Public engagement in critical making

- A feminist perspective on materiality of living

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Abstract

This thesis sets out to explore critical making practices within a makerspace, Sliperiet, in Umeå. Public engagements in the makerspace increases the possibilities for everyday citizens as well as particular interest groups and stakeholders to become involved in designing. The +Project in Sliperiet became the case study for this thesis, and feminist theories framework was used for analysis. This thesis explores different strategies to support publics in critical making practices. The results show that critical making practices are hard to motivate sometimes. Therefore, the process of engaging publics needs to strike a theme that is intellectually intriguing or interesting for the participants, in order to ensure involvement and active participation. Moreover, to adopt critical making, there is a need of having a clear structure, instructions, and support for the workshops. This thesis also extends the concept of materiality of interaction to materiality of living by analyzing people’s every day interaction.

Keywords: Critical making, public engagement, materiality, feminist HCI

1. Introduction

Technological innovation, design, and development is often aimed at providing improvements for people and contribute to a progressive society. Much of the hope in contemporary western societies are associated with design and innovation merging with creative industries such as arts, craft and activist movements (Florida 2002). The scope of innovation presently revolves around gathering traditional occupations and professions and combining them with arts, design and crafts. Scientists, engineers, architects and academics are expected to collaborate with people in design, education, arts and entertainment. In interdisciplinary themes people collaboratively create new ideas, new technology and/or creative contents (Florida 2002, p.8).

Richard Florida’s notion of the creative class, makers and do-it-yourself (DIY) movements with ongoing digitalization has together inspired politicians and city planners’ worldwide (Hatch 2013, Von Hippel 2001, Wakkary 2009). In Sweden several initiatives have been supported by the government as well as through the European Commission in order to re-structure and re-arrange organizations and companies for post-industrial manufacturing. These initiatives are simultaneously being referred to among other things as Fabrication
labs, Living Labs and Social Innovation platforms, and are also often defined through a collection of different activities that aspire to reach across different disciplines, professions and traditions in search for alternative and innovative practices. Often these activities are defined as user-centered, based on a systematic user co-creation approach integrating research and innovation processes in real life communities and settings. Also often, makerspaces put publics at the center of innovation, and have thus shown the ability to better mould the opportunities offered by new technological, and design concepts and solutions to the specific needs and aspirations of local contexts, cultures, and creativity potentials. Thus, the publics think and create/make new approaches to problems and explore futures in open-ended and creative ways.

1.1 Research Motivation

There is a collaborative initiative taken in Sliperiet with the name +Projet. This project has three different branches, including a branch named +House, which has the vision to build a fully functioning smart house of the future through 3D printing aka additive manufacturing technology. With this vision Sliperiet has become the collaborative makerspace in Umeå: a platform for critical making in design. For this research I was placed in Sliperiet for almost 2 months, as I believe the field of Human Computer Interaction (HCI) has also joined the movement of critical making and design for the future. For example, we can start sensing the need of investigating new approaches of user research when we see children as the design research partners, rather than just users (Durin, 1999). Or, when we see the thriving need for inspirations to design for the future (Odom, Zimmerman, Davidoff, Forlizzi, Dey & Lee, 2012). With the start of the third wave of HCI, there is a need in investigating the multiplicity of user experiences (Bødker, 2015). This need fits well into the setup of public engagement in makerspace to build for the future, as public engagement in makerspace could bring local contexts, cultures, and creative potentials. However, when ‘users’ become ‘public’ in the design process, then several questions arise such as, who are the public, or how to engage them or what is their roles in engagement (designers vs. participants) and so forth. Therefore, this study broadens the perspective of participatory design shifting from user research to public engagement in design through critical making, which in turn could broaden user research perspective in HCI.

This study has viewed critical making as a tool for public engagement in design. However, it was observed that there have been challenges of ‘materiality of interaction’ based on the conceptualization of matters during the process of making. The definition of materiality in HCI is still under the process of conceptualization (Rosner, Blanchette, Buechley, Dourish, & Mazmanian, 2012; Wiberg, Ishii, Dourish, Vallgårda, Kerridge, Sundström, & Rolston, 2013; Wiberg, 2015) and this thesis took a small step towards contributing to it. We, humans, interact with each other, and materials in specific setups. So, while investing public engagement in making, it became an obvious study focus to extend the concept of materiality of interaction. Moreover, keeping this in focus, feminist theories became an ally for this study, as feminist theories question and analyze the material set up around us from a socio-material, and interdisciplinary perspective (Hekman, 2010). Overall, this study brings an
intersection among public engagement in makerspace, materiality in HCI, and inspirations of design in the living.

1.2. Research questions and aim
This research aims to study/observe critical making approaches in design to understand a new way of user research in design from the legacy of participatory design research, and, aims to investigate interaction with materials in HCI from the feminist theories point of view. Therefore, this study has had two research questions in consideration to explore:

**Research question 1 (RQ1):** How can critical making be adopted in the design process from the participatory design research perspective?

**Research question 2 (RQ2):** How can interactions with materials (conceptualization of materiality) be analyzed from a feminist theories standpoint?

1.3. Disposition of the thesis
This thesis is divided into several chapters, and smaller sections in each chapter. The chapter 2 gives a foundation of the thesis. The section 2.1 elaborates participatory nature in critical making, and connects it back to Scandinavian tradition of participatory design research initiative. Overall, it lays out the foundation to understand public engagement in the critical making and, it’s relation to participatory design research. The section 2.2. and 2.3. elaborates feminist theories, and lays foundation of a few concepts that are being used in this thesis. The section 2.4 elaborates materiality of interaction relating it back to feminist theories. Chapter 3 is the methodology section. This chapter gives the justification of using case studies in this thesis, and describes the approaches that were undertaken to collect data within the scope of the case study. Chapter 4 discusses the information gathered during the two months’ involvement in the +Project. So, it can be viewed as the result section. Based on this foundation, I discuss, and analyze the findings from +Project in section 5 within the theme of RQ1. When publics in the design process comes from different situated knowledge, spaces, then there is a need of a theme that strikes their intellectual interest. Here, I start my argument with making as a mean of participation, and how different collaborative group can come together in a participatory design space which is open, and innovative. Then I discuss the possibilities these kinds of process can offer, and the challenges we may face while adopting it. From the foundation of section 2.2., and 2.3., and the findings from this project, I explored ‘Materiality of Living’ in the section 6. This is the discussion, and reflection within the theme of RQ2. Here, chapter 6 starts with my personal experiences with material in my living space, then, I tie it back to some results from Chapter 4 and the understanding of materiality from the perspective of norms, context, and meaning we create through experiences. Then, the chapter 7 critically reflects on the analysis from 5, and 6, and lays out how the situated workshops, public engagements, knowledges can be patched together to represent a holistic understanding. While exploring the participatory nature in the makerspace, this chapter presents +Project as the knowledge store house of all the situated knowledge it is gathering from different work packages, and public engagements. In the conclusion part, I have reflected on the overall process, and summarized the thesis.
2. Related Research

Design can be viewed as a conversation between the material, and the designer (Schön 1983, P. 76 - 104). Supporting the idea of Schön, Wakkary (2005 p. 66) explained an alternative consideration of design to be as an activity that is ‘related to complex but everyday (interaction) situation’. Again, somewhat similar to this, Orlikowski (2004) defined design as the constitution, and enactment of reality, so more or less, she saw design as the whole process of interaction with and within and among the designed tools (materials, and matter), spaces, and procedures. So, to have a meaningful design it is important to know the world we interact and live in (Nelson & Stolterman, 2012). For example, there was an initiative called ‘one laptop per child’, where the main focus was to come up with low cost, and low power laptop for the school kids in the low income countries to fit the needs of poor infrastructure in the school set ups in South America, Nigeria, and so on. The laptops offered to the kids were very small, and light so that the kids can easily interact with them (One Laptop Per Child). However, the question remains, how to make the sense of the world we live in where we all have partial knowledge (Suchman, 2005) about it? There have been diverse user research techniques in HCI under the subject of investigation to have a better understanding about the user group, and the world we interact, and live in. Such as, using cultural probe to collect data or build understanding about distant users (Gaver, Dunne & Pacenti, 1999), or using field research technique like rapid ethnography which includes studying the users in a situated space for a certain time to achieve a quick, but effective understanding (Millen, 2000) have been proven fruitful when we need a broader understanding of multifaceted user groups. However, let’s say, these users are spread around different situated spaces, and we want to design something for common publics, then how are we going to sew these spaces, and experiences together to get a common understanding? Moreover, the process of design can be studied through asking questions such as, who are involved in the process, how the process in evolving, and how we are embodying the gathered knowledge. We tend to call it, design research (Bayazit, 2004). And, the aim of this thesis was not to come up with a design solution, or come up with a new technology or artifact. But, to study how can critical making be adopted in design process. To study public engagement in critical making we need to understand what critical making is, and how it can be connected to participatory design research.

