Everyday Design: Comparing Families, Hobbyist Jewellers, and Steampunk Enthusiasts

by

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Abstract

This thesis reports on a descriptive multiple-case study that portrays the practices of three groups of everyday designers as a way to inform the design of interactive technologies. Previous research describes cases of appropriation and everyday design where people creatively transform and adapt design artifacts; however, there is still a gap in our understanding of how individuals precisely design and make things. The aim of this study is to discern the similarities and differences between the practices of the selected cases of everyday designers: family members, hobbyist jewellers, and steampunk enthusiasts. Based on the theory of practice, the analytical framework combines goals, outcomes, materials, tools, competences, and strategies to holistically describe those cases of everyday design. The findings point to a reconfiguration of how objects and technologies should be designed, but also a reflection on how designers can create materials, tools, and structures to support heterogeneous and creative design practices.

Keywords: Everyday Design; Appropriation; Hobby; Do-it-yourself; Interaction Design; Practice Theory

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1. Introduction

As interactive technologies and ubiquitous computing continue to evolve and surround us in many aspects of life, the discipline of interaction design is gaining in complexity, scope, and challenges (Zimmerman et al., 2004). Since industrialization, the design process of products, including interactive technologies, is typically regarded as a top down situation: designers and developers create a system and people (users) use it in order to fulfill needs and desires. However, in the past few decades, user-centered design and participatory design (Ehn, 2008; Bodker & Iversen, 2002) have become common practices in the industry of product and technology design. These strategies aim at including users in the design process through, for example, co-design, focus groups, field observations, and usability testing. In general, the goal is to gain an understanding of the users to create products that fit their expectations, needs, and abilities. Nevertheless, even if these techniques are continuously refined, people sometimes subvert the authority of the designer and transform design artifacts to fit their own situations. In short, once the artifacts leave the designer's drawing table, the design process does not stop: it can be pursued through customization (Marathe & Sundar, 2011), reuse (Pierce & Paulos, 2011), and appropriation (Dix, 2007; Dourish, 2003; Wakkary & Maestri, 2007). Examples of appropriation are hanging a jacket on a chair or sending an email to yourself as a reminder. These actions were not necessarily intended by the designer(s), yet people transform, use, and re-design artifacts so they become personal, based on people's understanding of their current and future situations (McCarthy & Wright, 2004).

Everyday design qualifies and defines the types of actions that people do to creatively transform and adapt objects in their daily lives. In a study of families in the home, Wakkary and Maestri (2007) observed a "form of creativity that we all take part in and one that helps us negotiate our daily lives" (p.163). Through their observations, they look at family members as 'everyday designers', people who show resourcefulness and adaptivity which lead to unique design outcomes. Everyday design includes

appropriations of artifacts and surroundings as design resources. In *A sustainable identity: The creativity of an everyday designer*, Wakkary and Tanenbaum (2009) redefine the user as an everyday designer and develop principles around this reconfiguration. Everyday design happens through design-in-use, which is a type of design that is in situ and in synchronicity with daily actions and routines. Three principles of design-in-use are described as implications of this study:

> *Design-in-use* involves a high degree of creativity that in the best sense of the word makes a user unpredictable.
>
> Design artifacts become resources for further creativity as an outcome of *design-in-use.*
>
> *Design-in-use* qualities emerge over time as do design actions. (idem, p.371)

These principles entail that designers leave a more open space for users to be creative and that appropriation is a design goal in design-in-use. The last principle also speaks to the evolutionary and complex settings in which families exist and design. Everyday design, and particularly design-in-use, brings a different lens for looking at end-users, which, as said earlier, can reconfigure the user as an everyday designer. Users are not only the consumers of goods imagined by designers, they are also creators themselves; they are not users, but they are designers (idem).

This view of the everyday designer was built on a study of families in the home. Recent research looks at other instances where non-professional designers design as well. In this thesis, the term non-professional designer refers to individuals who engage in design activities without having an education in design or for purposes other than economic benefits. Studies of crafts and hobbies such as gardening and knitting (Goodman & Rosner, 2011), do-it-yourself (DIY) communities (Kuznetsov & Paulos, 2010), and hacker subcultures (Rosner & Bean, 2009) also highlight the creativity and resourcefulness of individuals who create things outside of the common industrialized production model. For example, Ikea Hackers deconstruct and disassemble Ikea products to reassemble them in new personalized objects. The hackers then share their process and outcomes online with other non-professional designers (Rosner & Bean, 2009).

The studies of family members as everyday designers, as well as the studies of other types of non-professional designers aim at informing the work of interaction designers by providing insight on people's creativity and ingenuity and their patterns and routines. Each study provides a set of guidelines or a reflection on how to design interactive technology that would support the kind of actions observed in the study. Additionally, the goal of the these studies is to show that the top-down design model, even when including users in the process, cannot provide solutions that satisfy all users or all situations. In order to design for practices of everyday design, we need to understand the specific processes and strategies people use to reuse objects, appropriate things, and remake new design artifacts. However, there is a lack of documentation on the types of materials and tools used, as well as the competences and skills that individuals use when designing and making projects. A more holistic description of the practices of everyday design could further serve interaction design practice and research endeavors.

1.1. Focus and Goals of this research

The aim of this thesis is to further explore and describe the practices of everyday designers such as families, hobbyists, and expert amateurs. An in depth portrait of how people design in their everyday lives can orient how we might design to support these design practices. This research focuses on drawing this portrait and presenting a relevant discussion for the fields of human-computer interaction (HCI) and interaction design. In short, I ask how do the practices of everyday designers, hobbyists, and expert amateurs define non-professional design? Underlying this question is the assumption that these practices differ and that the similarities and differences can help qualify and define non-professional design. More important than the definition itself, is to understand how a description of everyday design can help design interactive technologies.

In order to address this question, three cases of non-professional design were chosen as a way to explore aspects of making and designing within the continuum of practices of everyday design. The cases include families, hobbyist jewellers, and steampunk enthusiasts. These three cases were selected because, a priori, they present

very different design perspectives that can allow for a more diverse and insightful comparison of everyday design practices.

I present a very short description of each group in order to clarify terms and show how each case is a variation of everyday design practices (more background information will be presented in chapter 2). Families design mostly to manage and support their daily activities. They reuse artifacts in ad hoc installations or in more complex systems. Hobbyist jewellers are a group where making aesthetic pieces is the main goal of the practice. They use new materials or found materials that they appropriate. Finally, steampunk enthusiasts are part of a subculture that re-imagines a world inspired by the Victorian era, where machines were ornamented and sustained amazement and imagination, and where materials such as brass, leather, and wood were common in the fabrication of everyday products. Steampunk enthusiasts are part of a community of makers (making costumes and machines following the steampunk aesthetic) who meet at conventions and other social events and through online structures.

The main research questions is *What are the similarities and differences between the practices of design of families, hobbyist jewellers, and steampunk enthusiasts?*

The focus of this thesis is to use these three groups of everyday designers in a comparison to find the similarities and differences across the cases. By comparing the cases, I hope to highlight the main points that are common to all three practices of everyday design, and to specify what aspects are particular to each practice. This comparison can then serve as a starting point to create guidelines for designing interactive technologies that support everyday design.

1.2. Approach

In order to investigate this research question, I use a qualitative method of inquiry. Qualitative research can help gain a holistic understanding of human experiences in a social situation through in depth and rich data collection (Merriam, 2002). More precisely, I follow a multiple descriptive case study methodology. Case study research aims at “retaining the holistic and meaningful characteristics of real-life

events" and is particularly helpful in describing in depth portraits of phenomena (Yin, 2009, p.4). A multiple case study design was chosen, as opposed to a single case study, in order to provide different examples of everyday design practices and to allow for a comparison between the cases.

To orient the propositions of the case study, I base my research sub-questions in the theory of practice originally theorized by Bourdieu (1977) and Schatzki (1996). Practice theory looks at practices as the basic unit of analysis of the social life. It is a routinized type of behavior that combines aspects of body, mind, things, knowledge, discourse, structure/process, and agency (Reckwitz, 2002b). A more in depth summary of practice theory will be presented in section 2.2. For each case of the study, I explore eight aspects of the practice of everyday design. I investigate:

- Goals and motivations: the principles that stimulate individuals to design
- Outcomes: the artifacts, systems, or routines created as a result of design
- Materials: the raw materials or design artifacts that are resourced to design
- Tools: the tools used to transform, adapt and appropriate objects
- Competences and skills: the abilities that lead to everyday design, and the physical skills to make things
- Strategies: the ways in which materials, tools, competences and skills are combined to respond to goals
- Strategies for Learning: the ways practitioners learn how to design and make
- Strategies for Sharing: the ways practitioners share their techniques and outcomes

Through interviews, observations, photographs, and video walk throughs, I collect data for each case in order to support or refute a number of propositions. For each aspect of practice, I describe how it is expressed in each case, and I compare the results in a cross-case analysis. The similarities and differences across the practices are the main findings of this research and serve as a starting point for the discussion.

1.3. Contributions of this research

This research hopes to contribute four main points for interaction designers and design researchers.

Firstly, it provides a portrait of three different practices that fit under the umbrella of everyday design: families, hobbyist jewellers, and steampunk enthusiasts. Their differences and similarities help further define what non-professional design and everyday design are, through the description of aspects of practice. This descriptive study of unique and diverse practices further enriches our understanding of creative practices people conduct in relation to their products, surroundings, and technology systems.

Secondly, guidelines drawn from the study and its analysis are presented for interaction designers. These guidelines aim not only at providing ways to design technologies that support appropriation and everyday design, but also at showing how the role of the interaction designer can change and be reconfigured. This research creates evidence for supporting and encouraging further development of materials, tools, and structures that aim at empowering people in making things and being creative.

Thirdly, this multiple case study shows how researchers can use the theoretical foundations of practice theory as a way to further investigate acts of appropriation and making. Previous research typically aimed at understanding specific parts of the practice of everyday design, often leaving behind aspects that can be beneficial to the overall understanding of the practice (for example, Crabtree & Rodden, 2004; Taylor & Swan, 2005; Tolmie et al., 2002; Wakkary & Maestri, 2007). Practice theory is a useful lens to look at appropriation and design-in-use as embedded in this complex web of aspects related to the self, the environment, and the artifacts.

As a fourth and final contribution, this research hopes to pursue the discussion about everyday design within the area of interaction design by providing new insights on different aspects of practice. More importantly, this study wishes to inspire designers to create materials, tools, and artifacts that can support everyday designers, hobbyists, and amateurs.

1.4. Overview

This research is presented in seven chapters. This section describes what topics every chapter will address and aims to give a clear roadmap of the way I chose to approach the writing of this thesis.

Chapter 2: Literature review

Chapter 2 offers background information in the format of a literature review of related works in a number of areas. I start by describing previous research about appropriation at different structural levels – as part of a social structure, in the workplace, in the home, and in subcultures such as expert amateurs and DIY communities. I present key conceptual points of the theory of Practice and examples of studies of practices. Finally, background information about the three cases, families, hobbyist jewellers, and steampunk enthusiasts is introduced.

Chapter 3: Methodology

Chapter 3 presents the study design and the methodology behind this multiple descriptive case study. The goal of this study and the research questions and propositions are presented in full length. The case study protocol is detailed for each case and includes the procedures for finding participants, meeting them, and collecting evidence. I report on how the data was compiled, coded, and analysed. At last, validity and reliability questions are addressed.

Chapter 4: Aspects of Practice: Goals, Outcomes, Materials, and Tools

Chapter 5: Aspects of Practices: Competences, Strategies, Learning, and Sharing

The heart of the thesis resides in chapters 4 and 5. The case reports and analysis and comparison between the cases are presented here. In order to simplify the reading and the flow of the chapters, I present each aspect of practice separately, going over results in each case, and then presenting the comparison between the three cases, in relation to this specific aspect of practice. For example, I start with describing goals and motivations of families, hobbyist jewellers, and steampunk enthusiasts. I then present the analysis and comparison of goals and motivations across the cases. Once

an aspect is fully described and compared, I turn to the next, in this example, to the description of outcomes in families. This structure was adopted in order to prevent repetitions between the case reports and the analysis of the qualitative data. Chapter 4 covers the goals and motivations for practitioners to make and design, the outcomes of practices, the materials resourced and used, and tools that served in the making process. Chapter 5 depicts the competences and skills that practitioners put in practice as they conceptualize and make things, as well as the general strategies that support the practices and the learning and sharing strategies within practices. Chapters 4 and 5 present the case reports and the analysis of the multiple case study through eight sub-sections (each is an aspect of practice). The analysis is divided and presented throughout the case study reports.

Chapter 6: Discussion

Chapter 6 starts by revisiting the initial case study propositions and applying the necessary revisions based on the results presented in chapters 4 and 5. The discussion is organized into six guidelines that can orient interaction designers to design interactive technologies that can support everyday design. Guidelines include designing for multiple lives of artifacts, creating materials for specific practices, building tools for making and sharing, focusing on education, and designing for multiple and heterogeneous practices. Finally, this chapter articulates a discussion about how the discipline of interaction design can be reviewed based on the different perspective on production and consumption everyday design brings. The chapter ends with a review of the limitations of the study.

Chapter 7: Concluding statement

Lastly, chapter 7 provides concluding remarks for this thesis. I summarize the argument and points made in the thesis, from a design perspective. I summarize the contributions of this research, and present potential avenues for future research. Further research can include conducting more case studies of everyday design practices, investigating the current tools and structures available that support heterogeneous practices of making, questioning the place of everyday design in the industry of design, and exploring and designing for practices of everyday design.

2. Literature Review

In everyday design, people who are not part of the professional design world creatively act upon objects and environments around them in order to adapt, transform, and appropriate through design-in-use. This chapter presents a literature review of works related to everyday design, non-expert designers, and practice theory which will serve as a theoretical foundation for the analysis. The goal of this chapter is to present relevant literature that leads to the research questions and propositions I present in chapter 3. I start by introducing studies that look at how acts of appropriation configure workspaces (CSCW) and how social groups can shape technologies (SST). Then, I summarize previous research that has shown how design-in-use is embedded in habits and routines of families and the origins of the term everyday design. Finally, I discuss more recent research that investigates do-it-yourself communities such as Ikea hackers, knitters and gardeners (Rosner & Bean, 2009; Goodman & Rosner, 2011). This review of literature demonstrates that there is a shortcoming in the description of the individual processes of everyday design. In order to investigate this specific view of everyday designers, I will use key concepts borrowed from the theory of practice (Bourdieu, 1977; Latour, 1992; Reckwitz, 2002b; Schatzki, 1996) which will serve as analytical lenses to construct the case propositions and analysis. I finish by introducing background literature related to the three groups presented in the cases of this study: families, hobbyist jewellers, and steampunk enthusiasts.

2.1. Design by non-professional designers

The premise behind everyday design is that people creatively and constantly appropriate and transform objects around them, long after those objects have left the hands of professional designers. In his book *Notes on the Synthesis of the Form*, Christopher Alexander (1964) distinguishes two types of design: *unselfconscious* design and *selfconscious* design. This differentiation only appeared when design was

professionalized in the late 1800s and early 1900s. Before that era, all individuals in a community were designers and craftsman at the same time. There was no institution teaching design skills and learning happened gradually "revealed through the correction of mistakes" (Alexander, 1964, p.35) and guided by tradition and habit. This was unselfconscious design. Today, we could argue that most objects are designed by professional designers and that the people who use them did not fabricate them (selfconscious design). The next sections show how research has studied design acts and outcomes generated by non-professional designers – by everyday designers.

The next section briefly summarize key research in relation to everyday design such as the social shaping of technology (SST) and computer supported cooperative work (CSCW) as a way to introduce the focus of this thesis, which is the individual acts and practices of everyday design. Looking at the phenomenon of appropriation from different lenses (studies of domestic life, the work place, and social groups) gives a good overview of the landscape of everyday design. Appropriation demonstrates how users are active in the process of accepting and using new technologies. In design, appropriation is described as how people use artifacts or systems in new and creative ways different from the designers' intentions (McCarthy & Wright, 2004).

2.1.1. Social Shaping of Technology (SST) and Computer supported cooperative work (CSCW)

In *Extending the Social Shaping of Technology Approach: Ideology and Appropriation*, Mackay and Gillepsie's (1992) present an extension to the Social Shaping of Technology (SST). The authors argue that the traditional approach in SST is limited by a technical deterministic perspective on the evolution of technology. The authors define technical determinism as the process by which technology influences and shapes how people live, but it is not reciprocally influenced (idem, p.686). Conversely, the SST approach "does not den[y] that technologies have social effects, the focus, rather, is on the social forces which give rise to particular technologies" (idem, p.686). They propose that the lifecycle of technology is not complete without adding marketing and the social appropriation of technologies to the first phases of conception, invention, and development and design. An example of social appropriation of technologies from the beginning of the twentieth century is the use of Ford's Model T by American farmers.

Kline and Pinch (1996) describe how the farmers used the car as a stationary power source and how they communicated new ideas and uses through newspapers and magazines. The Model T could be used as a farm tool, domestic technology, stationary source of power, and for transportation, demonstrating that technologies are appropriated in everyday use by particular subgroups, in this case, American farmers. The social shaping of technology sets an interesting departure point to further explore more precise contexts of technology usage and appropriation.

Appropriation happens on both the large and small scale. The social shaping of technology showed that individuals have the choice to accept, refuse or transform technology as a society. Similarly, work groups have been studied to demonstrate that software and tools in the work environment are also appropriated collectively, as part of computer supported cooperative work (CSCW). For example, Bossen and Dalsgaard (2005) report on a study about the development of a parasitic system created by employees of a software company. Despite the knowledge management system in place, the employees customized, installed macros, and created plug-ins that more effectively met their needs at the moment of use. Dourish (2003) presents the *Placeless Document* as a clear example of a system specifically designed to support appropriation at the workplace, and defines guidelines for achieving a balance between customization and mutual intelligibility. Importantly for the CSCW community, this work demonstrates how an understanding of technology appropriation can lead to the development of interactive systems that can more easily be integrated in the workplace.

2.1.2. Design in use in homes and routines

As researchers studied appropriation of technologies by societies and work groups, another corpus of research turns to appropriation of artifacts and surroundings in the home. Scholars have studied the routines and dynamics of families at home as a way to highlight considerations for the design of technology. Crabtree and Rodden (2004) use ethnography to study domestic routines of communication and organization structures to support messaging. Tolmie et al. (2002) observed routines (what they consider to be the "glue of domestic life" (p.399)) of families and neighbours as a way of finding opportunities for making technology as 'invisible in use' as routines. These findings can further orient the creation of 'unremarkable computing' that can more

naturally fit in the everyday context, and even be used as resources similarly to doors or alarms. Both studies argue that designing technologies for the home requires different attention than designing for the workplace and that context and habits need to be considered.

Domestic studies have also focused on understanding the creativity of home dwellers. Taylor and Swan (2005) observed the diverse systems used by family members to organize their homes and to communicate in their everyday lives. They argue that technologies should be designed to accommodate for the very rich and artful ways in which people organize their homes, and that designers should provide resources to foster these behaviors. Ron Wakkary and colleagues (Wakkary & Maestri, 2007; Wakkary & Maestri, 2008; Wakkary & Tanenbaum, 2009) have done ethnographic studies of Vancouver families in their homes and describe family members as 'everyday designers': home dwellers are viewed as creatively and resourcefully appropriating artifacts and surroundings in the home. The ongoing process of adapting systems to fit routines and activities in the home is described as design-in-use. For example, Wakkary (2009) describes how Kerry and Beck's three flat horizontal surfaces in the kitchen work as a system for storing and keeping objects. The top of the fridge, an open cabinet referred to as the 'microwaveless shelf', and a small table next to the kitchen are all put to new uses for holding objects in transition, keeping things away from children, and saving important documents. The specificity of this system resides in how it evolved over time based in the solutions for dealing with the "ever growing, unmanageable pile" (idem, p.14) of objects and how highly unique the solutions were to this context and this family.

This corpus of research highlights the everyday creativity of people, the uniqueness of designed systems, and the mutual intelligibility that flows between the members of a family or group.

2.1.3. Amateur and Do-It-Yourself (DIY)

The previous sections (2.1.1 and 2.1.2) describe how acts of design can be achieved by individuals, in an everyday context, to support family life or work endeavors. More recently, researchers have focused not only on the appropriation of objects and

surroundings, but also on how individuals (who are not designers) create explicit design projects resulting in the fabrication of objects.

Amateurs have been the focus of research particularly because they challenge the current consumption model by using a creative and rebellious do-it-yourself (DIY) approach rather than buying premade goods. In *The Rise of Personal Fabrication,* Catarina Mota (2011) describes the evolution of the DIY movement from the Arts and Crafts movement of the early 1900s, to a home improvement focus in the 1940s and 1950s, into "a creative act of rebellion against mass production, consumerism, planned obsolescence and waste" of the early 1990s (Mota, 2011, p.283). Today's DIY practitioners are adding the use of both off and on line technologies as materials and tools for projects.

Paul Atkinson (2006) defines "pro-active DIY" consisting of activities which

> contain significant elements of self-directed creative design input, and which might involve the skilled manipulation of raw materials or original combination of existing components, where the motivation is personal pleasure or financial gain. (p.3)

Kuznetsov and Paulos (2010) define DIY to be "any creation, modification or repair of objects without the aid of paid professionals" (p.295). In their paper "Rise of the expert amateur" (Kuznetsov & Paulos, 2010), the authors present an analysis of DIY practices on six websites (such as *Instructables,* and *Etsy*) supporting DIY communities. They argue that there are two reasons why DIY is gaining in importance: firstly, the accessibility and affordability of tools; and secondly, the appearance of new tools enabling sharing, particularly online tools. They highlight aspects of learning, creating, and sharing as central to DIY communities that share information online.

The DIY communities are supported by multiple tools and structures such as local production shops. Fab Labs, an initiative of the MIT's center for Bits and Atoms, are 50 similar workshops around the world equipped with tools like drill presses, saw tables, laser cutters, 3d printer machines, and soldering irons for empowering people to fabricate objects and technologies themselves. Hackerspaces provide similar tools, but most importantly emerge directly from the community and aim at supporting collaboration and peer learning (Mota, 2011).

DIY is not only about making things, it is also a reflection of who people are. Amy Spencer (2008) argues that shaping people's identity is at the heart of DIY: "the DIY movement is about using anything you can get your hands on to shape your own cultural entity: your own version of whatever you think is missing in mainstream culture" (p.11). Finally, Paulos (2012) reminds us that the origins of the term amateur comes from amator in Latin, which means to love (p.54). In addition to being passionate about a project, amateurs are also resourceful. The definition of *bricoleur* by Louridas (1999) (inspired by Lévi-Strauss in *La pensée sauvage*, 1962) exemplifies well the nature of the DIY practice: "The bricoleur makes do with what's there, with what he encounters" (Louridas, 1999, p.518).

In conclusion, the DIY movement and maker amateurs present interesting subcultures that embody the idea of appropriation and everyday design, and hence can inform the design of more open interactive technologies.

2.1.4. Summary

The appropriation of technology and everyday objects has long been studied through many different lenses, from a large social perspective (SST), as part of workplaces (CSCW) to a closer look at individuals and particular subcultures like the DIY community. This section (2.1) provides a brief summary of the broad literature in sociology of technology which describes the relationships between the evolution of technology within societies, subcultures, and groups. At an individual level, appropriation happens on a continuum ranging from very simple changes (e. g. reusing objects as-is while changing the context or use) to more elaborate and complex transformations (e. g. soldering, cutting, molding, programming). However, the literature about personal and individual practices of everyday design and DIY still contains some gaps, particularly in the description of the processes and strategies people use to transform artifacts and achieve their projects.

2.2. Approach: Theories of Practice

In this thesis, I use the theory of practice as lens to focus on individual acts of everyday design as part of practices. This approach was developed through the writing

of a yet to be published paper presenting practices of everyday repair and green DIY as a way to inform sustainable interaction design (Wakkary et al, forthcoming). In this paper, we use aspects of practice (goals, outcomes, materials, tools, skills, competences, and strategies) to articulate a comparison between the two sustainable practices of green enthusiasts (green DIY) and everyday repairers. Green enthusiasts refers to the individuals who use online resources such as tutorials and blogs for DIY sustainable projects to facilitate their own practices of making. The practice of everyday repair focuses on how people repair or use their broken objects.

This section summarizes key points of practice theory as a stepping stone for further analysis of the case studies.

In practice theory, practice is seen as the basic unit of analysis of social life. The theorists Pierre Bourdieu and Theodore Schatzki both wrote and conceptualized this theory, (in parallel with Giddens, Foucault, Taylor and others (Reckwitz 2002b)), but I first turn to Reckwitz (2002b), a cultural theorist, who takes aspects of both theorists' writings to flesh out the main characteristics of the theory of practice. He sees practice theory as an alternative to seeing the world as driven by *homo economicus* (action comes from individual purposes) and *homo sociologicus* (actions stem from social norms) perspectives. Reckwitz points out (2002b, p.246):

> From the point of view of cultural theory, the seemingly opposed classical figures of the homo economicus and homo sociologicus share a common 'blind spot': They both dismiss the implicit, tacit or unconscious layer of knowledge which enables a symbolic organization of reality.

This extract points to the important ideas of *implicit, tacit* and *unconscious* aspects of life often left behind in other sociological studies. A practice is a routinized type of behavior that combines aspect of body, mind, things, knowledge, discourse, structure/process, and agent (Reckwitz 2002b). In the concept of agent, Reckwitz proposes that individuals are carriers of multiple practices in their bodies and minds (Reckwitz 2002b, p256). For example, an individual can carry the practices of cooking, drawing, skiing, walking, questioning, and orienting oneself in the city. Practices are situated within individuals, and this is the only locus where they can be combined.

Theodore Schatzki (1996), who largely influenced Reckwitz, proposes to look at practice as the central unit of social life, and as an embodied phenomenon in individuals' routinized actions. Schatzki distinguishes two poles representing practices: *integrative* and *dispersive* practices, a distinction that can help further describe and compare practices. Dispersive practices are widely spread across individuals of the population and entail a tacit and almost unconscious knowledge to carry practices such as ordering at the restaurant or doing laundry. Dispersive practices are primarily linked through individuals' shared understanding of practice, highlighting the importance of intelligibility (making sense of the world) of practices between individuals. Integrative practices, although also tacit, show a more organized and sometimes normalized corpus of knowledge shared between practitioners in a particular group, for example, skiers or doctors. We see in this distinction a useful tool to look at practices of families (more dispersive in nature), hobbyist jewellers and steampunks (more integrative in nature).

Pierre Bourdieu, a sociologist who started to conceptualize practice theory before Schatzki and Reckwitz, argues that the social resides in embodied actions (Bourdieu, 1977). With the concept of *habitus*, Bourdieu explains how practices are supported by dynamic and enduring systems of materials, tools, artifacts, competences, and skills. It is this precise arrangement into strategies that aim at fulfilling goals and motivations. Motivations and goals (generative principles) are presented as capital in Bourdieu's writings. Our analytical framework draws heavily on these concepts.

Both Elizabeth Shove (2007), a consumer culture scholar, and Reckwitz (2002a) underline the missing discussion of artifacts and things in the theory of practice. They argue that practice theory, as presented by Schatzki and Bourdieu, is supported by materials and tools, but the relationship between individuals and objects is rarely discussed. Schatzki emphasizes that practices are not only discursive, but that they include both 'doings' and 'sayings'. Reckwitz presents the dual relationship between the bodily actions and the knowledge in the mind in Schatzki's work: for practices to be intelligible, they need a certain form of knowledge and know-how in the mind. However, this knowledge exists only as it is bodily expressed in a behavior (Reckwitz 2002a). This idea of embodied knowledge is not only a part of individuals, but objects as well. Reckwitz (2002a, p.208) presents parts of Bruno Latour's discussion of mediating technologies:

> Rather, it should be understood as “artefacts” or “things” that necessarily participate in social practices just as human beings do. To be sure, these things are “interpreted” by the human agents in certain ways, but at the same time they are applied, used, and must be handled within in their materiality.

How artifacts are interpreted by individuals relies on the *scripts* that are embedded in the artifacts themselves. Latour (1992) argues that scripts can be inscribed by designers in objects, and that people can ‘read’ immaterial and informational attributes, like a script, to understand how to use an object. Latour (1993) also presents the concept of *hybridity,* the idea that we live with hybrid combinations of human and non-human objects. Shove, in her book *The Design of Everyday Life*, explains how this combination of humans with tools create human-non-human hybrids where competence is distributed between the human (embodied knowledge) and the tools (embedded knowledge) (Shove, 2007, p56).

