend and hybridise their skills and cultural knowledge. This, potentially, provides positive implications for stimulating the fashion industry in a more sustainable and localised way, leveraging the arrival of large numbers of migrants in Europe. Moreover, the role of *Mode Uncut* was that of a change agent providing a vehicle (e.g. in terms of resources, facilities, a platform and network) to reconnect designers, makers, producers and consumers in new ways. It was recognised that such an approach could shape a more multicultural, open and localised fashion system, with the potential to join up with other socio-economically driven initiatives (such as makerspaces, repair cafés, second-hand clothing stores, swop shops, complementary currency systems, time banks, etc.) and the socio-technical communities of the maker movement. The project corroborated that *social making* shares many commonalities with the maker movement, whose activities are centred on local enthusiasts and communities of practice (Wenger, 1998) but, within such a practice, making also emerged as a means to evolve multicultural initiatives and led to the potential development of new VPs and socially-orientated enterprises. In line with a recent study on the cultural role(s) of makerspaces (Halligan and Charney, 2016), this project showed the potential for the emergent 'maker culture' to progress towards a 'making culture', joining up diverse organisations to make communities, systems, educational programmes, and markets, although perhaps such rhetoric currently outstrips the reality.

5.2. Generating different value propositions for local clothes production

Beyond the activity of retrospectively mapping the value proposition of design concepts created during the *makershop* (reflective value propositions), the use of the VP also enabled generating

speculative value propositions. These were framed within different economic models of local clothes production, inspired by Schumacher's (1975) concept of 'small is beautiful' where money and resources are retained in a locality or region. Within these models, as design researchers we took on multiple roles (i.e. entrepreneurs, facilitators, enablers, innovators, activists) creating value beyond the garments. We also enacted the concept of 'designers as host' (Williams, 2018) since in the *makershop* we created the conditions for meaningful interactions to happen and 'communities-in-place' (ibid.) to be built through micro-scale interventions. This might open up opportunities for independent designers to overcome the issue of precarious hire in the fashion industry and develop their own networks within local communities, working as catalysts for new enterprises creating alternative forms of value and exchange. We see great potential for designers to appropriate the VP tool in order to further develop their individual practice and new ways of making fashion differently, by fostering the creation of diverse types of value, incorporating local resources and skills. As the case study *Make Yourself…* illustrates, design can encourage a redefinition of enterprises, whose value propositions focus on individual, community, societal, environmental and economic goals, and are attuned to the holistic principles of sustainable development. In fact, the diverse locals engaged in making clothing became key drivers for valuing cultural diversities, providing social engagement, triggering new economic exchanges and enhancing environmental stewardship. Furthermore, new commercial capital was created by adding value to second-hand clothes and waste production fabric. However, beyond the final products, the project stressed the importance of the processes of making together and mutual learning, gaining a sense of 'togetherness", echoing the words of sociologist Richard Sennett (2012). Throughout the *makershop* event, there was evidence of the aggregation of increased human capital, as people acquired new skills or extended their know-how as teachers (Fuad-Luke, 2011). The strong sense of conviviality and common purpose also helped building social capital through both bonding and bridging. Building on former studies on the joyful and collective acts of making clothing together (Hirscher, 2015), meeting human needs and raising individual and community responsibilities seemed to have marked this practice of *social making* the most.

6. Conclusions

The on-going economic and social crises are opening up an opportunity for activating practices of *making clothing differently* that contribute to transitional and alternative exchange economies. This article showed that *social making* practices – such as those activated within the *Make Yourself…* project – can empower a new generation of maker-designers (having capabilities as professional, amateurs and citizens) to become 'complementary relational designers' (Fuad-Luke, 2014), triggering social interactions and contributing to shaping sustainable business models.

In particular, a social approach to a circular economy emerged throughout this project, fostering co-making practices that rescue the value of craftsmanship. Environmental benefits were identified to be integral to the *makershop* functionality, while both monetary and non-monetary exchanges pointed to more ethical economic possibilities. The project demonstrated the potential for maker-designers to become *prosumers* by creating their own local production system, from the perspective of their own needs and values, facilitated by design researchers. A new social business model logic emerged, opening up the possibility to create communities of maker-designers and local fashion networks, connecting diverse small units through sharing platforms and co-design strategies. It is envisaged that such a logic — based on meaning-making, participatory settings, mutual learning, new value creation — can shape a different fashion system, one that is more sustainable through being more democratic, open and localised. In line with the principles of fashion localism (Fletcher, 2016) and craftivism (Greene, 2014), the elements of social solidarity, micro-political actions and the building of social and cultural capital were set alongside the ecological benefits of such forms of production. These socialised and localised forms of exchange appeared as counteractions to global neo-liberal capitalist models of production and consumption, while the new relationships facilitated between diverse locals reinforced a politicisation of design. Finally, the *Make Yourself…* project embraced a 'design mindfulness" that values place, time, and cultural diversity (Findeli, 2001), as well as design intelligence, thinking, hermeneutics, persuasiveness, virtues, pluralism, new functioning and capabilities (Fuad-Luke, 2007).

6.1. Limitations and next steps

Given the timeframe of the project limited to three months (with one week of intensive *makershop* activities framed by prior- and post- co-design workshops to critically reflect and develop the concept) a longer-term project is needed in order to better understand how the types of value generated would change over time. Moreover, in order to activate disruptive change, a mind-set shift is necessary, and therefore further investigation on people's motivations towards *making clothing differently* rather than shopping is recommended. In view of future research, it is also advisable to consider how to re-frame making – and therefore production – and how to link it to different modes of consumption, by investigating how design processes can be linked to the use of the VP tool in a reflective or generative mode. Any VPs created then require testing in local conditions and markets; in fact, what might appear to be an innovative design concept with a viable VP on paper, might fail to galvanise support from local people as maker-designers or consumers. In fact, although the clothing concepts generated through the project embed a new value framework that addresses core sustainability issues, further experimentation is required to scale out and reach a broader audience of designers, consumers and producers, making fashion in radically different, fair and viable ways. Furthermore, how these VPs can be scaled up from niche initiatives to a critical mass that will genuinely disrupt the mainstream system of fashion manufacturing and retailing requires further investigation.

With this in mind, since the initial launch of the *Make Yourself…* project in Bolzano, we have applied the VP tool in a series of workshops with fashion design students at ESMOD Berlin (Germany) and Nottingham Trent University (UK), with a mixed student group in Konstanz (Germany), as well as in a workshop on 'alternative economies' in Helsinki (Finland). We also wish to further develop the concept of the *makershop* as a permanent space for local communities to prototype clothing concepts and implement sustainable business models of production and consumption. Finally, we envisage that such a model can offer an interesting platform on which to test future strategies for pushing the traditional boundaries of the design discipline, facilitating the process of transitioning towards more ethically-driven and alternative exchange economies through socialising value creation by *making clothing differently*.

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STUFF MATTERS IN PARTICIPATION: INFRASTRUCTURING A CO-SEWING CAFÉ

Anja-Lisa Hirscher and Ramia Mazé

This paper explores how acts of use and participation can be better understood and articulated in relation to the socio-material and spatial conditions of "infrastructuring". Infrastructuring is framed here as an object of design research and of design research, comprising the social activities and skills as well as the material tools and "stuff" that are integral to alternative spaces of production such as Fab Labs and makerspaces. We bring together theories from three different areas of research (peer production, Participatory Design and social practice theory), building a conceptual framework that is used to analyze extensive empirical material gathered while initiating, running and researching a 'co-sewing café' over 18 months with hundreds of diverse participants. Tracing our understanding of use and participation through literature and case analysis, we use illustrative figures and tables to articulate different types and dimensions of use in relation to one another and in relation to the empirical analysis that is detailed and recounted in various ways. The paper concludes by elaborating how types of use in reference to types of stuff provide insight on participant skills, learning and engagement that can result in change of roles over time.

Keywords: Infrastructuring, makerspaces, peer production, design, participatory design, user, use

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INTRODUCTION

In recent decades, there has been a growing number and variety of movements and platforms to open up design to more people and parts of society. People's ability to design for themselves has been '*radically* and *rapidly*' increasing as discussed in discourses of 'post-industrial design', 'open innovation' and 'open design' (Leadbeater et al. 2004; Mazé 2007; von Busch 2008, Fuad-Luke et al. 2015). This ability has been supported through the development of alternative platforms for design, including 'do-it-yourself' and peer-production spaces such as Fab Labs, maker- and hackerspaces set-up for and/or by people using tools, equipment and facilities to design and produce their own artifacts (Kohtala 2016; Seravalli 2012). Using such spaces can potentially enable and empower a user to develop a 'maker identity', as they become aware of and develop their own agency and skills and as they become part of a community making artifacts (Toombs, Bardzell & Bardzel 2014). These spaces are thus a highly relevant object of inquiry in design research, through which we can better understand such emerging types of production.

Within design and fashion research, roles of designers and users have long been at stake within discourses of Participatory Design (PD). Since the Scandinavian origins of PD in the 1970s, which involved workers directly in joint decision-making and in the design of their workplaces, PD has been motivated by 'the social and rational idea of democracy as a value' to enable and empower people to participate in the process, and to involve the tacit knowledge of users of design as 'expert of his/her experience' (Björgvinsson, Ehn & Hillgren 2012, 103). PD thus resonates ideologically with research on peer production and alternative spaces

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of production, given its premise of opening production to users as participants, stakeholders and, even, as designers.

A key theoretical as well as practical issue for PD that we extend and develop here is that of 'use'. First, by involving end-users in the design process, for example in making design decisions and even co-designing, PD puts into question the traditional distinction between roles of 'designer' and 'user'. Instead of separate and distinct categories, these can instead be understood as types of use along a spectrum of participation within design and production processes. In order to involve diverse participants in producing future artifacts, PD has systematically developed methods to bring in their knowledge, expertise and experience (Sanders & Stappers 2014). Thus, not only are users involved in design, but also in ideating the eventual use of artifacts – conceiving "use before use" (Redström 2008). Secondly, to fully involve participants, the focus of PD has shifted from the traditional end-product of design to the means. The means for doing design, including the methods, tools and toolkits, as well as other socio-material factors are conceived of as designed and, indeed, as the primary object or product of PD (Björgvinsson et al., 2010). Contemporary PD is increasingly concerned with understanding the design of means for 'infrastructuring' participatory processes.