Moreover, we live in a world of materials, matter, and spaces. How we interact with the world we live in is not only based what is there in the material set up, but what immaterial knowledges, and experiences we hold with us, and how we are interconnected with other materials, and humans in a social context. So, while designing for the world we live in, and the future world that we would want to live in, it is important to explore the interactions, and the interconnections. There is a deep relationship between designs, and making, where making is explicitly focuses on interacting with materials. Also, this whole process can be viewed from the concept of materiality. Materiality matters not only in design, but also in our everyday interactions with objects. And, we, the designers, or researchers, can draw knowledge from the materiality around us in situated spaces.
2.1. Participatory nature in critical making

Ratto (2011) works in what he calls critical making lab and challenge the long tradition within Western society of separating thinking and making through highlighting the interwoven material and conceptual work that making involves. The reason for doing this is that, there seem to be a gap between our conceptual understandings of technological objects and our material experiences with them.

Critical making is an exploration of how people can critically connect society and technology with their own daily experiences through investing in making physical creations and conceptual explorations. To do so, Ratto (2011) argues that, the combination of making and social theorizing is preferred to external viewing. The ability of the participants to engage with the social theories presented to them and to develop and share new understandings are intimately related to the joint conceptual and materially productive work.

As a potential of critical making Ratto (2011) puts forward the investments made by those who participate in critical making and those who can engender a caring for sociotechnical systems. We can view this as taking responsibility for the applied work, which might involve people in innovative technological or conceptual making. So, participatory nature in critical making platform could become a unique way in design research to bring people together from situated spaces and/or knowledge fields (see more in 2.3.) in order to produce collaborative common knowledge, or artifacts. Here, it is important to mention that, designers don’t only design artifacts, but the whole process of designing, and the design solutions become a source of drawing knowledge. Therefore, public engagement in critical making can offer us a collaborative platform for design research, and systematic knowledge production in HCI.

Public engagement in design can be traced back to participatory design (PD) research environment (Martilla, M. Nilsson, Seravalli, 2014). Participatory design initiative first came to Scandinavian research practice to bring democracy at workplace, and roots back to post-industrial democracy that gives workers autonomy of decision making (Gregory, 2003). Since then, participatory design research has evolved in the Scandinavian approach to innovation, and design research, but the main concept of having the users as design partner did not change from its core (Gregory, 2003). As the concept of democratization in workplace moved to democratization of innovation, participatory design research shifted the concept of user to the public (Björgvinsson, Ehn, & Hillgren, 2010). The products produced are usually for the people, so, it is important to make them part of the design process. It brings democracy in design process. So, collaborative design spaces offer new platform for innovation (Martilla et al., 2014). In this process, a community with no particular knowledge in technology, or particular knowledge in design, or innovation get an opportunity to be involved in innovation process. The same platform can invite people from different situated spaces, and different academia to share knowledge, and be a collaborative partner in the design process. Here, critical making may open up doors for the public to be part in the design process along with other stakeholders. However, different situated projects may come
with different situations. So, this study goes into structure of +Project to study their ways of public engagement, and from this experience this study offers notes about adopting critical making in design process.

2.2. Feminist theories and HCI
Feminism has always had a natural connection with HCI (Bardzell, 2010). With the need of third wave of HCI, feminist theories fits properly in HCI research. Feminist theories help in design research to research in digital culture (Bardzell, 2010). However, there is no one standard definition of feminist theories. Through different settlement of feminism from the first wave to third wave, feminist theories have conceptualized the theoretical frameworks to question, and critique the socio-material set up (Hekman, 2010). There is a common misconception that, feminism and feminist theories only evolve around with the concern of women. But, in reality, feminist theories borrow and extend the concepts of prominent social scientists and, philosophers like Latour, Ihde, Foucault, Wittgenstein and so on to explain the social construction of reality, and to study the relationships between human, and non-human agents (Hekman, 2010; Ihde, & Selinger, 2003). For this thesis, I leaned on different feminist theories such as, situatedness, partial knowledge, agential realism, discourses, norm, and social construction. In the later texts, I would describe them in details.

2.3. Making sense of situatedness, and partial knowledge
During her long work experience in IT industries, Suchman (2005) has observed how there is a gap between partial understanding of different groups of agents in design, and technology production, and why there is a need of translating the knowledge among different groups. Even though we aim for objective collective knowledge production, but our knowledge could be subjective and partial (Haraway, 1988). Our knowledge is situated based on our social constructions, so to achieve objective collective knowledge production there is a need of knowledge flow among different groups (Haraway, 1988).

I am arguing for politics and epistemologies of location, positioning, and situating, where partially and not universality is the condition of being heard to make rational knowledge claims... Feminism loves...the science and politics of interpretation, translation, sluttering, and partly understood. Feminism is about the science of multiple subject with (at least) double vision... Translation is always interpretive, critical, and partial. (Haraway, 1988 p. 589)

Therefore, partial, and situated knowledge may refer to our partial, and focused knowledge we draw from our experiences, skills, and the world around us. We gather this partial knowledge from several situated spaces that we interact, and live in. It can be both physical, and virtual space, or can be a combination of both. These situated spaces have their own discourses, and the knowledge we produce is related with that discourse (Hekman, 2010). Haraway (1988) also views situatedness as a primary focus of understanding us, and the material set up we live in. Examples of situated spaces could be our classrooms, living rooms, or a building, or a social set up, where different discourses, and norms connects us
within a social, and material set up. Digital spaces can also be examples of situated spaces, but, this thesis doesn't explore that.

Discourses are factors in society that influences the way we interact (Hekman, 2010). For example, when we enter into a library, we know that, we should not make noise. We learn this either from our childhood from our elders, or people around us, or maybe by explicitly from reading notice boards. This event is repetitive, and in many cases, we eventually conceptualize library with silence without getting reminders every time. So, silence could be an example of discourse in libraries. Here we can see that, discourses are related with norm. To elaborate what I mean by norm in human – non-human interactions, I would like to mention about Butler’s (2011) theory of performativity. Every material set up has its own discourse where the agents are connected with each other with certain performative. In this setup, some rules are explicit, and some rules we learn from our environment implicitly, and hence, in order to blend in, we perform our certain performances (or roles) in certain ways.

We cannot really look away from the importance from the understanding of situatedness, situated spaces, partial knowledge, and knowledge translation in designing, as design is based on the interpretation of the world, and interpretation is subjective (Nelson & Stolterman, 2012). Moreover, Nelson and Stolterman (2012) discusses about different design roles where the designers, stakeholders, users, clients and so on are embedded in the design process. Here, from a feminist standpoint, it can be argued that, they talked about the translation of knowledge among/between these groups. But, what about designing something for the future? Or, designing something that is for the people out there in the generic world? What if we don’t have a specific user groups? And, if we are conceptualizing, and designing something very common, for example, future home, then the concept of user shifts to public, and publics becomes the part of design process. Here, someone (an entity or agency) has to put forward to collect the situated knowledge, and sew it together to put forward some answers when the ‘users’ become the ‘public’.

