A Study of Everyday Repair: Informing Interaction Design

by

Leah Adriana Maestri

B.Sc., Simon Fraser University, 2007

Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Arts

in the

School of Interactive Arts and Technology
Faculty of Communication, Art and Technology

© Leah Adriana Maestri 2012

SIMON FRASER UNIVERSITY
Summer 2012

All rights reserved.
However, in accordance with the Copyright Act of Canada, this work may be reproduced, without authorization, under the conditions for “Fair Dealing.” Therefore, limited reproduction of this work for the purposes of private study, research, criticism, review and news reporting is likely to be in accordance with the law, particularly if cited appropriately.
## Approval

<table>
<thead>
<tr>
<th>Name:</th>
<th>Leah Adriana Maestri</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree:</td>
<td>Master of Arts</td>
</tr>
<tr>
<td>Title of Thesis:</td>
<td>A Study of Everyday Repair: Informing Interaction Design</td>
</tr>
</tbody>
</table>

**Examining Committee:**

**Chair:** Halil Erhan, Assistant Professor

---

**Ron Wakkary**  
Senior Supervisor  
Associate Professor

---

**Erik Stolterman**  
Supervisor  
Professor

---

**Carman Neustaedter**  
Supervisor  
Assistant Professor

---

**Steve DiPaola**  
External Examiner  
Associate Professor, School of Interactive Arts and Technology  
Simon Fraser University

**Date Defended/Approved:** June 22nd, 2012
Partial Copyright Licence

The author, whose copyright is declared on the title page of this work, has granted to Simon Fraser University the right to lend this thesis, project or extended essay to users of the Simon Fraser University Library, and to make partial or single copies only for such users or in response to a request from the library of any other university, or other educational institution, on its own behalf or for one of its users.

The author has further granted permission to Simon Fraser University to keep or make a digital copy for use in its circulating collection (currently available to the public at the “Institutional Repository” link of the SFU Library website (www.lib.sfu.ca) at http://summit/sfu.ca and, without changing the content, to translate the thesis/project or extended essays, if technically possible, to any medium or format for the purpose of preservation of the digital work.

The author has further agreed that permission for multiple copying of this work for scholarly purposes may be granted by either the author or the Dean of Graduate Studies.

It is understood that copying or publication of this work for financial gain shall not be allowed without the author’s written permission.

Permission for public performance, or limited permission for private scholarly use, of any multimedia materials forming part of this work, may have been granted by the author. This information may be found on the separately catalogued multimedia material and in the signed Partial Copyright Licence.

While licensing SFU to permit the above uses, the author retains copyright in the thesis, project or extended essays, including the right to change the work for subsequent purposes, including editing and publishing the work in whole or in part, and licensing other parties, as the author may desire.

The original Partial Copyright Licence attesting to these terms, and signed by this author, may be found in the original bound copy of this work, retained in the Simon Fraser University Archive.

Simon Fraser University Library
Burnaby, British Columbia, Canada

revised Fall 2011
Ethics Statement

The author, whose name appears on the title page of this work, has obtained, for the research described in this work, either:

a. human research ethics approval from the Simon Fraser University Office of Research Ethics,

or

b. advance approval of the animal care protocol from the University Animal Care Committee of Simon Fraser University;

or has conducted the research

c. as a co-investigator, collaborator or research assistant in a research project approved in advance,

or

d. as a member of a course approved in advance for minimal risk human research, by the Office of Research Ethics.

A copy of the approval letter has been filed at the Theses Office of the University Library at the time of submission of this thesis or project.

The original application for approval and letter of approval are filed with the relevant offices. Inquiries may be directed to those authorities.

Simon Fraser University Library
Burnaby, British Columbia, Canada

update Spring 2010
Abstract

Repair is typically seen in design as the restoration of broken objects to their original state. Repair by non-experts, or everyday repair, can often lead to novel forms of repair resulting in the creative repurposing of objects that are often unforeseen by designers.

Using a grounded theory approach, this study describes key aspects of repair including: the techniques non-experts employ for repairing their objects; the motivations that prompt acts of repair; and the outcomes that result from non-experts' repair techniques. Over the course of a year and a half, 42 participants between the ages 20-65 were interviewed with over 120 objects submitted of broken, repaired and repurposed artifacts. Both interview and image data were coded for distinguishing core concepts and categories, resulting in a theoretical framework. The goal of this framework is to inform the design of interactive technologies that anticipate the creative ways non-experts repair, reuse and repurpose their broken objects.

Keywords: Everyday repair, everyday design, interaction design, creativity, non-expert, practice
Dedication

For Dale, Alex, Mom, and Dad—my will that says “Hold on!”

~ Rudyard Kipling
Acknowledgements

It's been said that finishing a master's thesis can be an arduous and even painful experience. Conversely, my journey has been nothing but pleasurable and extremely rewarding. Even enjoyable!

I attribute my experience to my wonderful research colleagues and friends, who I have grown with in so many ways. Thank you Audrey Desjardins, Xiao Zhang, Nathan Waddington, Victoria Moulder, Henry Lin, Leila Aflatouni, Sara Salevati, and Sabrina Hauser, for making me smile everyday.

To all the participants who generously took the time to answer my numerous emails over the span of this study—my sincere appreciation goes out to you.

My gratitude also goes out to you, Erik Stolterman and Carman Neustaedter, for your great guidance and patience while I wrestled through the final stages of this work.

To my mentor and friend, Ron Wakkary—thank you for keeping me passionate and inspired in the past, present and future.

To my loving family – none of my achievements would be remotely possible if it weren’t for your unconditional love and support.

Alex – what it took for me to finish this thesis only represents a fraction of the kind of the strength, faith and perseverance I see in you everyday. Thank you for being that inspiration in my life.

Mom and Dad, I took your best qualities and tried to make them my own. From you Mom, I took your commitment, work ethic and love of work itself to seek out my own passions. My work (this thesis) has been a huge source of happiness for me because of the example you set. Dad, you’ve instilled in me a desire for knowledge and continual learning. Thus, you have shown me my purpose and what also makes me happy. Thank you and love to you both.
Last but not least—

Dale, any words I write here are grave injustices for expressing how grateful and honored I am to have you in my life. Your selflessness, patience, love, and above all else, your amazing positivity, are the foundations of this work. Thank you for YOU.
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approval</td>
<td>ii</td>
</tr>
<tr>
<td>Partial Copyright Licence</td>
<td>iii</td>
</tr>
<tr>
<td>Abstract</td>
<td>iv</td>
</tr>
<tr>
<td>Dedication</td>
<td>v</td>
</tr>
<tr>
<td>Acknowledgements</td>
<td>vi</td>
</tr>
<tr>
<td>Table of Contents</td>
<td>viii</td>
</tr>
<tr>
<td>List of Figures</td>
<td>xi</td>
</tr>
<tr>
<td>List of Tables</td>
<td>xiii</td>
</tr>
</tbody>
</table>