In this section, I summarized key concepts from different practice theorists. These concepts will be useful in our description of each case of this multiple case study. I propose to observe goals and strategies (including strategies for learning and sharing aspects of a practice) (inspired by Bourdieu), as well as outcomes (or artifact), materials, tools, and competences (inspired by Shove, Reckwitz, and Latour). This framework echoes the approach we used in our study of green enthusiasts and everyday repairers (Wakkary et al, forthcoming).

2.2.1. Studies of practices

The description of practices has previously been used as a way to inform the fields of human-computer interaction and interaction design. Understanding this complex combination of tools, materials and skills with goals and strategies can highlight important aspects of particular practices of everyday design. For example, Rosner and Bean (2009) present how HCI can learn from Ikea hackers, a subculture that uses, combines, and transforms Ikea products to create new objects. The authors focus on identity and creativity, technology and hacking, and conclude that “new creative tools should celebrate skilled, creative reuse and customization in order to empower the next generation of creative tinkering” (Rosner & Bean, 2009, p.422). In her study of book

binders, Rosner (2012) demonstrates how the accomplishment of book binding relies on everyday collaborative practices. Goodman and Rosner (2011) also study practices of knitters and gardeners as a way to describe the relationship between creative practices, materiality, and emergent information technology and online tools. Additionally, Torrey et al. (2009) conduct a study about how crafters document and search for knowledge about crafts on the internet. Their findings show that participants used online tools to seek information about techniques as well as inspiration for projects. In brief, the premise of this corpus of research is that understanding how individuals use and appropriate objects and tools can help designers better develop new technologies.

In the field of sustainable HCI, researchers aim at understanding environmentally sustainable and unsustainable practices to inform interaction design. Kim and Paulos (2011) develop a design reuse vocabulary based on the observation of e-waste that individuals kept as is, remade or remanufactured at home. Their study focuses on shape properties such as hollow or symmetric, material properties such as transparent or fragile, and operation properties, such as bending or filling. Their goal was to find ways to prolong the life of electronic products by supporting their creative reuse. Moreover, Maestri and Wakkary (2011) present a study of the practice of everyday repairers based on over 40 repaired objects. The results show everyday repair as a creative act supported by flexible, substitutable, and reclaimable material attributes.

Finally, in our own work, we present a comparative study between the practices of green DIY and everyday repair (Wakkary et al, forthcoming). As described earlier, we propose that in order to address sustainability issues as a whole, we need to move from studying the individual processes of the mind or actions, to understanding the complete practices. The goal is to define how each practice is configured and to investigate how interaction design can play a role in developing not only artifacts, but also tools and materials that support practices. We also argue that understanding practices as a whole can help develop imaginative opportunities and constraints to design for practices.

In conclusion, these studies of practice of DIY and sustainability show how investigating multiple aspects of practice can lead to a more in depth comprehension of non-designers' behaviors, goals, and actions. This understanding can in turn orient interaction designers and researchers towards designing future technology.

2.3. Study cases: families, hobbyist jewellers and steampunk enthusiasts

In this thesis, I use the practice theory approach as a lens to observe three groups who practice everyday design in different ways. In this section, I present relevant literature to introduce the three groups: families, hobbyist jewellers, and steampunk enthusiasts. Those groups were chosen based on how different their practices are within everyday design. By comparing them, I aim at demonstrating the relationship between the practices of the different groups and, hence, defining more specifically what everyday design is.

2.3.1. Everyday Designer: Families

The study of families adds to the literature presented in section 2.1.2. This section presents concepts of context, ever changing routines, and how families adapt to these everyday factors. Firstly, I restate that in everyday design, family members are considered to be everyday designers – creative agents that continuously adapt and modify their environment (Wakkary & Maestri, 2007).

The appropriation of artifacts and surroundings are mainly the repurposing of objects or environments for different uses. Design, in this case, means to reconfigure the use of an artifact by allowing it a different function than the intended one. The techniques used are simple, in great synchronicity with the context, and the outcomes should be intelligible by other family members. Simple actions and great complexity in systems has been observed in previous research (Wakkary & Maestri, 2007; Tolmie et al., 2002; Taylor & Swan, 2005).

Related literature about appropriation in families champions the dynamic systems that continuously evolve over time in homes through design-in-use (Wakkary & Maestri, 2007). Wakkary and Maestri (2007) place creativity at the heart of everyday design and argue that resourcefulness and adaptation play the role of supporting ever-changing routines and activities. Changes can be the result of collaborative or individual effort. Wakkary and Maestri (2007) created a pattern language revolving around the themes of resourcefulness, adaptation, and quality. For example, ‘making use of the half wall’ is a pattern of resourcefulness where individuals find a new use for a structure of the

environment, such as a half wall structure for sorting the mail, or using the inside of a cupboard as a step. They describe patterns showing how family members go about adapting their homes around their needs and routines. They also argue that resourcefulness can be understood as temporary ad hoc installations and actions, but can also be part of ongoing routines.

Crabtree and Rodden (2004) present the idea of *ecological habitats* in which instances of communication information are situated. These places are known by the family members and are referred to in order to locate particular resources. This conception of the spatial context of a home is also referred to in Taylor and Swan (2005) study of artful systems in the home. They add to the notion by stating that organizing systems include ecological habitats, as well as activity centers and coordinate displays. Further, they argue that those systems "are by no means static. The systems are continually being (re)designed to suit any actual case and to meet the ever changing needs of families as children age and relationships develop." (p.647)

Previous research on family members as creative agents show that individuals are resourceful through observations of and actions upon their surroundings and spatio-temporal contexts. These studies focus on routines, actions, and patterns, but fail in describing aspects such as tools and materials in relation to motivations. Further investigation can help draw a more complete portrait of the practices of everyday design within families, which can further inform the design of interactive technologies for the home.

2.3.2. Hobbyists: Jewelers

The second case of this study is a group of hobbyist jewellers. Gardeners, knitters, gourmet cooks, and model-makers are all examples of hobbyists that make something with their hands. Robert A. Stebbins (2001) coined the term 'serious leisure' to define a free time activity that is "profound, long-lasting, and invariably based on substantial skill, knowledge, or experience, if not a combination of the three. It also requires perseverance to a greater or lesser degree" (p.54).

Stebbins describes five sub-types of hobbyists: collectors, makers and tinkerers, activity participants (like hunters), competitors in non-professional sports and games,

and liberal arts enthusiasts (Stebbins, 2001, p. 54). I focus only on the 'makers and tinkerers' since it provides an appropriate space for observing everyday designers.

Makers and tinkerers can also fit under the definition of craft. Based on the definition of craft by the English Crafts Council (1995), Rachel Mason (2005, p262), an amateur craft scholar, argues that there are four points necessary to describe craft:

> Namely (i) the act or activity of making; (ii) skilled knowledge (what Gardner [1990] calls *bodily kinaesthetic intelligence*); (iii) 'craftspersonship', which plays a hugely significant role in aesthetic judgment and (iv) apprenticeship – a form of learning that is intuitive and in which knowledge and skills are acquired through modeling and practice.

In both the definitions of hobby and craft, the aspect of skilled knowledge and experience are central. This orients further how we can look at hobbyists who are makers. More precisely, I focus on hobbyist jewelers at home. The Hobby Industry Association (1998) and The Crafts Report (2001) describe jewellery making as a 'representative' craft because jewellery makers are demographically fairly typical crafters (Adams-Price & Steinman, 2007, p.319). This group presents a high level of skills and variety of techniques (Adams-Price & Steinman, 2007); shows predominant aesthetic and creative aspects of the work created; tends to operate under the contextual constraints of the home; and makes use of multiple options when selecting materials for creating jewelry. Adams-Price and Steinman (2007) present a study of psychological benefits of jewellery making in women who identify as jewellery makers at home. The authors conclude that creativity and generativity are main themes that allow women to gain well-being through their craft making.

Moreover, basic skills of jewellery generally have to be learned in a class (for silversmithing for example) or through making (like assembling beads and wires). Online tools are also available to share techniques, including tutorials and tips in jewellery making, such as www.craftster.org. In addition, with new tools for sharing products and selling, there are new possibilities for creating relationships between creators and consumers as well as between creators themselves (Saikaly & Krucken, 2011). For example, Etsy.com holds a large section for selling jewellery, hence, we see a revival of

home made jewellery. Moreover, Etsy.com presents itself as “more than a marketplace: we're a community of artists, creators, collectors, thinkers and doers”.

In conclusion, jewellery making as a hobby is a rich material practice that has not been studied in the context of HCI and interaction design. Although researchers have observed the implications of jewellery making on well being, on the current consumption model and as an income source, there is still room to understand embodied strategies, tools, and materials employed by hobbyist jewellers.

2.3.3. Expert Amateur: Steampunk enthusiasts

The third group of this multiple case study is steampunk practitioners. The steampunk subculture re-imagines a world inspired by the Victorian and Edwardian eras, where brass, leather, and wood constitute common fabrication materials and where steam is used as a main power source. Rebecca Onion (2008) writes in the Journal of Neo Victorian Studies: “Steampunks seek less to recreate specific technologies of this time than to re-access what they see as the affective value of the material world of the nineteenth century” (p.138).

The steampunk ideology was inspired by works of fictions of the early 1900s, by authors like Jules Verne and H.G. Wells (Gross 2006, p.60-63). Later, in the 1980s and 1990s, cyberpunk authors like Bruce Sterling, K. W. Jeter, and William Gibson started to write narratives displaying alternatives to past events and eras, and relied heavily on anachronism. Onion (2006, p140) writes:

> *The Difference Engine* (1990) by Gibson and Sterling is acknowledged to be among the genre’s foundational novels, in which the authors play with a favourite steampunk speculation: they postulate that the computer was first conceptualised in the era of steam power (as it was, by Charles Babbage), and that it was actually built as a mechanical device, taking up a large amount of physical space.

Steampunks reflect on the relationship between humans and machines and see modern technology as closed and rudely impermeable to the everyday person. Steampunks also miss the uniqueness and diversity of machines in the Victorian era. Profesor Calamity, a pseudonym of a well known theorist of steampunk, writes for the

Steampunk Magazine (www.steampunkmagazine.com). Calamity notes that "[t]he difference between the machines of then and now is the same as the difference between an old-growth forest and a soulless tree farm" (Calamity, 2007, p.5). Additionally, steampunk enthusiasts carry a desire to recreate and live in a time when machines and technology would be more "visible, human, fallible, and, above all, accessible" (Onion, 2008, p145)

Steampunk enthusiasts and practitioners use multiple online and offline structures to share ideas, inspiration and techniques for crafting machines and costumes. Annual conventions such as the SteamExpo (the first steampunk exhibition in Canada), and online groups and Facebook pages (such as Steampunk Canada), help practitioners meet, share, and stay in contact.

In *Steampunk as a Design Fiction*, Tanenbaum et al. (2012) provide a description of the steampunk practice as a way to present how, through design, practitioners can physically realize an imagined reality. The aim of this study is to further inform the practice of interaction design based on ideas of craftsmanship, uniqueness, and reflexive thinking about today's technology. Their online ethnography studies objects, materials, techniques, tools, and motivations for practicing steampunk. Akah and Bardzell (2010) also observe practices of appropriation of steampunks as a way to inform the design of empowering products.

Finally, steampunk is much more than a craft or hobby, it is an ideology that defines what being human means. In the eighth edition of the *SteamPunk* Magazine (2011), a quote from James H. Carrott, a cultural historian, introduces the edition:

> After all, what our world is and can be are more about human imagination than, well… anything else. And isn't that a lot of what steampunk has to say? Imagine! Play! Create! Push past the artificial boundary of time to ask the real questions: what does it mean to be human? What are we going to do with all this technology? How can we create the future we want and need? (p.2)

In brief, steampunk enthusiasts are an interesting group that can inspire interaction designer because of their ideology and views on today's technology, but also because of the hacking and DIY nature of their practices.

2.4. Conclusions

Design is typically understood to be how designers create objects for people. However, as discussed in this chapter, there has always been a reciprocal relationship between the objects made by designers and how people use them. The social shaping of technology is a well researched area and shows that people have great power in modeling how technology is being used and transformed. In CSCW and families and routines studies, researchers show that people can change, transform, adapt and appropriate objects and surroundings. This has led to understanding people as creative agents and to rename them *everyday designers*.

Families, crafters, and people in maker communities all have in common the lack of professional training for being designers, but they design in their everyday practices. Based on the presented literature, we can see that there is already a good understanding of what appropriation and design-in-use are, but there is a shortcoming in the understanding of how people combine tools, materials, and skills into strategies to make things. If we want to create tools to empower and support non-professional designers, we need a better understanding of the processes and techniques they use to make objects and systems. In fact, as shown in the theory of practice, we cannot separate the process from the competences, tools, materials, and context. Therefore, I propose to study practices of makers/designers as a way to inform the design of tools and materials for them.

3. Methodology

This research aims at investigating the differences and similarities between the practices of everyday design of different groups: families, hobbyist jewellers, and steampunk enthusiasts. This thesis is based on evidence acquired through multiple descriptive case studies.

In this chapter, I restate my research objective, and I present an overview of what qualitative research and case study research are and why they are a good fit to investigate practices of everyday design. Then I specify my research questions and the eight sub-questions and propositions I had before starting the data collection. These propositions will serve as a structure for the rest of the thesis and will be discussed in the case reports and analysis sections. Then, I describe the research design which includes methodological procedures for meeting with participants, collecting data, and analysing the data collected. Finally, I present how this research aims at maintaining validity and reliability.

3.1. Research objective

The goal of this study is to articulate a description of the various practices of non-professional designers ranging from the everyday designer to the expert amateur. In describing further how people engage in acts of design in their everyday life and hobbies, I hope to provide a more detailed view of what the conventional design practice calls the 'user'. In brief, I ask: *How do the practices of everyday designers, hobbyists and expert amateurs define non-professional design?* I believe that through understanding how people are creative and how they interact with mass produced objects, we can bring a new perspective to the design of future products and technology.

More precisely, for designers (particularly those who work as interaction, technology, and product designers), this research is beneficial because it highlights a

different perspective on who users are and how they interact with products once they are out of reach from the designers. This research can therefore provide a new framework for helping designers in the conception of technology and products that are more open to people's creative use.

For researchers, this research provides an important step in describing what everyday design and non-professional design are, enriching our theoretical understanding of the creative practices of people in relation to their use of products, technologies, and surroundings. This research also provides a novel approach to describing the appropriation of artifacts, through the lens of practice theory.

3.2. Methodological approach

3.2.1. Qualitative research

Qualitative research suggests that "meaning is socially constructed by individuals in interaction with their world" (Merriam, 2002, p.1). Qualitative research is valuable in understanding the experience of people within their social context from the person being studied perspective. In qualitative research, the researcher is the primary instrument in the data collection and analysis (Maxwell, 2005; Merriam, 2002). In addition, the study is conducted in a natural setting, in the real spatio-temporal context in which the phenomenon happens (Creswell, 1998). In conducting qualitative research, the researcher builds a holistic, descriptive and detailed portrait of the situation, events, or phenomenon that is studied with words, pictures, and videos. For these reasons, qualitative research is appropriate to explore and describe practices of non-professional design. Creswell (1998) describes five traditions of inquiry within qualitative research: biographical life history, phenomenology, grounded theory study, ethnography, and case study. Each tradition presents a different focus, and form for data collection and analysis that can lead to a better fit with different research goals.

3.2.2. Case study methodology

Case study research is a type of qualitative inquiry. Case study research aims at "retaining the holistic and meaningful characteristics of real-life events" and is particularly

helpful in describing in depth portraits of phenomena (Yin, 2009, p.4). It is largely used in medicine, law, psychology, and sociological studies and has a distinguished history in many fields (Creswell, 1998) to describe events, situations, and people. Case study research is particularly helpful when the focus of a study needs to be observed in a natural setting, and when the variables cannot be easily identified (Creswell, 1998). Moreover, Yin (2009) maintains that case study methodology is preferred when answering questions in the form of *how* or *why* (explanatory and descriptive studies). Case studies are also chosen when the focus of the analysis is on contemporary events, and when relevant behaviours cannot be controlled in an experimental setting (Yin, 2009).

The distinctive aspect of case study, and one of its key strengths, lies in its use of multiple data collection methods. Yin argues that there are six common sources of evidence: documentation, archival records, interviews, direct observations, participant-observation, and physical artifacts (Yin, 2009). All the sources have strengths and weaknesses and they are meant to be used in a complementary way. The advantage of using multiple sources of data is to develop "converging lines of inquiry" which lead to data triangulation (Yin, 2009, p.115) (also see section 3.7).

In the case of this study, I will conduct a descriptive multiple case study. The overall study will look at three cases: families, jewellery hobbyists and steampunk enthusiasts. Within each case, each participant will be a subunit of analysis. This case study design is referred to as multiple case and embedded design in Yin's (2009) terms. The rationale for using a multiple case study design is to be able to replicate or contrast results between the cases. The embedded design will provide an in depth description of individuals within each group, leading to each case's own conclusions, before being compared to the other cases.

3.3. Research questions and propositions

The research questions and the propositions are drawn from the literature review (chapter 2) I conducted before starting the research. The propositions are particularly important in case study research because they orient the data collection as well as the

data analysis. I present here the propositions as they were at the beginning of the research and, in chapter 6, I revise them based on the data and the analysis I conduct after my study. These propositions are the backbone of the thesis. According to Maxwell (2005), the conceptual framework is an initial model of what I think is happening with the phenomena I intend to investigate.

The main research goal is to understand ***the practices of everyday designers.*** In order to start a description of the non-professional design practices, I study three groups of non-professional designers: families, hobbyist jewellers, and steampunk enthusiasts. Each case does not represent a specific category of non-professional designers; rather they are an illustration of different types practices.

More specifically, I ask:

MQ1: *What are the similarities and differences between the **practices of design** of families, jeweller hobbyists and steampunks?*

MP1: There are different types of designers within the realm of non-professional designers. It ranges from families, to hobbyist jewellers, to steampunk enthusiasts. The groups are similar in that they all practice everyday design, appropriation, and design-in-use. All groups engage in an alternative way of consumption, production, and use. What differentiates the groups is the motivation (a generating principle that includes goal, intention, and need) for making or transforming something. This motivation influences all the other aspects in their practice (be it tools, materials, or the social aspect of practice, for example).

To answer this general question, I have developed a series of 8 sub-questions to orient the data gathering as well as the analysis. These questions were developed following the writings of theorists of the practice theory:

Q1: What are the differences in the **goals and motivations** in each case?

P1: Family members practice design-in-use as part of a routine. Actions are meant to make everyday life more convenient within a spatio-temporal context. Hobbyist jewellers design and make things with the precise goal of making unique projects. Steampunk enthusiasts also aim at making unique projects to wear in conventions and

costume play events (cosplay). Additionally, they can use their projects to challenge the existing mass production and consumption model.

Q2: What are the differences in the **outcomes** in each case?

P2: Outcomes in families are ad hoc appropriations and systems developed over time with common household materials. Jewellers create unique pieces of jewellery, and steampunk enthusiasts make costumes and machines that fit the ideology and aesthetics of the steampunk subculture. Steampunk outcomes are also online documentation of the process and finished projects.

Q3: What are the differences in the **materials** used in each case?

P3: The everyday designer in families uses materials found at home which are ready at hand to serve his or her ad hoc projects (or evolutionary systems). The hobbyist looks for and purchases specialized materials in order to achieve the practice of their hobby. Steampunks reuse and collect materials that can be transformed in what they envision as their project.

Q4: What are the differences in the **tools** used in each case?

P4: Everyday designers at home use no tools other than hands or basic household tools such as scissors or pens and markers. Hobbyist jewellers try to use appropriate (or professional) tools for jewellery making. Expert amateurs are comfortable using handyman tools and more specialized tools for fabrication.

Q5: What are the differences in the **competences and skills** needed in each case?

P5: Family members do not require particular skills in their practice except common sense and basic manual skills. The hobbyist jeweller needs competences related to jewellery making, which will be mostly specialized. The steampunk enthusiast is able to juggle with different competences and skills he can apply to a high range of situations. For all, the current skills an individual possesses influence what strategies are chosen for a project.

Q6: What are the differences in the **strategies** used in each case?

P6: In order to engage in the practice of design, family members reuse objects as-is, in an ad hoc manner to fit his present needs and develops systems over time to fit his routines. The hobbyist jeweller uses known professional techniques, adapted to his own home environment. Finally, the steampunk enthusiast tries, uses, and mixes any techniques to achieve his project.

Q7: What are the differences between the **ways of learning** techniques in each case?

P7: The families learn how to make things through intuition and trial and error. Jewellers learn their practice through classes and in the act of doing. Finally, steampunk enthusiasts look for different resources to learn how to make things (online, through other, and based on experience).

Q8: What are the differences between the **ways of sharing** techniques in each case?

P8: Family members do not typically share his practice with others outside the home. Depending on the community surrounding a hobbyist jeweller, there might be sharing through online tools and through craft fairs. Finally, steampunk enthusiasts who are part of a vibrant subculture have multiple ways of sharing projects and techniques through face-to-face and online opportunities.

The table below summarizes the propositions for the eight sub-questions.

Table 1. Summary of the case study propositions

	Families	Hobbyist Jewellers	Steampunk
Q1: Goals and motivations	Immediate needs and organization of the home	Make unique pieces of jewellery for themselves and others	Make unique projects for participating in Cosplay and challenging the existing consumption model
Q2: Outcomes	Ad hoc installations and systems	Unique pieces of jewellery	Costumes, machines and online documentation
Q3: Materials	Everyday materials found in the home	Purchased specialized materials in art stores.	Found and reused materials that can be transformed.

		Found vintage jewellery	Glue and paint too.
Q4: Tools	Hands and ready at hand tools	Specialized tools for jewellery making and replacement of expensive tools	Handyman tools and specialized tools
Q5: Competences and Skills	Common sense and basic manual skills	Specialized skills of jewellery making. Precise and high level for specific skills	High range of skills applicable to multiple situations
Q6: Strategies	Repurposing and reusing in an ad hoc manner or develop systems over time	Professional techniques adapted to home environment. Assembling.	Use, try and mix any techniques for making. Assembling and gluing.
Q7: Learning	Trial and error and intuition	Classes and learning by doing	Experience, online resources, learning from others
Q8: Sharing	Not outside the home, between family members	Maybe through online tools and craft fairs	Face-to-face meetings (conventions) and through online community

The case study questions and propositions are part of the chain of evidence proposed by Yin (2009). He argues that to increase the *reliability* of the case study, the researcher needs to maintain a Chain of Evidence from the research questions, to the conclusions of the study. An external investigator should be able to follow the logical steps between *research questions, case study protocol, citations to specific evidentiary sources in the case study database, case study database and case study report* (Yin 2009, p.123). Validity will be discussed in section 3.7 since it relates to data collection, data analysis and reporting.

3.4. The cases

The goal of this study is to explore the range of practices of everyday designers. In order to explore as wide a range as possible, I specifically chose three cases where I believe I will be able to highlight differences and similarities across the cases. While I have only selected three, there are many other cases of makers and designers. It is well known that artists and artisans appropriate and transform objects, however it is part of their professional practice and is deemed outside of the boundaries of this study.

Steampunk was chosen because it is driven by a philosophy questioning the current consumption model and therefore is likely to show a different view of the *user*. There is no professional equivalent to this practice. Steampunks already have a broad sharing system through conventions and websites to exchange ideas, techniques and visions. This group represents expert amateurs who share a common vision of the world.

Hobbyists who make things are common, they can range from cooks, model makers, painters, knitters, and people who collect stamps. Jewellers were chosen because the making aspect is central to the hobby (as opposed to collecting stamps) and long lasting (unlike cooking). Moreover, jewellery is open to using multiple materials and the look and feel aspect of the finished products is primordial. This group represents hobbyists.

Finally, families bring a perspective on the everyday life and on acts of making as part of people's routines. Families show how people have a creative ability to see the potential in objects and reuse them in different contexts. Families are seen as everyday designers.

3.5. Case Study Protocol

This section provides a description of the procedures I used to complete the study with each case. Every case was different, so I provide a specific description of the field procedures for each case.

3.5.1. Families

My study of practices of families draws upon a study that was conducted in 2005-2006 by Dr. Ron Wakkary with the goal of understanding the creativity of people in their everyday life. The original study is an ethnography of four families in East Vancouver, in BC. The families studied were two married couples (Ryan and Janis, and Dylan and Carrie) and two mothers with live in partners (Beck and Kerry, and Cate and Paul) with children from 2 to 13 years old. The original study was conducted in two periods of five months with more than 460 hours of observation and interviews (Wakkary & Maestri, 2008).

For this case, the data collection and analysis is the secondary analysis of the data collected in the ethnographic study of 2005-2006. The data collected contains a report of activities and observations for each meeting, as well as pictures and videos of artifacts or systems in the home. The conclusions of the original study (Wakkary & Maestri, 2008) identified patterns for design activities conducted by family members around the house. One of the outcome of original analysis was to describe family members as *everyday designers* (Wakkary & Maestri, 2007; Wakkary & Maestri, 2008). In this analysis, I observe more specific aspects of that design practice.

This data set follows the criteria of completeness of data, quality of data, and fit with secondary analysis questions proposed by Hinds and Vogel (1997) for assessing qualitative data for secondary use. I used the third approach the authors present for doing secondary analysis of qualitative date: *Reanalyze all or part of a data set by focusing on a concept that seemed to be present but was not specifically addressed in the primary analysis* (Hinds & Vogel, 1997, p.410). Data was collected about how the systems evolve over time, how members of the family interact with them, and how systems include appropriation of artifacts. Through these observations, practices of design of family members are described but not focused on within the scope of the first study. I retrieved information from the database about the techniques, the tools and the materials used, the skills needed, as well as the goals and motivations of family members.

3.5.2. Hobbyist Jewellers

The hobbyist jewellers study was the pilot study for this research. Participants were recruited through friends and acquaintances, and online posts through Facebook. A purposive strategy was used for the sampling of participants. The goal of the study is not to represent all hobbyists and achieve representation across socio-demographic variables, but rather to choose the participants that can add value and significance in portraying the practice of hobbyist jewellers.

I met with six hobbyist jewellers. Four live in the Greater Vancouver Regional District, BC, and two live in the Greater Montreal Region, QC. All participants are female. Their ages range from 23 to 50 years old. Their professional occupations are varied:

Lucia is a student of applied zoology, Sophie is a landscape architect, Tania is an elementary school teacher, Claire works in a yoga studio, Allison is an artist, and Veronica is an interactive arts and technology PhD student. All participants make jewellery as a hobby, and in one case, as a side business to her day-time job (Sophie).

When I met the participants, I presented myself as a Masters student and as a researcher. I make jewellery at home and have taken about two years of jewellery making classes as a hobby in Montreal. I did not want to influence how the participants would present their own work, so I preferred not to emphasize my own knowledge and experience of jewellery making.

3.5.2.1. Field Procedures

This section presents the detailed methods for the data collection during the fieldwork. Based on the case study propositions, the data collection techniques are meant to help collect the necessary evidence to support the ideas proposed.

The data was collected in three different ways. This method is inspired by Jenna Hartel (2010) who studied documentation management by gourmet cook hobbyists at home. The data collection methods are:

- *Semi-structured interviews* (the topics addressed are the same as the eight sub questions used to describe practices: goals and motivations, outcomes, tools, materials, competences, strategies, ways of sharing and ways of learning).
- *Photographic inventories* (including pictures of artifacts, materials, tools, environments, and actions, (also see Collier and Collier (1986))
- *Video walk through of artifacts or processes* (these are short videos where the participant explains in detail why and how an artifact was made (materials, tools, and strategies), or what the process is for making a specific type of object)

I conducted three sessions of approximately 90 minutes each with every participant. Fieldwork always includes a part where the researcher seeks to develop a rapport with the participant before getting to the core of the questions and interviews with the participants. The goal of this rapport building is for the researcher to gain the participant's trust which can lead to greater insight into the participant's world.

First contact –Getting to know each other. The first session allowed time for getting to know the participant and observing the practice of the hobby. Participants showed some of the projects they created to provide an overview of the extent of their practice. I asked questions about their background and the motivations for pursuing their hobby. These first meetings provided a base to structure questions and direct the observations for the next meetings.