In this paper, we inquire into types, issues and implications of use in relation to an alternative space of garment production, a 'co-sewing café' that has been studied over the past 18 months. The café is part of the first author's larger doctoral project, which has a mixed-methods approach combining qualitative research and 'research through design' (Koskinen et al. 2012). The set-up, running and ongoing development of the café can be understood as an extended process of infrastructuring, in which participatory methods, tools, materials and space have been considered as designed. Clothes-making techniques are shared, taught and learned amongst diverse participants, including some who are professional designers or dressmakers. As of January 2018, 42 workshops have been held including approximately 314 people.

In addition, the co-sewing café presents an opportunity to attend to and give an account of the detailed composition and development of infrastructuring. Akin to other doctoral projects within the contemporary PD tradition (c.f. Seravalli 2014), the setup, running and development of the café as 'research through design' has been carried out by myself, the first author, as a trained designer attending particularly to the practical material and 'designerly' aspects of infrastructuring. I have also studied the effects of infrastructuring through qualitative research methods tracing design activities, ranging from planning to day-to-day facilitation activities, as well as participant activities over the timeframe of 18 months. This qualitative data enables us to further specify and explore the research question: How can types of use and participation be understood in relation to socio-material and spatial considerations of infrastructuring?

INFRASTRUCTURING ACTS OF USE AND PARTICIPATION

'Infrastructuring' has become a key concept through which contemporary PD has developed notions of use and users. Indeed, the concept is useful for us in exploring how the roles of 'user' and 'designer' are blurred and continually renegotiated. With roots in the field of Science and Technology Studies (Star & Ruhleder 1996), infrastructuring has rapidly expanded as way to conceptualize the structures of PD processes (Karasti 2014; Karasti et al. 2018), and, further, to shift focus from designing for fixed environments, products or technologies towards a dynamic infrastructure that relates to different contexts (Star & Ruhleder 1996). Karasti and others (Karasti & Baker 2004; Karasti & Syrjänen 2004) have emphasized infrastructuring as an ongoing activity, describing a fluid and dynamic structure enabling and intertwining activities in a process of ongoing development through design and use phases including adaption, re-design and

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appropriation (Björgvinsson et al. 2010).

The concept is particularly useful for characterizing the flexibility, openness and adaptability necessary when designing for uncertain outcomes and future use (Hillgren, Seravalli & Emilson 2011). This objective of design, which can be called 'design for future use' (Redström 2008), involves infrastructuring as the social, material and spatial structures for sustaining a community of participants (Dantec & DiSalvo 2013). Beyond PD tradition in the workplace, Karasti (2014) argues for PD's relevance within communities, 'publics' and 'the commons.' Infrastructuring includes processes of community formation, of forming a public of committed participants (Dantec & DiSalvo 2013) able to take responsibility for a space and its forms of use. Infrastructuring can be understood as fluid and dynamic structure of participation, in which people and their actions cannot be reduced to terms such as 'user' and 'use,' prompting calls for research on 'relational qualities' (Jegou & Manzini, 2008; Hillgren, Seravalli & Emilson 2011). Indeed, infrastructuring involves a constant renegotiation of roles and relations, 'a continuous process of building relations with diverse actors and by a flexible allotment of time and resources' (Hillgren, Seravalli & Emilson 2011, 180). Thus, it becomes useful as a bridging concept between short-term PD projects and spaces such as Fab Labs, hacker- and makerspaces set-up by and for participants over extended periods of time (Kohtala 2016).

Conceptions of infrastructuring for such alternative spaces of production are according to Karasti (2014) as yet under-developed. A notable exception is in the work of Seravalli (2012), who has been exploring infrastructuring as a process within a makerspace called Fabriken. Describing the co-designing, establishment and running of the setting, she analyzes their tactics for participant involvement in the space as well as the 'participatory making of the space' as a form of infrastructuring. From this perspective, she sees a shift in understanding a makerspace as a fixed infrastructure for a defined use and community, towards spaces for infrastructuring, which offer a dynamically adaptable structure, to be redefined at 'use time for supporting emerging activities' (2012, 2). Allen, Agrest and Ostrow argue that, 'an infrastructuring strategy must not only pay attention to how existing infrastructures condition use, but, in doing so, at the same time also deliberately design indeterminacy and incompleteness into the infrastructure with unoccupied slots and space left free for unanticipated events and performances yet to be' (2000, in Telier 2011, 173). A challenge for the designer(s) during project time is to keep a future concept or space open, particularly if the future user is unknown, to enable infrastructuring as 'design-in-use'.

Designing for different acts of use

In instances of infrastructuring, such as in Fab Labs, hacker- and makerspaces, which leave use open to be determined by the user(s), user roles are thus also open. A user may visit once, they may create artifacts and appropriate the space, they may commit to responsible action sustaining the space. Complicating the dichotomy of 'designer' and 'user', this illustrates the problem of reducing roles to two, fixed categories. Another way to conceptualize use is in terms of acts of participation, following Redström's *RE:Definitions of Use* (2006; 2008, 410) from an act-based perspective, that is "what we do, rather than who we are.' Through his argumentation, acts of using, designing or appropriating need not be understood as mutually exclusive, rather, more nuanced and active relations between design and use can be formulated, as further elaborated and illustrated in Figure 1.

In Redström's terms, the first concept depicted in Figure 1, 'design-before-use', is strongly driven by a designer's perspective to determine use before actual use, e.g. referring to the traditional idea of PD in relation to the design of workspaces (Redström 2006). Secondly, in 'design-for-design,' designers aim to enable users to design objects for themselves (Seravalli 2012) – in relation to this paper, the term aptly captures the design of a makerspace. Design-

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for-design aims to result in 'design-after-design', in which a user becomes the designer during project time when facilitating designers are involved. 'Design-after-design' leaves open the possibility for involved stakeholders to initiate their own activities by performing design actions after the design of a given structure is concluded (Telier 2011; Redström 2008). The last notion, 'design-in-use' highlights the incompleteness of the designed object or space (Ehn 2008). Design-in-use is also referred to as 'at use time' or 'during use', in which the activities of users over time are in focus. As these activities may not be fully controlled and, indeed, may be left more or less open, this 'emphasizes the creativity that lies in the embedding and use over time' (Dittrich et al. 2002). In a sense, the user completes the design, while in use. With regards to infrastructuring, this requires the designer to open up the object of design to be determined by the user while in use.

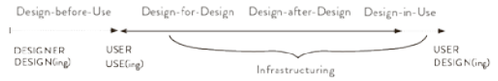

Figure 1: First author's interpretation of concepts referring to acts of designing and using, in which nuanced and active relations articulate a spectrum between the polarities of design and use.

Since makerspaces are often part of a larger context, external factors influence participants' acceptance and the sustainability of the space. Infrastructuring, as understood through conceptions of 'design-for-design' and 'design-in-use', captures the need for flexibility and adaptability. As a design approach, this can potentially support participation and extended use over time, as they can open for appropriation beyond only using and accepting the existing pre-designed structure. The design of a makerspace, what Seravalli (2012) refers to as 'design-for-design', participatory making or infrastructuring, can equally be referred to as an unfinished or open design, as it allows use and appropriation of an infrastructure (makerspace) after its establishment. In particular, 'design-in-use' and appropriation or 'design-after-design' phases can be enhanced by seeing makerspaces as 'spaces for infrastructuring (Seravalli 2012, 54)'. They offer potential for addressing a variety of participants, as the space can be reconfigured according to participants' needs or use activities, because, 'the 'use' that we simulate, create and invite as part of a design process, be it iterative or participatory, cannot deal with what it means for something to become someone's, what it means for an object to become part of someone's life' (Redström 2006, 130).

Acts of use becoming design

As mentioned above, in traditional PD, the design process is about envisioning 'use before use' (Redström, 2008), however, use is interpreted differently by the user and by the designer, especially when considering use and appropriation over time. This is particularly evident in alternative spaces of production, where a participant may act as a user but also as a designer. This informs our premise here, in which infrastructuring is considered as designed, not dissimilar to an unfinished object where the final use is 'undetermined' (Redström, 2008). Makerspaces as infrastructuring can be treated as 'objects' of design, in the sense evoked above, as dynamically structured processes that engage designers and users alike, independent of who they are, but in terms of how they use the object (in this case, the makerspace) beyond its original form ('design-after-design').

This premise expands our understanding of users, since infrastructuring enables extended forms of use, beyond making and designing objects towards facilitating makerspaces. Such use can also entail taking responsibility for its management and appropriation. The acts of use described here go beyond merely using something or some place, it can include becoming active participants, caring for a common space, supporting associated activities and values. Therefore, below, we differentiate among types of use, including extended forms of use, which are often lumped together. While

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performing an act of use, a user is changing their role towards becoming an active designer. Dittrich et al. point out that this is an important issue for PD, as it highlights design for change and 'brings into focus issues of coordination between use, design in use and adaptation and development' (2002, 124). A user starts to change their role from passively enacting a pre-designed use towards changing an object and its use to better fit their current need. In this process, users develop their skills by actively creating 'meanings that are so original that they become similar to designing' (Bredies et al. 2010, 159). These patterns of use and appropriation of an environment (Telier 2011, 177) can be also interpreted as social practices, as they refer to the act of change. Through use, change is enacted and meaning is created by the user through active involvement (acts and activities). In our analysis, and recognizing that change in skills is learned over time, we distinguish among types of use.

For example, in the co-sewing café, first-time participants can 'operate' *non-specific* everyday tools such as a clothes iron or vacuum cleaner without instruction, but they may need to learn how to operate a *specific* tool, such as a sewing machine. Users increase their competence by learning how to thread a sewing machine, or one can already be knowledgeable about how to operate the tool. 'Maintenance' entails keeping an existing artifact/service/space in good condition, a special case of which is the sewing machines that are maintained by the first author and a participant called Mr. Kraft, who is a local expert on repair. Further use practices derived from Carroll (2004, 3) among others, include 'adaptation', 'modification', 'tailoring' and 'redesign', all aiming to close the gap between the intentions of the designer and the actual use. For example, a user may alter, adapt or redesign the appearance or function of an original design to better fit their needs. In the café case, the design may include the infrastructure of the space and tools, garment patterns, materials and clothes produced. An advanced extension of this is when participants may practice 'appropriation'. Characterizing an act of taking possession of a thing by making it one's own, 'appropriation involves mutual adaptation' (Carroll 2004, 3), during which users may not only redesign but take over or take ownership of a design.

These types of use are summarized in Table 1, in which the two right-hand columns elucidate the types through instances from the case of the co-sewing café.