2.4. Materiality in HCI

Researchers agreed that, there is a need of understanding materiality besides immateriality (Wiberg, Ishii, Dourish, Vallgårda, Kerridge, Sundström, & Rolston, 2013). In HCI, immateriality could be seen as electricity, or computational techniques. However, if we put feminist theories in context, then immateriality could be our knowledge, and experience (Hekman, 2010). Here, it can be said that, both examples of immateriality are valid in HCI, but, one is from the perspective of human entities, and another is from the perspective of materialistic entities (objects or technologies). While having materials in focus, the researchers can focus into material properties (components, functions, textures, and so on) in order to design objects, or technology (Doering, 2011). Materials can also be complex, and have complex properties. For example, any object or a technological artifact such as a computer can also be seen as a new material for design (Wiberg, 2015).

We humans keep interacting with each other, and materials (and/or matters) in a complex set up. This complex set up, and interactions, lead us to the idea of materiality. However, what is materiality?
“Materiality” is a relatively recent entry in HCI discourse and few terms compete with it in popularity or ambiguity; what is materiality anyway? Is it a gesture to the poetics of form, or a metaphorical relationship between the digital and physical? Is materiality a literal concern with the physical substrate and the technical properties of thing-ness, or is it a cultural construct more aligned with meaning? Is it technology and use taken together? Is it an orientation towards the artifact? Is it more, or less, than an affordance? (Wiberg, 2015 p. 3)

While coming up with a common understanding of Materiality in HCI, technology or the object has been in the center of the discussion (Wiberg, 2016). For example, materiality could be similar to understanding the material itself, and its relations with other materials (Wiberg et al., 2013). However, as there is an emerging culture of integrating science – technology with feminist theories or infrastructure studies or media history or archeology to come up with collaborative systematic knowledge production in HCI, it is important to understand materiality from an inclusive perspective (Wiberg, 2016).

As of now, materiality can be understood from different dimensions. While extending the conceptualization of materiality of interaction, Wiberg (2015) mentioned about Lickder’s concept about ‘man-computer symbiosis’, which describes the entanglement between human, and machineries. Materiality of interaction, thus, focuses more into the relationship between humans, and technology. Moreover, the interaction driven approach has been a center of discussion in HCI for a very long time, but, currently we are moving towards cross-disciplinary platform to explore interaction (Rogers, 2009). Here, feminism has much to offer to explore materiality in HCI (Croon Fors, 2011).

Materiality is as much of a concern of HCI, as much as it is of the concern of feminist theories (Croon Fors, 2011). With the conjunction with feminist theories and HCI, we have been exploring identity, and power relation in social medias, and game design (Bardzell, 2010; Van House, 2011). We can use feminist theories to also investigate our relationship with the material world (Croon Fors, 2011). Materiality of interaction can be understood through agential realism (Croon Fors, 2011). In agential realism, material construction of reality is important besides the social construction (Barad, 2007). Barad (2007) takes Neil Bohr’s work as an example of material reality, where materials in place constructs a reality. She insists that, matter and discourse exists together (Barad, 2007). Barad, indeed, motivates us to understand materiality of interaction from a deeper perspective. While intersecting feminist theories, and HCI, storytelling, and narrative offers us a better understanding of the world we live in, and thus offers a better possibility for design for future (Croon Fors, 2011). This thesis takes up this opportunity, and explores materiality of interaction through feminist theories standpoint harnessing the power of storytelling and narrative.
3. Research design

A qualitative study can help the researcher to understand how social aspect of a situation shapes, or creates the reality (Merriam, 1998). As this particular study focus has been exploring makerspace, critical making, and interactions with material from a critical perspective, so it was obvious that, it is going to be a qualitative study. However, this study required a lot of understanding about internal structure, and culture of a makerspace which was not available in the beginning of the study. So, the complete exploration required the researcher to be in the space to explore, and outline the research design which is also a characteristic of qualitative study (Merriam, 1998).

3.1. Case Studies

Merriam (1998) has given the researchers profound ideas about case studies. Case studies is a usual approach to study a particular and descriptive phenomenon, and in nature the study is based on variety of information sources. Knowledge gathered from case studies is more contextual than knowledge derived from other formal knowledge sources. And interpretation of the phenomenon through one’s experience and understanding (reflective knowledge) is one of the key characteristics of case study approach.

This study is investigating a complex set up: makerspace to explore participatory design methodologies from a critical perspective, so, case study becomes an obvious choice due to its strength of investigating complex social units (Merriam, 1998: 41). In this study, the qualitative variables are the norm, context, people, and interactions in a complex set up of making, and living. Overall, the makerspace in Sliperiet, and the +Project offered the case study for this research.

3.2. +Project

+Project offers a participatory design environment, as it has several partners and stakeholder, and public can also be a part of the +project. However, the internal structure of the +Project, and how makerspace was involving the public was unknown to me. So, when I was finally given a space in Sliperiet to work with the +Project team, I saw a blurry and unknown journey ahead of me. I had my inspiration from feminist theories, and motivation to explore a participatory design platform, but nothing more. However, I saw that as an opportunity to design a methodology along the way of exploration. So, being in the makerspace, and observing the activities seemed to be a good start at that point. Through observation, meetings, and workshops I gathered material for this thesis, that I presented in the section 4. And, section 5, 6, and 7 reflects, and analyses the information gathered during the process to understand how critical making be adopted in participatory design research environments, and how interactions with material be analyzed from a feminist standpoint.

3.2.1. Observation

Being in the study space, and observation within a certain timeframe are common rapid ethnographic method to gather data, and to understand the context and culture within a space (Oulasvirta, Kurvinen, & Kankainen, 2003; Millen, 2000). Therefore, within the first few days I identified my key informants (Millen, 2000), from whom I can gather information
about the internal structure within the makerspace, and +Project. Gradually, I gathered information about how +Project is working internally. For the purpose of data gathering, I would usually collect the templates circulated inside +Project, and take notes on my laptop or sometimes on paper.

3.2.2. Meetings
Every Thursday the +Project has a weekly project meeting where different partners, stakeholders, or researchers provide updates, and gather collective information. The number of participants would change over time depending on the topic of discussion. However, there were at least 5/7 participants in every meeting, and the number of participants would vary within 15 over time. I have attended the project meeting during my placement in Sliperiet to observe, and collect information. Also, I have attended internal meetings in small groups (3 to 4 participants) to actively participate in the +Project culture, and activities. Other than that, I also have had meetings with professionals, and researchers to discuss about the workshops, and +Project. During the meetings, I would usually take notes on my laptop.

3.2.3. Workshops
During my stay in +Project, I worked with the Disruptive Making group (DM) (see section 4.3.). While being in the group, we organized two workshops where one of the workshop was designed with a follow up investigation. These workshops were crucial to investigative public engagement in the critical making.

The Makeathon: This three day long makeathon was arranged by the DM group and took place from Friday night to Monday evening. As part of the DM group, I attended meetings to plan activities, and plan strategic structure for the event. The aim of the makeathon was to come up with a future technology, or new system for construction methods, and construction devices or machines. The invitation was sent out to students of different academia, such as, technology, architecture, design, informatics and engineering, and hard copy of the invitation were distributed or posted around the Umeå university campus. There were 14 participants who participated in the event. The participants of this makeathon were students and professionals from technology, design, architecture, and engineering. The participants were divided in group of 3-4 people with a diverse mix based on their skills, or expertise. The demographic details such as age, or gender of the participants were not considered here, as age or gender has not been a specific focus in this thesis.