Questions, observations and pictures. The second session supported more observation of the practice. I started to ask questions concerning tools, skills, materials and techniques in a semi-structured interview fashion (see appendix B for the list of questions).

Closure –Videos and last questions. The last session focused on closing the topics that were left open in the previous sessions, and to record (videotape) processes of making, with or without narration by the participant.

In every session, I took notes by hand of observations and answers to questions. Some interviews were done via Skype and were recorded (audio and video) (see 3.5.2.2). I also took pictures of the artifacts, tools and environments in order to construct a photographic inventory of the practice of this jeweller.

3.5.2.2. Face-to-face and mediated meetings

Participants in this study were living in Vancouver and in Montreal. This entailed different procedures between meeting in person and meeting via Skype, an online video conferencing tool.

Previous research has focused on methodologies for mediated interviews such as email, voice over internet protocols (VOIP), and video conferencing (Hine, 2005; James & Busher, 2009). Media that removed social cues such as gender, facial expression and intonation could lead to a different behavior than a face-to-face interview (James & Busher, 2009, p20). More specifically, Bertrand and Bourdeau (2010) present a study that aims at providing a methodology for researchers to use the recorded verbal and non-verbal data from the skype-to-skype interviews. Their results reveal that Skype can provide advantages such as the possibility to record the interview, to analyze the body movement, and the freedom of meeting with participants all over the world without

the cost (money and time) of traveling. Skype is also viewed as a facilitator for provoking interviews in more comfortable settings (the participant's home, for example), diminishing the difference between public and private space.

In this case, the structure of the three sessions remained the same, but the data collection differed slightly. For the face-to-face meetings, I took pictures and videos of specific artifacts and events. For the online meetings, I used a software called ScreenFlow to record the audio and video feed as seen on my computer. I took screenshots from the video at crucial moments (when using a tool, or when showing an artifact or material) as a way to create the photographic inventory. I also took notes by hand. Additionally, since the quality of the video feed was not always good, I asked the participants to take pictures of what they made, their work environment and materials, and to send them to me via email.

3.5.2.3. Pilot study

As mentioned earlier, the hobbyist jewellers study was the pilot study for this research. A pilot study is an important step in the research design since it provides an opportunity for refining the data collection procedures (Yin, 2009).

While conducting the study, I adjusted the timing for the questions, pictures and videos depending on the participant. I also realized some questions were missing (particularly questions about goals and motivations) and added them. I was able to add the questions in the next interviews, so even though the protocol was different at the beginning, I changed it in the process of finishing the interviews.

I also used the pilot study to evaluate the differences between face-to-face and Skype interviews. In general, the two methods allowed for both answering interview questions verbally as well as showing objects and techniques. Some technical issues such as poor quality video (or a poor connection), and inadequate lighting were usually overcome. If I was not able to see a particular action or object, I asked the participants to take a picture and to send it via email. One limitation of the Skype interviews was that I was able to see only what the participant would present in the frame of the camera. In face-to-face meetings, I was able to better assess the environment the participant was working in. In addition, online interviews required the participants to change the setting

of how they usually worked. They needed to make sure the camera could see what they were doing, they changed the lighting, and sometimes had to carry their tools and materials in front of the desktop computer. However, I believe these drawbacks were not central to understanding the practice of everyday designers; therefore, I went forward with this methodology for the steampunk case.

I conducted a preliminary analysis of the data collected and did not find major issues that needed to be changed. All the modifications had been done as I was still conducting the interviews, therefore resulting in a dataset that was relevant and broad enough to answer the questions I proposed. Moreover, the case study was informative in understanding the opportunities and limitations of using both face-to-face and mediated through Skype interviews. For these reasons, I decided to use the pilot study case as part of the three cases of the final study.

3.5.3. Steampunk Enthusiasts

The last case of this study is the case of steampunk enthusiasts. The steampunk community is very active on internet, particularly through Facebook pages and groups. I had two strategies to find participants across Canada. The first one was to post announcements on Facebook group pages to get in touch with participants. The second strategy was the network sampling technique. I asked the first participants if they could refer one or two other steampunk enthusiasts that they thought would be willing to participate in the study. Similarly to the jewellers, a purposive strategy was used for the sampling of participants in order to choose participants that can add value and significance in portraying the practice of steampunks. Eight participants were recruited for this case. Three live in the Greater Vancouver Regional District, BC, one in Edmonton, AB, two in the Toronto region, ON, and two live in the Greater Montreal Region, QC. Their age range from 28 to 52 years old, three are female and five are male. Their professions are very diverse: Frank is a family doctor, Aaron is a programmer, Christine, Mario and Adrian are prop makers for movies and TV shows, Angel is an organizational psychologist, Kenneth is an employee at a fast-food restaurant, and Tera is an administrative assistant in a University department.

I presented myself as a Masters student and as a researcher. I did not present myself as a maker or as a designer, even though I have an education in industrial design, and am a hobbyist maker at home. Similarly to the jewellers, I did not want to influence how the participants would present their practice of making. I also admitted that I did not know a lot about the steampunk subculture, encouraging the participants to show me what they know and make.

3.5.3.1. Field procedures

The field procedures for the steampunks were very similar to the procedures for the jewellers. Based on the pilot study, I used the same protocol and conducted three sessions of approximately one hour and a half with each participant. I used semi-structured interviews, photographic inventory, and video walk throughs. For the participants outside of Vancouver, I used Skype and Screenflow to conduct interviews, observe the participants, and record the meetings.

In addition to these data collection methods, I conducted an online presence observation, similarly to Tanenbaum et al. (2012) in their steampunk online ethnographic study. As Hine (2005) states, "the growing application of naturalistic approaches to online phenomena" (p.7) lead to the establishment of the Internet as a cultural context, which proves that ethnographic studies can be applied to this context. Steampunk enthusiasts are very active online, particularly in sharing information about projects and ideas. Some participants had multiple pictures of finished projects and work in progress online, on their blogs or on their Facebook pages. If the participants gave me permission to look at and use these documents, I downloaded them and added them to the participant's folder.

3.6. Data management and Analysis

Case study research entails collecting multiple evidence through multiple data sources. The protocol described earlier presents the specific data collection methods for this study. The next step is to organize the data in a presentable database. Yin maintains that creating a formal database that other investigators can review helps in increasing the *reliability* of the case study (2009, p.119). He notes that a database

includes four components: "*notes, documents, tabular materials, and narratives*" (Yin 2009, p.119).

In this study, I used case study notes and case study documents. Tabular materials refer to quantitative data, or survey answers (which are not present in the research design). *Case study notes* are my own notes that report on interviews and observations. *Case study documents* are documents collected through the study. They include pictures, videos, and websites in this case. *Narratives* are answers to open ended questions in the case study protocol once the data collection is completed. Narratives were not directly used in this study, but a journal was kept to record parts of answers through the analysis phase.

3.6.1. Reporting

After each interview, I transferred my hand written notes to a word document (see appendix C for a sample). In the process of transferring, I started to organize the information following categories that emerged as I reviewed my notes. The categories included philosophy of making, materials, tools, and by projects as well. With every interview transferred, I also added comments at the end of the documents which summarized the questions I still had about things I had seen or we had discussed. These were very useful for leading the next interview when we started the next meeting. This first step in managing the data helped in extracting the first themes from the meetings, in relation to the propositions of the case study.

I also managed images and videos taken from the meeting. If the meeting was in person, I transferred the pictures and videos taken to my computer. If the meeting was through Skype, I saved the recording (from Screenflow) of the video and audio to my computer as well as the screen shot images of key actions or objects showed at the camera.

3.6.2. Coding

Once I had done the report for each interview and placed all images and videos in one folder, I coded the pictures (from my camera, screenshots, and internet) and videos. I used the initials of the participant, the number of the session, the type of media,

and the number of the media. For example, te2-P004 would mean Tera E., session #2, picture #4. I used the letter P for pictures, M for movies and W for web content (images). I also read through my notes and assigned a code for each important piece of information. I either coded it as an interview (I) data, or as an observation I made (O). This coding system was developed soon after the first meetings with hobbyist jewellers participants as a way to identify each piece of evidence.

Coding the data is part of the case study process where the researcher reviews evidence to support or refute the propositions he made at the beginning of the study. By coding information, it is easier to come back to specific points and provide the necessary evidence.

3.6.3. Assembling the data

Once the coding was done, I organized a table where I could fit in the notes from the meetings, and the codes for the pictures and videos. This provided a visual way to look at the data all at once ant to compare the participants within a case (see appendix D for a sample).

The first table for the data was organized by project (or artifact) that the participants made. For each artifact, I filled in the following categories: material, provenance of the material, procedure, technique, tool, skills, goals and motivation, learning, and sharing. These categories were drawn from the interview questions, my observations of the practice, the artifacts themselves and through videos and pictures.

Moreover, I added tables on additional topics important to the practice but that are not necessarily attached to one artifact or another. These new pages included general skills, tools, using internet, and more specifically for the steampunk study: convention and community, fandom, and sharing.

3.6.4. Data analysis

In this thesis, I use the propositions (section 3.3) as the backbone of the analysis I present in chapters 4 and 5. The description of goals, outcomes, materials, tools, competences and skills, strategies, learning and sharing constitute the core of the

findings and nourish the discussion. By linking the literature about practice theory to the propositions, I hope to follow the chain of evidence through chapters 4 and 5 as I show evidence and construct the comparison between the three cases.

Traditionally, I would present the case reports separately, and then provide the comparison of the three cases. However, since I have eight specific points to discuss in each practice, I propose a different approach to presenting the qualitative data and analysis. I present the report for each sub-question (for example: materials) for families, hobbyist jewellers, and steampunk enthusiasts, and then the comparison. This means I describe and offer the comparison for each aspect successively. This approach will help prevent repetition and will also help direct comparison of each topic between practices.

For each proposition, I group evidence from the data collected into different themes. These themes were sometimes observed across the three cases (highlighting the similarities between the practices); conversely, they were sometimes unique to one practice (underlining the contrasts and differences between the practices). Each theme is described and supported by examples in order to not only name characteristics of aspects of practice, but to also describe the subtleties and variations of the same characteristic in different practices.

3.7. Validity and Reliability

Reliability entails that if a second researcher were to do the same research, following the same case study protocol, he would come to the same results as the first researcher (Yin, 2009, p45). I documented the procedures for conducting the cases with jewellers and steampunks, and the process I went through for the secondary analysis of the families in my case study protocol (see appendix A). Additionally, I created a database (tables of data) to present and regroup the data I collected, hence providing available raw data that would be accessible to later researchers (appendix D for a sample).

The quality of a research also lies on the external and internal validity tests. Internal validity is reached when causal relationships are established between conditions (Yin, 2009, p.40). Internal validity is applicable mainly to explanatory or causal studies,

therefore it isn't crucial for this descriptive study of everyday design practices. The external validity of a study is whether or not the results tally with reality. Multiple tests can be taken to make sure that the research design can lead to valid conclusions. Typically, generalization from the cases is the hardest element of validity to assess with case study research. As Yin (2009) explains, critics usually argue that one case is not enough to generalize. However, case study research bases external validity on analytical generalization rather than statistical generalization (such as in surveys).

Maxwell (2005) proposes eight strategies for discarding validity threats and increasing the credibility of the conclusions. I use five of those strategies 1) *Intensive, Long-Term Involvement*: my research design addresses this strategy by meeting with participants three times, and over a period of about one month. 2) *"Rich" Data*: "data that are detailed and varied enough that they provide a full and revealing picture of what is going on" (Maxwell 2005, p110). In this study, rich data comes from the thorough notes from each interview, the videos and pictures as well as the description of the observations. 3) *Respondent Validation*: also called "member check", this strategy entails asking participants to verify notes and conclusions to make sure there are no misinterpretations. I sent the interview reports to each of the participants for a close reading, as well as a preliminary version of the findings and analysis (chapters four and five). 4) *Triangulation*: Triangulation is typically assured by having at least three confirmations of an idea by different sources of evidence (Stake, 2006, p. 33). Multiple data collection methods are used in this study: interview, observations, video and photography, and online presence in the case of steampunk enthusiasts. Triangulation is the process by which researchers make sure that the evidence they collect is not over interpreted, that what they have heard and seen is correct; hence, it reduces the chance for biases arising from one data collection method (Stake, 2006). 5) *Comparison*: Comparison between participants in the same group (for example between members of the steampunk group) can contribute to the interpretability of the results. Comparison between the groups can also help define better what non-professional or everyday designers are in this case.

3.8. Summary

This study is constructed to investigate the differences and similarities between the practices of different types of everyday designers: families, hobbyist jewellers, and steampunk enthusiasts. In this chapter, I have shown how and why I plan to use a multiple descriptive case study approach. The case study procedures describe in detail the types of data I collect and I also present how I will aggregate and analyze the evidence to support the propositions of this case study (regarding goals, outcomes, materials, tools, competences, strategies, and learning and sharing methods).

4. Aspects of Practice: Goals, Outcomes, Materials, and Tools

The next two chapters present the case reports for each practice as well as an analysis which consists of a comparison between the three practices of families, hobbyist jewellers, and steampunk enthusiasts. For each case, I describe, in a narrative way, the goals, outcomes, materials, tools, competences and skills, and strategies (including strategies for learning and sharing). These topics were chosen based on the theory of practice as outlined by theorists Reckwitz (2002a), Bourdieu (1977), Schatzki (1996), and Shove (2007) (refer to section 2.2) and inspired the eight sub-questions and propositions I presented in the previous chapter. For each proposition, I present data that can serve as evidence for supporting or refuting it. The evidence presented comes from multiple sources of data such as interviews, observations, pictures, videos, as well as web artifacts.

Chapter 4 shows descriptions and comparison of the goals, outcomes, materials, and tools, setting the ground for understanding what the practices are and what they are composed of. Chapter 5 describes competences and strategies to further investigate the relationships between aspects discussed in chapter 4. The analysis of the data is divided between the two chapters (4 and 5) and is presented in each section (e.g. goals, materials, tools, etc.), after the data has been presented. This structure is adopted in order to provide the analysis as the data is being described and prevent repetition, a common challenge when dealing with qualitative data.

4.1. Motivations and goals

The first aspect presented in order to describe practices are the goals and motivations that practitioners have to make and reuse things. Motivations are the generative principles behind practices: they stimulate and push people to take action.

Goals are what people want to achieve or resolve with their practice of everyday design. Motivations and goals are presented together in section 4.1.

4.1.1. Motivations and goals of families

Three main motivations and goals in families are discerned in this study: organization and task management, accomplishing necessary tasks, and supporting loved activities. The categories will be referred to as italicized phrases in the text (this structure will be used throughout chapters 4 and 5). In general, the actions of everyday designers in families are propelled by their immediate needs to help carry out daily routines.

The practice of everyday design in families generally aims at supporting the current lifestyle of family members. Appropriations of objects and their transformations are rarely the focus or the reason for making; rather, making is used as a way to facilitate other activities in the home. A first goal is *organization and task management*. Families often create systems that help the family members remember tasks or events. In a video walk through (EC_Evw_Munroe_07-03-15_session1_media_012.AVI), Beck explains how she changed from using a day journal to a calendar because her life is more "public property" now, meaning that she and her partner have to share their schedules to know who will take care of the kids at different times in the day and week. Activities are also marked on the calendar, and the use of arrows show continuous activities, such as their son's swimming lessons or his spring break.

Accomplishing necessary tasks is also a motivation for modifying things in the home, or reusing objects in different ways. For example, Cate uses the railing to hang washed clothing pieces that can not go in the dryer (figure 1).

Spontaneous and temporary actions of appropriation help families move from one activity to another, a necessity as well. The researcher's observations shows that in Lori and Abe's family, it is common to leave artifacts by the door, such as garbage, Abe's equipment for a music night, or a lunch kit as a way to remember to bring them outside. Another example shows how Cate's family moves objects from the table to the adjacent halfwall to make space for an upcoming activity (for example, changing from painting toy characters to eating) (figure 2).

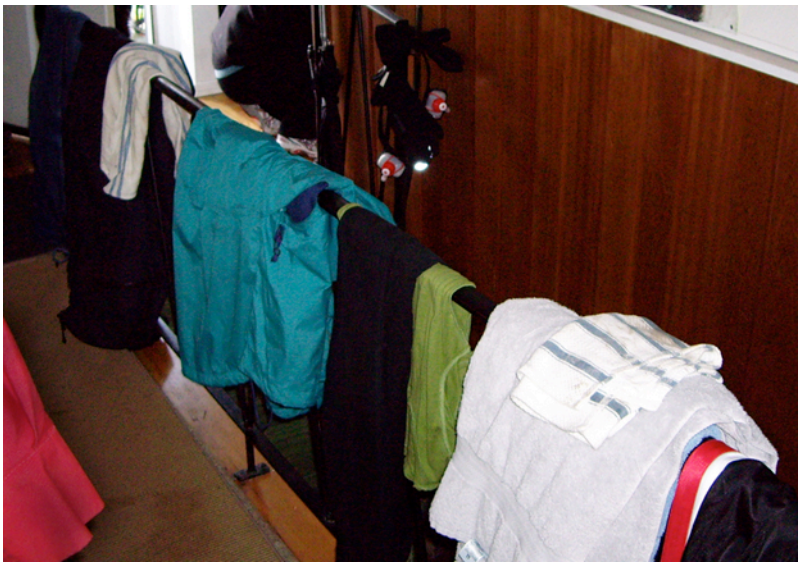

Figure 1. Drying clothes on railing (image from original study)

Figure 2. Cate and Paul's halfwall (images from original study)

Additionally to *accomplishing necessary tasks*, appropriation and making are also used to *support loved activities.* For example, Cate explains that she puts a lot of effort in organizing her recipes because she "loves cooking", as well as finding and trying new recipes, as she explains in a video walk through (EC_E_king_06-04-25_session1_video_004.AVI).

In brief, the motivations for appropriating and reusing objects and surroundings in families are to negotiate their daily lives, particularly the necessary activities, but the loved ones as well. Organization in the house as well as time and event management are also goals shared across the families.

4.1.2. Motivations and goals of hobbyist jewellers

Goals and motivations for hobbyist jewellers can be categorized in four sections: making unique jewellery, personal need and interest in making, aesthetic motivations, and opportunities for selling. For hobbyist jewellers, the motivation resides in the possibility to accomplish something unique and beautiful with their own hands.

A first goal shared by all the jewellers in the study is the goal of *making unique pieces of jewellery* for themselves and for others. This principle is supported by the feeling that something made by hand, and by someone you know is more special and meaningful than what is available to buy in stores. In an interview, Sophie recalls creating a necklace with a miniature pocket knife for her sister and how this was more special than creating the other pieces she sells through an online store (www.etsy.com). Moreover, Veronica explains that the conceptual part for making jewellery for family and friends is the hardest. She says that she

> need[s] to be observant of what they would wear, and what they like. It is very different from a mass production model, where you make 60 or 75 at a time, and the goal is to make the production cheap and fast. As a hobbyist, a necklace can take multiple hours. (interview 2)

Lucia adds : “I also make jewellery to be able to choose what I wear. I am disappointed in what is available commercially” (interview 1).

A second goal shared amongst the hobbyist jewellers is the personal need and pleasure for *making things with their own hands*. Most jewellers have engaged in other types of crafting before, and for them jewellery is one of multiple ways of self expression. Personal needs range from ‘being bored’ (Tania) to using jewellery making as a way to relax and ‘ground oneself’ (Veronica). For others, the simple act of assembling things brings satisfaction to the hobbyists (Claire and Veronica). For example, Allison says that discoveries and successes in techniques are the reason why she continues doing her work: when she figures something out, “it is almost more rewarding than the result itself” (interview 1).

Aesthetic motivations is also an important generative principle in hobbyist jewellery. Many projects stem from materials that were acquired because of their look and feel. For example, Allison bought dried rose buds because she appreciated that no

two were the same. She did not have a precise idea of her project, but the materials pushed her to think about how she could use them. Moreover, Lucia recreates miniature sculptures of food with Fimo clay, a colored clay that can be modeled by hand and hardens when cooked. In this case, the realism and the accuracy of the look of these pieces is a motivation in and of itself for Lucia.

Finally, the *perspective of selling pieces* is also a great motivation for creating more jewellery pieces. For example, the months of November and December are busy with preparing for craft fairs for Christmas (Claire, Allison and Sophie) and a greater demand on online stores (Sophie).

In conclusion, jewellers aim at making for the sake of making, but with considerations of who will wear the pieces (making unique pieces and making for selling). The look and feel of the materials and pieces can also stimulate the desire to make jewellery.

4.1.3. Motivations and goals of steampunk enthusiasts

In the steampunk practice, four motivations were identified: to embody an alternative to the current mass production cycle, to represent the unique aesthetic of steampunk, the pleasure of making, and the desire to participate in the steampunk community. In this case, the goals do not only encompass the activity of making, but also the philosophy and community behind the practice.

The possibility to embody an *alternative to the current mass consumption and production cycle* serves a core incentive for creating steampunk machines and costumes. Even if the “cool aesthetic” first caught their eye (Aaron and Adrian), it is the realization that they do not need to rely on mass produced goods that constitutes the heart of why they continue to be engaged in steampunk. Frank and Aaron state in interviews that with steampunk they are able to gain back a control over the fabrication of their everyday objects that was lost with industrialization. Some participants also explain how surprise and amazement are part of the realization that they are able to make much more than they thought they could.

The *unique aesthetic* of steampunk projects and costumes is a motivation in itself as well. Angel and Frank mentioned that they were interested and inspired by Victorian era fashion and design a long time before they knew that the objects they were collecting and making could be labelled as steampunk.

Similarly to jewellers, the genuine *pleasure of making* is also central to steampunk enthusiasts motivations. For example, Aaron explains that he first created a costume because he liked the looks, but he concluded that the DIY approach is what motivates him to continue making projects. The contact with materials and tools is seen as both fun and challenging and the achievement of projects brings great pride to the participants. The possible outcome of having unique pieces is also a motivating element for steampunk enthusiasts.

Finally, the perspective of *participating in the steampunk community* motivates all the participants. The steampunk subculture is highly active online (through blogs, Facebook pages, and websites) as well as through offline events such as annual conventions and monthly social and craft meets. Many participants created their first costume because they wanted to attend a convention. Participating in events is often augmented by the desire to promote the steampunk ideology and values. For example, Kenneth explains that he evolved from attendee to volunteer at the fan table and finally to sharing tips in panels at subsequent conventions. The possibility to share techniques and to inspire others is definitely an incentive for individuals to exchange with others, especially because it provides the opportunity to be inspired and learn as well.

In short, steampunks design and create costumes and machines because they enjoy making in the first place, but also because it can help them in participating in a community that reconfigures and proposes a different way to see the consumption and the production of objects and technologies.

4.1.4. Analysis: Comparing motivations and goals

This section compares the goals and motivations of each case. Table 2 presents a summary of the goals and motivations for each practice.

Table 2. Comparison of goals and motivations

Families	Hobbyist Jewellers	Steampunk Enthusiasts
Organization and task management Accomplishing necessary tasks Supporting loved activities	Making unique jewellery Pleasure of making Aesthetic motivations Opportunity for selling	Alternative to production model Pleasure of making Unique aesthetic Participating in steampunk community

In general, evidence shows that everyday design in homes is propelled by immediate or long term needs to pursue activities in the home for family members. Families appropriate out of necessity most of the time. Conversely, hobbyist jewellers and steampunk enthusiasts are two groups where the act of making can be an incentive in and of itself for pursuing their practices. In other terms, jewellers and steampunks enjoy making and have the luxury of having the time, the resources, and the space to accomplish projects.

For jewellers and steampunks, the aesthetic aspect of the creation is important; the look and feel of the final piece is well thought and can serve as a motivation for the making. In families, the appearance is generally not as important as the functionality of the system designed or the appropriated artifact.

The practices of jewellers and steampunks are different in the ideology supporting the movement of making. For steampunk practitioners, the idea of an alternative world where technology can be treated differently helps generate ideas and creates guidelines for costumes and machines. In the practice of hobbyist jewellery, there is no organized philosophy or trend that directs action. The motivation is intrinsic to the jeweller and the possibility to offer jewellery pieces to friends or customers is part of the goals of this practice. Particular to the steampunk community is the goal of sharing techniques and outcomes, compared to the practices of families and jewellers which are more individual.

Overall, goals can range from pure convenience and functionality in families, to the pleasure of making for jewellers, to a reactive movement to the current homogeneous consumption model for steampunks.

4.2. Outcomes

Outcomes of practices are the products that come out of everyday design. Outcomes are generally objects or systems, but can also be information sharing and online documentation.

4.2.1. Outcomes in families practices

I present outcomes of everyday design in families as three types: complex and established systems that develop over time, actions embedded in routines, and ad hoc (spontaneous and temporary) installations.

Generally, *systems* are constantly evolving and aim at un-cluttering the home environment or serving as supporting reminders for family members. The system of a three-tier hanging basket, a chalkboard, an agenda, and lists and notes demonstrate the complexity of how these elements are interrelated (figure 3). In a video walk through (Noric_06.04.17_MEDIA_003.AVI), Lori explains that all these elements work together: she writes on the chalkboard the upcoming events for the week as well as things she will need to buy when she goes to 'the Drive', a commercial street in East Vancouver. The same day, or one day before, she writes down the list on a note pad and places the list in the lower basket. When she leaves, she takes the list and places it in her wallet. When she comes back, if there were things she didn't get, she replaces the list in the basket in the hope that Abe, her partner, will get them.

Systems are also created to help organize objects such as toys, spices, recipes, and important papers and information.

Moreover, actions are not always part of systems, but are sometimes *embedded in routines* of families. Leaving things by the door as a reminder to take them out is a common action routinely used by family members in different households. Other examples include creative places to store things such as pots in the oven to save cupboard space (Lori). Uniquely using parts of the architectural structure of the home was also part of routines such as how Cate uses the metal railway to suspend clothing for drying.

Figure 3. Three-tier basket and chalkboard (images from original study)

Finally, the practice of everyday design also materializes through *ad hoc installations*. Here, I refer to actions that happen because of the place, moment and need in a spontaneous way. Observations show that ad hoc acts happen a lot during cooking where cutting knives are used to turn chicken in the pan (Cate), a glass is used to measure rice (Kerry), and other substitutions happen without questions asked. Using chairs to hang jackets or as tables were also observed and documented in the original study (Wakkary & Maestri, 2008). Brief, ad hoc acts can be motivated by convenience, laziness, or to preserve other things (saving plates) and subscribe to rules of making-do.

In general, the physical outcomes are to reuse objects without modifying them (reuse as-is) and giving them new functions, or new meanings by placing them within systems, routines, or quick on the spot installations.

4.2.2. Outcomes in hobbyist jewellers practices

Outcomes in the practice of hobbyist jewellery are pieces such as necklaces, bracelets, earrings, and small crowns. I distinguish two poles and a continuum of pieces in between to describe the types of outcomes: *assemblage, augmentation,* and *modeling*. In addition to this continuum, outcomes also include online blogs and stores.

Figure 4. ***Assembling: Seven polished rose quartz points assembled on a gold tone chain (Sophie) (image from Sophie's Etsy store)***

Assembled pieces require no gluing and offer the possibility to be disassembled without breaking any parts. Examples include materials such as loops, hooks, chains, beads, stones, or pendants. Most of Sophie's practice revolves around making compositions and assembling parts such as a pendant composed of rose quartz points and gold chain (figure 4). Also, Allison's work with silver wire wrapped around stones can be described as an assemblage (also see figure 11).

Moving along the continuum, the technique of *augmenting materials* is non reversible and requires the use of an adhesive to join or cover parts. Examples include the rock and small characters pendants by Sophie (see figure 16) and epoxy molded pieces by Veronica. Moreover, Allison augments her dried rose buds with epoxy as a way of preserving them longer (figure 5).

Finally, *modeled pieces* are also potential outcomes of the practice. Lucia mainly works with Fimo, a soft colored clay that hardens when cooked, to recreate miniature versions of everyday objects (usually food) (figure 6). Tania uses thread to create tatting (a form of crochet/knitting to make lace) pieces for earrings and necklaces (figure 6).

Figure 5. ***Augmenting: Epoxy pieces (Veronica); Epoxy coated rose buds (Allison) (images by Audrey Desjardins)***

Figure 6. ***Modeling: Fimo earrings (image by Lucia) and tatting (image by Tania)***

Often, jewellers create small series of similar pieces with the same materials, such as rose buds, beads, feathers, or stones. Finally, as a way to support her side business, Sophie created an etsy store[1] to sell her work, as well as a blog[2] to keep in contact with her buyers. She is the only participant to use online artifacts to support her material practice.