Type of Use Acts	Types of Stuff	Example
Operation	Non-specific everyday tool	Iron, Vacuum Cleaner
Maintenance	Specific sewing tool	Sewing Machine
Adaptation (Modification, Tailoring and Redesign)	Specific sewing tool	Sewing Materials (Fabrics etc.)
Appropriation	Infrastructuring Stuff	Patterns
Management	Infrastructure / Space	Key

Table 1: Types of use acts derived from literature. These types are elucidated through significant things (or 'stuff', see section 2.3) used in the co-sewing café, which have been derived from the first author's observations, diary notes and photographs. [Click for larger image.]

Practices of use

In order to account for a more extended and evolving spectrum of acts of use and participation, our understanding is also informed by interpretations of 'social practice theory', which has entered into design research in various ways including through studies of PD and 'living labs' (Kuijer 2014). While considered as a kind of 'micro'-sociology within the social sciences, social practice theory nonetheless considers larger and longer practices of consumption than typical in design research. Leading contemporary scholars in the field, Shove, Watson, Hand and Ingram, conduct research on D.I.Y. (do-it-yourself), in which 'the application of skill, knowledge judgement and passion and results in the production of something made and designed by the same person' (Shove et al. 2007, 42 referring to Campbell, 2005, 23). While primarily focused on social practices of consumption, their particular interest in D.I.Y. reveals consumption as a blurry category that may also include types of use and production at scales relevant to design research in general and to the study presented here.

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Further, practice theory pays particular attention to materiality as an intrinsic component of social practices. Following Kuijer's (2014) interpretation and development of practice theory in design research, we view the composition of social practices as the interrelation of three different components. Following other design researchers (Scott et al. 2011, Kuijer & de Jong 2012), we also adopt the following terminology of Shove and colleagues (e.g. Shove & Pantzar 2005, Shove et al. 2012) as analytic categories here: 'stuff' (materials), 'skills' (competences) and 'images' (meanings) (Figure 2). For our purpose, practice theory is useful in expanding the unit of analysis in design research to include larger and longer practices of participation (de Jong & Mazé 2017), including multiple, varied and changing practices of using space (co-sewing café), spatial arrangements including furniture, materials, tools (sewing machines and equipment), interaction with materials (fabrics, threads, etc.) and participants' skill-development.

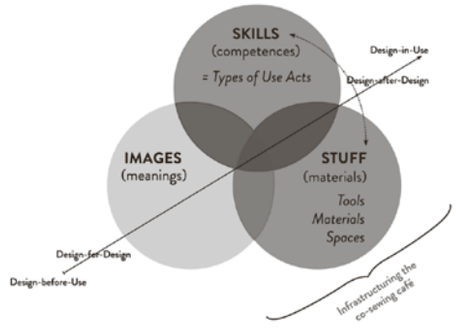

Figure 2: Representing the three interrelated components that shape and change use practices, part of the figure is adapted from Shove and Pantzar (2005). The figure combines this with elements from Fig 1, in order to express that use acts accumulate, extend and evolve over time as practices along a spectrum of use becoming design.

Figure 2 draws together the main concepts that we have derived from literature to analyze use practices and infrastructuring in the case of the co-sewing café. In this paper, we focus primarily on 'skills' and 'stuff' as categories through which we analyze use of the café over time. Through these categories, we are able to articulate and analyze types of use (Table 1) and users (Table 2), thus addressing the first research question in this paper. Further, examining use and users in relation to stuff, and the evolution and interrelation of these over time, we address our main research question concerning the interrelation of participation and spatial-material aspects of infrastructuring over time.

CASE – THE CO-SEWING CAFÉ

The 'co-sewing café' has been initiated and run by the first author with support from two colleagues (Stegen & Iran, c.f. Hirscher & Iran 2016), including designing the space, facilitating workshops, and acting as participating observer and documenter/photographer of the activities. As of January 2018, 42 workshops have been held, attended by 314 participants in total. The majority of participants are female, with ages ranging from 16 to 80, though most are between 30 and 60 years old. Each workshop had a varying number of participants ranging from 4 to 25, however, the average number (which fit comfortably in the space) was 6-8 participants. Of the average number of participants in a group, typically about half were regulars, and the others were first-timers or occasional participants.

The co-sewing café as a makerspace

The café can be understood as a makerspace, which offers an open, collaborative workshop environment shaped by its individual participants and purpose (Kohtala & Bosque, 2014). Located in a small town in southern Germany with about 6600 inhabitants, it was established in July 2016 as part of a bigger research project, a 'Reallabor' (real life laboratory),

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which investigated sustainable transformation of a rural context (Geiger, Hirscher & Müller 2017). The town has a history of textile manufacturing, however, today, much of the former factory spaces are unused and several revitalization projects have been initiated. The co-sewing cafe occupies a former 60 square-meter shopfront. It has been set up to contain 10-12 workstations, which include refurbished domestic sewing machines and donated sewing materials and fabric. During the research period, 3 hour-long workshops were offered 3 times a month over 18 months. Through garment design workshops, participants can develop their skills and competencies, learn to use the space and stuff, while designing and making their own garments. Each workshop provided sewing suggestions, such as garment patterns and examples to try on, accessible for different skill-levels, workshop facilitators provided support, advice and ideas for groups and individual participants.

In 2016, the project started with a first kick-off co-design session for more than 30 participants. From the start, the café was set up to attract and serve a diverse range of participants, in this way extending PD values to include the widest possible range of people and groups with differences in skill, representation and power (Keshavarz & Mazé 2013). To attract a greater diversity of participants, we visited the local refugee housing and a town-meeting, prior to the workshop, to introduce and discuss the basic concept. Thus, the purpose of the café surpasses that of producing garments but also enables learning and exchanging knowledge and skills, interaction and community-building among peers and various people with common interests.

ANALYSIS

In section 2, we discussed the different approaches of design for, with and by the user and how this is relevant to design for infrastructuring. This was followed by defining different acts and types of use and use practices evident in the sewing café. As a result, Figure 1 illustrates the spectrum between use and design in alternative spaces of production. In this section, we will elaborate how the different types of participation and use are linked to the type of user regarding their level of competence and the way the co-sewing café has been designed with the aim of enabling 'design-in-use' based on user appropriation of material and spatial elements. The aim is to clarify how, in the context of the café, specific socio-material and spatial conditions inform users' participation and acts of use, such as their redesign and appropriation of things for personalized use, which can be seen as becoming design through creating original meanings.

Typology of user participation

Through analysis of participant lists and observations, we compiled a general perspective on the spectrum of use acts in relation to types of stuff. For example, the majority of the 314 participants already knew how to use everyday objects such as an iron, scissors and cleaning tools, and we characterize this competence level as *beginner*. However, and already when needing to pin patterns to fabric, only about 30 people dared to proceed much further on their own, and the majority asked for assistance. Likewise, sewing machines were only used independently by 35-40 participants who visited several times (*regulars*). Only are 5-8 engaged in maintenance activities, including our local repair expert who oiled machines, changed needles etc., and former seamstresses or our dressmaker, who we would more aptly characterize as *visiting experts*.

For those visiting for the first time (*beginners*, see Table 2), facilitators introduce the space and offer close assistance in choosing suitable fabrics, pattern-cutting and handling sewing machine. Already on their second visit, most participants independently start looking at examples of garments on display, start choosing fabrics and looking for patterns in their size. After 2-3 visits, participants often start supporting each other with advice on color choice, sewing tips, etc., depending on their skills. This way of learning to use the space, its tools and sewing processes emerges naturally

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and is supported by the infrastructure, enabling a low threshold into the flow of activities, which is monitored and adjusted by the main author as facilitator, and some participants start who come very regularly. When participants start interacting naturally with the space, peers and community, they have started to personalized it to their own use. At this point, we refer to them as *regulars* (see Table 2). Regulars are a type of participant that are encouraged by facilitators to take action in planning and facilitating workshops for others. Thereby, regulars can transform into *active facilitators*, appropriating the space and taking the responsibility to assist and teach others. Of the 35-40 regulars, 7 have so far led workshops on their own. This account of types and changes of use illustrates how user roles are not fixed but can develop when supported by flexible infrastructuring. Initial and learned competences can evolve to the extent of participants becoming de facto managers of the café.

Table 2, thus, does not describe users per se but, rather, types of use activities and competencies that can develop over time and with practice (i.e. learning). Learning, in this context, refers not only to sewing skills and tool maintenance but use practices in which participants develop an understanding and skills related to the operation of the co-sewing café as a whole.

Types of Use Competence	Number of participants	Description
Beginners	314	Refers to people who come for the first time and those who can operate the basic tools and space. They may continue at this level or learn and improve their skills.
Regulars	» 40	Advanced users, for example those participating more than 3 times or on a regular basis who know how to use the space, independently operate machines, choose materials and use/adapt /create patterns.
Visiting Experts	5	Skilled locals, such as a former seamstress who assists occasionally or Mr. Kraft who repairs the sewing machines.
Active Facilitators	7	Active regular or very skilled participants who start offering to facilitate workshops, such as the dressmaker Naser (see 4.3).

Table 2: Types of use in terms of level of competence, described in relation to typical 'stuff' in the café case. This table is derived from analysis of participant lists, diary notes and photographs. By 'competence', we refer to knowledge and know-how (as per 'social practice theory') manifested in use acts, skills and ability to use types of stuff (see Table 1 and Figure 2). [Click for larger image.]

Examples of emerging 'stuff'

The next two subsections account for significant examples, which are extracted from longer, in-depth 'rich descriptions' from the analysis. In terms of significance, these examples articulate changing use over time and offer insight into evolving, emergent and unexpected correlations between skills and stuff. In particular, the examples below highlight how this generates new relations to existing stuff and even the introduction or creation of new stuff (i.e. infrastructuring).

Relatively soon after establishing the café space and running several workshops, the first author recognized that different sewing machine models caused confusion and trouble for some beginners. In response, labels and instructions were designed and applied at each sewing machine. In addition, we labeled the different materials and made guidelines for pattern-use (Figure 3). These additions were aimed at enabling participants to personalize their use of the space, boosting their competence so that they could independently create their own meaningful experiences.

Figure 3: Infrastructuring in the form of additional instructions for sewing machines and patterns.

Furthermore, we started establishing a 'showcase' collection of garments, completed with 'Made in Dietenheim' labels and a photo-gallery of those who made the garments. The labels were a simple way to mark participant attachment and meaning on their self-made garment (Hirscher 2013). The showcase and photo-gallery were initiated as a

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response to this common question by locals: 'What is a co-sewing café, and what do you do there?'. The showcase and gallery displayed garments (i.e. made and created stuff) of participants, even if the café was closed. The gallery also operated as source of inspiration for beginners, presenting the diversity of garments that could be made, for example with 'upcycling' techniques that were new to most locals. Through the showcase and gallery, a facilitator could explain to newcomers, for example demonstrating the theme of a workshop and the process from paper-pattern to ready-made garment, easing the entry level by showing manageable results.