## Chapter 1. Introduction .................................................................... 1
- Overview                                                             | 1    |
- Theoretical Roots in Everyday Design                                  | 2    |
- Focus and Goals of this Research                                      | 3    |
- Methodological Approach                                               | 4    |
- Contributions of this Research                                       | 6    |
- Thesis Overview by Chapter                                            | 7    |

## Chapter 2. Literature Review ...................................................... 10
- Introduction                                                         | 10   |
- The Role of Pragmatist Philosophy                                     | 11   |
- Sociological Theories on the Appropriation of Technologies            | 13   |
  - The Role of Designers and Users                                      | 13   |
  - The Social Shaping of Technology                                    | 14   |
  - Practice Theories                                                   | 15   |
  - CSCW and workplace studies                                          | 17   |
- The Role of Materiality and Aesthetic Experience                       | 18   |
  - Verbeek’s Concept of Technological Mediation and Latour’s Notion of Script | 18   |
  - Aesthetic Experiences with Technology                               | 20   |
  - Defamiliarization and Ambiguity                                      | 21   |
- Repair in Design                                                      | 22   |
  - Repair in Sustainable Interaction Design and HCI                   | 23   |
  - Repair in Product Design                                            | 25   |
  - Reuse and Appropriation within Creative Communities                 | 25   |
- A Note to the Reader: The Role of the Literature Review               | 27   |
- Summary                                                               | 27   |

## Chapter 3. Methodology .................................................................... 29
- Constructing a Grounded Theory of Everyday Repair                     | 29   |
  - The Constructivist Approach to GTM                                  | 30   |
  - Data Collection: The Use of Email and Social Networking Platforms   | 31   |
  - The Procedure                                                       | 32   |
  - Data Analysis: Coding for Categories and Concepts of Everyday Repair| 37   |
  - Coding Text and Image Data                                          | 37   |
  - Textual Analysis                                                    | 37   |
  - Visual Analysis                                                     | 39   |
Chapter 4. Grounded Theory Analysis: Findings Part 1 ........................................ 46
   Introduction ........................................................................................................ 46
   Understanding Conditions, Processes and Outcomes of Everyday Repair .......... 47
      Conditions of Everyday Repair ............................................................................... 49
      What Constitutes Broken? ....................................................................................... 49
      Motivations Behind Everyday Repair ....................................................................... 53
   Summary ................................................................................................................ 60
   Processes of Everyday Repair .................................................................................... 60
      Techniques ............................................................................................................ 60
   Materials and Tools of Everyday Repair Processes ............................................... 65
      The Digitality of Broken Objects ............................................................................ 65
   Assessing Repair Quality .......................................................................................... 70
   Outcomes of Everyday Repair .................................................................................. 74
      Restoration, Repurposing and Obsolescence as Outcomes of Repair ................. 74
   Summary ................................................................................................................ 80
   Conclusion ................................................................................................................ 80

Chapter 5. Grounded Theory Analysis: Findings Part 2 ....................................... 82
   Introduction ............................................................................................................ 82
   Theme: Conditions of Everyday Repair ................................................................. 83
      Concept: Attributes of Broken ............................................................................... 84
      Concept: Motivations Behind Processes of Everyday Repair ............................... 86
      Core Categories of Everyday Repair Motivations ................................................. 86
         Subcategories of Practical, Personal and Ethical Motivations ....................... 87
   Summary ................................................................................................................ 89
   Theme: Techniques and Processes .......................................................................... 89
      Concepts: Conceptual and Actionable Processes ............................................... 90
         Conceptual Processes and Techniques ............................................................... 91
         Actionable Processes and Techniques ............................................................... 92
      Concept: Physical Attributes of Everyday Repair ............................................. 94
      Concept: Assessing the quality of a repair ......................................................... 95
   Summary ................................................................................................................ 96
   Theme: Outcomes of Everyday Repair .................................................................. 97
      Categories of Everyday Repair Outcomes through Focused Coding .................. 97
      Concept: Repair, Modification and/or Repurposing? ....................................... 98
   Summary ................................................................................................................ 100
   Conclusion .............................................................................................................. 100

Chapter 6. Everyday Repair Framework and Discussion ....................................... 102
   Introduction ............................................................................................................ 102
   A Design Framework of Everyday Repair ............................................................. 103
      A Qualitative Description of Everyday Repair .................................................. 110
      A Visual Map of Everyday Repair Aspects ......................................................... 111
   Discussion ................................................................................................................ 115
      Understanding Repair as a Creative Process of Everyday Design ...................... 115
List of Tables

Table 3.1  Sample of Initial Coding of Participant’s Email Responses................................. 38
Table 3.2  Excerpt from Visual Analysis Excel Sheet ............................................................... 40
Table 4.1  Initial Coding of P15’s Email Response (Excerpt).................................................. 50
Table 4.2  Initial Coding of P8’s Email Response (Excerpt).................................................... 51
Table 4.3  Initial Coding of P34’s Email Response (Excerpt).................................................... 52
Table 4.4  Initial Coding of P5’s Email Response (Excerpt)..................................................... 54
Table 4.5  Initial Coding of P38’s Email Response (Excerpt).................................................... 55
Table 4.6  Initial Coding of P4’s Email Response (Excerpt)..................................................... 55
Table 4.7  Initial Coding of P2’s Email Response (Excerpt)..................................................... 56
Table 4.8  Initial Coding of P11’s Email Response (Excerpt).................................................... 57
Table 4.9  Initial Coding of P3’s Email Response (Excerpt)..................................................... 58
Table 4.10 Initial Coding of P31’s Email Response (Excerpt)................................................... 59
Table 4.11 Initial Coding of P13’s Email Response (Excerpt)................................................... 61
Table 4.12 Initial Coding of P4’s Email Response (Excerpt).................................................... 62
Table 4.13 Initial Coding of P31’s Email Response (Excerpt)................................................... 62
Table 4.14 Initial Coding of P11’s Email Response (Excerpt).................................................... 63
Table 4.15 Visual Coding of P15’s Image Submission .............................................................. 66
Table 4.16 Initial Coding of P20’s Email Response (Excerpt)................................................... 67
Table 4.17 Initial Coding of P1’s Email Response (Excerpt)..................................................... 68
Table 4.18 Initial Coding of P23’s Email Response (Excerpt)................................................... 69
Table 4.19 Initial Coding of P4’s Email Response (Excerpt).................................................... 70
Table 4.20 Initial Coding of P6’s Email Response (Excerpt).................................................... 70
Table 4.21 Initial Coding of P11’s Email Response (Excerpt).................................................... 71
Table 4.22 Initial Coding of P19’s Email Response (Excerpt)................................................... 71
Table 4.23 Initial Coding of P33’s Email Response (Excerpt)................................. 72
Table 4.25 Initial Coding of P12’s Email Response (Excerpt)................................. 75
Table 4.26 Initial Coding of P16’s Email Response (Excerpt)................................. 75
Table 4.27 Initial Coding of P34’s Email Response (Excerpt)................................. 75
Table 4.28 Initial Coding of P19’s Email Response (Excerpt)................................. 76
Table 4.29 Initial Coding of P32’s Email Response (Excerpt)................................. 77
Table 4.30 Initial Coding of P28’s Email Response (Excerpt)................................. 77
Table 4.31 Initial Coding of P2’s Email Response (Excerpt)................................. 78
Table 4.32 Initial Coding of P22’s Email Response (Excerpt)................................. 79
Table 6.1 Motivations of Everyday Repair ............................................................... 103
Table 6.2 Attributes of Broken as Conditions of Everyday Repair ......................... 105
Table 6.3 Conceptual Processes and Techniques of Everyday Repair ..................... 105
Table 6.4 Actionable Processes and Techniques of Everyday Repair ..................... 106
Table 6.5 Physical Attributes that Facilitate Everyday Repair Techniques ............... 107
Table 6.6 Assessing the Quality of an Object’s Repair ............................................ 108
Table 6.7 Outcomes of Everyday Repair ................................................................. 109
# List of Figures