[1] http://www.etsy.com/shop/CAMPandQUARRY

[2] http://www.campandquarry.com/

In brief, outcomes are either jewellery pieces (as part of a continuum between assembled and modeled), or, more rarely, online blogs and stores to show the jewellery pieces. Pieces can carry minimal material transformation in assembled pieces, or show major changes in modeled pieces.

4.2.3. Outcomes in steampunk enthusiasts practices

In the practice of steampunk, outcomes are *costume parts* such as armbands, skirts and shirts, *machines and accessories* for costumes, and *steampunk objects*. Online photo albums and blogs are also outcomes observed in the steampunk group.

Costumes are a large part of the outcomes of steampunk practice. Tera focuses mainly on sewing skirts, dresses, bloomers, and other pieces that she can wear at conventions and events (figure 7). Some participants (Aaron and Kenneth) use pieces found in thrift stores or worn in different events to create costumes.

Figure 7. Tera's costume (image by Tera) and the CELL by Aaron (image by Aaron)

The CELL (Compact Electromagnetic Linguistic Launcher), a creation of Aaron, is a great example of a machine constructed to be the focal point of a costume (figure 8). During an interview, he explained the origin of this machine that he now wears on his back, as part of his costume:

> The idea was to recreate a mobile device for communicating, this is also in reaction to the fact that today everyone has a cellphone, but this was unimaginable in that era. I wanted people to react and realize what technology we have today. I also make the joke that I only created one machine, so I can't communicate with anyone now. This is the ironic and funny side. It was also important that my machine had some functionality to it such as the piston, the lights, and the gears rotating. (interview 1)

Other pieces are created without the intention of being worn, but that still fit the steampunk ideology and aesthetic. These are classified as *steampunk objects*. Frank created a small bug that can carry messages, and Adrian is in the process of making a steampunk sea turtle skull (figure 8). Moreover, both Frank and Adrian have transformed a computer screen by changing the frame, the base, the buttons, and adding a one-way mirror on the screen to transform it into a steampunk screen. Transforming computer screen frames are often seen in steampunk practice (Tanenbaum et al. 2012).

Machines sometimes reach a high level of complexity, mixing different types of materials, including electronic parts. Christine and Mario created a steampunk dog machine called M.U.T. (Mechanical Universal Tracker) (figure 9). It took them about two months to build, working on it during evenings. It includes multiple pieces, and can be activated by a controller that makes it walk, wag the tail, move the head and bark (cm2-M001).

Figure 8. Sea turtle skull (image by Adrian) and Small bug (image by Frank)

In all cases, participants mentioned the freedom steampunk allows them. In comparison, other Costume Play performances (CosPlay) costuming requires participants to recreate a well known character from comic books, science fiction shows or from real historical periods. In steampunk, all objects made are original and one of a kind pieces.

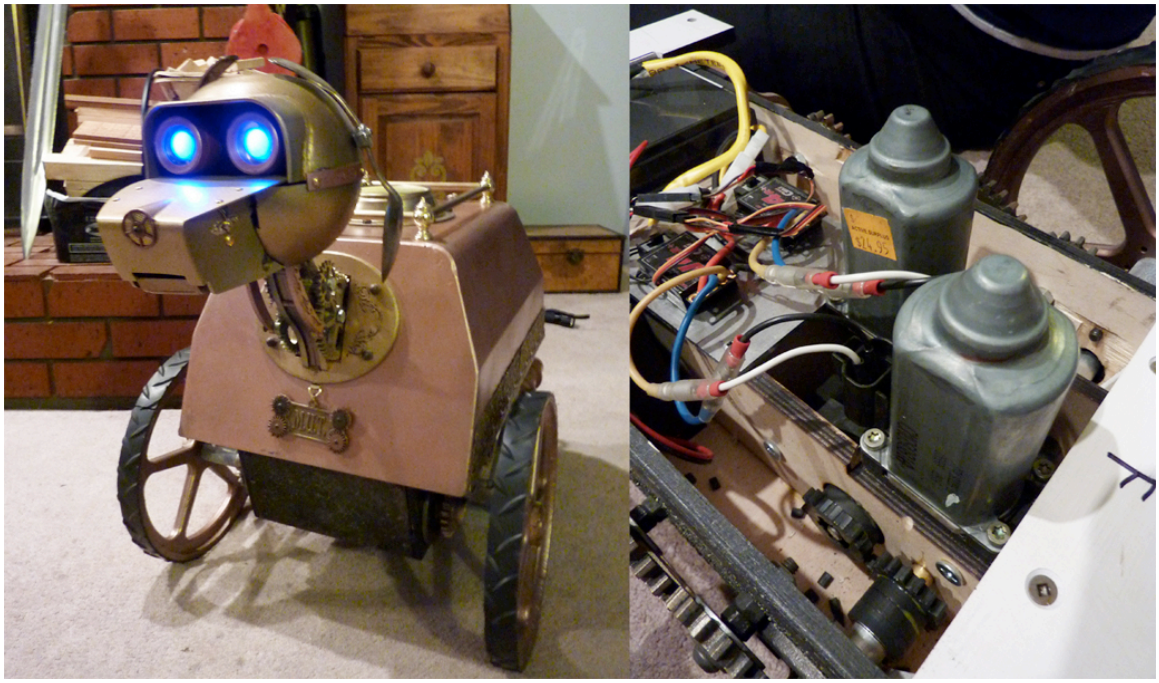

Figure 9. M.U.T. and its interior (images by Audrey Desjardins)

The outcomes can also be online artifacts such as photo albums on Facebook, personal websites, and blog entries and live events such as panels in conventions. Tera is the only participant who has a blog[3]. She presents posts about the process of making her sewing projects, commenting on where she finds inspiration and materials, the steps for making the project, the errors she makes and the solutions she finds.

[3] http://steamwenchsalon.blogspot.com/

In short, steampunk outcomes focus on the costumes and machines used in events and conventions, but are also aiming at documenting and sharing the making process of these objects.

4.2.4. Analysis: Comparing outcomes

Table 3. Comparison of outcomes

Families	Hobbyist Jewellers	Steampunk Enthusiasts
Systems Actions embedded in routines Ad hoc installations	Jewellery pieces: Assembling; Augmenting; Modeling	Machines and accessories Costumes Steampunk objects Online artifacts

The comparison of these three practices of everyday design shows that outcomes are unique and appropriate to each context. Firstly, the outcomes are found to reflect the goals and motivations described in section 4.1. Families' outcomes support other activities (spontaneously, or as developed over time). On the other hand, jewellers and steampunks make things which can then stand for themselves.

Jewellery practice is distinct from the other two based on the fact that jewellers create series of one kind of objects compared to singular objects in steampunk and family practices. Jewellery making as a hobby is sometimes used as a way to relax and free one's mind, so the repetitive action of making similar pieces is well suited. For example, Allison shows her process for coating rose buds with epoxy in a video, and she mentions how she makes a series of them until "she has enough or is tired of it" (ah1-M002.MOV).

In this comparison, I use the continuum observed in jewellery practice to also include family and steampunk practices. Outcomes range from assembled, to augmented, to modeled.

These qualifiers are not strategies, but characteristics of how the outcome pieces are made. Families are at the left side of this continuum, and we could also add reusing objects as-is to the far left. Steampunks can fit in augmented and modeled parts of this continuum. This distinction can also be used to describe strategies for making, and will be discussed more in chapter 5. As we will see in the next sections, the more the

outcomes are towards the right side (modeled), the more skills and tools are necessary to accomplish the project.

Finally, online outcomes are different between the practices. In families, they are non-existent. In jewellers, it is present only for one participant who is more serious about her hobby since it is a side business. Finally, it is common to share pictures and projects with others in the steampunk community.

4.3. Materials

In everyday design practices, people are known to resource many different objects and materials to make or transform things. Materials can be everyday objects, or can be used from scratch.

4.3.1. Materials in families practices

Most design actions in the house are to reuse certain objects as-is, hence the materials of everyday design practices are mainly common household objects. Objects can be categorized as architectural structures (e.g. door, half wall), furniture (e.g. fridge, chair), everyday objects (e.g. knife, bowl), and garbage (e.g. food leftovers, milk carton).

In order to further describe materials in everyday practice, I discern four attributes qualifying the objects. Objects that are *flat* invite family members to place other objects on top of them. For example, the top of the fridge was often used as a surface to either hide objects from children, or as a place to leave documents or objects that did not have another storage place. This finding was presented as part of the initial study (Wakkary & Maestri, 2009) and similar conclusions were drawn from this second analysis of the data. Objects that were *hollow*, or in the shape of a bowl or container, are used to contain and gather other objects or papers. For example, Cate uses empty milk cartons as a way to collect garbage for the day because they are not recyclable, and “it takes up too much space in the garbage otherwise” (EC_E_king_06-03-24_session1) (figure 10).

Figure 10. Milk carton as material (image from original study)

Objects that have *protrusions*, parts that reach out of the main object, are mainly viewed as places to hang things from. Chairs and stair posts are commonly used to hang jackets, and stove and fridge handles to hold dish clothes. Lastly, *thin and flexible* materials are used to cover and protect surfaces. For example, observations show that plastic bags (Kerry) and newspapers (Cate) are used to protect tables from glue or paint in craft projects.

Finally, there are exceptions to household objects as materials. When not using an as-is strategy, family members use labels, scotch tape, glue, cardboard, and paint as materials for simple projects.

4.3.2. Materials in hobbyist jewellers practices

I first describe the types of objects used, and then the attributes characterising these materials in the practice of hobbyist jewellery making.

Firstly, I make the distinction between two types of material: found objects as materials and raw materials. *Found objects* include pieces of vintage jewellery such as metallics chain, medallions, pendants, and stones. Found *natural materials* are also used, such as dried sea stars and dried rose buds. Other artifacts such as small characters for model making, small metal crosses, and silk flowers are also used. *Raw*

materials, or materials from scratch, include metal wire (silver, copper, brass), metal plates (brass), beads (acrylic, metal, glass, stone), thread for tatting, feathers, and Fimo. Epoxy is also used to coat objects, or to mold pieces. *Basic jewellery pieces* are also used in many cases, such as hooks for earrings, pins with loops or with flat ends, loops, and chains.

In general, in assembled pieces, the hobbyist jewellers uses rigid materials as the center of attention of the piece and flexible parts to make connections between the components. For example, in the making of the pendant with rose quartz, the stones are rigid, and are the focus of the piece, but Sophie uses metal loops which are easily opened and closed with pliers to connect the stones on a pin to the chain (refer to figure 4). Similarly, Veronica uses epoxy as a flexible material to contain sea stars to make a pendant. In the case of all modeled pieces such as tatting and Fimo, the materials are chosen because they are flexible and versatile.

The shape, weight, color, texture, and size are all important attributes that influence how the jewellers assemble and model pieces. Color, texture and shape are considered for their aesthetic qualities when creating compositions. The shape and weight are considered in relation to how a person will wear the jewellery piece. For example, Allison creates pendants with stones wrapped in fine silver wire (figure 11). At the beginning of each piece, she decides what orientation the stone should have to achieve the right visual and physical balance.

Finally, even if price is sometimes mentioned as a criteria for buying materials, accessibility is more important. For example, Claire uses feathers to create earrings and necklaces. In her case, she mentions not being a fan of feathers, but because her friend's mother had a large quantity to share, she decided to use this material. On the other hand, Sophie tries to find materials in rare and diverse places in order to create pieces that people will truly see as unique. She spends a great amount of time resourcing materials in art stores, garage sales and anywhere she travels. She says: "A big part of making the jewellery is about finding the materials. It is about finding things that people have never seen before". (interview 1)

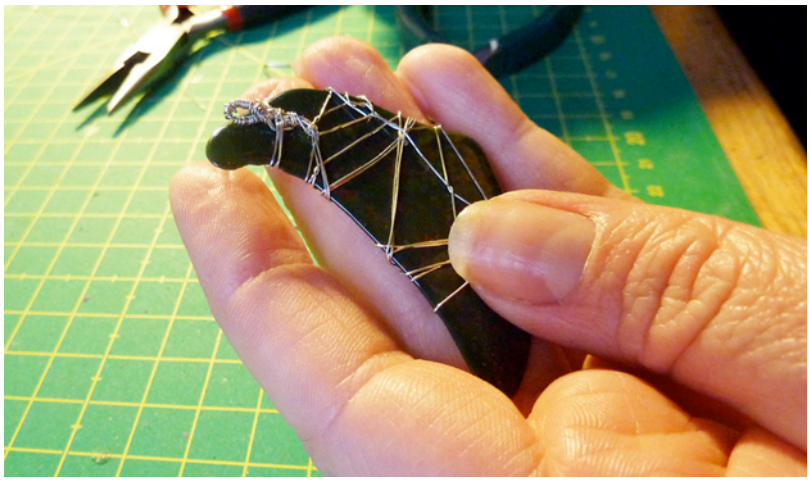

Figure 11. Blood stone wrapped in silver wire. (image by Audrey Desjardins)

In brief, hobbyist jewellers resource found and raw materials, as well as basic jewellery parts to compose their projects. They are able to balance rigid materials with materials they can transform in order to make combinations that support the aesthetic they want.

4.3.3. Materials in steampunk enthusiasts practices

Similarly to the practice of jewellery making, in the steampunk practice materials are either found artifacts or raw materials. In either case, materials are acquired over a period of a few months to multiple years at flea markets, garage sales, garbage, antique shops, second hand stores, and Ebay. When looking for materials, steampunk enthusiasts specifically search for particular aesthetic qualities and functional attributes. Firstly, participants look for materials that represent the Victorian era, and therefore the steampunk aesthetic, such as brass, copper, leather, and old wood. Steampunk classic artifacts like gears, pipes, gauges, and old lamps are also collected. Unique shapes displaying curves and ornamentation are also acquired, independently from the color or texture, since, as Kenneth says, “everything can be painted!”. Objects that seem easy to disassemble are also chosen for the potential parts they held.

Clearly, a large variety of objects are appropriated and repurposed into steampunk machines and costumes. As an example, in the fabrication of the CELL, Aaron repurposes a basketball pump into a piston, a wine wood box for the core piece, a

Figure 12. The CELL: appropriated materials. (images by Aaron)

toilet ring to frame the porthole, and slow motors from cardboard displays for activating the key and piston (figure 12).

In some cases, participants are able to find real *antique objects* that can fit as part of their machines or costumes – even if they are not specifically from the Victorian age. Examples are old clocks, Edison bulbs, vacuum tubes, a sextant, a radio from the early 20th century, antique Russian goggles, and a 1917 pocket watch (figure 13). Raw materials such as metal plates and shafts, wood pieces, as well as fabrics are also used.

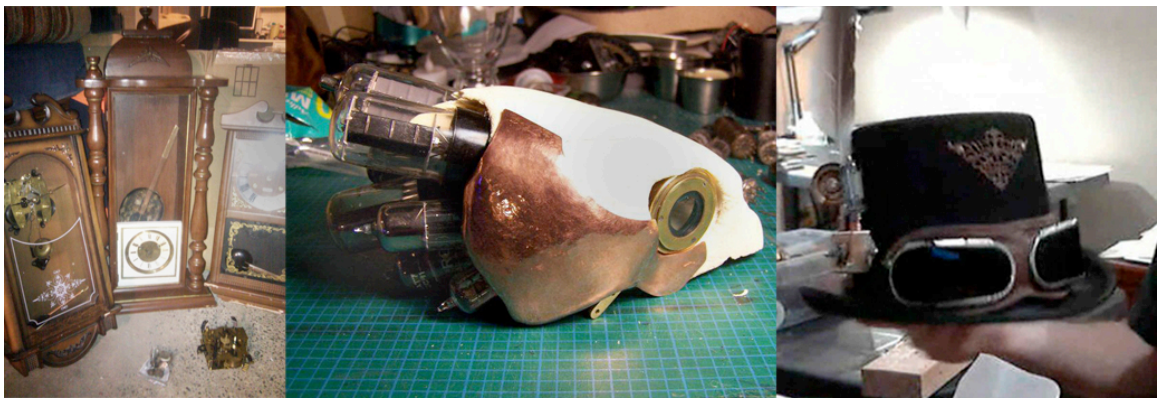

Figure 13. Antique materials: Old clocks (image by Aaron), vacuum tubes as part of a sculpture (image by Adrian), and antique Russian goggles (image by Audrey Desjardins)

In addition, the steampunk enthusiasts start to explore how to transform and reuse *electronic components* of artifacts. Not only they change the frame (for example, in the computer monitor screens Frank and Adrian made), but they also appropriate controllers for electric garage doors (to control Christine's M.U.T.). Frank also tries to use a CD player/alarm clock and use only the CD player parts by cutting out the unnecessary components. Simpler circuits with basic switches, resistors, LEDs and small motors are also created to animate the steampunk machines and costumes.

In short, steampunk enthusiasts resource a large variety of materials, and objects that they recombine and transform to make new objects and costumes.

4.3.4. Analysis: Comparing materials

Table 4. Comparison of materials

	Families	Hobbyist Jewellers	Steampunk Enthusiasts
Types	Common household objects	Found objects Natural materials Raw materials Basic jewellery materials	Found objects and antique objects Raw materials Electronic components
Attributes	Flat, hollow, protrusion, thin and flexible	Shape, weight, color, texture and size Accessibility	Steampunk materials (brass, leather, wood) Steampunk artifacts (gears, pipes, elaborate shapes) Easy to disassemble

In general, materials used in practices of everyday design are already existing objects that the everyday designer will transform into something else. Additionally, practices of hobbyist jewellers and steampunk enthusiasts have shown that raw materials can also be added or combined with found materials to create projects. In jewellery pieces and steampunk objects, attributes such as weight, color, and texture influence how the object can be used in a project. Particular to jewellery, this case was the only group where participants used pre made materials that were specific to the practice. Finally, steampunk practice is the most precise practice of the three, focusing on particular types of materials and shapes to fit the aesthetic of steampunk. The material attributes described intend to further define why these specific materials were chosen in each practice. It is important to remember that for families, the materials are

the common household objects, and that for jewellers and steampunks, the materials can come in a more raw form.

Skills will be discussed in larger detail in section 5.1, however, based on the observations about materials, and the propositions presented in chapter 3, a discussion about how materials and skills are related helps further describe the practices of the three cases.

The materials used by each group are closely related to the skills individuals perform. In families, materials are common everyday objects, because they don't need physical transformations, they can be reused as-is, and they are conveniently easy to access. Simple transformations that do not need specific skills are also observed, such as tearing open the top of a milk carton to be able to insert garbage.

In hobby jewellery practice, each individual masters different know-how for specific materials. It is rare to see jewellers master the work of many different types of materials. For example, Allison works with rose buds and epoxy, and stones and wire. Lucia works only with Fimo. Sophie works mainly with stones, chain and beads. Claire uses feathers and metal wire. They are all focused on a few types of materials

For steampunks, since the skills and abilities to work with a variety of tools are broader, the materials used were very diverse. Most participants still mention that when choosing objects they always reflect on how they can deconstruct and change them, but the range of techniques is a lot more important than for jewellers. Of course, within the community of steampunks, there are makers that are more comfortable with working with one type of material, such as fabric (Tera), and some that are completely at their ease while working with any materials (Adrian) such as leather, wood, metal, fabric, plastic, and resins.

This section shows how materials play a crucial role in the practice of everyday designers, be it from an accessibility and convenience perspective, seen in families, or on an aesthetic perspective, mostly seen in hobbyist jewellery and steampunk practices.

4.4. Tools

Tools are the objects used in order to help modify the materials used in everyday design.

4.4.1. Tools in families practices

In the practice of everyday design in families, in general, most of the materials used do not need a physical transformation to be appropriated. *Hands* are typically the only tools needed to reuse artifacts. However, exceptions include *household tools* such as: scissors, knives, markers, can openers, and glues, in order to cut, mark and join pieces. For example, Janis marks and labels different containers in her home as a way to keep things organized. She uses different markers and sticky labels to identify the content of baskets, bags, binders and even the inside of cupboards (figure 14).

Figure 14. Labels and markers as tools (images from original study)

4.4.2. Tools in hobbyist jewellers practices

In hobbyist jewellery practice, hands are the first tools used by the practitioners. In addition, objects around the house, glues, home made tools, and online tools are used to support the practice.

Before using any tools, jewellers use their *hands* to make and assemble things in their practice. Claire explains that only when hands fail to do something she turns to other tools. For example, in a video (cc1-M002.MOV), she wraps wire around feathers to

make earrings. She uses her fingers to keep the wire as close as possible to the feathers, and only when she needs more strength to press on the wire, she uses pliers.

A great variety of *objects found around the house* are used by hobbyist jewellers as a way of modeling the pieces they worked on. Claire uses various objects to wrap around and shape silver wire into earring hooks. She resources glasses, small bottles, and even handles of other tools she has like a hammer and cutters (cc3-M001.MOV). Similarly, in order to shape Fimo clay into miniature foods, Lucia uses her dissection kit from biology class, spoons, a pill bottle to roll Fimo, a straw as a dye, a pasta-making machine to flatten Fimo and mix colors (figure 15), and any other tool she finds ready at hand.

Jewellers also use different *glues* to assemble bits and pieces. Sophie uses epoxy glue to join little model characters into stone pendants (figure 16). Veronica uses epoxy as a casting substance to assemble found parts. She also uses an ice-cube tray as a mold to contain the resin and the pieces as they dry.

Additionally, some jewellers *build tools* to fit their precise needs. For example, Allison developed a system composed of tooth picks, cork board, books, and a home heater to support her epoxy coated dried rose buds (figure 17).

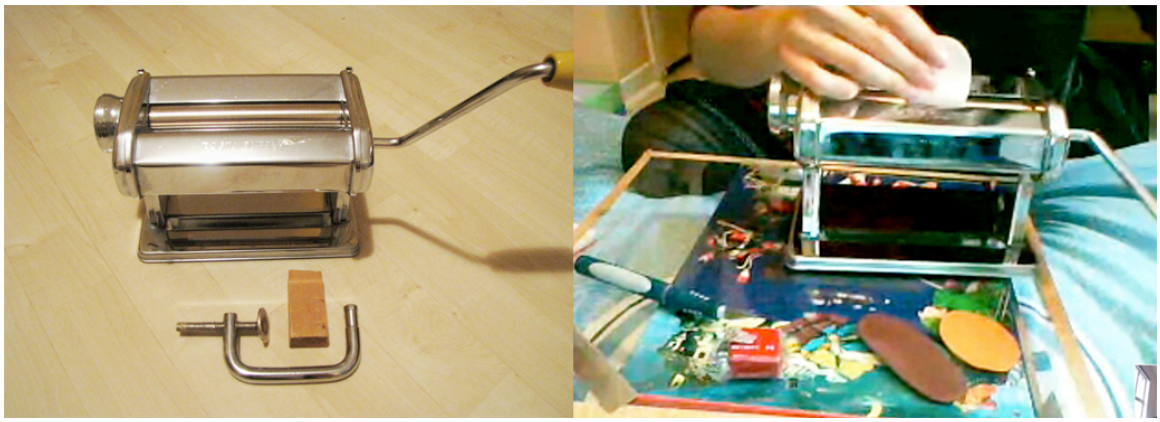

Figure 15. Pasta-making machine for Fimo modeling. (images by Lucia and Audrey Desjardins)

Figure 16. ***Using epoxy glue to assemble found pieces. (image by Audrey Desjardins)***

Figure 17. ***Drying rack for epoxy coated rose buds. (images by Audrey Desjardins)***

Internet resources like websites, online blogs, and stores are also considered as tools in the practice of hobbyist jewellers. Websites can bring inspiration for projects, information about techniques or what materials to use for projects, as well as tutorials presenting step by step descriptions for making projects. Tania uses multiple tutorials particularly when she started to do tatting.

Overall, although most hobbyist jewellers have basic jewellery tools like pliers and cutters, they use many other tools and objects that are borrowed from other fields such as household tools, kitchen tools, and craft tools. These findings are surprising and were not expected in the original proposition of this study, where professional tools were expected more than appropriated ones.

4.4.3. Tools in steampunk enthusiasts

Following the variety of artifacts and materials used by steampunk enthusiasts, they also utilize a wide range of tools. In general, tools are not specific to steampunk, they are also used as handyman tools, clock repair tools, jewellery tools, sewing tools and craft tools. I classify tools in this section based on the type of action they can achieve: *disassembling, measuring, joining, cutting, shaping, cleaning and finishing, protection,* and *inspiration*. However, similarly to jewellers, observations show that steampunk enthusiasts use their hands as basic tools for assembling, verifying and modeling parts.

Precision screw drivers are used to *disassemble* many artifacts acquired. Rulers and measuring tapes are used to *plan* and *measure* parts. Tools for *joining* are varied and adapted to many situations. Multiple types of glues such as epoxy, resin bond for plastic, gorilla glue for metal, fabri-tag for leather and fabric, and the hot glue gun are widely used by many of the participants. The hot glue gun is a tool that is either adored or hated by steampunk enthusiasts. It is recognized to be a great tool for quick fixes on almost any material, and it is also known to be used to fill in cavities and isolate parts of circuits (Aaron and Kenneth) (figure 18). However, some enthusiasts prefer the use of the ‘right’ glue for higher quality projects and durability issues (Mario and Frank).

Joining is also achieved with screws, nails, tie-wraps, sewing machines, duct tape, as well as soldering (copper, silver and gold torch soldering, as well as soldering iron with tin solder).

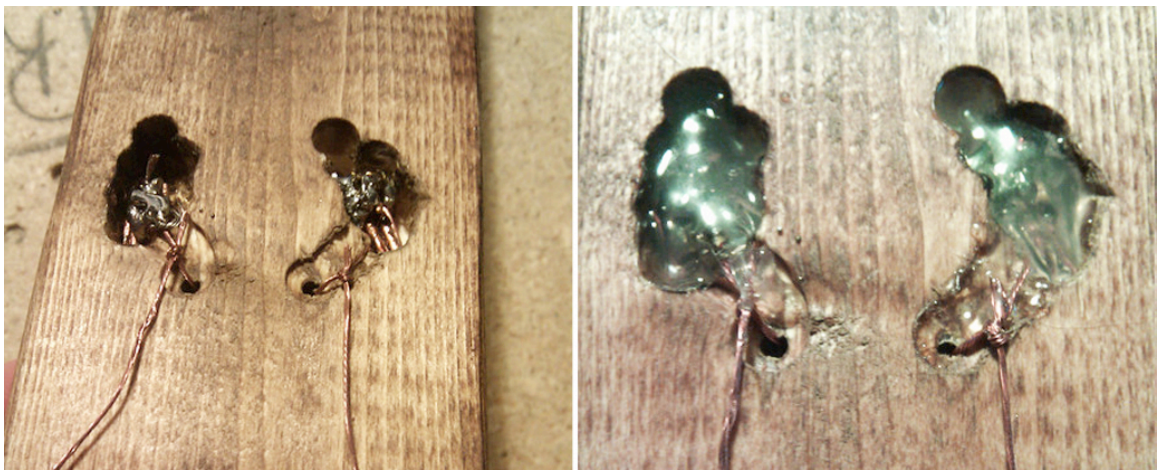

Figure 18. Isolating and supporting connections (in the arm of the CELL) (images by Aaron)

Cutting is used to separate pieces and to model parts. Metal and jewellery saws, jigsaws, scissors and cutters are used depending on the material. Additionally, the Dremel rotary tool is considered a favorite by some steampunk enthusiasts (Kenneth and Aaron) because, depending on the bit, it can cut, grind, pierce, sand, and polish pieces. *Piercing* is done on a press drill, hand drill or dremel.

In the making of the M.U.T, Christine and Mario had access to a CNC machine[4] because they were working on a television production at the time, as prop makers. This machine can cut and engrave very precise shapes on many kinds of materials.

Shaping (including bending, twisting, flattening, and wrapping) is generally done by hand, with the help of pliers, hammers, anvils, and occasionally heat guns. *Coloring* often meant to paint or apply a faux-finish on a material or on an assembled piece. Christine has a lot of experience in creating faux finishes that look like copper, oxydized copper, and brass. In a session, she explained how she uses three shades of metallic paint, and a green paint that she applies in thin layers to create the perfect match to real pieces.