Figure 4: Infrastructuring in the form of garment showcase and photo gallery.

Examples of competent participants' 'stuff'

In addition to the examples above of stuff amended or added by facilitators, participants also redirected or initiated infrastructuring stuff. A notable example is Naser, a highly-skilled refugee from Afghanistan, who found in the co-sewing café a space to apply his professional knowledge by preparing upcycling designs and patterns to be copied, while assisting participants in garment making. With his existing skills, he was immediately recognized as an 'active facilitator'. Soon after, he asked for a key to access the space in order to offer additional opening hours for other participants to conduct garment repair. Even though his German-language skills were very limited at the beginning, he wanted to assist people with sewing. Thus, together, we prepared posters with translations of sewing terminology into three different languages (Figure 5).

Figure 5: Infrastructuring in the form of a multilingual poster of sewing terminology to support Naser's own workshop facilitation.

Others with prior sewing knowledge participated in the space and workshops to benefit from the social setting or find inspiration. For instance, two experienced, local women participated very frequently, thereby developing a friendship and confidence to host their own workshops and to represent the co-sewing café at two local fairs. After hosting their own workshops, they felt that the space lacked rulers for cutting and pin cushions to enable a smoother working process. Thus, they brought self-made pin cushions and long wooden sticks marked as cutting rulers. They were personalizing the space for their own and others' use. An even stronger commitment was evident when they took over responsibility for a shared key. A considerable development of use acts and competence is evident in this statement by one of them: 'I would have never thought to make clothes for myself, I only did quilting for many years.' The interrelation of regular participation, existing and emerging skills as well as the given and emerging stuff enabled a change in their competencies towards 'active facilitators'.

There is one example of participation by a pre-existing group, a handcrafting club of local elders.

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Their 'group-leader' mentioned that she had always been more of a 'knitter, crochet person' but wanted to use the co-sewing café to improve her sewing skills and give back by sharing her knitting and crochet skills. After participating in three sewing workshops, she thus offered to facilitate crochet-workshops on her own, for which several crochet hooks were added to the café stuff. One workshop focused on upcycling T-shirts, for which they removed the sewing machines and formed a circle of chairs; a second workshop, inspired by donated yarn, offered instruction in decorative lace-making (Figure 6).

Figure 6: Upcycling T-shirt and lace-making workshop facilitated by the local knitting club.

In general, we can conclude that the more often people participate, their existing and learned skills can develop along with their self-confidence and social attachments. These can lead to redesign and appropriation of the facilities according to their own needs and community ambitions, which can range from identifying their preferred workstation and contributing additional tools to developing their own workshop themes and self-initiated and facilitated workshops. This illustrates that the co-sewing café is able to adapt to many types of use, enhancing participant's competence and supporting learning, personal meaning-making and spatial personalization of the space and stuff.

These examples also articulate the difference in between types of use evident in a traditional PD workshop from that of an alternative space of production such as a makerspace. While it is a space for many short and small workshops that may seem similar to those in PD, the co-sewing café also comprises long-term plans (both intentional and emergent) by its initiators and participants, including the ambition that the space is sustained and self-managed by participants after the research period. The cafe is thus closer to a commons-based peer-production spaces, in which participants use acts change not only toward making and designing own garments, but using, even (re)designing and managing the space itself, i.e. infrastructuring as 'design-in-use' (Figure 7).

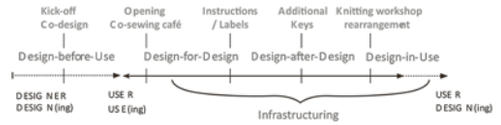

Figure 7: Events and significant stuff demonstrate the spectrum of types of use in the co-sewing café.

Articulating general types of participation

The analysis from which the above sections extract particular accounts and examples is summarized in Table 3 below. The structure of the table reveals how we have brought together categories and concepts derived both from literature and from empirical analysis.

In the table, categories from our conceptual model (Figure 2) such as 'stuff' are put in relation to acts of use (existing and learned 'skills' outlined in Table 1) and use/user types or competence (Table 2). While the Table 2 above includes a large number of participants characterizing a 'beginner' type of use, this Table 3 provides a more detailed account of the variety of stuff and skills involved. Through this account, we are able to make visible the more common types of participation in the café, including the necessary socio-material conditions and sources supporting general, everyday use by the majority.

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Through Table 3, infrastructuring can be understood to span the stuff intended and planned from the start to the evolving, emerging and unexpected stuff related to significant use acts. As a kind of inventory of all stuff over time, it also reveals notable change use practice (Figure 2) and the importance of a few particular types of use/user competences. Including stuff created, donated or requested, we emphasize infrastructuring as activity emergent from the socio-material and spatial practices of all those involved (including initiators and participants of many types and competences).

Stuff **Types of Tools**	**Skills** **Use/User Competence**	**Skills** **Use Acts**	**Source** **Who brought/made**
Non-specific			
Scissors Needles Pins Pin cushions	**Beginners**	Operation	Donations by former seamstress and Mr. Kraft (*visiting experts*) E.g. 5 pin cushions were made by *regulars* (see section 4.3)
Iron and ironing board	**Beginners**	Operation	Donations by different participants (*regulars*)
Trash bins, broom and vacuum cleaner	**Beginners**	Operation	Purchased Donation
Multiple plug socket	**Facilitators**	Operation	Purchased
Ruler	**Beginners**	Adaptation and Operation	Brought by *regulars*, measurement was made together (see section 4.3)
Specific			
12 sewing machines	**Regulars**	Maintenance Operation Appropriation	4 sewing machines purchased, thereafter donations from locals and Mr. Kraft (*visiting experts*), currently 12 machines
Crochet hooks	**Regulars**	Operation	Purchased for the workshop hosted by the knitting circle (see section 4.3)
Oil can	**Facilitators** **Experts**	Maintenance	Mr. Kraft made a special tool (see section 4.4).
Chalk and measuring tape	**Regulars**	Adaptation	Donated, sponsored by local firm
Patterns and paper	**Regulars**	Adaptation Appropriation	Self-designed, donated or open source patterns, provided by the facilitators or brought by participants (*active facilitators*)
2 dress forms/mannequins	**Regulars**	Adaptation Appropriation	Donated
Materials			
Fabric of different colors and materials	**Beginners and Regulars**	Adaptation	Donated
Thread of different colors	**Beginners and Regulars**	Adaptation	Donated
Buttons, zippers, ribbons, rubber, clips...	**Beginners and Regulars**	Adaptation	Donated
Spatial arrangement			
Furniture	**Beginners and Regulars**	Adaptation Appropriation	Donated Purchased
Space	**Beginners and Regulars**	Adaptation Appropriation	Rented
Emerging stuff			
Sample pieces, Example garments	**Beginners** **Regulars** **Experts**	Appropriation	*Facilitators* or *experts* create them before the workshops (usually 2-3 per workshop).
Produced garments, Garment showcase	**Beginners** **Regulars** **Experts**	Appropriation	*Facilitators* (see section 4.2)
Photo gallery, photographs of participants with their garments	**Beginners** **Regulars** **Experts**	Appropriation	*Facilitators* photograph each garment produced (see section 4.2)
Posters	**Beginners** **Regulars** **Experts**	Operation Adaptation	*Facilitators*, including poster with multi-language sewing terms (see section 4.2)
Instructions (for materials and machines)	**Beginners** **Regulars**	Adaptation Appropriation Maintenance	*Facilitators*, created for more independent use (see section 4.2)
Labels: "Made in Dietenheim"	**Beginners** **Regulars** **Experts**	Appropriation	*Facilitators* (see section 4.2)
Stamp: "Made in Dietenheim"	**Beginners** **Regulars** **Experts**	Appropriation	Created by one of the *facilitators* with a *participant*
3-4 Keys	**Beginners** **Regulars** **Experts**	Management	Landlord provides on demand of *facilitators*

Table 3: Summary of analysis shows the theoretically-derived categories in relation to empirical findings.

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Table 3 provides insight on the space and stuff provided as well as development of users and their interactions with stuff, which, in turn, impacts the space and its stuff in time. It illustrates that non-specific tools can be used from the beginning – these do not require an extensive learning process and may not foster longer-term engagement or active participation. In comparison, specific sewing tools require stronger engagement to understand their functionality, and thus learning takes place, even by experienced sewers, thereby changing their level of competence (type of use). The competencies participants gain by using different types of stuff, engaging in processes with stuff and with others, can enable them to work more independently, potentially developing from those needing instruction labels and facilitator assistance to experienced and knowledgeable regulars (Figure 8). Users' potential redesign, adaptation and appropriation process can be signaled early, for example in the act of choosing a preferred sewing machine, adjusting personal space and, from this personalized basis, creating own garments. Such acts of use can be observed already during a third or fourth visit, when participants start asking for a specific sewing machine they have worked with successfully before. Regulars know the machines and space, and they may dare to give assistance to newcomers, thereby applying their learned stuff-related competences to develop their social competence as facilitators.

Figure 8: A regular participant assists a beginner in using a sewing machine, supported by one of the facilitators.

In the 'specific tools' category, the oil can is significant as a particular tool created by local repair expert Mr. Kraft to oil the sewing machine parts. The machines must be oiled, but only by applying very small amount of oil. To enable others to perform the use act of oiling, Mr. Kraft made an oil-can with a small needle opening that only allows drops of oil to emerge. The oil can is a tool that represents the importance of local experts without whom the co-sewing café would not run as smoothly. These experts provide expertise, donations and, in the case of Mr. Kraft, the oil can tool as well as sewing machine repair at no cost. We refer to him as a *visiting expert* that participates with his own high-level of prior knowledge and expertise in conjunction with his strong experience and knowledge of the café space itself, both of which enable him to design perfectly adapted tools.

The categories 'materials' and 'spatial arrangement' do generally address both beginners and regulars, but still show learning, as associated stuff addresses users' individual abilities and choice of engagement. On one hand, they can follow suggestions of fabric, thread and spatial arrangement suggested by others, on the other hand, they can make their own personalized combination. This type of stuff, which is evident in most makerspaces as noted by Seravalli (2012), enables 'design-for-design' – tools and spaces that allow users to create own design objects such as garments.