Figure 3.1 Paper version of visual analysis coding ................................................................. 40

Figure 4.1 Venn diagram of everyday repair themes and categories from initial coding phase ........................................................................................................ 48

Figure 4.2 P15’s roommate’s cracked bowl ........................................................................... 50

Figure 4.3 P8’s closed off staircase transformed into storage space ..................................... 51

Figure 4.4 P34’s cellphone that only works when opened at a 30-degree angle ................. 52

Figure 4.5 P5’s broken vintage earrings from Australia ....................................................... 54

Figure 4.6 P4’s augmented desk using bricks ....................................................................... 56

Figure 4.7 P11’s broken cupboard door .............................................................................. 58

Figure 4.8 P3’s collection of old electronics ......................................................................... 59

Figure 4.9 P13’s broken hockey stick used as a replacement window stopper ............... 61

Figure 4.10 P16’s cellphone with large dead pixel hole ....................................................... 68

Figure 4.11 P1’s laptop with a water damaged screen ......................................................... 69

Figure 4.12 P6’s repaired (now broken again) dress shoes ............................................... 71

Figure 4.13 P19’s successfully repaired window crank ....................................................... 72

Figure 4.14 P33’s repaired bamboo rocking chair ............................................................... 73

Figure 4.15 P19’s rescued mug that was glued back together ........................................... 77

Figure 4.16 P22’s climbing rope repurposed into a doormat ............................................ 79

Figure 5.1 Axial code for Attributes of Broken .................................................................... 84

Figure 5.2 Axial code for Attributes of Broken with Subcategories .................................. 85

Figure 5.3 Axial code for Motivations of Everyday Repair ............................................... 87

Figure 5.4 Axial code of Everyday Repair Motivations with Subcategories .................... 89

Figure 5.5 Axial code for the concept Techniques and Processes of Everyday Repair .... 91
Figure 5.6 Axial code of conceptual and actionable processes techniques with subcategories .................................................................................................................. 94

Figure 5.7 Axial coding of Physical attributes of Everyday Repair ................................. 95

Figure 5.8 Axial code of Assessing Quality ........................................................................ 96

Figure 5.9 Axial coding for Everyday Repair Outcomes ..................................................... 97

Figure 6.1 The interrelationships of everyday repair conditions, processes and outcomes .............................................................................................................................................. 113

Figure 6.2 P6’s sunglasses repaired via acts of resourcefulness .......................................... 117

Figure 6.3 Headphone repair using expired credit cards and electrical tape. (https://picasaweb.google.com/dmaranan/Jerryrigging?feat=flashalbum#5566932613349931330) .............................................................................................................................................. 122

Figure 7.1 Repaired Alarm clock LCD using arduino and electronic wires ......................... 132

Figure B.1 This is an excerpt of the initial coding excel spreadsheet showing participants’ names (blacked-out for identity protection), alias (i.e. P#), and text response (color coded.) Initial codes are below (separated in two columns to show two rounds of initial coding.) .................................................................................................................. 147

Figure B.2 Initial codes (associated with above image, Figure B.1) .................................. 148

Figure C.1 Visual analysis coding of P19’s broken skylight crank and mug (above two images) and P20’s broken printer (bottom image). .................................................. 149

Figure C.3 Visual analysis coding of P8’s retrofitted desk and repurposed staircase storage space. ................................................................................................................................. 151

Figure C.4 Visual analysis coding of P7’s broken figurine that was glued back together .............................................................................................................................................. 152
Chapter 1.

Introduction

Overview

Repair is typically seen in design as the restoration of broken objects to their original state. *Expert repair* adheres to the goal of restoring broken objects. This thesis aims to reconceptualise the notion of repair by describing the ways *non-experts* creatively restore and repurpose their broken objects, with the further aim that this reconceptualisation can inform interaction design. These types of repair outcomes are mostly unforeseen by designers who believe the repair of interactive technologies is exclusively a matter of expert repair. In short, the technologies of today do not accommodate for the creativity and resourcefulness of non-experts. Using a grounded theory (GT) approach, this research describes the key aspects of non-experts’ repair practices proposed in the form of a theoretical framework for designers. Specifically, this thesis unveils a new perspective on repair, or what I refer to as *everyday repair*—the creative and adaptive actions that lead to the restoration and repurposing of objects and technologies.

In this introductory chapter, I start with an overview of how my previous research experience on a project called *Everyday Design* (Wakkary and Maestri, 2007, 2008, 2010) served as the theoretical foundation for this thesis. Following this, I describe the focus and goals of this thesis entailing the development of a theoretical framework for designers that holistically describes the practices of non-experts and how they repair their broken objects. This is then followed by a brief overview of the methodology used, specifically describing the GT process and how a constructivist approach was used to distinguish processes of non-experts towards design ends. I conclude this chapter with a breakdown of each of the six chapters that follow. In the following section, I describe
the key aspects of everyday design and how its findings served as theoretical inspiration for this thesis.