[4] CNC machine: computer controlled machine that can cut materials following the specifications of a digital file

Figure 19. Homemade polishing machine (images by Adrian)

Finally, *cleaning and polishing* pieces requires the use of files, sand paper, and tooth brushes. *Protection and safety accessories* are also used, such as goggles, gloves and ear protection.

While some participants use tools they already owned, others modify or create their own. For example, Adrian made his own polishing machine with a motor, a mandrel, buffing wheels, and a cookie tin that he cut in half and re-soldered together to create a protection case (figure 19). This example demonstrates the ease with which Adrian can assemble and model pieces to serve any purpose.

Finally, tools to find inspiration include books and pictures, but are generally online systems such as Google for image searches and Facebook for seeing what other members of the community are doing. More specifically, Tera, a seamstress, visits online museum costuming collections to find inspiration and guidelines (since she does not use patterns), such as in the conception of her first bustle skirt (figure 20).

In brief, steampunk enthusiasts use many different types of tools as means to achieve their goals. Hands and common household tools are used, but more specific tools for disassembling, cutting, joining, shaping, and finishing are also used.

Figure 20. Inspiration image and finished bustle skirt (images by Tera)

4.4.4. Analysis: Comparing tools

Table 5. Comparison of tools

Families	Hobbyist Jewellers	Steampunk Enthusiasts
Hands Few household tools	Hands Household tools Glue Homemade tools Basic jewellery tools Online tools	Hands Tools for disassembling, measuring, planning, joining, cutting, shaping, coloring, cleaning and finishing Homemade tools Protection tools Online tools

In the process of making, practitioners use their hands constantly, with or without additional tools. More specific tools are used when more precision or strength is needed. Across the three practices observed, I discern a continuum within the variety and number of tools used. Families use very few tools, and when they do, they are generally common household tools such as scissors or knives. Jewellers have a broader range of tools, but they are mostly specific to jewellery making, crafting and household use. Steampunks, have the broadest collection of tools, generally encompassing handyman tools, but also jewellery, and sewing tools. It is evident that the tools used are in direct relationship with the materials used (and skills), hence, the continuum observed here maps the one presented in the materials section (4.3.4). The relationship between tools and skills will further be described in chapter 5.

Online tools are not used by family members, but are commonly used to find inspiration and explanation of techniques in both jewellery making and steampunk practice. This further separates the practice of everyday design in the home, which is more reactive to the environment, hence it does not need additional inspiration, from the pro-active and aesthetically concerned practices of jewellery and steampunk.

Common to the practices of hobbyist jewellers and steampunk enthusiasts is the creation and fabrication of tools to support specific activities. The tools made reflect the skills of the practitioner, hence, in general, tools made by steampunk enthusiasts required more knowledge of different techniques than jewellery making. For example, Adrian, a steampunk enthusiast, built his own polishing machine (requiring skills of cutting metal, soldering, and electrical know-how). Allison, a jewellery maker, made her drying rack out of cork, toothpicks and a heater, with no specific skills other than ingenuity. Making tools was generally motivated by either economical issues (a polishing machine is about $400), convenience, or because the necessary tool simply does not exist.

In brief, tools for pursuing practices of everyday design can vary greatly between almost no tools, to a complete workshop. In the process of making jewellery or steampunk artifacts, tools are used at almost every step of the way, from finding inspiration, to assembling and finishing the pieces. Section 5.1 discusses competences and skills within practices, and will further develop the relationship between those two aspects of practice.

4.5. Summary

Practices of everyday design in families, hobbyist jewellers, and steampunk enthusiasts have been described in terms of goals, outcomes, materials, and tools. Results and comparisons show that goals encompass convenience and supporting one's everyday activities, as well as the pure pleasure of making and the need to reflect on today's relationships with objects and technologies. Outcomes are specific to each practice, and can be described along a continuum of reused as-is objects, assembled, augmented, or modeled. Common everyday household materials are used in all three

practices, but jewellers add particular found pieces or arts materials, whereas steampunks look for objects that really expressed the steampunk aesthetic. Hands are common tools across everyday design practices. Additionally, appropriation of tools are common in both jewellery and steampunk practices. Finally, steampunk enthusiasts distinguish themselves based on the great range of tools used.

5. Competences, Strategies, Learning and Sharing

This chapter further portrays and compares aspects of practices of families, hobbyist jewellers, and steampunk enthusiasts. Competences and skills, as well as strategies for making, learning, and sharing will be discussed and compared in the following sections. Additionally, discussions of strategies show how all aspects of practice: goals, outcomes, materials, tools, and competences are intertwined and influence each other to create this larger unit of analysis which is practice.

5.1. Competences and skills

Competences refer to the different abilities needed to accomplish a project. Most competences are mental, for example, the ability to think creatively. Skills, on the other hand, are the capacity to take action, such as the skill of sewing.

5.1.1. Competences and skills of families

In families, competences that support everyday design practice are the abilities to see opportunities, iterate, adapt, and organize materials and information. The skills performed by families are in the realm of basic skills such as writing, cutting, tearing, and folding.

In order to accomplish most acts of design-in-use, family members show the ability to think creatively, or in other words, to *see opportunities* presented by objects ready-at-hand. For example, Cate recognizes that a phonebook has the right shape to stretch her calves after running and Kerry sees a toy hat as a container to move other toys to a different room. Both examples require seeing objects differently than for their original intent.

The ability to *iterate* and the ability to *adapt systems* are central to the practice of everyday design. Families have ever changing routines; hence, systems need to follow this constant evolution. An example is Lori's reminder system composed of a three-tier hanging basket, a chalkboard, an agenda, and a combination of lists and notes (see section 4.2.1). Originally, the three tier basket was meant to contain fruits and vegetables and the decision to buy the chalkboard at a craft fair was not connected to the reminder system. Their functions changed as her needs evolved and, with no specific plan, she started to use these elements as part of her reminder system.

Another example of an iteratively constructed system is Cate's recipe organization (also see 4.1.1). Cate started to create a second iteration for her recipe organization system because she was not satisfied with the first one (a classifier folder divided alphabetically). The second system she developed, in addition to classifying the recipes by topic (appetizer, entrée, and dessert) like in her first system, allowed her to create two folders, one with tried and loved recipes, and one with recipes to try. As she explains in the video walk through (EC_E_king_06-04-25_session1_video_004.AVI), the new system prevents her from losing small pieces of paper holding recipes: once a recipe has been tried and loved, she glues it onto pages of the folder.

Lastly, knowing how to *organize materials and information* is also important in order to support fast paced lifestyles. Parents have developed different ways to keep track of important documents by placing them in specific containers as well as identifying bins and baskets to help other family members find and place things. For example, Janis uses a basket for each child to leave important documents 'away from everything else'.

In relation to materials and tools, skills in everyday design practice of families include basic skills like *writing and drawing* to identify things, *cutting and tearing* (paper or cardboard), and *folding* (paper or fabric).

5.1.2. Competences and skills of hobbyist jewellers

In the practice of hobbyist jewellery making, the competences observed are the abilities to conceptualize, to see opportunities in materials and tools, to experiment, to iterate, and to be resilient and determined. Skills are generally related to small hand gestures and precision tasks.

Figure 21. Claire uses materials to envision what her necklace could look like (images by Audrey Desjardins)

The ability to *conceptualize* is shared amongst all hobbyist jewellers and is sometimes embodied through drawings or by playing with materials without assembling. For example, Claire places charms and chains on the table to see what a necklace could look like (figure 21). She moves the parts around to see different possibilities and then makes her choice. Participants mentioned in interviews that conceptualizing is often related to the need to emphasize artistic aspects such as composing and balancing textures, colors, materials and weight.

The ability to *see opportunities* refers to the ability of hobbyists to see objects and situations in ways that are different from their original intent, similar to what was observed in the practices of families. For example, Claire says that she likes working in different rooms of her house because the objects surrounding her are different and can lead to different appropriations. Similarly, Allison argues that the aptitude to "extrapolate what things could become" (interview 3) is also necessary when looking at materials and tools.

As demonstrated by many jewellers' projects, the ability to *experiment* is often at the heart of developing new techniques for jewellery making. For example, this is how I described in my field notes Allison's cycle of iteration and experiment for developing a way to pierce dried rose buds in order to add a hook (also see video ah1-M001):

> Allison started to pierce dried rose buds first with a pin, by pushing on it, and turning it, but it did not work very well. So she looked for a different technique to make a good hole in the buds. All of a sudden, she thought about heat. She grabbed a candle, and heated a pin. And it worked. She says: "flash of insight, I just kind of knew. I wasn't sure it was going to work". (meeting 1)

Figure 22. Iterative process: making variations of earrings with feathers (images by Audrey Desjardins)

The ability to *iterate* is also common across the participants. Often, jewellers create small series of similar jewellery pieces, where each piece is slightly different. For example, Claire created a series of feather pendants and earrings, where pieces differ based on things she learned in the previous version (figure 22).

A similar process was described by Lucia for discovering what tools to use for modeling and adding texture to Fimo pieces. Iteration and experimentation can be long and frustrating, so the ability to *be resilient and determined* was presented by some participants. Tania mentioned that tatting is “all about practice and not giving up!” (interview 1).

Finally, the participants agreed that dexterity, precision, patience, and handiness skills are necessary for working on small pieces. Physical skills like modeling (bending wire and forming Fimo clay, for example), joining, and mixing are also basic in the practice of jewellery making. Mixing is used to activate resins, but also to change the color of Fimo clay (by adding acrylic paint).

5.1.3. Competences and skills of steampunk enthusiasts

Steampunk enthusiasts demonstrate a wide range of competences to accomplish their practice. They show the abilities to envision, to plan, to see opportunities, to experiment, to iterate, and to collect and combine skills. The skills performed are various and related to the tools used (see 4.4.3).

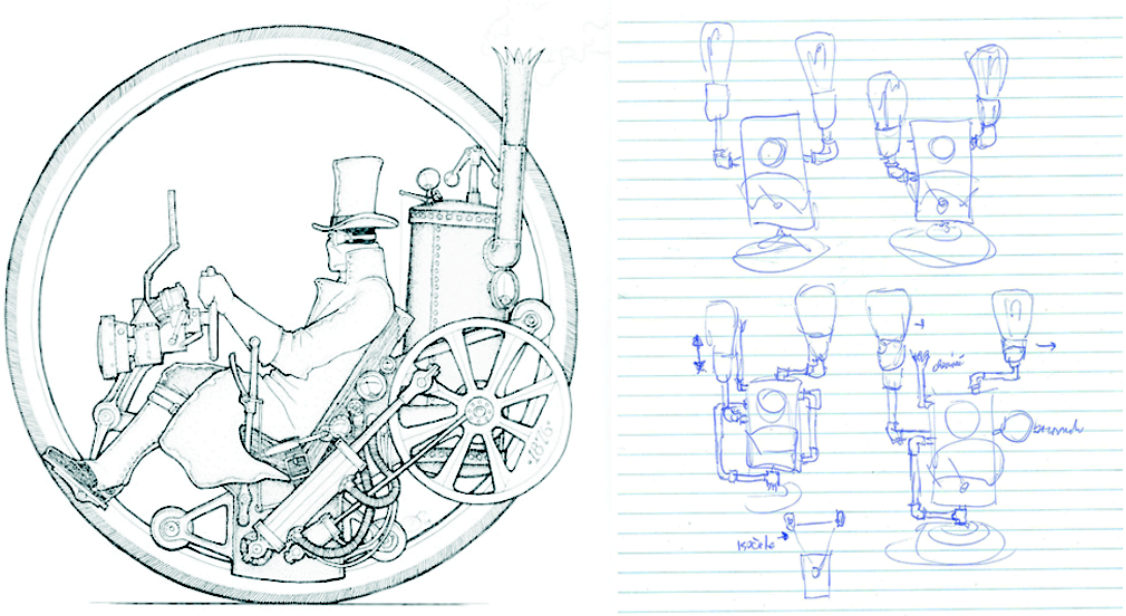

Figure 23. First sketches inspired in the steampunk fashion (image by Adrian), and lamp sketch (image by Frank)

Firstly, the ability to *envision* (or to *conceptualize*), combined with the ability to *plan* are cornerstones of the practice. All participants described how the first steps of a project always happen either in their mind or on paper (figure 23).

Conceiving happens in an iterative cycle that alternates among thinking, drawing, searching for materials, and starting to assemble. Participants explained that they typically do more conceptualizing than actual making because it helps refine ideas before 'sacrificing' materials. In an interview, Frank mentioned that he draws and measures a lot before cutting or piercing his pieces. One reason for this is that he does not want to make un-repairable mistakes on unique materials and a second reason is that he simply does not like to work twice. For example, Tera spends a lot of time pinning material on her mannequin until she is happy with the result. Pinning is reversible as long as she does not start to cut the fabric or start sewing.

Conceptualizing is also done through the making of prototypes. For example, Kenneth uses Bristol cardboard to create a quick version of a glove that would then be made out of copper sheets (figure 24). By using Bristol, he can refine the size and shape of the parts and then use the cardboard as a pattern for cutting the metal sheets.

Figure 24. Kenneth's Bristol cardboard prototype, planning for cutting copper sheets. (images by Audrey Desjardins)

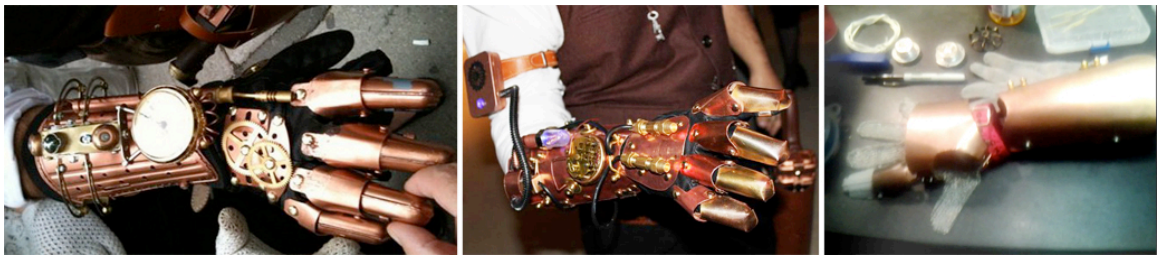

Figure 25. Kenneth's first two gloves (and the third one still in process) (images by Kenneth (1 and 2) and Audrey Desjardins)

The abilities to *iterate* and *experiment* are essential in the practice of steampunk. Iterative construction allows people the opportunity to learn from a previous prototype or experience to nourish their new projects. Kenneth had created two wrist bands and was in the process of making a third one at the time of our meetings (figure 25). The first was built out of plastic parts, painted in copper and gold. For the second one, Kenneth wanted to use only authentic materials such as copper plates and leather because he did not like the feel of paint on plastic and was looking for the metallic sound when he would move his fingers. The third glove aimed at solving the problem of how uncomfortable the second glove was by adding padding. He also modified the concept by adding a chain mill glove and articulated pistons that will look like they move the fingers.

Experiments are at the core of learning new techniques for steampunk enthusiasts. Experiments are more common than iterations in the steampunk practice since most projects are one of a kind. Aaron explains how he tried to curve brass plates to make an arm piece. He cut a U shape in a piece of wood to make two pieces, a male

and female part for making a mold to curve the metal plates. In this extract of an update via email, Aaron explains how he jury rigged it since it was just a one time project:

> As I feared, brass being quite "springy", it didn't remain as bended as I needed. Also, while it was easy to bend the centre of the sheet, it didn't work very well for the borders, especially for the larger pieces. Still, after letting the parts rest for a night while squeezed in the wooden shape under an anvil, they remained curved. If I had to do this kind of operation again, I would cut the wood shape into a more severe curve than I need to compensate for the fact that the brass will "unroll". But since it was a one-shot project, I supplemented this approach by wearing gloves and rolling the parts around a smaller spray can by hand. I didn't get exactly what I originally aimed for but I got something that works.

Experiments could also include multiple attempts before reaching satisfaction. For example, Aaron was looking for a way to isolate already soldered wires in his communication machine the CELL. Following the suggestion of other steampunk enthusiasts, he decided to experiment with melted wax (figure 26). He prepared small white candles and a larger red candle. After trying multiple combinations of candles and positions, he finally established that using the larger candle (which he thought would be cumbersome) is easy to handle and hot enough to melt once the candle is blown out.

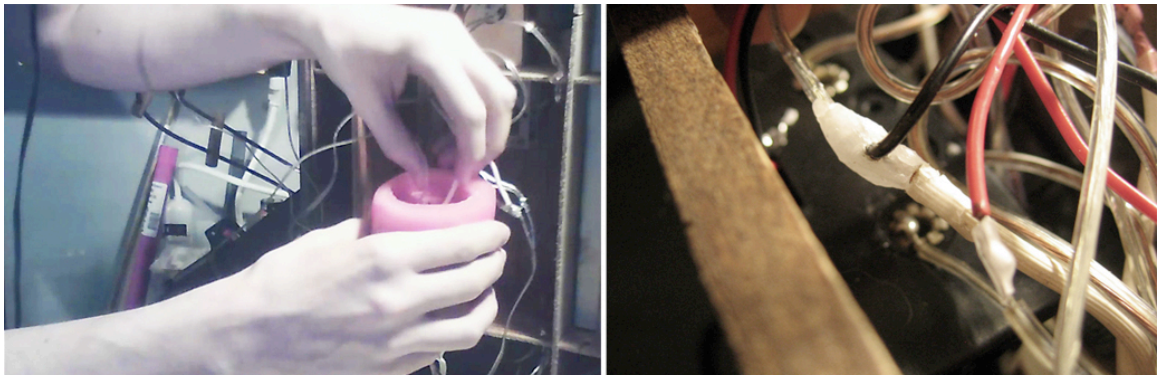

Figure 26. Wax dipping to isolate wires (technique and result) (images by Audrey Desjardins and Aaron)

Skills are closely related to the quantity and variety of tools used (section 4.4.3), and the sum of each participant's skills is understood to be greater than the individual skills themselves. In general, participants share skills like disassembling, measuring, joining, cutting, shaping, cleaning, and finishing. The ability to *collect and combine skills* is viewed as a great potential for tackling more complex and diverse projects. This is

described specifically by Christine, Mario, and Adrian who also work as prop makers in the television and cinema industry. In an application to participate in the show *Canada's Greatest Know It All*, Adrian (on Facebook: April 11th, 2012) describes his skills:

> I'm not just book-smart (which I am), but I also have a broad range of physical skills and actual life experiences under my belt, which give me exceptional challenge- and problem-solving abilities.[…] I build stuff for scifi and horror movies, I hunt and fish, I've designed an implantable prosthetic device that's been used in hundreds of patients, I've worked in the printing business, cash register repair and IT, I run businesses at renaissance and pirate festivals, I've published a magazine, had a one-man show of scrimshaw pieces at an artisans' gallery and won prizes at art shows. I've operated a fifteen-million volt particle accelerator, […] I can take apart, fix, and reassemble almost *any* mechanical device, from watches to DVD players to chainsaws.

Steampunk enthusiasts have very diverse sets of skills, and not all can reach the level of skills of Adrian, or Christine and Mario. Tera and Angel both have a more restricted niche where they are comfortable making steampunk costumes or accessories.

5.1.4. Analysis: Comparing competences and skills

Table 6. Comparison of competences and skills

	Families	Hobbyist Jewellers	Steampunk Enthusiasts
Competences	Seeing opportunities Iterating Adapting Organizing materials and information	Conceptualizing Seeing opportunities Iterating Experimenting Being resilient and determined	Conceptualizing and planning Seeing opportunities Iterating Experimenting Collecting and combining skills
Skills	Writing Drawing Cutting Folding Tearing Climbing	Modeling Separating Joining Coloring	Disassembling Measuring Joining Cutting Shaping Cleaning Finishing

Competences, as this table shows, are often shared across the practices of everyday design. However, the qualitative examples illustrating each competence differ in complexity and in the ways they are implemented across the cases.

Being able to see what objects can become a part of what was scripted by the designer is central to all practices of everyday design. Having in mind an idea of what that object could be like (either based on functionality or aesthetic attributes), serves to orient individuals in their search for appropriating artifacts.

The ability to *iterate* is observed in the three practices. In families, systems are constructed over time, with elements that change and evolve. Generally, if a system does not work anymore, the family members are able to imagine a different system, for example, the recipe system (Cate) and the reminder system (Lori). In hobbyist jewellery practice, the ability to iterate is central to the common process of creating series of similar artifacts as a way to master a technique (Claire and the feather wrapping technique). For steampunks, iteration is more rarely observed since most objects are unique, but is still part of some participants' practices. On the other hand, the ability to *experiment* is a pillar in steampunk practice and is also observed in hobbyist jewellery practice.

In the practices of home based jewellery and steampunk, a certain amount of *conceptualization* and *planning* is often done before starting to make a project. Drawing, measuring, playing with materials, and looking for inspiration are common to both practices. In families, conceptualizing happens very quickly, in situ, and in reaction to an unsatisfactory situation. There is no planning observed; the decisions are made in the doing of things.

In general, these competences are shared. However, some competences are specific to particular practices such as the ability to combine skills, or the ability to organize materials and information.

Skills between the practices are surprisingly different, compared to the similarities observed in competences. In order to clarify why this might be the case, I turn to Bruno Latour's concept of human-non-human hybrid. Hybridity is the distribution of skill between the human and the tool used (Latour, 1993). Latour argues that skills are

shared between the tool and the human when accomplishing a task. The comparison of tools in section 4.4 shows that each practice of everyday design has very different types of tools for making things. Tools are used to act on materials, which are different across the disciplines as well; hence, the skills to be able to master them need to be different as well. There is a reciprocal relationship between tools and skills where both sides influence the other.

In short, competences such as the ability to *see opportunities, iterate,* and *conceptualize* are developed with slight differences in each practice, whereas skills differ greatly between the practices, fitting the differences in materials and tools observed earlier.

5.2. Strategies

This section describes general strategies in the practices of everyday design. Strategies represent how practitioners combine materials, tools, competences, and skills to create projects that fulfill their goals. Strategies show how all the aspects of practice are intertwined to construct the practice itself. Sections 5.3 and 5.4 describe specific strategies to learn and share aspects of practice. These are presented separately since they hold particular interest to the human computer interaction and interaction design communities.

5.2.1. Strategies of families

Family members use different strategies of everyday design in order to support their lifestyles and everyday activities. Strategies include: to reuse objects as-is, to resource materials, to deal with things later, and to identify objects. These strategies reflect the use of mostly common household objects as materials, and the use of almost no tools to achieve everyday design in homes.

First, family members are experts at *reusing objects as-is* to accomplish a different function than the objects' intended ones. Hanging jackets on chairs (all families), using the piano bench as a table (Cate and Paul's family), and using a magazine to collect finger nails (Lori) exemplify well the variety of objects that can be

resourced in the home. Similarly to *reusing as is, jury-rigging* entails making the best out of a current situation, and providing a quick fix. For example, Lori uses her wallet as a flat surface to write something on a piece of paper on the go (figure 27).

Reusing objects also means *resourcing materials* that are available in the context of a need. This strategy is closely related to the competence of *seeing opportunities in objects* (section 5.1.1).

In order to continue accomplishing necessary daily tasks, the strategy of *dealing with things later* can help focus on important activities. For example, in a video walk through, Kerry explains how things such as school bags, jackets, and other articles are left on her son's stroller when she comes back from picking him up at school and are then put away later in the evening (EC_E_munroe_07.03.15_media_011.AVI).

Identifying objects is also a strategy to help family members find things around the house and be organized. For example, Janis uses identifying labels on all of the doors of the kitchen cupboards to list what should be stored in each (see figure 14). Location can also be a way of identifying objects; leaving things by the door can signifies that they are ready to leave and should not be forgotten.

Figure 27. Lori uses her wallet as a flat surface to write (image from original study)

5.2.2. Strategies of hobbyist jewellers

Various strategies are discerned in the practice of hobbyist jewellers that combine the findings about materials, tools, and competences. Making series, letting the materials speak, serendipitous discoveries, making experiments, and resourcing materials and tools were observed during the study.

First, the strategy of *making a series of similar pieces* provides opportunities for jewellers to practice, iterate, and master particular techniques. This strategy allows participants to develop tricks and even tools for a specific type of jewellery piece they make. For example, Allison creates multiple pendants with stones wrapped in silver wire. Through this process, she developed a know-how for seeing what tension was necessary and she started to use a needle to release unnecessary tension. At one point, she modified the needle by bending it at two places so that it could serve as a hook (figure 28).

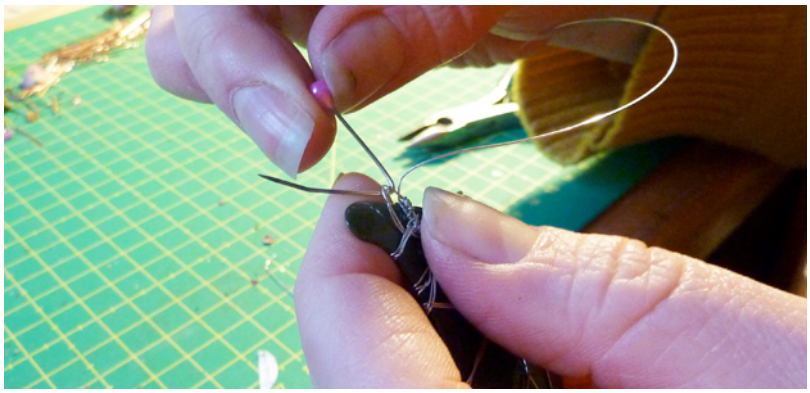

Figure 28. Bent needle in the practice of wrapping stones with silver wire. (image by Audrey Desjardins)

A second strategy for hobbyist jewellers is *letting materials speak* and act based on this exchange between the material and the practitioner. This concept was theorized by Donald Schön who defines it as a *reflective conversation* between the practitioner and the situation (and materials) (Schön, 1983, p.132). As the practitioner reframes a problem, he discovers new possibilities that then inform further action (idem). In jewellery, as the practitioners move materials and try things, the materials speak back, telling the jeweller what decisions to take. For Veronica and Allison, this concept is crucial in the conceptualization of pieces. For example, in the creation of the stone

pendants, Allison explained that the stone itself plays a defining role for how the final piece will look. As she wraps the wire around the stone, she follows the angles created by the wires as well as the stone. For Veronica, materials have intrinsic properties and limits and, as she assembles pieces, she says she cannot impose her own ideas on the materials; conversely, it is the material that leads her aesthetic exploration. Conversations between jewellers' ideas and their materials can take time, sometimes days. Jewellers sometimes let pieces sit on their desks before assembling them, to make sure they were pleased with the configuration.

Thirdly, the strategy of *serendipitous discoveries* is a part of what hobbyist jewellers called "how things just happen" to borrow Tania's words. There is a certain amount of unconscious action and movement in the making of jewellery which leads to desirable outcomes by accident. In describing her process for the stone pendants, Allison says: "I don't pay too much attention, but the wire always ends where the hook is supposed to be" (interview 2).

Fourthly*, making experiments* is a strategy for discovering new techniques or new uses of materials. Experiments typically stem from a material that hobbyist jewellers want to explore further. For example, Veronica explains how she developed a technique for burning an undesired surface treatment on old jewellery pieces through a series of experiments (interview 3):

> First, I tried with a propane torch to burn off the label on alloy tins. It was too hot and melted the whole thing. My next step was to try with the burner of an old stove. It was hard to control the tipping point for when the part would melt, and I did not like the fact that I was doing experiments like this in the kitchen. Finally, I tried with an open flame on a candle. I was able to take the leafy stuff away from the parts that I like.

Finally, the last strategy is *resourcing objects as tools*. Hobbyist jewellers resource many objects to model or transform materials (see 4.4.2). This is sometimes motivated by investment considerations, or by the wish to better control a tool, but also by the immediate desire to finish a project. For example, Claire mentioned multiple times that she is very impatient and prefers to jury-rig a solution than to wait for having the right tool.

5.2.3. Strategies of steampunk enthusiasts

Steampunk enthusiasts also share multiple strategies in their practice of designing and making. Their strategies are oriented towards the making of things, such as resourcing and collecting materials, working on different projects at a time, and respecting materials. Steampunk enthusiasts also demonstrate strategies related to the community aspect of their practice with strategies like make believe and the creation of characters.