To structure their group activity, the makeathon had some strategies, and material that would invoke participants’ creative thoughts. In the first session, the participants were introduced to a playful activity. This activity is designed by Dimitriou (2016), where she created different cards under three different categories. The three categories are, material, animal, and technique or a method. Each team were allowed to draw one card from each category, and then brainstorm, through inspiration driven from these three cards, on how they can approach the main task.

Even before the cards were introduced to the participants, some of the members of the +Project played with them to see if they work. In our team, we got the sponge/foam as the material, folding as the technique, and magpie as the bird. The first approach we had was to
try figure out what characteristics each of them have, and try to combine some of the characteristics to come with a new methodology, or machinery for construction. For our given cards we speculated technologies such as floating home, or scissors that can cut and seal plastic at the same time. The concepts or the artifacts produced from this workshop are not important for this study, as this study focuses on understanding design process than the produced artifact itself.

Figure 1. We Brainstormed through playing cards before the workshop. Cards category: Animal – Magpie, Technique – Folding, and Material – Foam

Workshop with follow up investigation: This workshop with follow-up investigation is designed in an intensive way. I have been a single researcher planning the work-frame, but, I have gathered suggestions from the people around me. Seeking suggestion from the people around me has also been part of this work-frame. While designing the work-frame, I used reflective analysis (see more at 3.2.4.) as a way to keep analyzing my own work. Therefore, different sets of questions emerged during the process of designing the activities. These are the question that worked as a motivation to explore materiality of interaction: What is norm around a living room? How to challenge it? Why it is important? Is living room the space, or the living around it? How involved people are with their living room? Do they have any emotional attachment around their living room? What kinds of objects are mostly used, and what kinds of objects are their favorites? Can they be part of their living?

My first method was for two workshops, and compare them. But, my primary plan was missing the main component of understanding public engagement. Lindström and Ståhl (2014 a, b) explored the concept of ‘public in the making’ throw sewing circles. They hosted several sewing workshops where people gathered around, and they co-articulated knowledge through the process of learning and making. When participants did not know how to use a particular material, the participants were taught, and they overcame their distance towards unknown by doing. The small sewing groups met regularly in a domestic setting. I wanted to do something similar to it but in a shorter time frame, and in a collaborative innovation space. During my meeting with Croon Fors, Lindström, and Ståhl (2015), I gathered feedback from them. In my primary planning of the work frame, I focused on inviting participants who are feminists, eco activists, and the survivalists so that we can gather different situated views. But, I received the feedback that, if I skew my participant group will I be able to have a complete view on public in making? And, will I have enough time to conduct several workshops? Moreover, I received a suggestion of investigating ‘living’ with
That means, the participants can take back the artifacts, or prototypes they would create during the workshop, and can keep changing it. However, during the workshop day, due to rain, no participants took their artifacts with them. After gathering the feedbacks, I structured this activity in the form of a two-hour workshop, and a follow-up investigation. The two-hour workshop uses critical making as a tool to balance thinking and doing. And, the follow-up investigation was supposed to bring back perspective from the participants’ living space.

The +House aims to build a future home, so, I narrowed down my focus in line with this to living room space. The thesis aimed in understanding interaction with materials, and explore open innovation process. Therefore, my workshop aimed to brainstorm future living room concept through thinking and making. And, the follow-up investigation focused to understand the living with material, and understand norm in a living space. I hoped to gather enough understanding about materiality through my situated position in the +Project, and by engaging with the public through this workshop with follow up investigation.

The focus of this initiative was to invite the public of Umeå. But, it was difficult to reach out to general public in a shorter time frame, and also, as understanding norms was one of the focuses, we invited people who care about norm creativity in living room. The invitation was sent out to different focus groups who work with norm criticism for example, Center for gender studies, and also hard copies of invitation were posted around the Umeå university campus area. The follow-up investigation was designed with the inspiration from cultural probe. The participants were given a notebook where they were asked to log their daily activities, their used objects and technologies in their living room area, and what they like and dislike about their living room area. They were also given a task to write a ‘fantasy story’. This task was designed with the inspiration from The Future Workshop Methodology (Apel, 2004). From this, I borrowed the idea of critique phase, and fantasy phase. In this task, they were asked to identify their most used, and most liked object or technology that they use in their living room, and they were asked to answer some questions regarding that. In this task, they were asked to identify their most used, and most liked object or technology that they use in their living room, and they were asked to answer some questions regarding that. The questions were supposed to critique their use of the object or technology they chose. For example, there were questions like, do the user really need to use it, or if the object or technology could think, what it was thinking right then, or how it can be different. After answering the questions, the participants were supposed to write a scenario on their daily activities in the living room without their chosen objects. This task was designed to understand how deeply these objects or technologies are connected with their daily living around their living room area, and what is the norm around their interaction with materials. These tasks were given to them for a week, and after a week they met for a follow-up interview. The follow-up interview was there to talk more in detail about the tasks they have completed, and based on their experiences to get feedback on the process.
3.2.4. Framework for Data Analysis
This study focused on qualitative exploration of the makerspace in Sliperiet with the aim to understand how can critical making be adopted in the participatory design research environment, and focused to explore interaction with materials from feminist theories standpoint. So, feminist theories framework was an obvious choice for the qualitative analysis in this study. Moreover, the feminist theories framework was adopted in a reflective analysis (Wakkary, 2009) process. Wakkary (2009) borrows Schön’s (1983) view of reflective practitioner to explain reflective analysis. Here, a researcher or designer constantly reflects on the what she has to understand what could be in future. And, in this thesis, I borrowed this concept to reflect through feminist concepts. I saw the feminist theories as a tool that provides us with the concepts, or terminologies to understand and question the reality. For example, here, the concepts of situated knowledge, performativity, norms and material complexity were applied to reflect on the data gathered, and also to reflect on the process of data gathering, and the process of being in the space.

4. Exploring an Unknown Territory
This thesis focuses into exploring public engagement in participatory design research environment, and explores materiality of interaction. Therefore, the multidisciplinary initiative at Sliperiet, the +Project has been the inspiration, and center of the study. The +Project initiative aims at research and development in the field of additive manufacturing where there will be an investigation towards new ways of designing, bio-based materials, and large scale additive manufacturing. This project is organized in three parts, such as, +U, +House, and +Labrary. The +U part offers the collaborative platform in Sliperiet as conjunction among local and international thinkers, makers, and organizations to move forward new ways of design, innovation, sustainability, and so forth. The +Labrary part aims to offer an open makerspace, and showroom that will be made available to different groups situated in different fields such as, researchers, educators, students, architects, designers, engineers and entrepreneurs. And, +House project aims to build a smart home by the year 2008 through large scale additive manufacturing. +House project will show a collaborative outcome of all the research, and development initiative taken in +Project through multidisciplinary platform. As +Project aims for designing a home for the future and producing knowledge which will accessible to various groups, by collaborating with diverse fields of studies, +Project seemed to be a good case study to study critical design approaches, and future making from the perspective of feminist theories in a participatory design research environment, and to investigate ‘materiality’ in HCI from feminist point of view.

4.1. Work Package (WP): Situatedness in +Project
The complete +Projects are divided into small work packages with specific aims. Each work packages have professionals, and enthusiasts or students from different knowledge focus or academia. There has been work packages such as, Sustainable Business Model, Disruptive Making (DM), 3D wood, Home Made, In House, Make yourself at home, Internet of spaces,
and light house. Though these groups have specific aims, but, these aims may change depending on the groups, and needs they identify with time.

Among these work packages, 3D wood package is exploring organic materials as 3D printing filaments. DM is exploring new ways of design, and bringing critical perspective in it. Internet of spaces is exploring tangible technologies, and internet of things in house environment. Home Made, In House, and Make Yourself at home are exploring the concept of home, having architectural exploration through 3D printing to print houses, and having overall discoveries in relation to housing, and home. And, the Light House is exploring relationship between interaction, and light.