**Theoretical Roots in Everyday Design**

The aim of this qualitative study looks at how non-experts *creatively* repair their broken objects. I’m interested in a particular form of creativity that manifests in the everyday – what John Dewey (1934) describes as a constant *doing and undergoing*, as we actively adjust to everyday situations. My interests in understanding everyday creativity stems from the previous work I did on the *Everyday design* project (Wakkary, 2007, 2008). Lead by Professor Ron Wakkary, everyday design started in 2005 and is an ongoing collaborative research project currently taking place at Simon Fraser University’s School of Interactive Arts and Technology program. Inspired by other design ethnography studies on the home (Blythe and Monk, 2002; Crabtree et al., 2002; Crabtree and Rodden, 2004; O’Brien and Rodden, 1997; Taylor and Swan, 2005; Tolmie et al., 2002) everyday design also employed ethnographic observations of families in the home to understand how individuals engage in design actions and thinking. More specifically, the aim of this project was to reconsider family members as *everyday designers*—people who actively modify, adapt, and resource objects in the home to better suite their unique and ever changing needs. We referred to this process as *design-in-use*, as artefacts and systems would endure incremental changes over the course of their use in the home. This project was also inspired by pragmatist views, particularly Dewey’s notions on everyday creativity, as we saw acts of adaptation, resourcefulness and appropriation as creative actions based on the reflexive and adaptive actions individuals imposed on their artefacts and systems.

Not unlike this thesis, the goal of everyday design was to develop a theoretical framework for interaction design, providing insights into the creative ways interactive technologies are adapted within the context of the home. To do this, we conducted ethnographic observations of four families residing in the Vancouver Eastside. Families consisted of 1-2 parents all with young children ranging from ages 5-13 years of age. The study took place over two five-month periods with sessions ranging between 3-4 times a week for three hours at a time. Through the employment of *participant*
our observations focused on the actions, processes and interactions by which family members carried out their daily routines.

Over the course of a year, we discerned several design patterns that made up a theoretical framework of everyday design. This framework includes the following aspects: emergence—the incremental process by which artefacts and systems are created and changed over time; adaptation—the creative ways family members transform and modify the physical and functional attributes of artefacts and systems; resourcefulness—the way people use objects and materials that are immediately available to them to facilitate their routines and daily activities; and lastly, quality—the reflexive process by which individuals continually assess the state of their objects based on their ability to fulfill individuals’ needs, and fit within the ecology of the home. As mentioned above, this framework served as a foundational theory for my own explorations into repair as a creative process.

Given the theoretical influences of pragmatism and everyday design, the goals of this research looks at understanding the fundamental ways individuals creatively deal with their broken objects and how designers can learn from the processes they employ for informing the design of interactive technologies. In the following section, I describe the focus and goals of this research given my own ideological background and interests in everyday design.

Focus and Goals of this Research

The overall aim of this thesis (as part of everyday design) is to inform the design of interactive technologies that accommodate non-experts processes of repair. This research takes a qualitative and anthropological approach, where focus is placed on how individuals engage in their daily activities—or more specifically, what processes and actions they employ for managing situations. I chose to study repair since it reveals how individuals deal with and solve problems in unexpected, unwanted and unplanned for ways when encountering a broken object. In the instances of breaks, individuals are often forced to confront the situation and find some solution to repairing their object. My inclinations were that repairs were reactive, unplanned and often unwanted, thus
promoting individuals into action. In this regard, situations where repairs were necessary seemed like a good place to observe everyday creativity and the characteristics it involved.

In trying to contribute further insights to the notion of everyday design, this work looks to reveal how the actions and processes of non-experts take on creative qualities that can help designers rethink who they are designing for and how they might facilitate these actions through material and practical considerations. In this light, everyday repair is seen as part of, and can add to, the lifecycle of interactive technologies. As I describe in chapter 6, everyday repair will be situated as part of everyday design and interaction design theories, adding further insights to the adaptation, emergence and quality assessment of everyday systems and artefacts.

In the following section, I give an overview of the employment of the grounded theory method and how it served as a well-suited methodology for constructing a theory of everyday repair.

**Methodological Approach**

Since there is little research or theory on the notion of everyday repair, specifically in the context of interaction design, I chose a constructivist grounded theory approach as discussed by Charmaz in her book *Constructing a Grounded Theory* (Charmaz, 2006) for conducting this research. By definition, Charmaz describes the constructivist approach as follows:

“I have explicated [interpretive and positivist traditions] by arguing that grounded theory has taken somewhat different forms since its creation... Constructivist grounded theory is part of the interpretive tradition and objectivist grounded theory derives from positivism... A constructivist approach places priority on the phenomena of study and sees both data and analysis as created from shared experiences and relationships with participants.” (pp. 130)

Using a constructivist approach was well suited for developing a theoretical framework for interaction design, as its emphasis on understanding individuals’ process and actions matched my own interests in investigating what processes non-experts
employed when repairing their broken objects. The method also provided a structure in which I could collect, analyze, interpret and validate my interpretations with participants in an iterative and collaborative manner. As I describe in chapter 3 (see Methodology), I explain how the following key questions were explored using grounded theory methods and techniques:

1. How can everyday repair be described and what implications does the notion of everyday repair hold for design?

2. How are acts of everyday creativity by non-experts, as part of everyday repair, helpful to interaction designers when designing interactive technologies?

3. What conditions instigate acts of repair? Why are non-experts motivated to repair their broken objects and can designers use these motivations within their own design practice?

4. Are there techniques and strategies to everyday repair that can inform interaction designers?

5. What are the physical attributes of repaired objects that facilitate acts of repair? Can designers learn from these attributes when thinking about the fabrication interactive technologies?

6. What are typical outcomes of repair and what implications do these have for the reuse of obsolete and unusable interactive technologies?

Through a series of online interviews with 42 participants all within the ages of 20-65, both text data and images were collected through the use of email and the social networking application Facebook. Approximately 120+ objects were submitted as examples of what individuals deemed broken, repaired and repurposed as a result of repair techniques. Using grounded theory methods such as line-by-line and word-by-word coding, participants’ text and image data were analyzed over the course of a year and a half. The outcomes of the analysis include core concepts and themes that describe the larger picture of everyday repair. In the chapters that follow, I describe the
Contributions of this Research

The final contributions of this research are three fold. As I mentioned in the above section, the use of the grounded theory method looks to provide a new theory around the notion of everyday repair. Specifically, this new conceptualization of repair aims to expand on and reframe conventional notions of the terms broken and repair to encompass acts of creativity, adaptations and repurposing. By describing individuals’ actions, processes and techniques derived from participants’ text and visual data, I consolidate these as part of a theoretical framework for designers. Specifically, The framework proposed will describe the following aspects: the various notions of the terms ‘broken’ and ‘repair;’ techniques and strategies used in everyday repair; the material and physical attributes of designed objects that facilitate and/or hinder everyday repair; and lastly, the outcomes of everyday repair that can help guide design processes.