Firstly, they develop the strategy of *resourcing and collecting materials*. Frank particularly appreciates the opportunity of reusing and recycling objects, and this goes hand in hand with the goal of gaining back control of the production of everyday objects (see 4.1.3). Keeping an open mind and looking in unexpected places can often bring discoveries. For example, Aaron was looking for materials to make a piston for his CELL. As he was walking in a department store, he walked through the sporting goods row and stumbled across a basketball pump. He then simply painted it and had a steampunk piston. Also, most participants have a collection of various materials at home, often classified by the type of material in different bins. As they make projects, they remember these collected pieces and can use them when appropriate. Additionally, Adrian writes as a comment to a picture of his bench on Facebook (figure 29) that his bench and the materials he has collected on it are a source of inspiration: "Where do you get your ideas? I'm occasionally asked. I just have to sit at my bench and ponder what's on it for a bit..."

The strategy of *working on different projects at a time* is also common among the participants. Letting projects sit for a while, particularly when a challenging or irreversible step needs to be taken, helps steampunk enthusiasts either find solutions to the challenges or make sure they are completely certain with the look and functionality of the project. For example, in a session with Angel (session 2), she worked on three projects at the same time, going back and forth between them as she glued parts and waited for the glue to set.

Figure 29. Collecting and storing parts: Frank's wardrobe for materials and Adrian's workshop and workbench (images by Frank and Adrian)

Respecting materials is important for all the participants. When acquiring old objects (like old watches and clocks), steampunk enthusiasts do not disassemble a piece if they see the possibility of repairing it, even if it entails asking a professional outside of the steampunk community (for example, Angel knows a watch repairer she goes to in these situations). Respecting materials can also mean using the real materials instead of creating faux finishes to make plastic look like old brass, for example. Aaron argues that it is also easier for him to work with the real materials than to work with paint. Materials are also a source of inspiration in steampunk practice. Kenneth says that "objects are blank canvases for further creative acts" (interview 3). Projects can start from a group of materials or a single object that can inspire a complete machine or outfit. For example, Kenneth always wanted to make a steampunk version of the Ghost Busters Proton Pack (figure 30). As soon as he saw a particular ceiling fan part, he visualized it as the cyclotron, he knew he could start the project. Kenneth recalls this moment as being a stepping stone in the project.

On the other hand, a central strategy in steampunk practice is to *make believe* both in terms of functionality and materials. Kenneth and Aaron both explain that the inside of the machines do not need to be well finished, it is only the parts that others can see that need to be convincing. Using fake materials can also help reduce the weight of some props, allowing more comfort during long days at conventions. Paint is one of the best ways to transform plastic material and make it look like brass or copper.

Figure 30. Steampunk Proton Pack – with ceiling fan part (image by Kenneth)

Finally, the strategy of *creating a character* is often used to give a direction to the machines and outfits steampunk enthusiasts make. For example, Aaron created the character Baron Celsius Von Farenheit who is the inventor of the CELL, a compact, mobile device that can allow people to communicate. With this character, he can generate different narratives when explaining what his machine does. Characters also help build a stronger sense of community between steampunk enthusiasts. For example, Adrian created small animated wooden figurines based on Kenneth and other's characters (figure 31). These figurines show how recognizable characters can help steampunk practitioners build a strong sense of community.

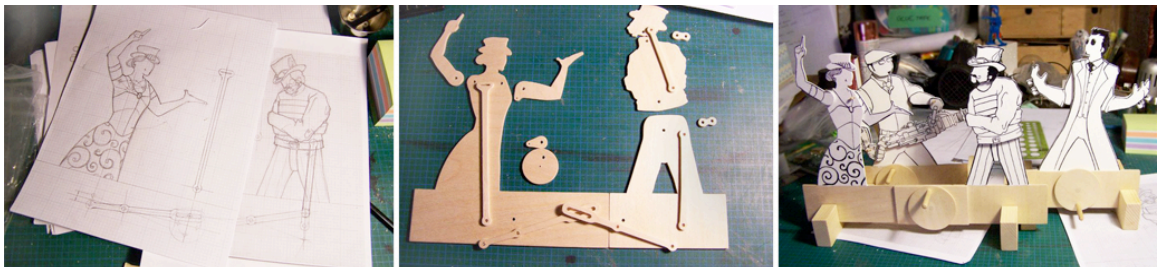

Figure 31. Wooden figurines based on steampunk characters (images by Adrian)

5.2.4. Analysis: Comparing strategies

Table 7. Comparison of strategies

Families	Hobbyist Jewellers	Steampunk Enthusiasts
Reusing as-is Resourcing materials Jury rigging Dealing with things later Identifying objects	Making a series Letting materials speak Serendipitous discoveries Making experiments Resourcing objects as tools	Resourcing and collecting materials Working on different projects at a time Respecting materials Make believe Creating a character

Overall, strategies are generally oriented directly toward the goals and motivations of the practitioners; thus, strategies differ between the practices. Strategies in families mostly aim at finding a quick solution to situations in order to continue on with everyday activities, such as dealing with things later or identifying objects. Jewellery making strategies are all oriented towards the act of making, supporting the idea of making unique pieces, while enjoying the activity of making. Steampunk strategies are two fold: they aim at making, but also at supporting the ideological and creative side of the steampunk community.

Strategies also present a reflection on how competences, skills, materials, and tools are combined to form a practice. In the case of families, no tools or precise skills are necessary to reuse as-is or to jury rig. Resourcing materials in the household also mirrors the materials used in the practice of everyday design in families. In jewellery practice, the making of a series of similar pieces shows how practitioners often focus on mastering a few techniques (with the use of experiments as well). Steampunk enthusiasts adeptly combine materials and tools with competences while working on different projects.

Practitioners demonstrate the use of reflexive practices and reflexive conversations with materials (Schön, 1983). Both jewellery and steampunk practices show an ongoing dialogue between materials and the practitioners: letting materials speak for jewellers, and respecting materials for steampunk enthusiasts. Examples include wrapping wire around stones while following angles of the stone, repairing old watches, and seeing an idea from a material, which then sparks a project. The reflexive

practice happens in families through reflection-in-action, as family members reflect and resource materials around them to help resolve unsatisfactory situations they are in.

Resourcing tools and materials is also expressed in each practice of everyday design. Similarly to the competence of seeing opportunities in one's surroundings and available objects, resourcing is central to appropriation and everyday design since it allows practitioners to reflect and act upon the world around them.

In summary, common strategies refer to central aspects to everyday design, whereas different strategies across the cases show that particular techniques and processes need to be used in order to achieve goals and motivations, but still follow the abilities and available materials and tools each practitioner has.

5.3. Learning Strategies

This section presents how practitioners learn how to perform their practices. The strategies for learning also speak to the materials and tools used, as well as the competences and skills.

5.3.1. Learning in families

For everyday designers, learning happens mostly *through evolving systems* and less often from other individuals. Learning through evolving systems entails that systems are built, adapted, and changed as individuals see what is not working correctly for their own ever changing situations. For example, Cate describes how she realized that using an old alphabetical classifier to organize recipes was not ideal for her because she was losing small cut outs at the bottom and was not able to find what she wanted (see 5.1.1). Based on this experience, she created a new system where she glues down recipes she likes to pages in a binder. This illustrates well how everyday designers learn by doing and through design-in-use.

In addition, when elements that are part of a system are changed, individuals have to learn how to use the new elements to fit within the existing system or change the system if the changed parts cause too many conflicts. During the study, Lori and Abe

received a new fridge and stove. The fridge was higher than the previous one, forcing the family to remove the microwave that was usually on top of the fridge to place it on the counter top. This change required the family to learn how to use less space the countertop, but also provided new opportunities for putting things on top of the fridge.

A rare case where family members *learned from one another* was observed when Beck showed his son how to use the side of his fork to cut his food. This type of person-to-person sharing, though, was not very common in families.

5.3.2. Learning in hobbyist jewellers

Hobbyist jewellers learn how to make their crafts in different ways such as: with documentation, by doing, through observation, and as part of childhood.

As described in 4.4.2, *documentation* such as the Internet (and books for Lucia) is one of the ways used to learn new techniques. However, most of the participants prefer *learning by doing* and use trial and error processes as well as observation. For example, Tania reports that to learn tatting, she had to take a needle and a thread and try it. The more practice she had, the better she became. Additionally, with more practice, she was able to read more complex patterns for tatting and started to modify them to create more unique pieces. Moreover, *observation* is a common strategy to learn how to make things. Lucia said: “You look and you make!” (interview 1).

Participants often mentioned that they *learned how to craft as kids* with their parents. Allison mentions that her mother is an artist and seamstress, her father a welder, and her grandmother collected crystals and stones. Tania also explains that her mother is a seamstress and she always recalls her as being in the process of making. She says “I think that my need to make things comes from seeing my mom always sewing” (interview 1).

Based on our proposition, we expected hobbyist jewellers to take lessons or classes for jewellery making, however this was not observed within our participants.

5.3.3. Learning in steampunk enthusiasts

The large number of skills and competences mastered by steampunk enthusiasts are generally learned through multiple channels such as from others, through doing and experiments, with classes, and as part of childhood.

Learning *from others* at conventions, during panels at conventions, and through online tutorials are different ways in which the knowledge is shared between steampunk enthusiasts (see 5.4.3). For example, Kenneth describes how he participated and shared his techniques in a panel about 'Steampunk Gadgetry' at CNSE 2011 (Canadian National Steampunk Expo); but at the same time how he learned tips from other panellists. For example, he met Adrian and learned from him how to use the sheathing of a shoe lace to sheathe wires in machines so that they gain a steampunk look.

Learning *by doing and through experiments* is also shared among the participants. Adrian argues that experiments are meant to stretch horizons and he affirms that "he doesn't know he can't make something until he tries" (interview 1). Adrian also likes to look at and observe new tools as a way of learning how to use them, in addition to trying and experimenting on his own.

Some participants had taken *classes* to learn electronics, welding, or sewing many years ago without the intention of using these skills for their steampunk practice, but found the skills useful when they joined the steampunk community. Online tools such as tutorials are sometimes used, but the difference between the level of competence and skills of the tutorial and the practitioner often causes problems. Some tutorials are too advanced and require prior knowledge: for example, Tera is often set against sewing tutorials using terminology she does not understand. Conversely, Adrian views tutorials on certain websites, like www.instructables.com, as entry level tutorials, therefore he does not find them useful.

Finally, the acquired skills and philosophy of making were often present at a *young age* in the participants. Many times, they recalled playing with Lego, making crafts, playing with a soldering iron at 12 years old (Kenneth), and they recognized the influence of their family members. For example, Adrian learned how to turn small wood pieces on his grandfather's metal lathe; he remembers building small scale models as a

teenager and describes how he was exposed to arts during his childhood because his mother was an artist.

5.3.4. Analysis: Comparing learning strategies

Table 8. Comparison of learning strategies

Families	Hobbyist Jewellers	Steampunk Enthusiasts
Through evolving systems Learning from one another	Documentation Through observation By doing Through childhood	Learning from others By doing In classes Through childhood

The learning strategies from the three cases do not differ greatly. Learning by doing and learning from others (either other practitioners or from other people's work and through observation) are common to all three cases. These findings highlight the importance of the act of making and the social aspect of practice. Learning from others shows that individuals influence each other and they base a part of their creations and actions on what others have previously made (also see the sharing strategies section 5.4). Particular strategies that are unique the groups studied are learning with documentation for jewellers and learning through classes for steampunk enthusiasts.

Finally, learning as part of childhood was apparent in both practices of hobbyist jewellers and steampunk enthusiasts and it was mentioned repeatedly in interview questions. There is no data in the original family study about learning from parents as a child, but it would not be a far stretch to assume that as children, we learn a lot from parents in all aspects of our lives, and everyday design is part of it.

5.4. Sharing Strategies

Practitioners demonstrated different kinds of strategies for sharing techniques and outcomes of their practices with other practitioners.

5.4.1. Sharing in families

Sharing in the everyday design practice of families happens mainly inside the house, between the family members. Often, mothers create systems that are meant to be *shared with their partners and/or children*; sometimes successfully, other times not. Calendars are common in each household for sharing schedules and activities. For example, Lori uses a reminder system for herself and her partner (see 4.2.1). Abe eventually started to use it as well by looking at the chalkboard and lists left in the three tier basket. Moreover, the mail system created by Cate is organized as a way to distribute the mail to her tenant and other family members (figure 32). She places mail on the chest, the mini shelf at the right of the front door, at the top of the stairs to the basement, and on the kitchen halfwall, segregating important mail from junk mail and separating mail for her tenant in the basement, her partner, and herself. Others in Cate's household are not completely aware of the system, but they recognize what mail is addressed to them based on where it is situated (top of the stairs or on the shelf).

Figure 32. Shared mail system (images from original study)

5.4.2. Sharing in hobbyist jewellers

Generally, the sharing of techniques and knowledge is *unidirectional* in the case of hobbyist jewellers. Participants look for information from other jewellers but would not share their own techniques spontaneously unless someone asked. For some participants, a lack of interest and time prevented them for creating a blog or having an online presence (Allison and Lucia).

Online sharing was rarely used in jewellers' practices. One example is Sophie who maintains a blog[5] and an Etsy store[6] for sharing her work (figure 33). She uses the blog to share work in progress, inspiration and reflections about her work and to receive comments from friends and people interested in her work. Interestingly, she says that she would not share her techniques for making because she felt they are not "professional enough to share with others" (interview 2). She uses the store to sell her work as a side business to her day job. For her, sharing her finished work is important and creating a coherent company image and name occupied a lot of her time when she decided to change the name of her company from *Sadie Design* to *Camp + Quarry*.

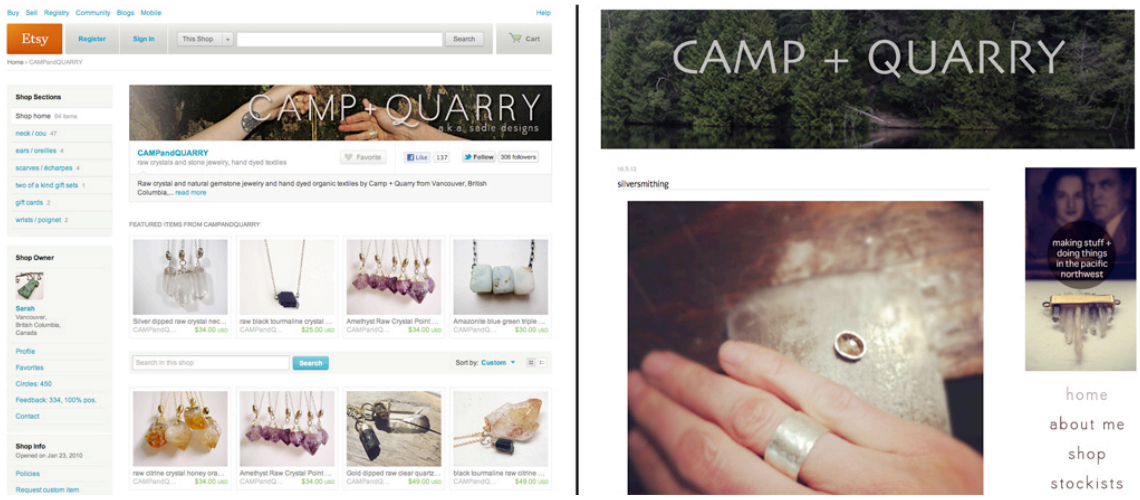

Figure 33. Camp and Quarry Etsy store and blog (images by Sophie)

For other participants who do not share online, making jewellery *as part of a group* is a way of sharing ideas and techniques. For example, Veronica said that "Crafting is contagious" (interview 1) when she described how her jewellery making influenced her roommates to join in.

[5] http://www.campandquarry.com/

[6] http://www.etsy.com/shop/CAMPandQUARRY?ref=seller_info

5.4.3. Sharing in steampunk enthusiasts

Sharing techniques, projects, and ideas is at the centre of the practice of steampunk, and is, in itself, a motivation for many participants. Instances of sharing include conventions, panels, online sharing, and monthly meetings.

Annual conventions and exhibitions are opportunities for steampunk enthusiasts to meet with similarly minded people and to show off new costumes and gadgets. Adrian thinks it is place to display creativity with a 'show-and-tell' attitude where people are open and do not mind sharing their own techniques. Conventions include *panels* where experts show how to make costumes and machines. For example, Christine and her husband Mario are considered experts at making props for movies and television shows and they apply this knowledge to prop making for steampunk. They usually travel with their 'panel kit' which contains different types of paint samples to show faux-finishes, molds and casts, and before/after pieces.

Figure 34. Frank and Aaron presenting at a panel at ComiCon Ottawa (image by Aaron)

Aaron, Kenneth, Frank, and Adrian have also participated in steampunk panels to share their own techniques and tips. In a panel called 'Steampunk Gadgets and Gizmos', Aaron and Frank shared their design process, the tools and materials they use, and answered questions from the audience (figure 34).

The steampunk community is also represented by small groups in different cities such as Toronto, Montreal, Vancouver, and more. Each group organizes *smaller events*

throughout the year to stay in contact with people in the same area. For example, Tera organizes monthly craft meets and book club meetings. Her goal is to discuss and exchange with others about projects, but also about the philosophy of steampunk as it is portrayed in books.

The *online aspect* of the steampunk community is also very strong. Facebook pages[7] and groups are active and people use the walls to share links to other projects, materials, tools, and ideas. Individuals also share questions about many aspects of prop and costume making they want input from other enthusiasts. For example, Aaron was looking for a way to remove the manufacturer's stamp on a brass tube. He posted his question and within a couple hours steampunk enthusiasts had replied to use nail polish remover. He used the same strategy to find a way to isolate his wires in the CELL (also see section 5.1.3). Finally, online structures allow steampunk enthusiasts to share pictures of finished projects as well as pictures of past events.

5.4.4. Analysis: Comparing sharing strategies

Table 9. Comparison of sharing strategies

Families	Hobbyist Jewellers	Steampunk Enthusiasts
Sharing systems within the house	Unidirectional sharing Online tools to share work in progress and outcomes Making jewellery as a group	Sharing techniques and outcomes at conventions Panels Online sharing Craft and social meetings

The sharing of information and knowledge is very different between the three groups. We can see a gradual change from families who do not share outside the house, to hobbyist jewellers who seek out information without sharing their techniques, and finally steampunk enthusiasts who are highly engaged in sharing techniques, inspiration, and ideas with others.

[7] http://www.facebook.com/SteampunkCanada and http://www.facebook.com/SteampunkMontreal

Sharing was most encouraged in the steampunk community through multiple channels for maintaining relationships with like-minded people. Compared to jewellers, the fact that steampunk conversations happen in a back and forth manner helps foster more exchange. Additionally, sharing the process, and asking questions, as opposed to mainly sharing outcomes creates starting points for reacting to and commenting on other individuals' work.

Sharing was sometimes restrained due to the possibility of comparing participants' techniques with professional techniques for making projects. Sophie mentioned that her process was "not professional enough" (5.4.2), and this was the reason why she did not want to share with others. Similarly, in the steampunk group, Tera explained that she does not like to show others how to sew in her craft meetings because she knows there are professional seamstresses in the group. However, when there is no concern for professional comparison, steampunks are more than happy to share techniques and tricks with others (using online tools, and in conventions and craft meets). It appears that participants are not comfortable sharing when they know they are jury-rigging their way through a project, and that there is probably a 'real' or 'professional' way to achieve the same goal.

In conclusion, sharing is encouraged in communities that are very active, both online and offline such as steampunk enthusiasts. Small groups such as families, and jewellers did not show as many instances of sharing.

5.5. Conclusion

The table 10 exhibits the findings of the three presented studies and shows the important points of the comparison between the three practices.

Table 10. Summary of the findings

	Families	**Hobbyist Jewellers**	**Steampunk enthusiasts**
Goals and Motivations	Organization and task management Accomplishing necessary tasks Supporting loved activities	Making unique jewellery Pleasure of making Aesthetic motivations Opportunity for selling	Alternative to production model Pleasure of making Unique aesthetic Participating in steampunk community
Outcomes	Systems Actions embedded in routines Ad hoc installations	Jewellery pieces: Assembling; Augmenting; Modeling	Machines and accessories Costumes Steampunk objects Online artifacts
Material Types	Common household objects	Found objects Natural materials Raw materials Basic jewellery materials	Found objects and antique objects Raw materials Electronic components
Material Attributes	Flat, hollow, protrusion, thin and flexible	Shape, weight, color, texture and size Accessibility	Steampunk materials (brass, leather, wood) Steampunk artifacts (gears, pipes, elaborate shapes) Easy to disassemble
Tools	Hands Few household tools	Hands Household tools Glue Homemade tools Basic jewellery tools Online tools	Hands Tools for disassembling, measuring, planning, joining, cutting, shaping, coloring, cleaning and finishing Homemade tools Protection tools Online tools
Competences	Seeing opportunities Iterating Adapting Organizing materials and information	Conceptualizing Seeing opportunities Iterating Experimenting Being resilient and determined	Conceptualizing and planning Seeing opportunities Iterating Experimenting Collecting and combining skills

Skills	Writing Drawing Cutting Folding Tearing Climbing	Modeling Separating Joining Coloring	Disassembling Measuring Joining Cutting Shaping Cleaning Finishing
Strategies	Reusing as-is Resourcing materials Jury rigging Dealing with things later Identifying objects	Making a series Letting materials speak Serendipitous finds Making experiments Resourcing objects as tools	Resourcing and collecting materials Working on different projects at a time Respecting materials Make believe Creating a character
Learning strategies	Through evolving systems Learning from one another	Documentation Through observation By doing Through childhood	Learn from others By doing (experimentation) In classes Through childhood
Sharing strategies	Sharing systems within the house	Unidirectional sharing Online tools to share work in progress and outcomes Making jewellery as a group	Sharing techniques and outcomes at conventions Panels Online sharing Craft and social meetings

Chapters 4 and 5 have depicted the practices of everyday design of three cases following eight aspects of practice. Differences and similarities have shown that those practices can be placed under one large umbrella of everyday design, but that they are clearly distinct and unique. The similarities between the three practices depict what is at the heart of everyday design.

- Materials used: common household objects
- Tools: hands and household tools
- Competences: ability to see opportunities, to conceptualize, and to iterate
- Skills: separating (cutting) and modeling (folding)
- Strategies: Resourcing materials and dialoguing with materials
- Learning strategies: by doing and from others

For each aspect, there are also differences that further characterises each practice. Those differences, as well as differences in goals, outcomes, skills, and sharing strategies demonstrates the variety of practices within everyday design. The heterogeneity of the practices is rich in comparison to common mass produced and consumed products. Chapter 6 will look more into the implications of design.

One way to look at these differences is to use Theodore Schatzki's concepts of integrative and dispersive practices (Schatzki, 1996). Dispersive practices are generally spread across most members of the population, entail tacit know-how, and unselfconscious competences. Integrative practices, although also encompassing tacit know-how, also include organized structures and knowledge. A similar analysis was conducted to compare the practices of everyday repair and green enthusiasts in a previous study (Wakkary et al., forthcoming). The concepts of dispersive and integrative practices were useful to articulate better the differences between the very common and unselfconscious practice of everyday repair and the more organized and documented practice of green enthusiasts.

The practice of families can be described as a dispersive practice, whereas jewellers and steampunk enthusiasts follow more organized integrative structures to accomplish their practices. Almost no specific tools or skills are necessary to accomplish appropriation in homes. The materials used are already there and it is through experience and through design-in-use that everyday design happens. These characteristics lean towards a dispersive practice. Hobbyist jewellery making is more integrative by nature, but not as much as a professional jewellery making. Participants followed their own instincts and rarely took a jewellery class, however they used online and offline tools for finding inspiration and understanding how to make things. Finally, steampunk enthusiasts were also closer to integrative practices, because of the strong sense of community of members that subscribe to and encourage a specific ideology and aesthetic through online structures and face-to-face events.

In conclusion, the three portraits provide an in depth investigation of three unique practices of everyday design. I have compared eight aspects of practice based on the case study propositions presented in chapter 3, and through multiple data sources I presented the similarities and differences between the three practices.

6. Discussion and Implications for design

Grounded in the findings and comparisons of chapters 4 and 5, this chapter highlights how an understanding of the different practices of everyday design can help the rethinking and reconfiguring of interaction design and the role of interaction designers.

This chapter aims at providing starting points for reflections and discussions among designers and researchers in HCI and interaction design. The points discussed are supported by clear and precise examples from the data collected in the case study. Firstly, I revise the case study propositions in the light of the findings and comparisons of the previous chapters. Secondly, I present guidelines to design for the unique and creative practices of everyday design. The guidelines are mostly oriented towards artifacts, materials, tools, education, competences, and goals. Finally, I articulate a discussion that can reconfigure the practice of interaction design through a different perspective on the production and consumption model as well as on the empowerment of people and the fostering of individual's creativity. I conclude by listing the limitations of this study.

6.1. Revised propositions

The table 10, in section 5.5, serves as a starting point for reviewing the propositions of the sub-questions of this multiple case study. Most propositions are supported and verified by the study, however, the cases also revealed particularities and subtleties that were not part of the original propositions. I present the revised propositions in framed boxes for each proposition and then discuss the changes in comparison to the initial propositions.

Q1: What are the differences in the **goals and motivations** in each case?

P1 (revised): The goals of each practice are different and there is little cross-over between the cases. Families design in a reactive way in order to go through and support events and activities of daily life. Hobbyist jewellers and steampunk enthusiasts make for the pleasure of making. Jewellers focus on the unique and aesthetic aspects of the pieces they create, whereas steampunks emphasize the ideology and community behind their practice.

This proposition is more precise than the original proposition and highlights the pleasure of making as a shared motivation between the hobbyist jewellers and the steampunk enthusiasts. The interviews with the participants provided insights to the day-to-day reasons for making, which differed from previous studies that relied on online ethnographies in the case of steampunk (Tanenbaum et al., 2012). In addition, the new proposition also includes the findings relating to the sharing aspect of the steampunk community that serves as a motivation in itself.

Q2: What are the differences in the **outcomes** in each case?

P2 (revised): Outcomes are very different across the practices. Outcomes for families are ad hoc appropriations and evolving systems developed over time with common household materials. Jewellers create unique pieces of jewellery, often in small series, and steampunk enthusiasts build costumes and machines that fit the ideology and aesthetics of the steampunk subculture. Online documentation of the processes and finished projects are also part of the outcomes in steampunk practice.

The findings of the study match the original proposition about outcomes in practices for the three cases. An additional precision concerns the series aspect of the outcomes of jewellery practice. This finding influences the understanding of competences and strategies in hobby jewellery making.

Q3: What are the differences in the **materials** used in each case?

P3 (revised): The everyday designer uses materials found at home, which are ready at hand to serve his or her ad hoc projects or systems. The hobbyist jeweller also

uses found objects in or outside the home, as well as raw art materials like clay, epoxy, feathers, and wire. The steampunk enthusiast uses similar materials to jewellers and adds more raw materials such as wood, leather, and metal. The attributes of materials chosen were also found to be important in this study. Families look for objects with particular functionalities such as containing or hanging. Jewellers focus on textures, colors, and shapes to combine in compelling compositions. Finally, steampunks search for materials that can reflect the steampunk aesthetic of brass, leather and old wood, as well as ornamented shapes.

Families and steampunk enthusiasts show evidence supporting the initial proposition that families use common household objects as materials and steampunk reuse objects and use raw materials. Conversely, jewellers' practices are surprising in that they make use of found materials in comparison to exclusively specialized materials that were expected in the original proposition. The use of found materials describes more the dispersive nature of hobbyist jewellery making compared to professional jewellery making. The revised proposition also describes the attributes of materials, which were not described in the original proposition. This addition was necessary since these attributes are the reasons why everyday designers choose to work with different materials.

Q4: What are the differences in the **tools** used in each case?

P4 (revised): In all three cases, hands are common and central tools in everyday design. Similarly to how they use materials, families use the least amount of tools (only basic household tools), jewellers use the same tools as families and furthermore basic jewellery tools and homemade tools, and steampunks use the same tools as jewellers, as well as handyman tools, and more specialized tools such as CNC machines. In addition, both hobbyist jewellers and steampunk enthusiasts referred to online tools for inspiration and sometimes for learning techniques and processes.

Family and steampunk tools support the original proposition. Contrarily to what was expected, jewellers do not use many professional tools in their practice. Other than economic reasons, the pleasure of resourcing artifacts as tools was also a motivation for choosing homemade tools over professional tools. New to the original proposition is the

use of online tools by both hobbyist jewellers and steampunks enthusiasts. This finding confirms that the planning and conceptualizing phases in everyday design can be important in more integrative practices in nature such as steampunk and hobbyist jewellery making.