Here, we can see, Sliperiet as a collaborative makerspace, where different WPs can be seen as the situatedness inside the makerspace. But, how their produced knowledge is being translated to the other groups? Every week, the +Project has an internal meeting where different WPs gives their updates to other members. In those meetings, different WP members share their ideas, and concerns, and seek for feedbacks, or suggestions from others.

4.2. Participatory nature in the makerspace

Sliperiet is a three storied building situated near the Umeå river, Bildmuset, HUMlab, Umeå School of Design, and Umeå School of Architecture, that offers the collaborative makerpace in Umeå. The team of the +Project is situated on the second floor, and the labs and the studios equipped with 3D printers, lasers cutters, and other digital - physical equipment are situated on the ground floor, and first floor. Here, Sliperiet offers the participatory makers platform for innovation, and research, and +Project is using this space with its specific goals: +U, +House, and +Labrary.

Sliperiet has two unique situated makerspaces, named, Fablab, and Softlab. Where the Fablab mainly has all the 3D printers, laser cutter, and material for making technical or mechanical or physical prototypes. Where the Softlab focuses more into making wearable prototypes integrated with fashion, and integrated textiles. In the Softlab they have, digital textile printers to knitting machines.

This makerspace is an open innovative space that has collaboration, and participation in its nature. It offers a potential for collaborative innovation process along with public engagement. Due to participatory nature in +Project, Fablab, and Softlab are used by collaborative partners both from Sliperiet, +Projects, and the public. For example, Fablab is open for the public every week where different people can gather around and get involved in the process of making, and design. It can be seen as a contribution to the participatory design research, as participatory design has evolved with time, and the concept fit into public collaborative nature in making future (Björgvinsson et al., 2010). However, every design process has its own goals, or aims. We are trying to achieve something with every attempts we take. Either we are making and designing for us, or for others, or for specific needs. Then what is the goal towards the participatory nature in the makerspace, Sliperiet? Usually, the workshops, or open innovatory initiatives taken place in Sliperiet are documented, and the produced knowledge is shared among the members. So, sharing or knowledge translation
became a common approach towards systematic knowledge production inside Sliperiet. The team leader, and other members of +Project are in the process of sewing the situated knowledges produced from each WP together towards the goals of +Project. Moreover, +Project too has a goal of producing a 3D printed house by the year 2018. This house is going to be the embodiment of the collective knowledge from all the WPs.

Future is for everyone regardless of their gender, age, sexuality, or any demographic or intersectional characteristics, so designing for future needs voices from around the corner where everyone’s insight can be designing inspiration (Ehn, Nilsson, & Topgaard, 2014). However, it is a very difficult to customize future large scale houses to meet each and everyone’s needs. In this case, what could be the nature of public participation? To explore this, I got involved with the Disruptive Making group to design workshops, and user participation methodology from a creative inquiry perspective.

4.3. Public participation in +Project
Understanding, public participation in the makerspace has been the primary focus on this thesis. The process itself gave crucial understanding of how critical making be adopted in the participatory design research, and the insights gathered were very important to understand materiality. The DM group arranges different kinds of workshops, and public gatherings to gather ideas, and develop new technology, or methodology for constructions, and design. Through these workshops, and public gatherings participants from different places inside, and outside Umeå can be a part of the +Project makerspace. During my stay within +Project, we organized a Makeathon, and a workshop with follow up investigation.

4.3.1. Results from Makeathon
During the Makeathon, most of the teams (3 out of 4 teams) had similar approach towards using the cards for brainstorming as we had while brainstorming. As I have already interacted with the materials, and the concept, I did not want to join any team having in mind not to manipulate their ways of approaching. With their permission, I took notes of my observation, and conversation with them on my laptop. While communicating with them, what I understood is, as the cards belonged to three different categories, so to combine them, they thought of combining some characteristics from each category that may lead to ‘something new’. Also my personal observation is, two of the categories (Technique, and material) are very important in making, or constructing, or thinking about designing. But, the third category, the animal, brought critical approach in the usual way of thinking in design, and making.
Moreover, two of the team had people with previous experience in the card topics given to them. In that case, the people with experience became the motivation in the group work. We can see it as, people bringing their situated knowledge in the makerspace. At the end of the Makeathon, the groups presented their prototypes, and concepts to the juries. The complete process was documented by the +Project team. The participants used the Fablab, and the Softlab throughout the two days and interacted with the 3D printers, laser cutters, and other materials to come up with their prototypes, and methods. After the makeathon, the participants came up with the idea of ‘spider cell’ houses where the rooms will be like spider cells, and the walls will be movable (Appendix 1.1), or looked for material inspiration from bio components. However, these speculated ideas, or concepts were not considered in this thesis as a scope of study, as the main aim of the thesis was not to investigate designed artifacts.

4.3.2. Results from workshop with follow up investigation
There were 8 participants participating in the two hours of workshop. Only 8 participants might not be a complete representation of the public of Umeå, but the insights from them were very valuable for this thesis. And, 4 participants took part in the follow up investigation. 4 of them had been associated with designing, or crafting previously, and others did not have enough idea about any kind of crafting, or designing. Here, three of the participants were males, and three were females, however, the demographic details of the participants were not the focus of this study. The details such as age or gender were not considered in data analysis, and reflections. Participants were asked to seat around a big table, so that they can communicate with others around them if necessary. However, some participants knew some other participants, whereas others were completely new to the social environment. The two hour workshop had two tasks. In the first task, the participants were given some color cards. And, they were asked to pick up one card that represent their current living room, and one card that represent their future living room. And, they were asked to
write down three characteristics or keywords associated with that color, or the room. In the second task, the participants were asked to create their future living room. Participants were given different crafting materials to create the models. The materials are: big cardboard sheets, pre defined box walls made out of cardboard sheets, play dough, glue guns, 3D pens, and regular arts materials such as color paper, pens, glue sticks, paper clips and so on. 3D pens are technological pens to create 3D objects, or to draw in the air. If one presses the button, melted filaments come out of it, and it instantly gets harder getting open to the air. They usually look like real pens, but, much thicker.

While they were working on their house models, I kept communicating with them in a friendly manner, and asked questions about the models, and experience of making. I wanted to distant myself from the participants, and at the same time gather as much information possible through observation, and friendly conversation during the workshop. With the permission of the participants, I took notes on my laptop, and also I have recorded the conversation in audio format. After almost an hour, the participants were asked to share their model with other participants, and all the other participants were encouraged to engage in a conversation. Through this process, I jotted down some more points that popped up during the discussion. The results from this workshop were noted because, it fitted with the scopes of the study, specially, to understand interaction with material in situated spaces.

![Figure 3: Living room as a center of socialization: one participants is showing the future of living room where the walls are movable, and everything is accessible](image)

From the color cards, the most words that popped up associated with future living room are, socialization, warm, relaxing or calming, and spacious. Moreover, automation, and a place for the children were also preferable. And, during the complete making and crafting process, the participants kept expressing their ideas, and desires around their living room. And, the most mentioned topic in the conversation was how living room is a center of socialization in their homes. For some participants, it is the center where they socialize or spend time with other members living in their living space, again, some participants mentioned they use this space when they need to socialize with people from outside. However, people with children mentioned that, this space is used by the children to play, or spend time. Participants also desired to have objects in the living room to be easily accessible, and movable, so that, whenever they need a bigger space for socialization it would be possible.

During the seven days task and the interview, participants mentioned their couch, and TV or laptop as their most used objects. By going through their logs and during the interview, it was clear that, they mostly use the living room as a place for socializing with their
housemates, family members, or friends. They either watch movies, or play games, or eat together while watching TV shows, or movies. Here, they either connect the TV with their laptops, or they connect the TV with cloud services like Netflix. Netflix is a global streaming service of TV shows, and movies¹. During the interview, the participants expressed that, seven days were too long for the tasks they were given. One of the participants expressed that, he felt reluctant towards the activities because, the focus ‘norm creativity’ could not attract him. Moreover, he also felt distant to connect with other participants, because, he did not know them beforehand. Again, two other participants, found it very close to their daily life, as they found it fascinating to explore their own living space with the help of the tasks. They saw a connection that, norm creativity was related with the norm in their living space. Moreover, while I was meeting a member of the +Project, and sharing the results gathered from the workshop, she also was willing to give her insight. She mentioned that, in her living room the most used objects are their couch, and their dining table, where she uses the couch to lay there and knit, and her kids use the table for playing. The kids get on the table, or get under the table and invent different ways of playing.