Secondly, this research contributes further insights to everyday design theory in two ways. It shows distinct overlaps between the creative actions of non-experts and everyday designers, namely in how they adapt and modify objects to suite their needs. Furthermore, it sheds new light on the relationships non-experts and everyday designers build with their objects and how these play a role in the execution of repair actions. Lastly, the findings of everyday repair point to key considerations for interaction design. More specifically, I argue that interaction design can use the everyday repair framework as a set of guidelines for informing the design of interactive technologies that lend themselves to repair and repurposing. The framework may also suggest physical material considerations for designers, when trying to anticipate and facilitate everyday repair techniques and processes.
Thesis Overview by Chapter

Based on the overview of this introductory chapter (Chapter 1), the content of this thesis will be broken down into the next 6 chapters:

In chapter 2, I start with an overview of related literature in which this work situates itself—specifically within the context of Interaction design and HCI discourses. Other sub-areas include those related to the Social Shaping of Technology (STS), workplace studies, and practice theories. This literature review serves two purposes; first, it lays out the landscape of interaction design related discourses and perspectives that underline the motivations behind this research study. Second, the literature review reflects the findings derived from the grounded theory analysis, highlighting how processes and actions of non-experts materialize in different ways based on repair conditions and outcomes. Using everyday design as the theoretical foundations of this research, I describe how this study takes on pragmatic inclinations for understanding individuals’ creative actions of repair, referring to the ideas of the late John Dewey. I also give a brief overview of the corpus of studies within HCI and interaction design including research endeavours that look at sustainability issues within Interaction design and HCI, as well as work that tries to understand creative practice within creative communities like hackers and tinkerers.

Chapter 3 gives a description of the grounded theory methods used for collecting and analyzing participants’ data. I provide a brief overview of the media used for collecting data – namely email and Facebook. I also describe the types of data collected by participants, which include both text and images. I then give a description of the participant group and interactive process by which data was analyzed and validated via subsequent email discussions with participants over the course of a year and a half. I also give an overview of the specific methods used as part of my process, including word-by-word and line-by-line coding, memo writing and axial coding. I explain how these techniques were useful for inductively coding, comparing, synthesizing and interpreting participants’ data towards the development of a theoretical framework.

In chapters 4 and 5, I describe the key findings of the study in terms of two phases; I refer to these as the initial coding phase and focused coding phase, as
prescribed by Charmaz (2006) in her description of the grounded theory method. In chapter 4, I discuss the initial coding phase of the data analysis in which word-by-word and line-by-line coding techniques were used to derive initial patterns that encompassed non-experts’ everyday repair practices. It is in this phase where the concepts of everyday repair conditions, processes and outcomes emerged. In chapter 5, I describe how the initial codes defined as part of these concepts were further synthesized through the use of memo-writing, axial coding, as well as through further follow up email discussions with participants. The outcome of these two phases resulted in the discernment of core concepts and categories that describe the larger picture of everyday repair. More specifically, I explain how these final codes highlight non-experts’ motivations and techniques, as well as the physical attributes of objects that facilitate repair and their associated outcomes.

Chapter 6 gives a more in-depth overview the everyday repair framework, detailing the various concepts, categories and subcategories described in chapters 4 and 5. This final framework emphasizes the various factors designers can account for in instances where repair is a viable course of action – specifically looking at the motivations, techniques and processes, and outcomes that encompass everyday repair. As part of this framework, I provide a qualitative description of how everyday repair occurs as an iterative process. I represent the flow of this process in a visual diagram inspired by Glaser and Strauss’ notion of a conditional matrix. The goal of this visual schematic looks to provide a clear representation the key dimensions of everyday repair and how the relationships between conditions, processes and outcomes influence each other over time. I conclude this chapter by coupling the everyday repair framework with the existing framework of everyday design, describing how both frameworks overlap and present a larger theory for informing interaction design practice.

Lastly, in chapter 7 I give a summary of the focus, goals and contributions of this thesis. I also provide some considerations and limitations of this work and the future explorations that will investigate these considerations further.

To summarise chapter 1, I provide a brief overview of the goals, methodological approach, and research contributions of this thesis. In the chapters that follow, it will become clearer how the everyday creative practices of non-experts can serve as a lens
for interaction designers when accommodating for acts of adaptation, repurposing and restoration in the design of interactive technologies. The implications of this research also aims to reframe the way we understand repair, encompassing conditions, processes and outcomes that are unique, unexpected and of course, creative. As alluded to above, the following chapter discusses the related literature that maps out the various discourses around the adaptation and repurposing of technology and how repair can contribute to these unresolved issues.
Chapter 2.

Literature Review

Introduction

This review presents a corpus of literature that speaks to the key aspects of everyday repair featured in my theoretical framework chapter (chapter 6). The theories and works I describe highlight the key aspects of everyday repair, namely everyday creativity, materiality, everyday practice, aesthetic experience, and the appropriation and adaptations of technologies based on social dynamics. Many of these theoretical texts help ground the epistemological views of this research for understanding the adaptive uses of technology. Also included are key philosophical and sociological texts that speak to the underlying theoretical orientations of this work.

The first part of this review starts with a description of theories that have influenced and inspired my interests in everyday creativity. I look at pragmatist philosophy from the point of view of John McCarthy and Peter Wright (2004) and describe key concepts that inspired the construction of a grounded theory of everyday repair. I also address various sociological theories related to the studies of humans and the social adaptation of technology—specifically the analytic frameworks related to the Social Shaping of Technology (SST) (Oudshorn and Pinch, 2003; Bijker, 1990; Akrich, 1992; Mackay and Gillespie, 1992), Practice theory (Schatzki, 1996), Instrumental genesis (IG) (Rabardel and Béguin, 2000) and Adaptive structuration theory (AST) (DeSanctis and Poole, 1994). This discussion will also provide theoretical insights around my own observations made on the ways non-experts adapt and creatively repurpose their broken objects.

The other half of this review will outline current research in the fields of HCI, interaction design, and product design related to processes of repair. At present, there
are no research initiatives that look at repair as a creative process for informing the
design of interactive technologies. There are, however, studies that do address the
need for designing more repairable technologies—we see this specifically in the
emerging field of Sustainable Interaction design (Blevis, 2007; Odom, 2009; Huang,
2008; Jung, 2011), as well as in product design initiatives concerned with disassembly
(Shu and Flowers, 1995; Takeuchi and Saitou, 2005). To address the core concepts
around the creative repurposing of broken objects and the motivations that prompt acts
of repair and reuse, I provide some background on research initiatives that look at
designing for (and with) appropriation (Gaver et al., 2003; Sengers and Gaver, 2006;
Höök, 2006), defamiliarization (Dunne, 1999), and the proactive acquisition of old
technologies for creative applications and use (Rosner and Bean, 2009; Paulos and Kim,

The Role of Pragmatist Philosophy

“The statement that individuals live in a world means, in the concrete,
that they live in a series of situations... It means, once more, that
interaction is going on between an individual and objects and other
persons. The conceptions of situation and of interaction are
inseparable from each other”. (Dewey, 1997, p. 43)

The particular aspect of pragmatism that motivated this research is based on
pragmatist’s notion of creative action—that is, the ways people create and resource the
things around them that help facilitate their everyday situations (McCarthy and Wright,
2004). This type of mundane creativity encompasses the ways people go about doing
and undergoing everyday life based on their unique experiences. One of the primary
motivations of this thesis is to understand this type of everyday creativity as one
approach to improving existing interaction design theory and practice.