The stuff specifically designed for and with the participants, such as the showcase and labels, illustrates that while running a makerspace with the basic tools 'designed-for-design', there can still emerge design opportunities. Participants can ask or simply start adapting to the flexible needs or competencies of themselves and others, sometimes to promote their own engagement with the stuff and the space. Infrastructuring leaves space open for

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participants to design, and the spectrum between user and designer renegotiated.

The key plays a very unique role, as it relates to a use act signifying taking on management activities. The key enables independent access for participants to use and facilitate activities in the space, and it comes with a quasi-legal responsibility for securing space. We came to consider this as part of infrastructuring when Naser asked for a key and, thereafter, we provided an additional key for more facilitators. Infrastructuring addresses matters of flexibility, while for us this refers to 'design for future use,' or use beyond project time towards sustaining a community of participants. Participants' use of the key to run their own workshops represents the strongest level of competence and attachment to the space thus far. This level of competence shows the potential for the co-sewing café to be self-managed beyond project time, through which 'design-in-use' or 'design-after-design' would be reached through infrastructuring by many in the community over time. These findings are illustrated in Figure 9 below, which portrays the spectrum of use acts in relation to levels of existing/learned competences in relation to significant types of stuff. The figure also indicates the most advanced type and level of participation, i.e. management of the space and infrastructuring processes.

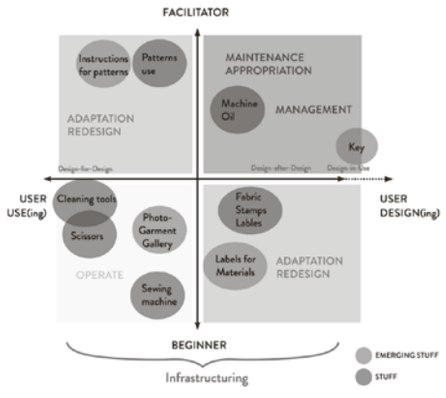

Figure 9: Illustration of correlation between use types, stuff used and design/use spectrum.

DISCUSSION AND CONCLUSIONS

This paper brings together theories from multiple research fields (peer production, PD and social practice theory), forming a conceptual framework to articulate and analyze use and participation in an alternative space of production, i.e. the co-sewing café. While research focusing on user roles tends to remain preoccupied with individual identities and demographics, framing participation in terms of acts of use enables articulation of more nuanced types and changes (including learning) along a more fluid spectrum of activity spanning between design and use. Drawing in social practice theory allows us to explicitly account for the materiality through which infrastructuring takes place. Thus, infrastructuring is argued as a bridging concept across research fields to address use and participation at different scales spanning from traditional PD to alternative spaces of production such as Fab Labs and makerspaces, which are characterized by larger and longer socio-material practices. Our elaborated categorization (Table 3) offers a contribution to research on such spaces, since research to date has only touched upon socio-material influences upon user roles and transformation. A notable exception is the analysis by Toombs, Bardzell and Bardzel (2014) of tools as indicators in the development of a "maker identity," although our analysis is even more extensive regarding types of stuff and use.

Figure 2 represents our conceptual model that combines concepts from multiple research fields, relating stuff and skills along a spectrum of use practices that may change over time. Practically, this model resulting from literature analysis is also a framework through which the extensive empirical material on the co-sewing café can be analyzed and discussed. Thus, the model may articulate a broad and robust framework that can also be applied in the detailed analysis, with potential for directly

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impacting forthcoming choices in the development of the café. With the model, we aim to contribute thus both to multidisciplinary theory-building and to the practices of ourselves and others working with alternative spaces of production.
In the tradition of 'research through design', practical and the empirical analysis have also sharpened, influenced and shaped our theorization of key concepts drawn from literature. Tracing our evolving understandings of participation in literature and case analysis, the illustrative figures throughout the paper articulate different dimensions in relation to one another and in relation to the empirical analysis presented in the form of Table 3. Drawing together key dimensions derived from the literature and empirical analyses, Table 3 directly addresses the research question in its form and content. The analysis of the table illustrated that within the co-sewing café, evident types of participation are identified and manifested through the personal use practices and the frequency of participation. The types of use in reference to the type of stuff provide insight on the level of skills and engagement of the participant and the roles they attune to or change over time. These types of participation can be understood and articulated in relation to the way they use or interact with the space, its tools, materials and infrastructuring 'stuff', making the co-sewing café their personalized own. Through our change-model, supported with detailed reflections on key-events, we could illustrate these interrelated change mechanisms building on learning over time. We propose that acts of participation can be understood as types of users building on their level of competences. These different types of users may change their role, and acts of use towards stronger or weaker types of participation, impacting the co-sewing cafés socio-material and spatial conditions.

The role of the designer is seen in this context as enabling a fluid infrastructure that attunes to a spectrum of possible participation – designing for infrastructuring. Significant extracted examples, conveyed here through anecdotes, such as that of the physical key to the café, bring to life the overarching aim of the café of enabling personalized and sustained use beyond project time, fostering "design-in-use" or "design-after-design". Seravalli (2012) and Toxler (2010) have pointed out a particular challenge of long-term sustainability of physical makerspaces with regard to common struggles with continuous participation. Ultimately, the future self-management and sustainability of the café is a subject for further research, in which findings from this paper may be applied, including learnings about how infrastructuring enables changes in space and participation over time.

We are aware that this research has also certain limitations. Within the scope of the paper, it has not been possible to provide depth accounts (including some theoretical inconsistencies and potential contradictions) of concepts within and across multiple fields and disciplines. Our framing of key concepts and the conceptual framework are thus open for further development, testing and iteration. Likewise, the extent of empirical material offers the possibility for deeper analysis regarding some quantitative and temporal aspects. These and other issues, including further analysis of the interviews, will be reported in future publications.

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[p4]Paper 4

Hirscher, A.L..

"Hey, I can do that too!
— Skillful acts
of use thriving
in a co-sewing café

Under review.

HIRSCHER, A.L.

"Hey, I can do that too!"— Skillful acts of use thriving in a co-sewing café

Skills are highly important for a democratic design process, enabling everyone to participate and skilfully use designed tools and methods. This is particularly relevant for extended participatory design (PD) contexts growing in scope and time span, for instance in community or peer production environments. Skills develop over time and thus inform design interventions, possibly beyond the project time. Relatively little PD research has been devoted to the role and notions of participants' skills. Recognizing this gap, this paper develops a detailed account of skills, building on literature supplemented by insights from practice. The case in practice is a co-sewing café, understood as a space for infrastructuring, allowing for changes informed by its context and participants' skills. As a research-through-design experiment, I ran and documented it over eighteen months, hosting hundreds of participants. Skilful acts of use and participation play important roles here, which are exemplified with an approach to studying skills in extended PD contexts. The paper concludes with an overview of the different skills practiced and developed in the café and suggests that designing for skill development contributes to sustaining participation in this context, and thus contributes to research addressing the challenges in extended PD and infrastructuring today.

Keywords
participation, participatory design, skills, infrastructuring, peer production, makerspaces

1
Introduction

Participatory design (PD) practice and discourse have focused heavily on the design of "tools" and methods for facilitating participatory processes; however, they have neglected PDs' earlier motivation to foster skill development in reclaiming the knowledge of workers. For instance, early PD focused on designing tools and methods for anyone to use so they could participate in the design process on a common level, for example, with "cardboard computers," and contribute to the final product design (Ehn and Kyng 1992). Early explorations concerning participation and skill, especially those related to technology development at the workplace, started in the 1970s in Scandinavia (Ehn 1988). Voicing PD's democratic ambition that anyone should be able to participate illustrates the role of skills as power in informed and reasoned decision-making and using (or refusing to use) an artefact in a specific way (Bratteteig and Wagner 2014). Likewise, tools rely on skills being used, thus skills build the bridge between tools and the possible depth of participation. Therefore in PD, skills—both those existing and those acquired through, for example, sharing and (mutual) learning—have always played an important role and evolved alongside the notion of tools and methods (Ehn 1988). Skills are thus considered as important to PD, enabling participation in the design processes (see, e.g., Smith and Iversen 2018; Galliers et al. 2012). However, certain discussions in PD critique the too strong focus on methodological and tool development as being too narrow and limiting when designing for environments in longer-term PD projects (Vines, Clarke, and Wright 2013; Hyysalo and Hyysalo 2018). For example, the tool focus neglects the analysis of the depth of participation in the PD processes (Gerrard and Sosa 2014), which goes along with the reduced attention given to the notions and development of skills as PD outcomes.

In recent decades, the focus of PD has extended from developing technological applications and products with the future users towards designing with(in) communities for different scales, environments, and extended time spans (referred to as *extended PD* in this paper). PD is extending the object of design towards understanding the design of *infrastructuring* as consisting of participatory processes (Björgvinsson, Ehn, and Hillgren 2010) enabling *design-in-use* (Ehn, 2008; Dittrich, Eriksén, and Hansson 2002; Henderson and Kyng 1991) or *design-after-design* (Telier 2011; Redström 2008) in order to support citizens in growing their capabilities (Huybrechts et al. 2018). This is particularly interesting when comparing early PD, where skilled users contribute to the future design of artefacts, with contemporary PD, especially infrastructuring, where gaining skills through participation gains stronger emphasis (Huybrechts et al. 2018). The concept of infrastructuring is particularly useful for addressing the necessary flexibility, openness, and adaptability required when designing for uncertain outcomes and future use (Hillgren, Seravalli, and Emilson 2011). Karasti and colleagues (Karasti and Baker 2004; Karasti and Syrjänen 2004) have emphasized infrastructuring as an ongoing activity, describing a fluid and dynamic structure enabling and intertwining activities in a process of ongoing development through design and use phases that include adaptation, redesign, and appropriation (Björgvinsson et al. 2010).

Infrastructuring in PD is also blurring the roles of user and designer, influenced by spatial and temporal arrangements, and the tools and skills of participating actors. In an earlier paper, I have investigated the notion of "stuff" (tools, materials, spaces) impacting on the blurring of user/designer roles in

infrastructuring (Hirscher and Mazé 2018). Here, I will thus look in depth at skill development and practice in the processes of PD infrastructuring. The literature associated with extended PD and infrastructuring lacks nuanced articulation and theorization about developing and practicing different types of skills. A deeper account can be found in Ehn's early work (1988), which provides a detailed description of skills development; thus, this paper builds on these early developments in PD. This research will contribute to PD discourse in providing a detailed analysis of skill development by illustrating through a case in practice, that participants' skills should be central to designing for PD and infrastructuring processes. The case, a "co-sewing café", highlights that focusing on skills enables us to design beyond the roles of users and designers. The café is considered as a successful PD case, sustained beyond its project time, self-managed by its participants. Therefore, this paper is dedicated to the role of skills in a designed infrastructure and the potential impact on sustaining participation. Insights from literature and practice will explore this with the following research questions. Why is a nuanced understanding of skills important in order to address specific challenges in extended PD? How can different types of skills be understood in relation to one another and within practice?