5. Open innovation: New approach towards participatory design research

Anderson (2012) has seen additive manufacturing, and digital fabrication as a new way to revolutionized making, and designing. Making 3D printed objects or prototypes are cost effective in terms of variety, complexity, and flexibility or customization, and the 3D scanning is an easy way to depict the reality that is in front of us. However, the process itself is not automatically consisted of conceptualization of interaction with maters. For example, I can 3D scan the desk I use for working at home, but, the process of 3D scanning will not explain my relationship I have with my desk. The Work Packages in +Project have their own ways of dealing with ideas, however, two of the basic focuses in +Project has been to combine the process of making with thinking, and knowledge production. For example, there has been an initiative in this project to look for architectural inspiration from nature, where the lead of the architecture team, Carlos is developing 3D printed samples to conceptualize his thought process around automation, and architecture. In one of the meetings, he presented his developed models where he was conceptualizing different shapes that can be used in building houses. In +Project, additive manufacturing aka 3D printing, and laser cutting is becoming a strong tool of making, and thinking. Taking Ratto’s (2011) words, it can be said that, the +Project, and Sliperiet are the center for critical making, and the participatory nature in the makerspace offers open innovation for the future.

Open and collaborative innovation in the software industries is nothing new. Through the Free and Open Source movement, software has become something that can be acquired by the people, and for the people. With a similar concept, the makers’ movement is offering the openness in the hard technology (Anderson, 2012). As Anderson (2012) puts it, the participatory nature in critical making offers the industries or agencies to get a ‘free help’

¹ For more information see: https://www.netflix.com/se-en/
from the public in technology development. However, I would see it as, both giving the public the tool to express their ideas in making the reality along with the designers, and it also offers, the researchers and the professionals, the scope to understand the distant users in a more profound way. For example, through the workshop with follow up investigation some participants felt involved in the process of +House, which in turns motivated them to share their daily activities around their living room with us. Again, one participant did not feel enough involved with the complete initiative, so he did not have the motivation to complete the tasks. Moreover, during the Makeathon participants had the query what will happen to the prototypes that they are creating, and they were told that, if some of the methods, or concepts, or the technology prototypes are found resourceful for the +Project, then in the long run it will be implemented. This was one of the incentives for the participants to complete the two days workshop. However, here, most participants were either professionals, or students from design, technology or architecture who had the motivation to showcase their skills, and abilities. Unlike this scenario, in the other workshop, the participants only had the motivation to participate in the workshop from their personal beliefs. As not everyone completed the tasks properly, it was observed that, it was hard to motivate the participants in the workshop with follow up investigation. Therefore, it can be said that, there is a need of striking theme that would engage the distant participants from situated knowledge, and spaces. In the workshop with follow up investigation, norm in the living room was a theme, that attracted some participants, again, confused some.

Here, many would argue if the aim of such platform is to transform the publics into designers? As Schön (1983) says, a professional is accountable of putting the professional systematic knowledge in action. I would argue that, the goal is not to transform everyone into design professionals. However, the users and clients don’t even need to be the passive partners of design. They too have their situated knowledge that can be shared through active participation. And, active participation makes the participants feel more involved with the cause, as they are not providing their information, or insights for something distant, rather design, and innovation becomes by the people, and for the people.

Here, I conceptualize passive participants as the participants who are involved in the process to provide insight from user perspective. And, I conceptualize active participation as, participants are involved in the process as active partners in design research or design process. They could be active partners in generating design ideas along with providing insights for user evaluation. In case of +Project, it was said that, if any prototype created by the participants, or any idea generated by the participants becomes useful for the 3D printed house, then those prototypes, or ideas will be carried out by the +Project. However, the ultimate authority lies within the +Project. So, unlike many free software, the participants may not avail the service or the product for free. For that reason, (Anderson, 2012) saw it as ‘free labor’. However, I still think that, through this platform, participants are actively involved in the process from a certain perspective. For example, they are not actively working with different WPs relentlessly to come up with architectural, design, technological economical solutions, and so on. But, they are attending workshops. So, if I compare it with open source software analogy, then, participants in the makerspace are not contributing in the codes, but they are contributing in the process. But, if they can come up with something
valuable besides their insights, then, there is a possibility that it will be acknowledged. Martilla et al. (2014) also opens up similar discussion, if it is free labor or empowerment. Here, business perspective brings a new dimension to understand innovation, and ownership. However, this thesis does not touch the aspects of business, it can be studied further. Therefore, up until now, there is a difference between openness in software production, and open innovation processes (Martilla et al., 2014). In the open software movement, people could use free software, and the copyright ownership would go under open license. The open innovation process I am describing here does not automatically give ownership of the products to the participants. So, how the products will be distributed among the collaborative partners, and who will have the ownership of the intellectual properties, this can be studied further from a different perspective.

Even though making is a powerful way to involve public in the design process (Gauntlett, 2011; Ratto, 2011), it comes with its own challenges. When the DM group involved other enthusiasts, or professionals related to designing, or technology background, the process of getting them started with the main workshop and materials were easy. They were given the playing cards to help them with brainstorm, and they were offered to use the Fablab and Softlab for two days. They had their previous experiences from their professional, or academic background, and they started applying them into actions in the makerspace. However, when we invited people with no prior knowledge in design, or technology background, some of them needed more time to get accustomed with the materials, and balance their process of making and thinking. None of them used the 3D pen. While asked why, one person replied that she wanted to use it, but she couldn’t figure out how to do it. Even if we had one professional in the workshop to help out the participants, but still, she couldn’t break her hesitation to interact with the 3D pen, and ask for help. In this situation, other materials like color papers, cutter, glue guns and so on seemed to be the most used ones. But, from the follow up interview it was clear that, here not knowing how to interact with the 3D pen was not the main barrier, but, the time limit was the critical barrier. The participants needed more time to get accustomed with the materials, and themselves. On the other hand, the Fablab, and the Softlab filled with equipment became a place for interesting innovation for the Makeathon participants. Again, two participants from the workshop with follow up investigation, was really fascinated by the 3D pens though they couldn’t use it. When asked, they replied, they will use them if they get to attend a similar workshop again. It shows that, new technologies like 3D printing, laser cutter, or 3D pens have the potential to attract publics in the critical making process, even though many of them might be seeing or using them for the first time.

In the case of sewing circle (Lindström, & Ståhl, 2014b), it was a long term public engagement, where people had a long period of time to make the connections. This indicates that, detailing out a proper time frame is as important as to understand what kinds of materials are going to be used in the making workshops for what kinds of participants.

It is difficult to create an open collaborative space for all the participants in a short time. For example, in the workshop with the follow up investigation, one participant did not feel completely engaged with the other participants during the workshop. One of the major reasons behind this was, he did not feel connected with the term ‘norm’, whereas, the same
term was intriguing for most other participants. That’s why, there is a need a proper instruction during the workshop. Moreover, based on the observation, and the feedbacks received from participants (from the workshop with follow up investigation), a two hour workshop is not ideal for making and thinking if we invite participants with no prior knowledge in design, or crafting. Either, there needs to be several workshops for short time where the participants can keep coming to (just like the sewing circle), or the workshop needs to be more than two hours so that the participants have enough time to relate to the materials, and other participants.