John McCarthy and Peter Wright’s book Technology as Experience (2004)
provides relevant descriptions for how pragmatist philosophy can be applied to the
design of technology. The main premise of this book also shares goal of this thesis,
which is the need for informing the design of interactive technologies through the
reconstruction of current theories and practices. Conventional theories and practices
(particularly those within the psychologically-driven traditions of Human-computer
interaction (HCI), are mainly concerned with technology’s usability and less so with the personal experience and relationships people have with technology. McCarthy and Wright see pragmatist philosophies as particularly insightful for HCI, interaction design and user-centered design, as these disciplines are beginning to shift their focus towards understanding the everyday lived experiences of individuals. Pragmatism, the authors implore, is particularly well fit for understanding ‘technology as experience,’ quoting the following statement from Richard Coyne:

“[It] embraces the primacy of human action, the practicalities of human involvement, the materiality of the world, the interaction of the senses, and the formative power of technology.” (Coyne, 1995, pp.17)

For McCarthy and Wright, pragmatism is a useful perspective for:

“... understanding technology and design. (pp.19) [...] Many [pragmatists’] ideas about the relationships of producer, consumer, artist, appreciator, author, reader, and character, and about the process of creative understanding, can be usefully employed in conceptualizing the relationship of designer, technology and user.” (pp. 20)

In short, by using pragmatist analytical frameworks, researchers can begin to inform technology design by going beyond an understanding of technology use as a means to an end. In this light, designers can expand their understanding to include the emotional, personal and sensual experiences that influence the way technology is incorporated into people’s lives.

Grounded theory also roots itself in pragmatism, as one of its founders, Anselm Strauss, was influenced by Chicago school pragmatism and its philosophical views on the dynamic, interpretive and creative nature of action and interaction. The constructivist grounded theory approach used in this thesis takes both from Strauss’ and Charmaz’s methodological views (Charmaz, 2006), where both data and analysis are created from shared experiences and relationships with participants (I discuss this further in the following chapter – see Chapter 3, Methodology). In short, understanding acts of repair is focused on not just the means (i.e. tools and materials) by which non-experts execute their actions. Observations are also made on the processes by which these actions occur within individuals’ lived and unique situations, the interpretations of which are
validated by the participants themselves. In this light, a construction of everyday repair theory echoes the very same pragmatic commitments as those outlined by McCarthy and Wright for informing the design of interactive technologies: to facilitate emotionally and uniquely personal actions of people; to accommodate for the feltness of life by centralizing the way people do and undergo everyday activities; to respond meaningfully to people’s socially connected sense of self; and to be open to individuals’ personal experiences, including the way they interpret, feel and pass value judgments.

Sociological Theories on the Appropriation of Technologies

One of the key implications of this research highlights the need for interaction design to consider the ways in which technologies (broken or not) are adapted and creatively repurposed towards new contexts of use. Acts of creative repurposing (which I synonymize with appropriation) were evidenced by the number of cases in which participants transformed the physical and functional properties of their broken objects towards new purposes. As a popular discourse within the fields of HCI and interaction design, appropriation is both a relevant and important aspect of this study and has thus been included as key feature of this literature review.

The Role of Designers and Users

I start this section off with the work of French cultural theorist Michel de Certeau (1984). De Certeau has been frequently referenced within the disciplines of HCI and CSCW, primarily for providing theoretical insights into the relationship between design intent and how technology is actually used (Dourish, 2006). Though De Certeau’s focus was mainly concerned with power relationships (i.e. the “tactical” spatial practices of the masses in response to imposed “strategic” spatial practices of those in power), his work addresses similar tensions underlying the relationship between designers and users. Paul Dourish (2006) provides an interesting take on De Certeau’s ideas for describing how the practices of designers (i.e. those in authority) structure the intent of cultural artefacts, which result in their appropriation by everyday users (i.e. the masses). De Certeau referenced the term bricolage—a term first coined by French anthropologist Claude Lévi-Strauss (Lévi-Strauss, 1962) to describe the practice by
which people appropriate artefacts within their everyday settings. This notion encompasses making-do with the immediately accessible through inventive practices (De Certeau, 1984).

Similar to De Certeau’s theories is literature within *Science, Technology and Society* (STS) and *Social Shaping of Technology* (SST). This body of work provides an array of analytical frameworks used to understand the socio-political development of technology. In particular, STS takes a distinctive stance in challenging the dominant technological deterministic approach to innovation and development by arguing for a more social constructivist approach. Below, I describe some of the key texts that champion the social appropriation of technologies.

**The Social Shaping of Technology**

In Oudshoorn’s and Pinch’s book *How Users Matter: the Co-construction of Users and Technology* (Oudshoorn’s and Pinch, 2003), the authors describe and apply their theory of innovation using the medical field as a case study. Similar to De Certeau’s case studies on power dynamics, Pinch and Oudshoorn describe the crucial part actors have historically played in the development of medical technologies that tend to the needs of patients through bottom-up approaches (i.e. Advocate groups). Other related work includes Wiebe E. Bijker’s SST framework called *Interpretive Flexibility* (Bijker, 1990). Here he develops a protocol for interpreting the ‘success’ and ‘failure’ of a technology based on the various influences of social groups. He uses historic accounts of the plastics industry as an example of how the framework can be used. Another key text comes from Madeleine Akrich’s paper *The De-scription of Technical Objects* (Akrich, 1992). The study she describes addresses the symbiotic relationship between technological determinism and social constructivism, as together they direct the integration of technologies within a given context. She emphasizes that evaluating the success of a technology’s integration within a cultural group setting can only be determined once the technology is used in situ. She also highlights the need for designers to understand and anticipate the evolution of designed artefacts in context. In this light, the design process should not be thought of as the final stages of production; it needs to include the process of technology’s implementation within a social context.
**Practice Theories**

In his book *Social Practices: A Wittgensteinian Approach to Human Activity and the Social* (Schatzki, 1996), Theodore Schatzki develops an analytical framework that looks at practice as a central phenomenon for understanding the social constitution of individuals. Schatzki describes a particular form of practice, entailing individuals’ *performance* of actions, or their *carrying out* of certain doings and sayings, which are linked by shared customs and understandings. This concept is also tied to another notion of practice, which speaks to the spatio-temporal unfolding of bodily activities within a specific context or organization. More specifically, practice is seen as a set of considerations that governs how people act. Action in this regard, is viewed as “a motivated response to an unacceptable situation that aims to bring about a condition relieving this unacceptability.” (pp. 96)

Schatzki champions practice as the central phenomenon for understanding social life, as it is the site in which *understanding* is structured and *intelligibility* (i.e. making sense of the world) is expressed. Schatzki also sees practice as inherently social, based on its actions made present to others (what Schatzki refers to as *appearance*) through bodily acts. These actions thus instigate reactions, attributions, teachings and corrections from others who learn and participate in those actions. Constitutive of these actions are the *doings* and *sayings* within practices, which provide discernable ways for researchers to understand the *mentality* of people—or as defined by Wittgenstein, the *way things stand and are going*. In the context of social theories, *mentality* is a fundamental dimension for understanding human coexistence, specifically individuals’ mental states, intellectual attitudes, and actions that are found and constituted in practice.