The co-sewing café is part of a larger doctoral project, established by myself with support from two colleagues. I designed and facilitated the co-sewing café as a type of makerspace, offering an open, collaborative workshop space framed by its individual participants and purpose (Kohtala and Bosque 2014). The purpose of the café surpasses that of producing garments and moves towards learning and exchanging knowledge and skills in order to foster social interaction and community building amongst peers with common interests. Following a research-through-design approach (see, e.g., Koskinen et al. 2012; Brandt et al. 2011), I designed the co-sewing café following PD values, aiming to attract a diversity of participants, something underrepresented in traditional technology-driven hacker- and makerspaces (Fox, Ulgado, and Rosner 2015), addressing different age groups, female participants, and refugees. The setup, running, and development of the café were carried out by myself as a trained designer, attending particularly to the practical, material, and "designerly" aspects.

2 The understandings and challenges regarding skill in Participatory Design

Skills, and designing for skills and skilled work (in reference to computer artefacts), and mutual learning amongst designers and skilled workers have always been important to PD (Ehn 1988). In early PD, participants included highly skilled workers with craftsman's abilities, skilled as professionals with "instrumental work skills and social interaction competence" (Ehn 1988, 454). Ehn (1988) further distinguished between the different types of tacit knowledge as a sensual experience. These are *knowledge by familiarity* and *formalized* or *automated tacit knowledge* (represented with the social competence of making judgments, for instance learned by experience or by the guidance of someone more skilled). Theses PD processes aimed to enable workers "to use and enhance their skills while avoiding any unnecessary or negative constraints or automation of their work tasks" (Robertson and Simonsen 2012, 4). However, a detailed account of and descriptive terminology for the acquisition of different types of skills through PD processes and techniques is missing.

Skills in PD are described as a key aspect of mutual learning, enabling a "master–apprentice relation in a double sense," where designers gain insight from highly skilled users and vice versa (Ehn 1988, 377). Roles (designer vs. user) are assigned by associating specific skills with them. However, in extended PD, particularly in infrastructuring, roles become more blurred (Hillgren, Seravalli and Emilson 2011). Related studies on end-user development—in particular, studies on meta-design (Fischer and Scharff 2000) and the work of Botero (2013), which bridges the PD and end-user discourses—have also acknowledged this. I therefore propose the importance of understanding nuanced differences in skills in order to shed light on the blurred spectrum of design and use in infrastructuring. Therefore, I understand participation as skilled acts of use, following Redström's (2008) act-based perspective that is emphasizing "what we do, not who we are." This description does not stress roles but allows a more in-depth view on participants' skill development and how different types of skills are interrelated with the way people participate. To conclude, skilled acts of use are not only enabled through the designers providing tools or methods for participants, but are also informed by highly skilled users. This underlines that research in extended PD and in infrastructuring in particular is calling for nuanced accounts of skills in order to better understand their role in practice and in regard to sustaining participation.

Contemporary PD is extending the design process towards structures that allow participants to become driving actors enhancing their skills in design and reflection (Smith and Iversen 2018). In particular, infrastructuring is identified as contributing to a new perspective and focusing on designing for skills that focus on the "intangible outcomes of design, such as new skills, insights and a reflective stance towards technology" (Smith and Iversen 2018, 14). Infrastructuring enabling users with skills during participation has been elaborated on, for example, by Huybrechts et al. (2018) who discussed "capabilities development" in infrastructuring processes and the related challenges. Hillgren, Seravalli, and Emilson (2011) explored infrastructuring in design for social innovation, addressing how to acknowledge the existing capabilities of very diverse participants within design-based infrastructuring approaches and beyond. Further, Leong and Robertson (2016) explored PD methods that reflect skills in regard to voicing values by involving aging people in contemporary PD processes. Birk (2017, 777) further elaborated on "infrastructuring the social" in marginalized Danish communities, concluding that therein lies "the potentials for subjective transformation—the acquisition of new skills, new knowledge, and new ways of being in the world." These researchers recognize skills as important to PD; however, they do not offer a detailed analysis and description regarding different types and their explicit impact on the spectrum of participations.

For extended PD discourse, makerspaces exemplify specific challenges and conceptions of infrastructuring processes. Seravalli (2012) explored makerspaces and described them as spaces for infrastructuring because they offer a dynamically adaptable structure that is redefined at the "use time for supporting emerging activities." These designed infrastructures potentially enable users to engage in design-after-design and design-in-use, building on users' skills in order to take over the responsibilities of former designers/facilitators (Seravalli 2014; Hirscher and Mazé 2019). However, a particular challenge in regard to sustaining participation and the resulting sustainability of makerspaces has been identified (Seravalli 2012; Troxler 2010). Therefore, the co-sewing café, as

successfully sustained beyond its project time, provides the materials for analysis and highlights the role of skills in order to better understand the spectrum of possible participations.

3 Skills discussed in relation to alternative spaces of peer production

Fab labs and hacker- and makerspaces are spaces set up for and/or by people using tools, equipment, and facilities to design and produce their own artifacts (Kohtala 2016; Seravalli 2012). Participation in such spaces is often discussed as being directly related to the acquisition of practical skills. The acquisition of skills is considered as empowering participants/makers with greater independence from market-dictated consumption patterns and allowing them to foster local community initiatives (Lindtner and Lin 2017; Seravalli 2014; Kohtala 2016). As an example, longitudinal research on digital fabrication technologies, embedded as education in Danish schools, has shown that these fabrication technologies offer students the means to learn and practice skills in digital production (Smith and Iversen 2018).

Skills in communities of peer production are considered as highly important for developing a "maker identity" and participants' agency, which help the participants to feel connected to the respective community and thus contribute to its sustainment (Toombs, Bardzell, and Bardzell 2015). In other words, maintaining and sustaining such a community requires labour, skills, knowledge, and sociality in order to care for others and the space (Toombs 2016). In addition to skills and knowledge, Toombs, Bardzell, and Bardzell (2015, 8) highlighted that the "member's abilities to care for one another" are essential for the "continued success of these communities." One major aspect of care is identified as sharing skills amongst the members. When members have special skills, they can develop an identity related to those skills but also care for others by transferring these skills (Toombs 2016). Similarly, in spaces emphasizing practices of repair, "skills and knowledges of repair are assembled and shared between fixers and participants, in ways driven by shared motivations and affective connection" (Houston et al. 2016, 1409). Besides these authors, little research is dedicated to specifically exploring and articulating how different types of skills inform the "mechanisms of skill-sharing and educational practices within these spaces and their impact on questions of access, inclusion, and empowerment" (Foster 2017, 9). Therefore, the following section will explore different notions of the skills relevant to the case analysis and discussion.

4 What constitutes skilful participation?

This section elaborates on PDs early interest in skills because this paper proposes revisiting skill development in PD as an important area of research given the challenges of sustaining participation in PD infrastructuring environments (i.e., in makerspaces). There are obviously many relevant theories related to skills, from Marxist epistemology towards pedagogical learning theory; however, the detailed elaboration of the philosophical background and their compatibility are beyond the scope of this paper. Therefore, I only refer to PD and peer production literature in regard to skills and neglect the research on learning science that has explored, for instance, "learning as a process of participation" (Paavola, Lipponen, and Hakkarainen 2004, 557) and propose this as a subject for future research. The analysis in section 5 will then deepen the preliminary findings from literature by investigating how skills were realized in the co-sewing café.

Related to PD discourses, Ehn's notion of skills, which should be seen as within his larger framing that is oriented towards Marxist epistemology, acknowledges two kinds of knowledge production (Ehn 1988). He distinguishes between *theoretical knowledge production*, represented through insight and new understanding, and the *acquisition of skill and competence* (Ehn 1988). He further defines four categories or stages of knowledge, referring to Joachim Israel's work as a Marxist sociologist (Ehn 1988, 88). The first stage is referred to as *understanding*, where one does not necessarily reflect upon the reason for knowing something, and moves on to *awareness of understanding*, comprising reflection about what was previously self-evident. *Insight* is articulated as the next stage, a stage that actively produces knowledge by approaching situations with a different view. Thereby, a new design can be created through a new understanding. This way of reflecting can be incorporated into new everyday practices and *skills*, resulting once more in *understanding* but also in "the acquisition of new knowledge in the sense of competence or skill" (Ehn 1988, 90). By mastering a skill through in-depth reflection and the ability to practice it well, new routines can be created "within the frame of social interaction" (91). According to Israel, quoted by Ehn (1988) this is called *creativity*.

In contemporary PD research, such detailed descriptions of the different types of skills and their acquisition are missing. Kolko et al. (2012) offered an interesting exception in exploring informal learning and technical skill development in their PD- and maker-/hacker-inspired "Hackademia" project. With their research, they aimed to address the lack of interplay between skills, emphasized through the predominant model of higher education being strictly discipline oriented, claiming that "this narrow sense of expertise is ultimately tied more to identity than aptitude" (Kolko et al. 2012, 129). They offer insight into learning in an environment similar to makerspaces and describe that learning occurs through discovery and exploration motivating "learners to develop self-directed, *creative problem-solving skills*" (131). Due to the projects similarities in approach, the same principles and definitions to learning and skill acquisition will be adopted in this paper, building on the *Learning Partnership Model* (Baxter Magolda and King 2004). The identified principles include "validating learners' capacity as knowledge constructors," "situating learning in learners' experience," and the definition that learning is "mutually constructing meaning" (Kolko et al. 2012, 131). Further, it is relevant to distinguish between "individual competencies—the skills, mindsets, and motivations of individuals' as 'soft' and 'hard' skills" (Morgan et al. 2010, 28). *Soft skills* are seen as *social skills*, the ability to building interpersonal relationships, "generating leadership, loyalty, and legitimacy" *Hard skills* are *manual skills*: "technical, financial and logistic" skills (28).