Q5: What are the differences in the **competences and skills** needed in each case?

P5 (revised): Many competences are observed across the three cases such as the ability to see opportunities, to conceptualize, and to iterate. The ability to experiment is shared between hobbyist jewellers and steampunks. Only a few competences differ between the cases, such as the ability to organize in the case of families and the ability to combine skills for steampunk enthusiasts. Conversely, the skills are different between the practices, following the same basic pattern described in materials and tools, where families have the least amount of specialized skills and steampunks have the most.

The description of competences is more specific than in the original proposition and presents more similarities between the practices than expected. Instead of seeing particular competences for different practitioners, the study demonstrated that the abilities of everyday designers are at a higher level and relate to the abilities to conduct a project, in the larger sense of the term. On the other hand, the level and range of skills observed in the study were similar to what was expected in the original proposition.

Q6: What are the differences in the **strategies** used in each case?

P6 (revised): Some strategies are shared between the cases, such as resourcing objects and engaging in reflective conversation with materials. However, most strategies are directly related to the goals of each practice, hence they differ from one another. Also, strategies reflect the degree of skills, the tools, and the materials used in each practice. Families show strategies for on the go adaptations such as jury rigging and dealing with things later. Hobbyist jewellers focus on aesthetic qualities and developing techniques for making as they experiment, let serendipitous finds happen, and resource objects as tools. Steampunks develop strategies for fabricating, but also for being present and active in the community.

Families' strategies follow what was presented in previous literature, and therefore what constituted the initial proposition. Hobbyist jewellers do not show the use of professional techniques, as expected. Instead, the study demonstrates that hobbyist jewellers are creative in developing ways of making, and that hobbyists do not necessarily aspire at gaining professional techniques. Steampunk enthusiasts' observations support the initial proposition, but strategies for participating in the community were observed as well. Conversely to what was predicted in the original proposition, the practitioners showed that some strategies in relation to materials and artifacts are shared across the practices. This hints at the importance of materials, objects, and tools in the practices of everyday design.

Q7: What are the differences between the **learning strategies** in each case?

P7 (revised): Learning strategies are similar across the practices: learning by doing and learning from others are central to the three cases. Additionally, learning during childhood is also common between jewellery making and steampunk practices. Classes and books are uniquely used in steampunk practices for learning particular techniques, while online tutorials are favoured by hobbyist jewellers.

As anticipated in the initial proposition, everyday designers learn by doing and from others. In addition to the original proposition, the study shows the importance of learning during childhood. Jewellers were expected to learn through classes, but it wasn't observed in the study. This shows that mastering the same techniques as professional jewellery makers is not a goal for hobbyists. Furthermore, steampunks were not expected to learn with classes or books, however, the findings demonstrate the opposite. This also reiterates on the importance of combining skills in steampunk practice and demonstrates that classes, even if not oriented towards steampunk practice, can teach skills that can be appropriated in the context of steampunk practice.

Q8: What are the differences between the **sharing strategies** in each case?

P8 (revised): Sharing differs greatly across the practices and ranges from almost no strategies for sharing to sharing across multiple channels. Families share systems inside their homes only with other family members. Jewellers only share outcomes with

others and sometimes use online tools or craft fairs to do so. Finally, steampunk enthusiasts have multiple ways of sharing projects and techniques through meetings and conventions, as well as online tools for sharing questions, inspiration, techniques, work in progress, and finished products.

The findings about sharing strategies are in line with what was predicted in the original proposition.

The new propositions show that the practices of everyday design are unique and diverse, but that some key characteristics are always expressed in those practices, hence showing that families, hobbyist jewellers and steampunks all engage in practices of everyday design. The new propositions help address the main question of this research:

MQ1: *What are the similarities and differences between the **practices of design** of families, hobbyist jewellers and steampunk enthusiasts?*

MP1 (revised): There are different types of designers within the realm of everyday design. They all engage in resourcing and appropriating materials, they design-in-use as they conceptualize, iterate, and learn by doing. The three groups use common household objects, and transform artifacts with their own hands or household tools. All groups engage in alternative ways of production and use of design artifacts. What differentiates the groups is the motivation for making or transforming things and systems, and the specific additional tools, materials, skills, and strategies for designing and making.

This proposition demonstrates that there are more similarities in the strategies and competences across the cases than expected originally. However, the differences were accurately predicted to be in the motivations, which then influence the use of particular tools and materials and, consequently, require different types of skills.

6.1.1. Everyday designers, hobbyist, expert amateurs

In chapter 3, before the main research question, I state that the aim of this research is to understand *how do the practices of everyday designers, hobbyists and*

expert amateurs define non-professional design? Throughout the study, and in the description of the results and analysis, I used the term everyday design as an umbrella term to describe the practices of families, hobbyist jewellers, and steampunk enthusiasts. Everyday design qualities were described in the introduction as a way to orient this research. However, the results of this research show that the studied practices are in fact part of everyday design as well. Design-in-use principles such as a high degree of creativity, using design artifacts as resources, and the emergence of qualities over time were observed in all three practices (Wakkary & Tanenbaum, 2009). New user identity characteristics like “from consumer to creator”, “from over-determined to underdetermined”, and “from user to designer” (idem, p.372) observed in the everyday designer are also witnessed in jewellers and steampunks. The results show that all participants are creators in that they make and imagine artifacts, they decide to take a space in the design world to be underdetermined by appropriating artifacts, and they are designers through the creative processes they use for transforming and adapting their objects and tools.

From the point of view of seeing hobbyist jewellers and steampunk enthusiasts as everyday designers, the need to distinguish everyday designers from hobbyists and expert amateurs is unnecessary. Examining practices themselves from multiple perspective can help better define the different practices of everyday design. The goal of this thesis was not to create a taxonomy of the types of everyday designers or non-professional designers, but to understand aspects of everyday design that can inform the design of interactive technologies.

6.2. Guidelines to support everyday designers’ making and designing

The results of this multiple case study speak to what interaction designers can do to support these practices of design and making, and other creative practices of everyday design. The three studied everyday practices provide insight for designers who have an interest in how people actually use their products and how people might demonstrate individual, and sometimes collective, agency when using these products in their everyday lives. This perspective helps imagine how designers can change their

roles to share their agency with the people who use the designed products in their daily lives. Everyday design practices are an example of how individuals gain back control and freedom over the design of the objects they live with by being part of the design process. It is an example of how design does not need to be a top-down enterprise.

With everyday design, there are opportunities to develop more meaningful relationships with materials and objects by allowing people to engage, not only through using objects, but through the making, transformation, and adaptation of artifacts. Heterogeneous practices can support more lifestyles and different types of people (who have different skills and interests). Empowering individuals to adapt and transform objects in their daily lives can help them create a better fit between their needs, their environments, and the artifacts they own. This provides a more profound relationship with design objects and can augment the chances for objects to be kept longer, which entails environmental sustainability and human benefits.

Based on the data and analysis presented earlier, I offer guidelines that can help designers consider the multiple practices of everyday design when they build products. These ideas can provoke reflection about what the role of the designer is and how we see and understand who we term users or consumers. More importantly, these points can inspire designers to design differently.

6.2.1. Building objects for multiple lives

One lesson that comes from the data is that practitioners in the three cases are very good at appropriating objects and transforming their functionalities to better fit their current needs. Regardless if these appropriations are temporary or permanent, part of routines or one time actions, the commonality between the practices is: once a product is situated in a house, or on a work bench, it becomes new material for new iterations of design. The practices described can serve as inspiration for strategies to design objects that can survive our fast paced model of consumption and be part of second and third lives.

Firstly, the study of families has shown that basic shapes like flat surfaces, hollow objects, and objects with protrusions encourage appropriation by inviting and supporting simple actions. Can we design something similar in interactive technologies,

particularly in software design? Is there a corresponding construction in software that can help people do the equivalent of hanging, pulling, or containing digital artifacts? In design-in-use, practitioners look for attributes they know will provide a solution for the goal they have at that moment (remember the example of Lori using her wallet as a flat surface to write on). The situation is two fold. First, individuals need to be able to recognize these attributes of an object and to know what the effects will be if they decide to use it. Secondly, objects need to be accessible at the time and place where the need arises. There is a need for creating products that are accessible and intelligible by individuals, enough that they can then decide to use them in different ways.

Secondly, hobbyist jewellers and steampunk enthusiasts reuse objects to remake pieces of jewellery and steampunk costumes and machines in a large part due to aesthetic considerations. Hobbyist jewellers focus on texture, color, weight, and shape and try to visualize objects as part of a composition (raw materials or found objects). Steampunks look for specific materials and shapes that remediate the materials and machines of the Victorian age. The very meticulous work of choosing objects emphasizes how individuals are sensitive to intrinsic qualities and values of products. Authentic materials were cherished and working antiques were respected in both practices.

The stories behind found objects were often mentioned as mysterious and precious for practitioners such as Veronica, Allison, Angel, and Christine. They all wish to glorify those existing (and sometimes imagined) stories by creating new pieces. For example, Angel had found an old man's watch, and the matching lady's watch months later. She decided to make a pendant with the two watches as a way to reunite the two objects coming from the same manufacturer. Heirloom objects are common in non-digital artifacts such as wooden chairs and tables, old grandfather clocks, and paper photographs. Will Odom's (2009; 2012) research is related to this interest in preserving and developing stories for objects as it aims at understanding why we preserve and discard things, and proposes ideas on how digital artifacts could also achieve the status of heirloom objects. Can we design interactive technologies that will create the same awe, magic, and respect enough to encourage people to champion them?

Lastly, functionality was particularly important for steampunk enthusiasts. When choosing objects to work with, participants often mentioned thinking about how they would disassemble the parts. Making objects that can be taken apart has been part of industrial design for many years. Can we transfer this knowledge and goal to interaction design as well? Once the objects are taken apart, steampunks have developed multiple techniques for assembling things back together and reconstructing new products (as observed in this study as well as in Tanenbaum et al. (2012) online study of steampunk enthusiasts). Tools and materials can also be thought of for this aspect of the deconstruction/construction in the practices of everyday design.

In brief, building artifacts for multiple lives can mean providing attributes that can be leveraged by people (like hooks and flat surfaces), to build in inspirational material (and interactional) qualities, and to allow for disassembly and reconstruction of objects.

6.2.2. Creating materials specific to practices

Materials used by the practitioners in these three cases can be categorized as household objects or raw materials such as metal, stone, thread, or leather. However, the distinctive qualities of these materials are the attributes that mattered to each unique practice. Objects and materials are chosen for their shape, color, or texture in a way that can serve the goals of the practice: creating balanced and unique compositions in jewellery or reviving the aesthetic of the Victorian era. The same objects can be chosen in different practices for completely different reasons. There might be an interest in designing materials that are exclusive to certain practices. In interactive and tangible technologies, materials like arduinos, lillipads, sensors, and LEDs exist to support the practice of hobbyist or professional programmers and hackers. They are built to support the specific practices of making electronic machines and prototypes. The desired attributes in this case are connectivity between elements, the ability to program the micro processors, and, in some cases, the aesthetic qualities of the circuit and output sections.

Additionally, materials were also chosen because of a practitioner's ability to work with that specific material. Jewellers typically choose a small quantity of materials to work with, so that they can learn how to work with that material and push its limits. In

the case of arduinos and sensors, the materials require that the practitioner has precise knowledge and skills in programming and circuit building to be able to model and activate the parts, as much as a steampunk enthusiast needs to know how to solder if he wants to work with metal. In both cases, specific skills are required to modify and use these types of materials, which is in and of itself not a problem. However, if we want to encourage appropriation and modifications to a larger population, designers of interactive materials can aim at creating materials that are accessible and malleable for more than programmers and hackers.

New materials can also aim to be in sync with the common tools everyday designers use, in addition to fitting their skills. Materials that could be used in the home need to be easily modeled with hands without requiring a designated space like a studio. An example of an existing new material is Sugru. On its website, Sugru is described as: “the exciting new air-curing rubber that can be formed by hand. It bonds to most materials and turns into a strong, flexible silicone rubber overnight” (http://sugru.com/). Sugru fits nicely with family members’ tools and skills and can be used to hack or repair objects in the home. Of course, this does not support temporary solutions or quick solutions because it needs time to dry, but it could be used in systems and longer term appropriations. Designing interactive technology materials can be inspired by materials like Sugru. While clearly understanding the context of use and the skills of practitioners, it pushes the limits of home made repairs and hacks. Can interactive materials also be modeled just by hands? Can these materials be coded and programmed with tools everyday designers already know?

In summary, materials can be designed for specific practices by focusing on particular skills, tools and goals of a group of practitioners. Electronic materials and structures already exist for hackers and programmers. Can we make interactive materials that would better fit other everyday practices?

6.2.3. Develop tools to support making and sharing

In the practices of hobbyist jewellery and steampunk enthusiasts, particular tools such as glue guns, Dremels, pliers, and cutters were often used in many projects. Although many tools were adapted and appropriated, these tools were central to the

practices observed. In addition to designing new interactive technologies, could designers think about making appropriate tools for allowing people to modify existent technologies?

Tools can also be the starting point of a practice. Adrian, a steampunk enthusiast, mentioned how much he loves tools and how they are the first things he buys when he wants to learn a new technique or work with new materials (see 5.3.3). Engaging and compelling tools can be the start of a practice of making in the digital realm by piquing people's curiosity and by being easy to understand and learn. The study also shows that tools are closely related to the skills of individuals. It seems like the more skills a practitioner has, the more he or she is willing to try other tools and techniques. When designing tools, similarly to designing materials, designers need to verify that the tools can be adapted to the level of skills known in specific practices.

Specialized tools can empower people greatly and allow them to make projects that they could have not done with hand tools alone. In the case of steampunk enthusiasts, the access to a CNC machine transformed the way Christine and Mario were able to make precise pieces like functional gears and detailed engraved embellishments. The economic investment, the space needed to operate, and the knowledge about how to run these types of tools can discourage practitioners from acquiring these tools. However, in the last few years, some organizations are setting up workshops with specialized tools such as CNC machines, laser cutters, and 3D printers. These organizations, like FabLabs and HackerSpaces (see 2.1.4), provide the tools and the necessary space for members to use them. The evidence from the steampunk case indicates that there is more demand and need for similar spaces. These studios and workshops encourage and support everyday practices that are more integrative and structured in nature.

Finally, the study demonstrated that sharing and being part of a community can foster the development and exchange of skills and techniques for making. The participants already used Facebook pages and groups, personal blogs, instructables.com, etsy.com, and google.com as tools to share processes and outcomes. Can designers think about other tools to help share information, ideas and inspiration, knowledge, and questions? These sharing tools should mainly help

practitioners make contact with like minded people and encourage discussions. It should also be made clear that everyone is invited to share, and even if a technique is not the 'professional' way to make something, it can still inspire other people. This may encourage people like Sophie and Tera to show what they know and not be hesitant to share their jury-rigging techniques, which could then inspire other people.

6.2.4. Focus on education

The three cases show that learning everyday design techniques and competences happens through learning by doing and learning from others. Learning by doing is mainly composed of trial and error processes, observations, experiments, and curiosity. In a chapter of the book *Open Design Now* (Abel, 2011), Caroline Hummels describes how design education should shift in order to accommodate and encourage this set of skills and competences, which also includes imagination, opening up, ambiguity, questioning, collaborating, and open-ended conversation (Abel 2011, p.164). She argues that these skills are necessary for designers to be prepared to design for open design, a design where makers allow the free modification, documentation, and distribution of the designed artifacts they produce (idem, p.11). I add that these skills could be part of everyone's education in order to help develop skills and competences that can be used and reused in everyday design practices.

Education and learning can happen as part of communities. The steampunk group exemplifies how a community can support learning from others through conventions, panels, and online sharing. One online example of a community for learning making practices is the GirlsGuild, a project by Cheyenne Weaver and Diana Griffin at the Austin Center for Design, in Austin, Texas. The Girls Guild is a website aiming at connecting working artists with young women through apprenticeships and workshops to share knowledge and skills of making. This structure encourages exchange, learning, and the building of a sense of community.

Competences like thinking creatively and resourcing materials can encourage more acts of appropriation and making in the physical world. As seen in the study, acting in the digital world can require more skills and it was observed only in the steampunk group. Education about digital fluency and digital literacy can start at an early age.

Similarly to learning math or French or English as a language, young people can also start to learn how to program. This study also shows that learning or being exposed to crafts and arts as a child has an influence on how individuals approached projects, techniques and materials later in life. An example of a programming tool for children is Scratch[8], a MIT Media Lab project. It aims at empowering children with an easy and simplified language for programming interactive stories, art, music, animations and games. Up to now, about 2,5 million projects have been shared on the website. If we want to empower people to apply everyday design to interactive technologies, there is a need to teach basic skills in programming to allow people to modify and transform the existing technologies.

Finally, education can help develop skills and competences in relation to specific materials, particularly digital materials. Learning at an early age and learning through a community of makers can be valuable strategies for encouraging people to engage in more practices of everyday design.

6.2.5. Support iterations and experiments

Systems and projects are often built over a period of time, through multiple experiments and iterations. Evolving systems in homes, series of jewellery pieces, and prototypes in steampunk practices are common ways to achieve solutions, through iteration, that are assured to fit the initial goals. In all cases, iteration takes time, not only in the making of the different artifacts, but also in the time for reflection, discovery and resourcing of materials, and experiments. Today, the landscape of interactive technologies changes at a high speed pace. We can reflect on how much time people have to use and iterate on a certain type of product or technology before a new type is launched on the market. Is this a factor that can have an influence on everyday practices with technologies?

[8] http://scratch.mit.edu/

Experiments are often done on pieces that were not as precious as the envisioned final piece. Steampunks work with many parts that are unique, so when they need to try a technique for cutting, piercing, or adhering they typically try on a similar piece of material first before attempting to work on the unique piece. Rough, quick and dirty prototyping is more likely to support experimentation in the practices of everyday design. Experiments also need immediate (or relatively fast) results to allow individuals to progress with their projects. What would be an equivalent to prototyping with cardboard, or trying on a piece of scrap leather in the realm of digital technologies? Today, technologies are seen more as precious, expensive, and hard to disassemble artifacts. Could designers think of ways to provide people with less intimidating and sterile objects, hence stimulating more opportunities for experimenting and iterating? Designing low quality or low fidelity parts of interactive technologies could serve in the process of making experiments for everyday designers who want to start working with electronic components.

6.2.6. Designing for heterogeneous practices of everyday design

Chapters 4 and 5 demonstrate that practices of everyday design have different goals and outcomes, which influence the other aspects of practice. The three cases presented are only three examples within a larger and more diverse set of practices that can all be understood as everyday design. This finding speaks to how designers can view and understand the users of the systems and products. Instead of thinking that users will appropriate and transform objects, designers can now envision how practitioners have different motivations and goals for making and adapting things. The same toy hat can be reused in distinct ways by families (to carry other toys), jewellers (to hold beads and materials), and by steampunks (who might cut it, glue to it, and paint it).

In order to understand and design for the subtleties of each practice, designers and researchers can further explore how individuals engage in acts of everyday design. Two options are available. Firstly, the tools and materials they use are already hints to how products could be designed for particular practices. This approach entails that designers stop designing one-size-fits-all structures and artifacts and start designing for smaller subgroups, subcultures, and communities. Jewellery basic materials and gears and pipes for the steampunks are pieces that are designed specifically to support each

practice. Secondly, on the other hand, another approach would be to design openly enough to support the making in many different practices. Common household objects are used as materials in the three practices and hands are tools shared across the participants. This demonstrates that common materials and tools can be offered to everyday designers in different practices. Also, products that can easily be disassembled and reconstructed and artifacts that have intrinsic compelling aesthetic and functional values, could leave up to the practitioners to make them fit their own subcultures. Designing for heterogeneous practices can mean to either focus on one particular practice, or to design open and broad products that can then be appropriated by different subcultures. Both approaches require different strategies, either to correspond to the particularities of each practice, or to design for the commonalities between the practices of everyday design.

6.3. Reflections on interaction design

This study can also inform designers and researchers in reconfiguring and rethinking what the role of interaction design and technology research can become.

Everyday design, as expressed in the three cases of this study, presents and embodies an alternative perspective to the current consumption and production model. Practitioners sometimes show alternatives unconsciously, like families, and sometimes in a conscious and proactive way, like steampunks and hobbyist jewellers. For example, Lucia, a hobbyist jeweller, decided to make her own jewellery because she was not satisfied with what she could find in stores. Frank, a steampunk enthusiast, decided to start making things as a way to gain control back on the objects that surround him everyday. Aaron create the CELL as a way to critique and have other people reflect on our relationships to mobile technologies. These examples show how people can participate differently in the production and consumption cycle through everyday design.

By having people be part of the design process, consumption becomes more than a simple trade of money for goods. Coming back to a model where people engage with objects and transform them is not only good for the environment or for guaranteeing a better fit with people's needs. Encouraging people to be creative and inventive can

have many personal benefits. Jewellers and steampunk enthusiasts have explained it clearly: a large part of the motivation for making things is the inherent pleasure of making. The balance between fun and challenging aspects of making and finding techniques that work after many experiments are two points that can drive everyday practitioners. This finding shows that users do not always want ‘user-friendly’ products. They are ready to work and spend hours on modifying an object that can then better fit their needs or ideologies. As presented earlier, being able to make things in their own ways brings a feeling of control over the objects that are modified.

The process of making brings individuals closer to objects as well. Being able to understand all the steps that are required to create something creates a different relationship between the individual and the object. Jewellers were very sensitive to this new relationship between themselves (the maker) and the object. When giving jewellery pieces to others, the participants were aware that they were also giving a part of themselves through the object. Participating in the making of an object can bring a more meaningful relationship, which can then lead to more compelling and meaningful interactions.

A different production and consumption model would also have environmental sustainability implications. By allowing objects to have second and third lives through a new and evolutionary design, we could start to reduce the quantity of general waste and e-waste. Furthermore, changing the consumption and production model also means changing the role of the designer. As presented in section 6.2, this study points to six different ways in which designers can help individuals pursue their practices of everyday design. In this new model, designers not only make objects, they also make materials, tools, and structures to support exchanges and discussion in communities.

6.4. Limitations of the study

Descriptive case studies are often hard to generalize because of the nature of this type of inquiry. In this study, firstly, there were only three cases observed and studied. This three case model was chosen in order to describe each case in detail and in depth. However, this makes theoretical generalization more challenging. Additionally,

these three cases were chosen because of their differences in order to show the wide range of practices within everyday design. In order to verify the generalization, studies of practices like knitting, model making, repair, and more should be also compared alongside the three cases presented in this research.

Selecting two contemporary cases and one second data analysis case also results in some limitations for this study. For the cases of jewellers and steampunks, the interview questions and protocol were developed in direct relation to the research questions. Also, adjusting the necessary questions throughout the three sessions was possible in the contemporary cases. In the case of families, the data was already collected and the notes were from the ethnographers of the original study. There were some instances where there were examples of everyday design and transformations that could have been useful for the study, but were not detailed in the original study. As part of the observations made in the original study of everyday design, the ethnographer noted important renovations in the house of the Cate and Paul's family (reconstructing the inside and outside wall of the house). In this case, the ethnographer was not present when the family was doing this work, therefore I have no data about what tools or materials were used in this case. Therefore, I discarded these cases and focused on more common acts of everyday design practice in homes. Since the data of the family study was rich and contained many more examples, this omission does not bring doubts to the validity of the findings.

The duration of the study also differed between the study of families (five months), and the study of jewellers and steampunks which were one month each. For questions of time and resources, the studies of jewellers and steampunks were shorter. This can be seen as a limitation of the study, but the goal of the observations and meetings were clearer than the study of families, and after three meetings, I had the sentiment that enough data was collected in order to cover the practice of each participant.

6.5. Conclusion

The beginning of this chapter provided a revision of the case study propositions based on the results and comparison of the three cases. These new propositions are summaries of the important similarities and differences across the cases, and served as a starting point for the discussion part. I presented six guidelines for designers to support practices of everyday design. I also articulated a discussion that can help reconfigure and re-imagine what interaction design should be, in the light of everyday practices.

This thesis is a descriptive multiple case study of practices of everyday design. The comparison between the practices highlights how multiple practices of design and making can be supported by different goals and competences. Most of these practices exist outside of the process of design in industry. Although interaction designers can learn from these practices, there is still work to be done to help reconcile how designers make and conceive, and how people engage in creative practices. As presented in section 6.2, some tools, structures, and materials exist today to help individuals engage in creative practices and rethink our relationship to artifacts, and technology. The ideas presented in 6.2 also point to new ways designers can help foster everyday practices.

7. Concluding Remarks

Everyday design is a powerful starting point to reflect on interaction design as a practice and interactive technologies as artifacts and systems that are part of our everyday lives. By highlighting the creativity, resourcefulness, and competences of everyday designers, we can provide a new perspective to the mainstream idea of the user.

Previous research has shown that different groups engage in appropriations and making practices as part of their daily routines or as part of hobbies. The appropriation of artifacts and technologies, the adaptation of systems, and the transformation of objects have been studied through different lenses, including social perspectives and more individual points of view such as in homes and at work (chapter 2). These studies show how users are unpredictable and surprising and how user-centered design techniques cannot predict and prepare for all of the users' situations and behaviors. These studies also construct a new identity for the user (Wakkary & Tanenbaum, 2009). The user is no longer seen only in terms of how he or she might achieve a task, but as a creative co-agent that reuses, re-invents, and renews artifacts and surroundings through design-in-use. This new identity reframes the user through a more holistic lens that looks at the multiple and various goals and motivations one might have for using design artifacts.

In order to direct the practice of interaction design towards designing for everyday designers, it is clear that there is a need for gaining a better understanding of the processes they use to transform object in detail. Previous research has focused on different aspects of appropriation, the maker culture, and everyday design (chapter 2), but there is a shortcoming in the description of processes and strategies for making, which include materials, tools, competences and skills.

Practice theory was identified as an appropriate theoretical background to understand the multiple intertwining aspects of everyday design. This perspective allows us to look at everyday design as a practice, which entails that all dimensions of the

design process are looked at, including the why (goals and motivations), the what (outcomes), and the how (materials, tools, competences and skills) (chapter 2). Practice theory also directs attention to the strategies employed by individuals to combine the previous aspects described in the design process into the making of a project. In the context of everyday design, practice theory is also useful to describe integrative and dispersive practices (Schatzki, 1996), which resonates with the differences between the dispersive practices of families on one hand, and the more structured and shared integrative practices of hobbyist jewellers, and steampunk enthusiasts on the other hand.

In order to better understand the practices of everyday design of families, hobbyist jewellers, and steampunks, I designed a multiple descriptive case study of three groups of everyday designers (chapter 3). The goal was to use the three groups in a comparison to unveil the differences and the similarities across the practices of everyday design. The results show that each practice is unique in terms of goals and motivations, materials, and tools, but that strategies and competences are often similar across different practices of everyday design (chapters 4 and 5).

The concluding remarks of this thesis revisit the research questions, the research contributions and outline four directions for future research in relation to everyday design and interaction design practice and research.

7.1. Revisiting the research questions

Since the propositions were revised in chapter 6 (section 6.1), here, I revisit only the main research question, which was to determine the similarities and differences between the practices of families, hobbyist jewellers, and steampunk enthusiasts. I start by summarizing the particular findings for each practice, which demonstrate the differences across the cases, and then present the common aspects to all three practices.

In brief, the practice of family members relies heavily on finding ways to get by in daily events and activities. Creating systems to better organize information, or to be more efficient in achieving daily chores are as important as the spontaneous acts of

appropriation that are central to everyday activities. The use of very few tools and materials other than common household objects support the creative, ever-changing design-in-use actions that family members engage in.

The practice of hobbyist jewellery is motivated by the goal of creating unique jewellery and by the enjoyment individuals have when engaging in the making of jewellery. Materials are the focus of the work and they drive most of the decisions hobbyists take when resourcing and appropriating tools to model or assemble pieces. The abilities to envision and experiment combined with artistic sensibility as well as dexterity and patience are shared competences between hobbyist jewellers in this study.

The practice of steampunk enthusiasts is motivated by the goal of remediating a past that never existed where steam, brass, leather, and wood are assembled to create outfits and machines. Steampunk enthusiasts demonstrate ease in working with different types of materials, as well as utilizing, exploring, and experimenting with a wide range of tools. The opportunities to share knowledge, techniques, inspiration, and finished projects are numerous in the steampunk community, both online and offline.