Overall, open innovation in makerspace offers an open platform to participatory design research environment, where different stakeholders, clients, and users can meet, and share ideas through making and thinking. These kinds of workshops can be adopted to invite diverse groups of people, and engage them in the design process. In this way, cumulatively all the small workshops could present the voices of public, thus makes the participatory design research more democratic (Martilla et al., 2014). For example, Sweden is currently accepting a lot of refugees from Syria, and they too have their situated knowledge to shape the housing for the future. So, +Project could also involve them through workshops like these. In the DM group, we talked about this, but, within my two months’ stay it was not possible for me to arrange more workshops. Moreover, participatory design research in its core have had the motivation to give more power to the general public in the design process (Björgvinsson et al., 2010). And, an open innovation platform offers the participants with the material to conceptualize their thinking with making artifacts. Therefore, we can say that, public engagement in critical making offers a newer understanding of participatory design research. However, the process engaging people in the making process is not always as smooth as it may sound. There is a need of detailing out how to engage the participants, what kinds of participation we are looking from them, and how to compile the ideas or motivations we get from them. In this, it is important to consider these factors: how long the workshops will be in what intervals or how many times, what kinds of materials will be used in the workshops, and how to motivate the participants to use the materials they might have never used to get the workshop going. Moreover, there is a challenge of crossing the barrier of being the passive participants to the active participants in the design process.

6. The materiality of living

Recently I have got a new couch for our apartment. I live in a one room student apartment with a very limited space. So, when we got the new couch, it interestingly changed our daily lifestyle. I have a small table just beside my bed, so that we can keep the laptop on the table and watch shows together sitting on the bed. We would also eat on bed keeping our food on the table. But, when we got the new couch, we transferred the table in front of the couch. Our activities inside our room/apartment is already very limited: eating, watching shows together, or talking to each other consist our living norm and lifestyle. Therefore, once we got the couch, our center of interaction, and daily activities started revolving around the couch. It was very interesting for me to observe, how one material (the couch), and its
relationship with another material (the table) changed our relationship with other material situated in our living space.

We all have our norms around our situated living spaces. During the two hour workshop, seven days’ task, and the interview, it was clear that, the participants’ daily activities evolved around the objects they had around them. Living room for them is a place to socialize with other members in the household, and people from outside, and, their interactions with the objects or materials placed in the living room created the meaning of socialization in that particular context. Not only that, the interactions with the material also created the meaning of living room: a common shared space, a place to relax, and a place to socialize.

Most of the participants’ daily activities in their living room evolved around their couch, and TV. They would either eat while watching shows, watch shows or play games with other members in the house or with friends, or simply relax on the couch reading books, or using their laptops. In the living room, the couch, the TV, and the laptop became the mean of socialization, and relaxation. Here couch is a mean of sitting, and the TV or the laptop became the mean of doing something or a mean to connect with others. Hence, people are creating meaning through their interactions with the materials. We can call it materiality of the couch, and TV or Laptop in the particular context of living room. It is the meaning we create through interaction with materials from the perspective of personal experiences within a situated space. It is the relationships that exist between the materials, and the living agents. Here, materiality could be the ‘meaning’ both human and non-human agents are creating through interaction in a particular context. This meaning is created in our daily living in our situated spaces.

Therefore, the concept of materiality goes beyond the object itself and the interactions, and now, we can call it, materiality of living. We don’t only conceptualize our material experiences through functionality of the artifacts, if we did, then the job of the table would only have been to place something on top of it. We conceptualize our material experiences through multiplicity of interaction in certain situations. While the TV became center of socialization in living room, the smartphones could be a mean to distance oneself from others sitting in a gallery (Bødker, 2015). So, to understand this complexity of shared experience vs. personal experience created through multiplicity of interaction, we need to go deeper into understanding how humans live in situated spaces. The situated spaces could be our living room, or offices or even public shared spaces such as public restrooms. And, the contexts could be different occasions, and different norms that we create around us. This is the complexity of materiality (Hekman, 2010). The matter we are interacting with, and the meaning we are creating are not so separate from each other (Barad, 2007), and, there is a liquid state of space: in that liquid state the interaction between the material and humans creates the meaning (Mathews, 2006). In other ways, in that liquid state we get entangled in performances.

During the Makeathon, not all the participants knew how to use the laser cutter, or the 3D printer, but, during the two days of workshop, they helped each other out, and also got support from the DM team to use the materials to conceptualize their thinking. Again if we look it from a different perspective then, they created a temporary bonding during the workshop while interacting with each other having the materials, and objective (coming up
with an artifact or design method) in the focus. Again during the two hour workshop, the participants did not have enough time to get accustomed with the unfamiliar materials (i.e. 3D pen) neither they had time to help each other out, or to create a bonding with each other keeping the material in focus. Moreover, there was not any specific instruction given to them that, they should seek help from each other or they should work as a team, though it was mentioned that, they can interact with each other. But, the participants were interacting with the other participants they knew beforehand. In these scenarios, the participants created their own norms of seeking help or not seeking help from their expectations or their preconceived notion they had about the workshop around their interaction with materials.

To elaborate more about materiality of living through performativity, and norms, I would like to draw an example. We use the computer lab (room 476 in the MITthuset) where the computers are shared. No one needed to tell us that, we need to turn off the computers before leaving, or, not to play music in loud speaker, or to be sensitive towards the shared computers because someone else will use it after us. These are unwritten rules that prevail in the computer labs around the computers. Once we get in that room, we know how to perform, and discipline us. However, when we are using our own computers, we have our own personal rules if we are not sharing it with others. It’s somewhat depends on our personal habit if we should keep ourselves ‘logged in’ in the computer. Most modern laptops come with personalized setting for each accounts, and we can connect our laptops with our cloud storage. We create a personalized environment around the materials we are using. Therefore, while designing technology, we need to understand the norms around it in situated spaces.

All these norms associated with interaction can emerge in a certain context. For example, in the living room, the socialization could take place within the family members, or the housemates, or among housemates and people outside of the house. In these two scenario, how people will interact with the couch, and TV or laptop might change, as it represents a combination of private-public sphere from personal perspective. Benyon (2005) calls it ‘community of practice’. Benyon (2005) describes three components of contexts: physical environment, social context, and organizational context. In this paper, combining the three components I refer to context as the platform where the norms take place. For example, while watching a movie with family in the living room, the context can be the physical aspects such as: the lighting, the closed space, the level of sound, and social context could be it’s a private shared space where family members are co-interacting with the materials.

Overall, it can be said that, humans interact with each other, and the materials in a normative situated space under a certain context, and co-create meaning through interaction, which in turns becomes part of our living. This, I call, the materiality of living. All the meaning we create around us is part of our reality, and any design is interconnected with this reality.
7. Feminist Notes, and a Disclosure

One is not born, but rather becomes, a woman. (De Beavoir, 1949 p. 267)

The famous quote from Bevoir reminds us how we become who we are today. At human birth, we don’t have all the knowledge about how to interact, or how to conceptualize what is around us. But, with time, gradually, we conceptualize our material knowledge around objects. And, we constantly compare what we see based on what we know. As Latour (2010) puts it through the idea of social construction: the way people look at, conceptualize, and interact with the material world. In HCI, we can call it as having a mental model towards any technological artifact (Benyon, Turner, Turner, 2005), and, this knowledge is drawn from our partial immaterial understanding (Haraway, 1988) and how we are connected socially in the material world. That’s why, the kids (see section 4.3.2) saw the tables in the living room as a material to play with, whereas, for the adults it became a center of their social communication. Or, television is just a mere screen that was fulfilling the purpose of playing games, or watching movies which became a mean of socialization. Or, for my father, the smartphone he uses is a crucial tool to communicate with us, and the outer world, while for me, my smartphone is multifunctional: it’s simply a mini computer for me where I can edit my documents to watch videos on the go. In this way, we co-exist with our TVs or laptops or smartphones and their meaning to us changes over time. In Haraway's words, we can call it, kinship with the materials (2001, 2003). The human and non-human agents co-exist, and co-evolute in certain context (Haraway, 2003a, 2003b). Here, Haraway takes up the example of humans’ kinship with the dogs. Dogs are not only pets to humans, but, they become friends of humans. The relationship evolves with time, hence, it affected the dog breeds, dog training, and so on. In the same way, it has affected how human behave with dogs, or having a dog changes someone’s lifestyle. Technology in present world has a similar affect. What technology and artifacts we surround us with affect us, in the similar way, we affect them. We co-exist, and co-evolute with them. For example, the existence of table opened up new ways of playing for the children, and again, the use of table in that particular context changed because, there were children around it.