For the intents and purposes of this thesis, I refer to Schatzki’s framework for describing my own observations of repair as a type of practice—one in which the repurposing and making of objects are understood based on individuals’ conceptions of *broken*, *scrap*, or *obsolescence*. I liken the notions of *conceptual* and *actionable* processes (outlined in chapter 5) to Schatzki’s notions of mind/action and body—that is, the dual relationship of the mind’s state and how it directly influences bodily acts. The category *conceptual processes* has direct overlap with what Schatzki refers to as *inner*
episodes—phenomena that speak to the inherent and implicit knowledge of individuals. It is a kind of self-knowledge that is pre-meditative, known and/or felt only by the possessor. In our own framework, we refer to inner phenomena as a person’s instinctive and subconscious knowledge based on the implicit ways individuals know how to resolve a challenging situation.

Also directly related to everyday repair are Schatzki’s discussions of discursive and integrative practices. Dispersive practices entail those that are widely spread across various populations and social groups and are primarily linked through individual's shared understanding of these practices. Some examples include the practice of ordering, questioning, imagining, examining, describing, etc. Integrative practices are those found in more specific organizations and domains of social life. Like dispersive practices, they are linked by individuals' shared understanding but also include rules and are driven by ends, tasks and goals set within an organization's practice.

Dispersive practices are particularly germane to the techniques and processes defined in observations of everyday repair, as they speak to individuals' doings and sayings that are mostly learned and transcended through tacit understanding. They are often devoid of any organizations' rules and/or goals, which are staple features of integrative practices. Taking the example of describing as a discursive practice, understanding entails the following three aspects: (1) a person's ability to carry out the practice of describing; (2) the ability to identify and/or relate to one’s practice of describing, as well as see it in others practice; and (3) knowing how to respond to or be prompted by acts of describing. The overall structure of dispersive practices exist as a network of shared actions that along with their understandings, spread and are adopted by others based on their own sense of how to enact them.

What a person does on any occasion (in the execution of a dispersive practice) depends not on the practice itself but instead on the understanding he or she has of his or her situation. This situation, which a person deems as somehow unacceptable, prompts him or her to look for a preferred condition that remedies the situation through action. The actions that follow are motivated by the need to relieve this unacceptability. In the context of everyday repair practices, these set of actions emerge almost naturally.
within various contexts, understandings and social orders. In chapter 6 I will describe how dispersive practices are a useful way for understanding the everyday repair actions discerned from the grounded theory analysis.

**CSCW and workplace studies**

Within the discipline of Computer Supported Cooperative Work (CSCW), many studies on appropriation have focused on the context of the workplace for understanding how organizations adopt and adapt collaborative work systems. Dourish, in his seminal paper called *Placeless Documents* (2003), argues that by understanding how technology is appropriated within the workplace, designers can then develop interactive systems that can easily adapt and integrate into unique workflow dynamics. For Dourish, appropriation is best thought of as "the incorporation of technology not simply into practice but into systems of meaning. Appropriation is the creation, management and communication of meaning, within a community of practice" (Dourish, 2003).

More analytical theories for understanding appropriation in CSCW include models like Adaptive Structuration Theory (AST), as proposed by Gerardine DeSanctis and Marshall Scott Poole (1994). In their paper *Capturing the Complexity in Advanced Technology Use: Adaptive Structuration Theory*, DeSanctis and Poole describe the need for an evaluation method that assesses the influences and implicit changes of advanced information technologies (AIT). Such systems include group decision support systems (GDSSs) and the effects they have on organizations’ workflows. They describe AST as an affective approach that takes into consideration both the deep social structures of a technology and the actions of humans who adapt and/or change the use of a technology to meet their individual and/or group needs. The authors argue that appropriations are not automatically determined by technology but rather are executed by people actively selecting how technology structures are used and adopted.

Rabardel and Béguin (Rabardel and Béguin, 2000) address appropriation in the context of *Instrumental Genesis* (IG), a conceptual theory derived from Activity Theory (Kaptelinin & Nardi, 2006), French psychology and ergonomics. The authors propose a model for designing information processing systems that regards instruments as not only material objects, but as social and cultural entities. A key concern of IG is the
transformation of material artefacts into instruments. In this regard, appropriation is seen as a defining aspect within the process of instrumental genesis. IG accounts for both the transformation of artefacts as the user’s activity unfolds, and the creation of what the authors refer to as utilization schemes—the ways individuals conceive of using a tool based on their social and unique contexts. These schemes can occur simultaneously in the emergence and development of an instrument. There are two dimensions to IG based on the dual role psychological and material aspects play in the appropriation of artefacts. The first dimension, instrumentation looks at the subject and describes the evolving knowledge-set of an individual around the use of a tool—specifically, the emergence of utilization schemes and skills that are acquired through the practice of using the tool. The second aspect, instrumentalization, looks at describing the incremental changes of an artefact’s structure and functionality, as well as the extension of its intended use through appropriation.

Segueing from the notion of instrumentalization, I now move on to other sociological theories that look at how cultural artefacts are socially adapted and appropriated based on their materiality and aesthetic qualities.

The Role of Materiality and Aesthetic Experience

There is of course, another way to look at the social processes inherent in the repair of technologies—that is to understand our relationship with technologies as influenced by their material and aesthetic qualities.

Verbeek’s Concept Technological Mediation and Latour’s Notion of Script

Another important aspect of understanding repair as a practice is to understand the mediating role of technology in practice. For this I turn to Peter-Paul Verbeek and Bruno Latour for their views on technological mediation and the affects of technological determinism on practice.

In his paper Acting Artifacts: Technological Mediation of Actions (Verbeek, 2006), Verbeek uses a phenomenological approach for understanding how humans interact
with the world and how technologies have a direct impact on how meaning is drawn from experiences with the world. More specifically, Verbeek looks at how technologies mediate human interactions with the world from the standpoint of *perception* and *praxis*.