My interpretation of the types of skills discussed above is illustrated in figure 1 below. The way in which skills are performed, but also constantly changing, is connected to new knowledge production and meaning making, identified as learning or developing skills by practicing them over time. The four stages identified by Ehn (1988) build an interrelated learning process and increase with learners' experience. The acquisition and practice of a skill is considered as constructing new knowledge while creativity is seen as the ability to embody a skill so deeply that one is able to develop new routines and practices for the skill, understood

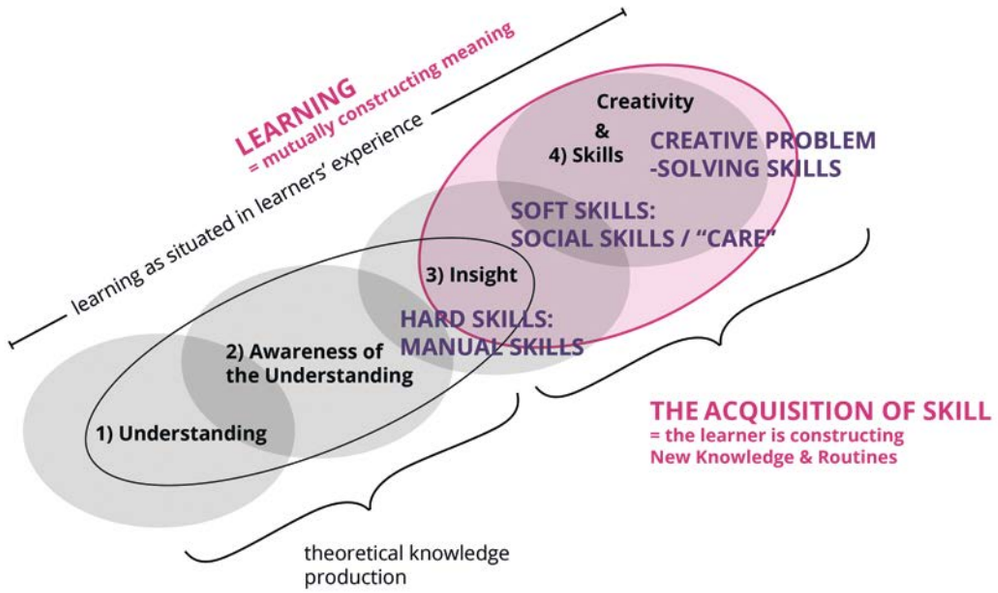


Figure 1
Acquiring skills refers to learning and practicing different types of skills over time.

as a creative problem-solving skill. Different types of skills (manual, social, and creative problem-solving skills) are identified and placed according to my understanding of them along the learning spectrum covering the four stages.

5 Exploring skills in the co-sewing café

5.1 The co-sewing café

The co-sewing café is located in a small town of about 6600 inhabitants in South Germany. It was established in July 2016 as part of a bigger research project, a "*Reallabor*" [real-world laboratory] that investigated sustainable transformation in a rural context (Geiger, Hirscher, and Müller 2017). The co-sewing café occupied a former sixty square meter shop front, hosting ten to twelve workstations, which include refurbished domestic sewing machines, and donated sewing materials and fabric. The material for analysis were collected during eighteen months, documenting forty-two workshops, each three hours long, with approximately 314 participants. In each workshop, the facilitators provided sewing suggestions (such as suggesting garment patterns and examples to try on) that were accessible for different skill levels while workshop facilitators provided support, advice, and ideas. I designed the café in a way that allowed participants to start making a garment on their first visit, aiming to reduce barriers such as the lack of space, tools, skills, ideas, and materials. I planed the workshops to have achievable goals in order to ease the entry level and

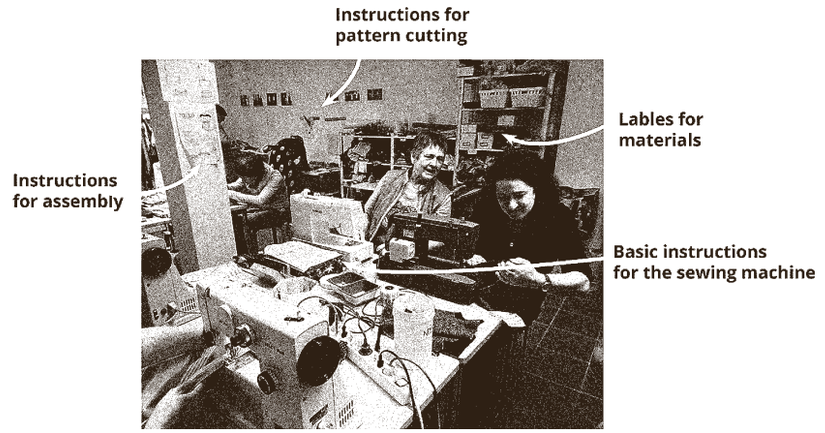


Figure 2
Enhancing skill development and independent making through specific design adjustments.

reduce the fear of mistakes or the experience of frustration. For instance, *upcycling* a male shirt to a skirt can even be managed by a sewing beginner in two hours. Further, I intended to enhance independent making and collaboration amongst participants by designing grouped workstations and created labels for tools, machines, and materials (see figure 2). I also observed the need for instruction and multilingual posters, which were added to increase independence from facilitators, allowing for individual skill development. A more detailed analysis on the designed and emerging "stuff" can be found in an earlier paper (Hirscher and Mazé 2019).

5.2 Documentation and analysis methods

A multi-method research strategy was applied and played out as a "triangulation" of methods (Gray and Malins 2004, 15). In the co-sewing café, I drew upon documentary methods resembling autoethnography, as developed within research through design. More specifically, I kept and analysed a "reflective journal" on my designerly activities (Gray and Malins 2004, 57) and to record notes throughout the setup and after the facilitation of each workshop. Further, qualitative inquiry has been a primary methodology for collecting and analysing the case in regard to people's experiences with the space, its tools, and its members. Participant lists, including, dates, names and times of participation, document the routines of the participants. Twenty-six short, semi-structured interviews were conducted with the participants after their first or second participation. Extensive photographic documentation comprising approximately 1200 photographs taken by me and other participants provide additional material.

The structured interviews with fifteen open questions collected in-depth information about reasons for participation; the experience of the workshop in regard to learning, interactions, and outcomes; and general feedback on the co-sewing café. They were recorded, transcribed, and coded following an open, thematic coding strategy (Flick 2014). In the coding process, the repeated quotations related to a specific code were only coded once per interview. The resulting 57 codes were recognized and

structured in ten categories for analysis. The majority of participants were female; ages ranged from 16 to 80, though most were between 30 to 60 years old. Each workshop had a varying number of participants, ranging from four to twenty-five; however, the average range was six to eight participants. Typically about half were regulars, and the others were first-timers or occasional participants. Their prior experience of sewing varied from participants who were total beginners with little to no prior knowledge (12) to those who were very advanced (14).

6 Analysis and Findings

The analysis of the interviews in reference to the photographs and observations allow an in-depth account on the interactions with tools, space, and peers with a special focus on acquisition, practice, and the sharing of skills. Special attention is given to the participants' experiences and reasoning for (sustaining) participation in the co-sewing café.

6.1 The findings from the interviews

The interest in learning "new sewing skills" and the concept of upcycling were identified in the interviews as the most stated reason for participation. These two aspects are of course interrelated in many ways as learning upcycling requires certain manual skills in sewing, but also the creativity to reimagine what an unwanted object could become. This also points to an emerging interest in revaluing unwanted garments with upcycling. Second, the social aspect was prominent when participating in the co-sewing café; the "exchange with others," the aspect of "meeting new people," and having the possibility for cultural and generational exchange were highly important. This was followed by a strong interest in the specific "theme of the workshop" and wanting to "find inspiration" or "be creative," which link back to the shared interest in upcycling and doing so by learning sewing. Fairly often the aspect of "having fun" arose and a general "interest in sewing" and "daring to start" with it, which gave a positive reassurance that people felt attracted by the concept of the co-sewing café, which was aiming to lower the barriers for beginners.

The interviewees were further asked about the personal benefit they saw in participating and in the co-sewing café in general. Most interviewees benefitted through "advice, ideas, and assistance" provided in the co-sewing café. Equally important were "sewing with others" in order to learn and exchange in regard to a shared interest, "learning new skills," "having fun / finding a new hobby," and "gaining confidence and pride" in one's skills. Access to sewing "patterns and inspiration" were also seen as having great personal value, followed by the aspect of "revaluing old garments," "renewing skills," and gaining "awareness of a craft and of sustainability." These all value participation in relation to gaining, sharing, or performing skills through a shared interest while enabling a feeling of having pride in one's abilities. An interesting aspect was that the actual object, a "garment to take home," was only mentioned by two interviewees as the main benefit. Even though each workshop was advertised with a specific theme (i.e., a product outcome), the collaborative learning process of actively making the garment was valued higher.

6.2 The co-sewing café as a space for infrastructuring and developing skills

In this section, the different types of skills from section 4 are explored in reference to the interview results, journal notes, and observations. This analysis aims to better understand how skills are practiced and developed, and how this relates to challenges identified in spaces for infrastructuring. In addition to the notions identified in the literature (manual, social, and problem-solving skills), *facilitation* and *upcycling* are added as design skills.

6.2.1. *Manual skills (sewing and garment construction)*

One of the main reasons for participation and a personal benefit identified was gaining manual skills in sewing and garment construction. Each workshop offered different themes (i.e., types of clothing to be made) at varying skill levels. The support of the facilitators depending on the individual skill level enabled a step-by-step learning process of clothes making. This allowed participants (independent of their prior knowledge) to gain new manual skills. One participant said: "I like sewing very much and, on the other hand, the co-sewing café offers a possibility to extend my hobby, to learn new skills. I don't actually sew clothes; I do patchwork and felt, here I have the opportunity to learn clothes making."

Experienced participants often added personalized details to their garments or increased the level of difficulty by adjusting the provided paper pattern, constructing new knowledge and routines. Further, instructions and patterns were often copied in order that the process could be repeated at home, enhancing learning new skills through repetition. A participant observed the following: "I really learn something from it [the co-sewing café]. If I do that at home, there's nobody to help. But once you've made a garment here, and then repeated the steps, you can do it on your own."