The similarities across the cases arise mostly in the competences and strategies for designing and making. All participants engage in resourcing and appropriating materials they find either in the home, or in a number of other places such as thrift stores, garage sales, or arts stores. They design-in-use as they conceptualize and iterate on projects or series of similar pieces. All demonstrate that learning by doing, even though it is not the only strategy for learning, is at the center of processes of making and always increases the level of skills and of the outcomes. Some similarities are also observed in the basic materials and tools used in the practices. The three groups use common household objects, sometimes exclusively, sometimes in combination with other materials. Finally, practitioners transform artifacts with their own hands, or basic household tools such as markers or scissors. In short, the study shows that all groups engage in an alternative way of consumption and use.

7.2. Contributions of this research

This research hopes to contribute both to interaction design practice and design research. I outline four contributions of this research.

Firstly, the case reports and the comparison between the cases provides an in depth description of three practices of everyday design. The individual descriptions provide knowledge about these particular practices, hence adding to the current descriptions of different practices of everyday design (also see Goodman & Rosner, 2011; Kim & Paulos, 2011; Maestri & Wakkary, 2011; Rosner & Bean, 2009; Tanenbaum et al., 2012; Wakkary et al., forthcoming). Additionally, the comparison of the practices and particularly the analysis of the commonalities and differences help build a more detailed and more accurate picture of what everyday design is and what it might entail.

A second contribution of this research are the six guidelines for leading interaction designers towards designing for practices and for everyday designers. In section 6.2, I present and describe the guidelines and how they arose from evidence in the study. These guidelines speak to larger topics than only the design of interactive technologies. Designing materials and tools that can support everyday design can also become part of the role of interaction designers. Making things that people can use, break, repair, modify, change, and live with can not only encourage appropriation, but also experiments and iterative processes, which are central to everyday design. Focusing on teaching basic coding and electronic skills can also lead to more everyday design in the realm of interactive technologies. Moreover, the guidelines also include examples of existing structures or products that encourage creativity and empower people for making, demonstrating that this future is not that far off.

The third contribution of this research is methodological and speaks to the usefulness of the theoretical background chosen: the theory of practice. By the means of this research, I provide an example where practice theory is a valuable approach for describing everyday design. The lens of practice, with its different aspects, allowed me to focus in detail on goals, outcomes, materials, tools, competences, and strategies. The categorization was helpful, particularly in the context of a case study, because it

provided a frame for the research questions, the propositions, the data collection, as well as the data analysis. It also provided boundaries to the cases. The categorization was not the only way to describe the findings. Strategies were presented and helped combine elements of practice in order to achieve the practitioner's goals. In brief, elements of practice theory were effective for drawing a holistic portrait of everyday design.

Finally, as a fourth contribution, I hope that this research can contribute to the start of an exciting discussion about how we can foster more everyday design practices. Discussion and collaboration between researchers, academics, and professionals should focus on how we can empower people and encourage them to be creative and pursue everyday design. This discussion can also look at refining and adjusting what the role of the designer should be in the field of interaction design.

7.3. Lines for further research

This research provides a start for further research in the everyday design field, both in theory and in practice. In this section, I propose four directions for future research: conducting more case studies of everyday design practices, investigating the current tools and structures available that support heterogeneous practices of making, questioning the place of everyday design in the industry of design, and exploring and designing for practices.

Firstly, this research presents only three cases of everyday design practices, a very limited number along the large continuum of practices. It would be of interest to pursue this research with additional groups of everyday designers. This could verify the findings proposed in this study, but more importantly, it could open new areas of interest. What would it mean to design for the practices of cooking? Model making? Gardening? Is there a possibility that these practices show something different than the cases presented in this thesis? Moreover, a study of more extreme practices of everyday design could also be interesting. Skiing and hiking present very specific outdoor conditions, where everyday design can sometimes be a question of life or death. The story of Aron Ralston, depicted in the movie *127 Hours* by Danny Boyle, based on the

autobiography, *Between a Rock and a Hard Place* (2004), provides an extreme example of everyday design. Ralston's accidental fall in a canyon leads to his arm being trapped between the wall and a rock. During five days, he resources everything he had carried in his backpack (a multi-tool, his climbing gear, and a camera) to survive and finally amputate his arm and leave the canyon. While this dramatic incident is perhaps a rare example of the extent of everyday design, there are areas where everyday appropriation of artifacts is an accepted part of life - the arts are also an area where appropriation and subversion of authority are common. Finally, groups such as homeless people and cultural events like the Burning Man gathering, and other more radical groups also show different perspectives on what it means to consume and produce artifacts and technologies. Investigating other groups can also help in identifying the limits and boundaries of everyday design.

A second orientation future research could take is to examine existing tools and structures that support heterogeneous practices. Physical spaces like Fab Labs and Hacker Spaces are places where tools and help are available for people who want to make things. Evaluating how these local resources help foster creativity, as well as a sense of community could also highlight how we can create future tools and structures to support everyday design. Online tools such as instructables.com, crafters.org, and etsy.com aim at providing peer-to-peer support for tutorials and finished projects. Exploring these tools through the lens of everyday design and practice theory can show opportunities and limitations and can inform the design of future online tools.

The third direction would be to ask: what is the place of everyday design in today's industry process. Are they two entities that do not work together, or can one inspire the other and vice and versa? Understanding the professional practices of interaction designers in relation to the life of products after production could help find opportunities for the integration of appropriation in the design process. I argue that there is a necessity to include appropriation as part of the lifecycle of the design of artifacts in order to design technology that is both more relevant to people and more sustainable. By giving an authorial role to the user, we increase the possibility for uniqueness, mutual intelligibility, creativity, and better fit for context. These are crucial for profound adoptions of artifacts and can lead to longer usage, repair and reuse; hence it can be beneficial from an environmental sustainable point of view as well as from a human point of view.

This direction of research touches more on business and design management fields and multidisciplinary research teams could collaborate to fully address this question.

The final axis for further research is to conduct research through design. This implies that by designing objects, or materials and tools, the researcher/designer can learn about the theoretical ideas he or she puts forward. Eva Brandt and Thomas Binder (2007) from the Center for Design Research in Copenhagen explain how design experiments, within design research, can test not only the guidelines for design, but also the possible results of such a process.

> We think of the design experiment in design research as on the one hand the result of a truly designerly engagement with possible form that can be appreciated and evaluated as design and on the other hand as a deliberate attempt to question what we expect from such design. (Brandt & Binder, 2007, p4)

The line between practice and theory is too often hard and inflexible. I believe we could greatly benefit from blurring that line and doing so more often. In the context of everyday design research, and the guidelines proposed in this thesis, design experiments can start to address the design of artifacts, materials, and tools for everyday design.

In conclusion, describing and understanding practices of everyday design is only the beginning of a larger transformation in the design, production, and consumption of design artifacts and interactive technologies. This research has shown that everyday designers are creative and resourceful to achieve their goals with their own competences and skills. Hopefully, this study, and the guidelines for interaction designers, can nourish a design process where everyday design is championed and where personal creativity is revived to reconnect with design objects and systems.

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Appendices

Appendix A.

Case Study Protocol

1. Procedures for meeting with the hobbyist jewellers and the steampunk enthusiasts

I will conduct three or four sessions of approximately two hours with each participant. Field work always includes a part of “hang out” before getting to the core of the questions and interviews with the participants. This aims at letting the participant gain trust and feel more comfortable around the researchers; which will lead to more openness into participant’s world.

First contact –Getting to know each other

The first sessions will allow time for getting to know the participant, observing the practice of the hobby or of the do-it-yourself projects that they do in order to get a better understanding. It will also allow for people to show some of the projects they created. I do not assume that I will see a lot of appropriation the first time. The appropriation may lie in the tools used, in the environment surrounding the practice of making, or in the materials used.

Questions, observations and pictures

The second session will support more observation of the practice. I will also start to ask questions in a semi-structured interview fashion. I will audio-record the answers to these questions, and will take notes. I will take pictures of the artifacts, tools and environment in order to construct a photographic inventory.

Closure – Videos and last questions

The last session with the participants will focus on closing the topics that were left open in the previous sessions, and to record (videotape) sequences of action of appropriation, with narration by the participant. I will also take final pictures of objects or actions that I did not take in the previous sessions.

2. Having sufficient resources while in the field

During fieldwork, I will always bring a camera (video and photo), paper, a pen, an audio recorder, the list of questions pertaining to the group interviewed and a shooting guide for pictures and videos. The shooting guide will allow me to stay focused on what data is relevant and necessary to the study. It includes three levels of information: 1) space or room the work is being done, 2) the collections of tools and materials owned by the participants, and 3) the items appropriated (tools, finished or in progress projects).

3. Making a clear schedule of the data collection activities and providing for unanticipated events

I will meet with one participant at a time for hobbyist jewellers and steampunk enthusiasts, so I can manage my schedule around their time schedules. I will be as flexible as I can in order to let the participants feel comfortable. I will meet the participants at their homes, or where they practice their hobby. I will prepare in advance the meetings for each person and will cope with delays by communicating with the next participants (and rescheduling if necessary).

4. Procedures for protecting human subjects – Consent form

Each person who might be part of the study will give informed explicit consent through an informed consent form. This form will provide information about the nature of the case study and formally solicit (Yin, 2009, p.73) their volunteerism for participating. The informed consent form will be accompanied by:

A *study guide*: This document describes what I am looking for in the study and presents the steps of the 3 to 4 sessions of observations.

And a *list of questions for the semi-structured interview*. This list contains all the points and questions I want to address during our meetings.

See InformedConsentForm.pdf, StudyGuide.pdf, and ListQuestions.pdf

There is no possible harm in this study for the participants. I will protect the privacy and confidentiality of the participants so that they will not be put in undesirable positions or contacted in the future for participating in a different study by me or another researcher.

This research procedure will be reviewed by the Office of Research Ethics at Simon Fraser University and will be conducted conditionally to the approval.

All the data collected (transcripts, memos, photos, videos) will be kept in an external hard drive locked by a security code. Only Ron Wakkary, the project supervisor, and myself will have access to that date. The data will be kept for at least three years, as stated by the policy of SFU.

In all the publications (thesis, presentations, articles), I will protect the anonymity of the participants by using pseudonyms to refer to them.

Appendix B.

Interview Questions for Hobbyist Jewellers and Steampunk Enthusiasts

Introduction

This document presents the questions I will ask over the course of our four meetings. I will audio record your answers and then transcript the significant parts.

For each object or system that contains some level of appropriation, I will concentrate on:

- Did you repurpose one or multiple artifact(s) in the practice of your hobby [jewellery or steampunk]? (tool or end product)
- Looking closely at each appropriated artifact, describe the process you went through to achieve the project.
- What are your motivations and goals for making that project?
- What tools did you use?
- Where did your ideas come from?
- How did you know what techniques to use?
- How did you learn that technique?
- What physical aspects of the artifacts played an important role?
- Did you share your project with others? How?
- What are the implications of sharing the project (or technique)?
- Did you apply that same process/technique to other projects after this one?

In addition to the verbal answers you will provide, I might ask for a video walk through of how an artifact is created, step by step or take pictures of the artifacts appropriated, your tools, and your work environment.

Appendix C.

Sample of the field notes

SESSION NOTES AND REFLECTION

PROJECT: Techniques of appropriation – STEAMPUNK

RESEARCHER: Audrey

SUBJECT: Aaron

SESSION DATE: March 14th, 2012. Wednesday. Session #2.

START TIME: 16:20

END TIME: 18:00

LOCATIONS: Skype. Video recorded

** The interview was in French, and my notes as well. Here is the translation to English of these notes.

SUMMARY OF ACTIVITIES AND OBSERVATIONS

Tools

Most of the tools he has for steampunk are tools he already had. There is nothing really specific to steampunk. (It is more the materials that are specific than the tools).

The Dremel

This is one of the top tools he uses. (without this, there is not a lot happening!) He uses different bits and tips with the dremel:

- The small disk for cutting: cutting metal sheet and sticks. Eg. for top of chimney (but it becomes extra sharp, so he needs to sand it off after).
- The small stones to grind
- The sand paper cylinders.

The Drill Press

He doesn't have one at home, but his father has one, so sometimes he works over there. There are a lot of things in steampunk that are round or cylinder, and to pierce then, it is really hard without a drill press. When he doesn't have access to it, he usually punches a small mark with an old punch, and then uses the dremel.

The hot glue gun

Amongst many things, he uses the hot glue to isolate things. (it is basically liquid plastic that becomes hard). It doesn't work on flat surfaces, you have to use it where things are already intertwined.

Limits of hot glue:

- doesn't work on a flat surface
- it is not completely rigid once solidified, it will always be a bit flexible.
- There are threads of plastic everywhere after! You have to take them away.

- He has to manage the temperature. Sometimes it becomes too hot.

Advantages: if you make a mistake, you can easily take an exacto and take it away.

(he also recently learned, but didn't try, that the glue gun can melt epoxy too, to undo errors!).

Other tools:

- He is thinking about buying a small mouse (electric sanding machine, really small, easy to move and control).
- Security goggles and gloves are more than necessary. Gloves for protecting against heat mainly (work with candles, or with metal, it heats up pretty fast). Even then, there are always small accidents (cutting, burning), it is part of it!
- Small cutting tool for tubes (clip that presses on two sides, and has little rotating blades. You tighten the claw around the tube, and then turn). He bought this one for making the USB stick.
- He recently bought a jigsaw mainly for cutting wood. He realized that it was pretty easy to make any shape he wanted, even in small pieces.
- Helping hands: for soldering this really helps! (he got it almost at the end of making the CELL, and he had sworn a lot before that!)
- He used his pliers to sew his cellphone case with the metal wire. His hands were not strong enough to pull the needle.
- Head lamp for playing in small dark corners of props.

Choosing the tool

Different ways to choose a tool:

- From experience
- By learning from looking at how his dad did it. And then tries the same thing
- By intuition (sometimes, he knows that a technique can work now, but it'll be hard for other steps after, so he changes the technique. Same as in his job as a programmer).
- By mistakes. If one doesn't work, try something else.
- By elimination. He looks at the tools, looks at the potential ones. If he is pretty sure, he will try it. If he thinks it might work, but really not sure, he will try it on a pilot on the side, where he can't break the prop or anything else.
- If nothing works, he goes and buys the tool he needs.

If something doesn't work after different tries, he just walks away from it, and let it sit for a while, the idea will come after a while by itself. He doesn't have to make it work that day, so he has the luxury of letting go for a while. He was lucky that for the CELL almost all his ideas worked in the first place. It was a bit harder for the last pieces he installed, eg the corners.

Eg. he was looking for a cylinder to shape the spring antenna. He didn't find anything in the basement, so went upstairs in the living room, standing, looking around for cylinders. He finally saw the rock band drum leg. Took it down to the basement and turned the antenna. This was an elimination process.

Work environment

His apartment was an old hair dresser store and the basement was the lunch room for the employees. They were the first ones to move in when they changed it to an apartment. The basement was never really finished. The room he works in is about 9x10 feet.

In the basement of his apartment, he has a whole wall with holes to attach his tools. (black panel with regularly spaced holes, making a grid). A store nearby had them, and they closed, so he took one panel, and cut it to fit this area.

In front, he has a small coffee table found in the back alley.

He typically reorganizes his tools and materials once he has no more space to work on.

Top shelf is to store mainly all liquid stuff: paint, glue, nail polish remover (removes the industry marks (numbers and letters) on brass tubes (he asked on the facebook steampunk page, and all the girls replied that this was the way to do it!)., crazy glue, contact glue, stain for wood.

Materials

He uses rivets made for wood to hide any holes! (they are in brass).

Choosing materials

It happens in different ways:

- Sometimes he doesn't question it at all, he just gets them, e.g. the clock mechanisms
- Sometimes the piece is ordinary, but really cheap, so even if he doesn't know if he is going to use it, he buys it.
- Sometimes, he is looking for a specific piece.

There are two strategies:

- Start from the piece: sees a piece and it gives him an idea of what to do with it, or he doesn't know what to do, but still finds it inspiring and will eventually find a use.
- Start from the goal (what he wants to achieve).

There are two types of duct tape: the smooth one (thicker, but sticks less), and the one with the strings inside (thinner, a lot stronger and sticks more).

Many times he went to home depot knowing what he wants to achieve, but not knowing what piece he needs. (found the chimney at the home depot).

Sometimes, he finds materials that are more authentic than his idea (eg. the clock key, he was wondering how he was going to make it, and then found a real one).

He has to look at places other than the ones you know. It is in unknown areas that you find new things.

Philosophy of making

When making the props, he does not try to make things following the methods of the era. It is more about the final result than the way to get there. The inside of pieces do not have to be pretty, only the exterior counts. The inside part of the CELL, is actually considered an exterior part since people can see in it. Only the frame around is part of the interior, where he can hide things.

Help from others

Sometimes his wife helps him with larger pieces, eg. cutting a large sheet of wood, installing the board on the wall for the tools. She also helps for ideas sometimes.

He also gets inspirations he sees everywhere. There was an episode in the MASH series that presented two electric cables on the wall, separated by 3 inches. This is where he got the idea for the CELL. There is real current that goes through these wires. People are often scared since they are so used to the fact that everything is always isolated. But there is only 3V going in these wires, this is less than when you put your tongue on a 9v battery.

Link to other Cos Play

There is a link between medieval full size play and steampunk. When he was playing Dungeons and Dragons, he wanted to play it live, so he made a costume for this. Once he started, he really liked the fabrication part as well. For the steampunk, he started with the idea of participating in a steampunk full size, but it stopped after a while. Today, it is not really about playing, but more about the making of the costume and prop. He doesn't need the competition model that much anymore.

When he likes something, almost everyone knows. But steampunk is not a lifestyle, it is still a hobby. (even if he brings certain aspects of it in his life, eg. usb stick and cellphone case). He also transferred the diy philosophy to other aspects (watching homemade movies more than blockbusters)

Conventions

He goes to convention to see other people and to talk to people. This is the main motivation for going there. This was different 10 years ago, where he wanted to meet with stars. He is really interested in knowing the people in the steampunk community and help them if he can. This is his way to tackle the "problem" of steampunk becoming mainstream. Instead of letting it happen and being unhappy, he wants to orient people so that they make things, and not just buy a costume (this is the main problem he thinks). He doesn't mind having more people, he just wants it to stay a diy community.

The steampunk trophy

Adam Smith made it. The base is either a bell or a lamp base. It is made of brass, and the two wings are black plexiglass.

Demo 1: taking a gear off the shaft

He takes a pair of pliers that don't really close on the shaft. He holds the shaft vertically, on an anvil (he had it for his leather projects), with the pliers around the shaft, placed on top of the gear. Then he hammers it to release the gear. This is not the best way to do it, and when the gear is too tight, it can deform it.

Demo 2: Wax

For some time now, Alexandre had been looking for a way to isolate the wires he soldered together in his CELL. Following the advice of friends in the Facebook Steampunk community, he decided to try to coat them with wax. He brought small white candles, a larger red candle, and some wax shavings he had.

He installed the CELL on its back, on a small table that fits exactly between the leather suspenders. He lit the candle and waited for the wax to melt. Once it was partly liquid, he blew the candle, and he dipped the wires (at the connection) in the wax. It solidified almost instantly when he took it out of the wax. There were some instances were the wax didn't want to cover all around the wire. It was either too cold, or the wire was creating a heat sync.

The biggest problem he encountered was how to reach from the candle wax to the wires since the wires were not that long. He tried to hold the small candle with gloves (he switched from big gloves to more precision glove). Also, he realizes that once the fire is off, the wax solidifies quite quickly. In between every wire, he has to light the candle again.

He tried with the candle still lit on, but quickly decided not to do so.

He tried with the larger candle. It seems like the wax is more liquid and solidifies less quickly. He can take it in his hands and bring it to the wire, something he couldn't do with the smaller candle. He thought the bigger one would have been more cumbersome, but it works better because he can move it.

Observation: this is really a trial and error process. It is really like an experiment.

There was a wire that was supposed to be attached to the box for the batteries, so he used black duct tape to attach it and isolate it at the same time.

Demo 3: Hot glue

He uses hot glue to isolate wires as well.

He has a relay for his 3 circuits and he needed to isolate those as well. But he didn't want to isolate the fourth pin, since he could still use it for another circuit eventually.

He puts the relay in a small vise to hold it and prevent it from falling on the side. He starts to put glue around each pin, to isolate them. His main goal is also to gain in solidity, so that it is not only the solder that holds things together.

Using hot glue instead of wax for the wires was not a preferable idea since he knew it would make a large ball of glue on the wires (when not attached to anything else). But he used it anyways at places where the connections were already big.

He uses the hot glue to isolate the wires on the LEDs as well, and to add a ball in the box, so that the LEDs do not change position in the box. This is to be sure he has constant quality of light.

* he turns on the lights he is gluing to see what is going on!

CELL

Electricity Circuits

There are 4 circuits in the CELL:

- 9V: motor for the piston, and the 12V relay (which then powers the other 3 circuits)
- 2 small AA batteries: the amber LEDs and the motor for the clock key
- box for 4 batteries (but bypasses one): white flash when telegraphing
- 2 big batteries for turning the small gears. (set up in parallel, doesn't augment the voltage but increases the reserves)

Adding the corners

He got the corners, but didn't like the screws, so got some small cushion nails. It was a pretty good puzzle to put this together and still have the front part slide into place. The two bottom corners, he used 2 real nails, and one fake one in the middle (glued with crazy glue or hot glue). At the top, the false nails are on the sides, and the real one is in the middle. In order to slide correctly, he had to cut small slots to let the nails go.

New projects on the way

The articulated arm

He bought tubes (brass) and shafts (aluminum). Each fits perfectly in the one the higher size. He wants to make a piston with them (similar to the basket ball piston on the CELL, but with the real materials). He also has sheets of brass (thick enough) that he wants to curve and fit on his arm (maybe with leather). He wants to attach the pieces with a hinge at the elbow. And attach the two pistons at the shoulder, elbow and wrist. He doesn't know the details yet.

The electric crossbow

He needed a spring for this project, and found springs on mouse traps at the dollarstore (4 for 1$).

Buttons for a writing machine

He found a wooden dowel that fits perfectly in one of the brass tubes. He wants to cut small slices and make buttons by adding a paper inside with something written on it, and coat it with epoxy. He doesn't know how it will react.

Other references:

From an email sent today:

- Une entrevue donnée à CNSE pour City TV. Après l'intro, tu peux sauter à 7:25: http://www.youtube.com/watch?v=LNJtI4h2vIA&feature=youtu.be

- Le "Mad Sience Fair" de CNSE par Doctor Holocaust: http://www.youtube.com/watch?v=qUA-K3CKGUQ&context=C47d9a87ADvjVQa1PpcFN4BHsLa_5npJIx__dE4s3InNEQCjWs3SA=
- Et des entrevues avec Adam Smith, Lee Ann Faruga et moi à G-Anime. Tu y verras le CELL avec les dernières modifications: http://www.youtube.com/watch?v=oYFxoEol8Ic

Comments:

- how did he figure out the electricity wiring?
- Other demos?
- Physical attributes of objects he picks.
- How many conventions every year?
- Importance of his professional job, and his education?
- Any techniques he masters?

Appendix D.

Sample of the database table

Creator	Artifact	Materials	Provenance of material	Procedure (steps)	Tools used	Technique	Skills required	Goals and motivation	Learning	Sharing
Allison	Rose buds earrings (1-P007)	rose buds (1-I001; 1-P003)	found them and bought them in Chinatown (1-I002)	She coats them with epoxy (1-I003) and makes earrings and necklaces	see below			she just knew she wanted to buy them (intuition) (1-I004). She likes how each bud is different, how no two are the same (3-I005)		
Allison	Old jewelry	old pieces of jewelry. Geometry attracts her eye. (3-I010). She likes older darker brass color (3-I011).	garage sale and value village (1-I014), and from friends. Sometimes she knows what she wants to do with them, sometimes not, she just wants them (1-I015)	collecting the jewelry.				She chooses the pieces intuitively. (3-I008) And because they are cheap (3-I009)		
Allison	stones wrapped in metal wire (2-M001)	metal wire (platinum or silver), semi precious and precious stones. It is easier to work with irregular shaped stones compared to perfect geometric shapes. (2-I021; 2-P008)		Technique is mostly based on intuition (2-I011). First, she decides what orientation the stone will have, based on its shape and weight (2-I014). She follows the angles in the stone (2-I012). The next place she goes with the wire is where it has to be secured (2-I013; 2-P009). She does not pay too much attention, but she always ends where the hook is supposed to be.	pin (to release tension in the wire (2-O002)), pliers (to pull the wire),	wrapping, tensing, bending, pulling	Some stones are more challenging than others. She says it is frustrating but she wants to "conquer the stone!" (1-I013). Concentation is needed when woking with the silver wire because she cannot pull on it as much as with the older wire (2-I010). Every step is hard (making the loop, starting the wrapping, keeping the tension). "It is not finished until it is finished!" (2-I016)		The two types of wire (platinum and silver) have different properties and she needs to adapt her technique to the physical qualities of the wire (work faster or not, prevent from breaking) (2-I009). The whole process is evolutionary. She gets better at it (2-I018)	She started to look at youtube videos since our last visit, but she did not find anything that would make her change her practice (2-I019)
Allison	Loop for the stones necklaces	wire		she makes two single loops, and then wraps some wire around the loops to strengthen them. She used the needle that she bent 90 degrees to hold the 2 loops together and to be able to wrap around them. (2-I017)	pin, plier	bending, wrapping, pulling	precision	making sure the loop is strong enough to hold the piece (this is why there are 2 loops before wrapping)		

Allison	toothpick for holding the buds (1-I005; 1-M002)	tooth pick (fits exaxtly in the loop of the hook 1-O003; 2-I003)	home	She uses the tooth pick to insert correctly the nail/hook in the buds. She holds the tooth pick to dip the bud in exoxy, and then puts the tooth pick on the rack for drying	tooth pick	hanging, press fit in the hole of hook. Piercing,		not touching the epoxy with her fingers. Being precise. Using the toothpick to hold the bud as it dries so it doesnt touch a flat surface		
Claire	Brown feather earrings - from demo #2 (2-M001; 2-P015; 2-P017)	wire, feathers		This time , she follows the same steps, as in demo #1, but she wraps more wire, creating a larger base of metallic nest. (2-P015)	hands, pliers	wrapping	"there is a little creation, but not as meticulous as the hooks." (3-I014). She says there is not a big importance to the form because of the organic look and feel (3-I015).	There is contrast between the two materials, but through shape (bird's nest) she can see a link. There is symmetry in the piece (2-I015)	She tried to do the loop at the end (which is not what she usually does) and realized it was harder this way. She will do it differently next time (2-I017)	
Veronica	Purple pearl earrings	purple pearls (2-V002) and white crystals, metal nail	found the purple pearls on a necklace and the white crystals at the good will store (2-V002)	choose beads and pearls based on their quality - weight and how they are mounted on the string (2-V002). Cut the top of the nail to be able to use both sides for making hooks (2-V002). Use thumb to prevent the top of the nail to fly away (2-O004). Use the table to close the loops (2-O002; 2-V003)	pliers (flat, cutters and curly pliers), table	found materials, appropriation of tools	measuring, finding, reusing as is, protecting (thumb), applying pressure (table)	it is getting harder for her because of her eye sight (2-V003). Dexterity is necessary too (2-V003)		measuring pliers learned from the woman she worked with (see line of pliers)

Appendix E.

CD-ROM Data

The CD-ROM attached contains the videos referred to in this thesis.

Section	Description	Name	Size
4.1.1	Beck explains from day journal to public calendar	EC_Evw_Munroe_07-03-15_session1_media_012.AVI	32 MB
4.1.1 and 5.1.1	Cate explains her recipe system	EC_E_king_06-04-25_session1_video_004.AVI	82 MB
4.2.1	Lori explains the reminder system	Noric_06.04.17_MEDIA_003.AVI	39 MB
4.2.3	M.U.T. in action (Christine and Mario)	cm2-M001-s.MOV	69 MB
4.2.4	Epoxy coating for rose buds (Allison)	ah1-M002.MOV	90 MB
4.4.2	Claire uses hands and tools	cc1-M002.MOV	52 MB
4.4.2	Claire resources tools	cc3-M001-s.MOV	23 MB
5.1.2	Allison develops her system for piercing buds	ah1-M001-s.MOV	170 MB
5.2.1	Kerry explains things on the stroller	EC_E_munroe_07.03.15_media_011.AVI	76 MB