What exists is emergent, issuing from complex interactions between embodiment and the world (Tuana, & Morgen, 2001 p. 238)

In chapter 6 while elaborating materiality of living, I mentioned about a liquid state of space between the material, and humans that creates the meaning. There, what did I mean by this liquid state? Even though the physical materials are concrete, but the space between us and, the material is not unchangeable. All the interactions take place in the space between the material, and the humans. These interactions are influenced by the norms, our situated knowledge, and the context we are living in that moment. The meaning we create through the interactions between material, and human is emergent, and changeable. For example, the tables in the living room became a mean of playing for the children, or TV became a
mean of socialization. This in turns becomes our reality of present. In case, of +Project, the future house is not going to be situated in a far future. It will be situated in a near future (by 2018). Therefore, it might not be something completely different than what people may expect from a house in present. It needs to be somewhat similar to what people can associate themselves with. This reminds us again about Wakkary (2005 p. 66), design is about activities that are 'related to complex but everyday (interaction) situation'.

Now, how possible it is for the designers to go into situated spaces to gather knowledge? In +Project, the tactic was not to go to the public, but, to invite public in the makerspace to build something together. This is how Sliperiet becomes a platform of participatory design research, and +Project becomes the placeholder to exhibit the knowledge gathered from situated sources. In the DM group, my approach towards public engagement was to combine the use of cultural probe, critical making, reflective analysis, and norm criticism to be with the distant users, and understand their lifestyle in their living room. The same approaches can be applied to understand multiplicity, and complexity of interactions, experiences, and the meaning that we create around us in other contexts. Here, drawing collaborative knowledge from multiple workshops with different public groups, or enthusiasts, or interest groups can offer us cumulative public perspective. The workshops like Makeathon also help the researchers to gather situated knowledge from different stakeholders, or agencies. I view this approach as a reflective practitioner involved in makerspace trying to patch situated knowledges to come up with collaborative knowledge practice. Here, the reflective practitioner herself has to continuously reflect on her actions based on the knowledge she has, and the information she gathers. And, in our case, the overall process was not easy, because, we needed to put an extra effort to make the participants feel involved in the design process rather than just they being simple data points.

To handle this responsibility, our recommendation to interaction designer is to be prepared: prepared to act in a design process, encounter new design situations, learn and develop as designer, and understand historical developments, and future technological trajectories. (Löwgren, & Stolterman, 2004 p. 171)

Finally, it comes down to the designer or the researcher to be reflective, and thoughtful to able to patch the situatedness in the makerspace, and draw cumulative knowledge from it. In the case of +Project, it is not the responsibility of one singular researcher, or designer, it is a shared responsibility of the WPs to come to proper plans how to express the cumulative or collaborative knowledge. I see the upcoming 3D printed house as one of the ways to express the embodied knowledge that are being gathered through these small workshops, meetings, individual experiences, and smaller projects. Moreover, documentation becomes a very important key in storing all the knowledge gathered from different sources. However, if publics are part of knowledge production through open innovation in makerspace, then, should not they have access to some of the documentations? Moreover, how can we present the knowledge to different agencies through a common platform? Obviously, as mentioned earlier, the prototype (in this case, the 3D printed house), is one of the ways to express the embodied knowledge. But, there could also be a systematics documentation and
presentation of the whole process that is taking place in the +Project since its birth, which may work as a knowledge store house, and inspiration for the researchers, or agencies who would want to take a similar step. A neighbor of Sliperiet, the Bildmuset can be an example of knowledge source, where they exhibit art works from the students of Architecture school, and design school. However, the exhibition stays for a certain time, and new artifacts, or prototypes replace the old ones. If +Project showcase some of their works, and knowledges they are producing, then it can also offer a common platform for people where they can access the knowledge.

8. Conclusions
This thesis took a humble approach to contribute to user research in HCI by looking into makerspace, and open innovation process through studying public engagement in critical making. This thesis also tried to contribute in systematic knowledge production in HCI, by elaborating the concept of materiality of living. Moreover, this thesis discusses my reflection during my two months of engagement in the +Project. The concepts of case studies, observations, interviews, and so on, helped to conceptualize the methodologies used in this thesis. However, in the first few weeks of my exploration, as I was being exposed to a complex structure within +Project, I have had a data flood, where I was confused what notes to take, and what to avoid. But, I then, limited the information gathering process by focusing more into the meetings, and workshops. Moreover, as I collected data, at the similar time, I was analyzing, and reflecting on them with the framework from related research in the field, and I was connecting them with the examples I draw from my surrounding. Other research methodologies such as, semi structured, or open interviews of the researchers, stakeholders, and the participants engaged in the +Project could also have been fruitful for this research. However, at the beginning of this study, I did not have enough knowledge about how +Project is working, or how critical making is being adopted in design, so, it would have been challenging for me to structure questionnaire for interviews. So, being in the +Project, and gathering information seemed to be the logical option for me.

I saw Sliperiet as a makerspace that offers participatory open collaboration. And, during my involvement in +Project, I reflected on the aspects of open innovation, and public engagement. Moreover, I also reflected on the challenges that come during collaborating with publics who don’t have prior knowledge to the advanced materials such as 3D pen, and, the challenges of collaborative participation when public from different situated spaces come together. This thesis also tried to conceptualize the materiality of interaction from feminist theories perspective. This thesis took the +Project as a case study, and information were gathered through observation in the makerspace, interviews, and workshops. Then the data gathered from the case study was analyzed through feminist theories perspective. While analyzing, the concepts of situated knowledge, norms, performativity, contexts, and kinship were used.

I have viewed the makerspace as a platform to engage publics, and different stakeholders such as, the designers, researchers, or academics through the process of interaction with materials, and making. And, it broadens our understanding of participatory design research ways, and opens up possibility for public engagement in critical making. However, it comes
with some challenges because, not everyone might be comfortable in using the materials that would be offered to them. Hence, there is a need of clear structure: who would participate, what kinds of materials would be used, and what is the end goal of the workshop, there is a need of proper time management: how many workshops in what time frames, and overall there is a need of proper instructions and support to engage the participants in the making and thinking process. Along the way, this thesis also opens up an understanding of interaction with the materials from a feminist theories perspective: Materiality of living. Materiality of living offers us with the understanding of norms, contexts, situated spaces, multiplicity of interactions and the meaning we create through our interactions with each other, and with the materials. The material world, and our subjective interpretation, and interaction is part of our reality. In this process of constant interaction, and interpretation the material understanding emerges in certain contexts.

The world we live in is situated in different contexts, and groups. And, when we try to come up with design solutions for future, we need to have a bird’s eye view into the world we live in, and the reality we create. We need to patch the knowledges we gather from different sources, and then we present it embodied in the prototypes, or artifacts we create. In case of +Project, they have a potential to not only present the world with the 3D printed house. But, they can also become a placeholder of knowledge. They can become the placeholder of the experiences and memories of the public during their engagement in the design process, and the ideas gathered during the overall process. They may need to come up with something like museum where they can show they progress from the beginning. But, this is a hard choice of the +Project team to select which prototypes, and ideas are to stored and presented, and which are not. The overall documentation process could be a potential resource of knowledge in participatory nature in critical making, and the knowledges that they are producing along the way.

References


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Figure 1.1: Spider Cell