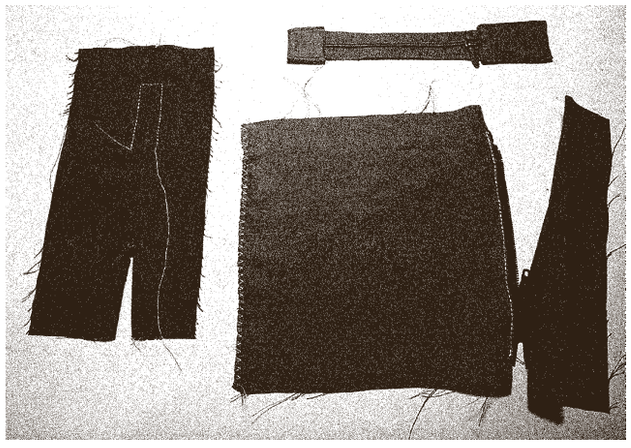
6.2.2. *Social skills (sharing skills as care)*

The development of "soft skills," (i.e. social skills) understood as building relationships by sharing skills during workshops, is also identified as care. Care is highly important for sustaining a community of participants, as identified by Toombs (2016), elaborated above. This is a very prominent aspect in the co-sewing café, occurring across every level and type of participant. Support structures were built naturally amongst the participants, because half of the participants had prior sewing experience. The participants mostly worked in groups of two to three people, while more the experienced participants gave advice to the beginners, for example, advice about cutting, threading the machines, or sewing techniques (figure 3). When mistakes occurred, shared creativity was gathered for innovative problem solving, including helping to unstitch,[1] illustrating care for others. A participant noted the following: "When everyone is working creatively, people just help and support each other."

Another example is a former seamstress who occasionally participates by advising others (figure 4), thereby developing social and facilitation skills. Her manual skills put her in the position of taking responsibility for others, sharing her skills, and helping others to develop their skills. The space for and ability to share skills and knowledge seems a very important aspect of social skill development and sharing a common interest in a feeling of community. One interviewee said: "I think it [the co-sewing café] is a meeting place. Old and young and everyone are really getting in touch. Everybody can bring in their abilities."

1 Unstitching a wrongly made seam is experienced and expressed by the participants as a time-consuming and frustrating process.

↑ Figure 3
Practicing social skills: sharing manual skills between beginners and advanced participants.



↗ Figure 4
Skill sharing as caring across different generations and nationalities.

→ Figure 5
Manually skilled participants are developing their own tools to facilitate independent workshops.

↓ Figure 6
Upcycling, practiced by Naser; acquiring creativity as a design skill.

6.2.3. *Facilitation skills (hosting workshops)*

The acquisition and practice of social and facilitation skills are, in the context of the co-sewing café, strongly intertwined, often building on already acquired manual skills in sewing. Developing facilitation skills is reflected in participants' abilities to adapt and develop the organization and running of their own workshops, including the transfer of their skills to other participants. This is documented through the increased number of independently facilitated workshops over time. When participants are manually skilled, they start to practice social skills during the workshops and gain confidence in their facilitation skills. This becomes evident when they start to develop their own tools and methods for facilitation, as illustrated by one former participant offering a "how to sew in a zipper" workshop (figure 5), for which she prepared half-ready samples to ease participants' learning experience.

6.2.4. *Creative problem-solving (design as upcycling skills)*

In this analysis, I refer to creative problem solving as design skills, in particular upcycling, which can be acquired by anybody, especially if they have certain manual crafting skills already. The co-sewing café attracts a wide variety of participants, some more skilled than the facilitating designer. This can be demonstrated with the example of Naser, a young Afghan refugee who used to work as a dressmaker. Of course, he already had great manual sewing skills, which enabled him to gain and practice facilitation skills. In addition, he could practice the German language, supported by local participants and multilingual posters we designed with my colleague's language skills. Beyond these skills, he very easily learned design skills. After participating once, he offered to facilitate a workshop on upcycling without prior knowledge of the concept. We had provided him with four old men's shirts for preparation and discussed the basics of upcycling with him. Within a week, he presented three upcycled garments that were modelled by his wife (figure 6).

Other participants, with less manual skills, can use samples he prepared to gain inspiration to creatively reinterpret garments as well. One participant said "Making something from materials that you would otherwise throw away, or that perhaps wouldn't otherwise be used, in order to create something new, something really new, that is really like being a designer."

Specifying design skills as learning to creatively redesign unwanted garments (upcycling) allows the better description of the learnings of manually skilled participants without assigning roles to them and illustrates their growing skill set over time. This highlights the important nuances that can be identified by differentiating types of skills and acknowledges participants' diversity of skills enabling them to independently plan, design, and host co-sewing sessions.

7 Discussion

This paper formulated notions of the skills described in extended PD while identifying an absence of a versatile skill perspective in both PD and material peer production discourses. The relevant notions of the skills found in literature (i.e., manual skills, social skills, creative problem-solving) were explored through practice, that is, through the co-sewing café, in order to elucidate specific nuances relevant for this specific context. Notions, such as *facilitation skills* and *upcycling as a design skill*, were acknowledged as important for running and maintaining the co-sewing café over a long period of time. The identified types of skills need to be understood in relation to each other, interlinked through a process of constant learning over time. They are partly building

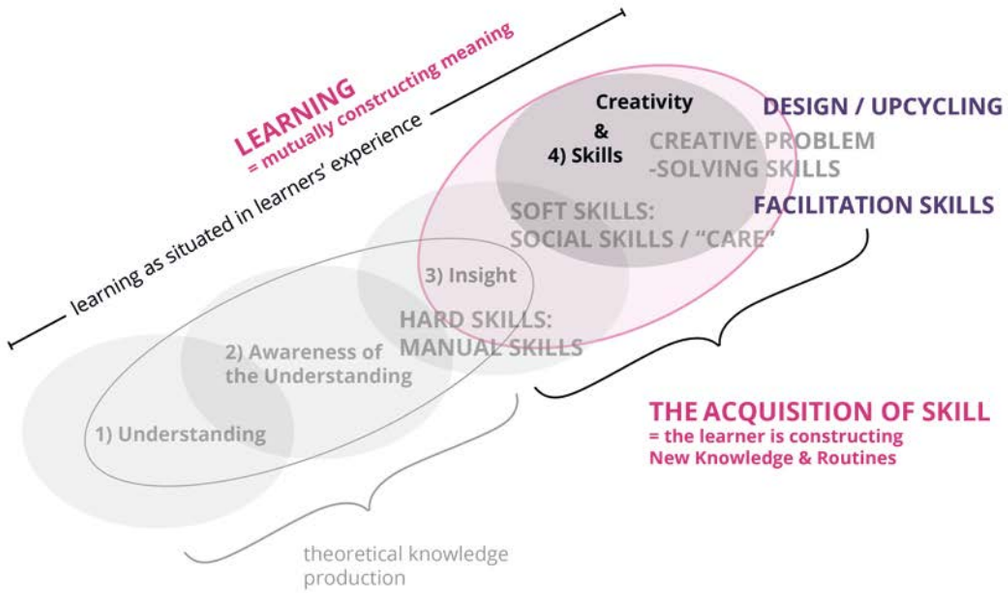


Figure 7
Differentiating skills: adding the facilitation and design (upcycling) skill as a specific skill in the case in practice.

upon each other, as illustrated in figure 7, which adds two specific skill notions that were identified in practice. For instance, manual skills in sewing are a prerequisite to act as a facilitator or practice upcycling. Social skills and facilitation are closely related as facilitation is built upon social skills and a feeling of caring for one's peers, and the space and its activities. These relations were identified through in-depth accounts of the practice. The materials collected suggested that there are missing terms in the related literature and suggested possible perspectives that could be adopted to address the particular challenges of extended PD and infrastructuring today, such as emphasizing skill development during participation.

The co-sewing café allowed participants to perform, share, and acquire skills, being flexible and open towards changes occurring over time. These changes were often informed by participants either having or lacking skills. For instance, improved manual skills foster moving from independent making towards social and facilitation skills but require instructing labels for more independent working and use of machines and materials. These infrastructural changes enable independent making and foster social and facilitation skills, which are essential for sustaining extended PD spaces or initiatives. They enable the sharing of responsibilities and tasks such as workshop facilitation beyond these falling to the person initiating the activities (e.g., a design researcher). Thereby, they also enable participants to make changes to the space and its way of working, moving towards design-in-use.

The participants further understood my direct design intentions for the co-sewing café, such as practicing upcycling in a social and collaborative setting and fostering sustainability knowledge by revaluing disposed garments. The concept of upcycling even seemed to trigger a common interest or issue, as identified in the interviews, that provided reasoning for sustained participation. Understanding the co-sewing café as a space for infrastructuring enabled participants to nourish their interests and skills, allowing for changes to the infrastructure in order to address their personal interests beyond the project time. Similarly, Dantec and DiSalvo (2013) described infrastructuring as providing participants with the framing and capacities to address shared issues in the future.

The paper proposed that a nuanced understanding of skills is important in order to better address the challenges of extended PD. Differentiating the types of skills can elucidate the ways in which participants actively engage with a space and activities. In the co-sewing café, the participants started by following the proposed procedures but quickly developed manual skills that led towards more independent making and taking responsibilities for facilitation. The variations in developing skills were illustrated within the co-sewing café's analysis but they can most likely be extended in other related contexts. The findings gained through practice open up potential for further research on the important role of skills in infrastructuring over time. Infrastructuring enabled the participants to constantly develop their skills further, giving them reason to participate and a personal benefit from participation. The opportunity for skill development at every level can be interpreted as potentially nourishing sustaining participation due to the openness of who is (or can be) doing what. Therefore, this paper emphasizes the important role of skills in such contexts and does not define participants by identities (gender, age, occupation, nationality) or roles (designer, user) but by the types of knowledge they have and by their skills. Thereby, the issues of future self-organization beyond providing designed tools can be addressed (Huybrechts et al. 2018) and enable participants to continue independently.

8 Conclusion

Exploring and establishing notions of skills allowed us to better understand the role of skills in relation to challenges experienced in extended PD. The paper contributes to PD research and beyond by elucidating these notions and their interrelation by analysing and adding to them through practice. In summary, figure 7 offers a starting point for further discussions on skills in relation to research projects. In this specific case, the concept of upcycling could be seen as triggering a shared interest or issue to provide reasoning for sustained participation. Recognizing the limited discussion on the role of the different types of skills in PD and peer production discourses, and PD's preoccupation with roles calls for further research on the roles and nuances of skills in both infrastructuring and extended PD.

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Design, use and participation intersect in novel ways when a diverse community of people gather together to make clothes. This book examines the fluidity that flourishes at these intersections by introducing findings from three "research through design" experiments which brought communities together to sew, upcycle and design new garments. The study examines concepts of skillful participation in alternative spaces of peer production and the designer's role in facilitating the social and material aspects of making clothes together. Departing from early participatory design and peer production literature, this research investigates what happens when participants (designers and users) make (clothing) together in new forms, spaces and community contexts.

As a result, the study documents how the role of participants (designers and users alike) evolves over time and is determined by the participants' skillful acts of use. Hence, the dissertation looks beyond predefined roles and instead advocates for designing flexible spaces, which allow changes in participation and anticipate unexpected use.

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