From a perception standpoint, Verbeek refers to Ihde’s notion of *technological intentionality*—the ways technologies are embedded with purposes that can either amplify and/or reduce how we see the world. The intentionality of a technology is not fixed but is rather shaped by the relationships people build with them who have different interpretations and thus, have different intentionalities regarding their use. This notion is also similar to Schatzki’s notion of *world intelligibility* (how things make sense to individuals) and *action intelligibility*—that is, what makes sense to people to do as “signified” by the object (or signifier.) The variance in interpretations and intentionalities is what Ihde refers to as *multistability*; the essence of a technology that is changed and transformed based on the context in which it is used. Consequently, technology’s ability to transform our perceptions can have a direct affect on how we conduct our practices.

Given Verbeek’s phenomenological background, he was interested in how artefacts mediated human actions and how this influenced the way people lived their lives. Not unlike Schatzki’s view, praxis is the way humans are made present in the world. In referring to Latour’s notion of *script* (Latour, 1992), Verbeek highlights the influence artefacts have on action and what humans do (and choose to do), which is often co-shaped by the artefacts that they use. Like a script, an artefact has a prescribed way of use that people recognize through their immaterial or informational attributes in much the same way that signs do (Latour, 1992). Scripts are often directed and inscribed by designers; this is what Latour calls the *delegation* of features of an artefact. Artefacts however, may have scripts that are implicitly included, where explicit scripts work out in ways they weren’t intended. These transformations are often an outcome of what Latour refers to as *translations*. Translations play a key role in the *multistability* of an object, where by the repurposing of an object’s intentions can alter the practices usually associated with it.

The degree to which a technology mediates activity is dependent on the present state of the object both in practice and in perception. Verbeek refers to Heidegger’s notions of *readiness-to-hand* and *present-at-hand* as a framework for describing the
relationships people have with technologies and how the emergence of either instance can inform how to better facilitate people’s interactions with the world. *Readiness-to-hand* maintains humans presence with the world, entailing an individuals complete focus on an activity without conscious thought directed at the tool they’re using. Technology in this sense is a mediator of human-world relationships. *Present-at-hand* is the point at which individuals are made aware of their tool due to a break down of the artefact itself.

These concepts have also served as a theoretical framework for understanding the processes and techniques of everyday creativity. In everyday repair, it was useful to distinguish the physical attributes of broken objects as a means of understanding how they compelled individuals to resolve their breaks. Using Verbeek’s perspective, it can be said that common modes of practice and nuanced uses of materials can be based on their multistability and the degree to which they become present-at-hand. This presentness can often compel individuals to think about how to resolve an unacceptable situation, finding creative alternatives for repurposing their objects and materials around them.

**Aesthetic Experiences with Technology**

According to McCarthy and Wright, aesthetic experiences in pragmatist philosophy include the relationship between people and the experiences they have with their objects. These experiences often provide some sense of creative fulfillment. In the context of interaction design and HCI, aesthetic experience has also been a useful perspective for understanding how to design for appropriation. Aesthetic experience was also another aspect of everyday repair observed in the ways non-experts found satisfaction in the prolonged use and/or repair of their broken objects. The following literature describes current research work that explores both aesthetic experience and its theoretical application towards appropriation. Notions such as ambiguity, de-familiarization, and estrangement are explored as parallels to what individuals constituted as *broken*, which are meant to provoke more aesthetic experiences when interacting with technology. The goal for most of this work is to move individuals beyond modes of utility and compel more creative interactions.
Defamiliarization and Ambiguity

In Anthony Dunne's Hertzian Tales (Dunne, 1999), the author argues for a 'poetic' and 'artistic' driven approach to the design of everyday objects. Dunne suggests that current designs have reached a point of stagnancy in their user experience and advocates for designed objects to move towards characteristics that embody notions of 'estrangement', 'dematerialization', 'defamiliarization' and 'alienation.' He sees these as new ways of creating new perspectives for interacting with the world via aesthetic experience. Though he doesn't use the word appropriation, he does critically analyze the dual roles of the designer as author and people as 'protagonists and developers' of everyday objects, as they ultimately consume and interact with designed objects. People thus, play a fundamental role in shaping and evolving the cultural meaning/semiotics behind the objects they use.

In Phoebe Sengers and Bill Gaver’s paper (Sengers and Gaver, 2006), the authors describe the potential for using ambiguity as a tool for fostering more creative interactions with technology. Ambiguity can be used for eliciting multiple interpretations from people that go beyond the single authoritative interpretation that is inscribed by designers, thus creating the opportunity for appropriation. They explain that multiple (even conflicting) interpretations assigned to technologies can co-exist, as well as facilitate various interactions that take place over time. They also suggest that ambiguous technologies can better adapt to shifting contexts of use, as well as pave the way for more poetic and artistic forms of interaction that go beyond usability. In a similar paper by Gaver, Beaver, and Benford (2003), the authors further champion the use of ambiguity as a resource for designers who commonly try to avoid and/or repress it. Gaver et al argue that:

"Traditional concerns for clarity and precision are superseded in such systems by the need to provoke rich resources for experience that can be appropriated by users."

Consequently, the authors see ambiguity as a being a vehicle for appropriation despite the negative perception the larger HCI community has towards it as a design outcome.
In Kristina Höök’s paper *Designing Familiar Open Surfaces* (2006), she shares similar ideas to those of Gaver and Senger around the notion of *interpretation*. Höök argues for the need to create more *open surfaces* that support individuals own interpretations and appropriations of their technologies. Höök emphasizes the need for technologies to facilitate individuals embodied experiences, which over time influence the way technologies are adapted and used (she describes this as *naturalness* and *familiarity*). Lastly, Höök suggests that in order to design for appropriation, systems need to make activities visible and adaptable to individuals and groups.

The research described above speaks to some underlying aspects regarding everyday repair from the standpoint of object materiality. Firstly, Dunne’s notions of defamiliarization and alienation shed further light on understanding how interactions with objects deemed broken, dysfunctional or scrap can instigate actions of repair and creative repurposing. My purpose for including Gaver, Sengers and Benford’s views on ambiguity is meant to emphasize the ways individuals salvage scrap and remnant parts from broken objects based on their interpretations of how materials could be used. I’ve found in my own observations of non-experts that acts associated with salvaging lead to creative repurposing. Salvageable materials also contain a certain level of ambiguity, as their purpose is no longer clear or well defined. Lastly, Hook provides further insights into the notion of open surfaces, which also highlights an important aspect of materiality. Specifically, it speaks to the degrees of simplicity objects possess that also provide clear directions for individuals to appropriate them towards different contexts of use.

**Repair in Design**

The following literature describes current design theories and practices that consider repair as a factor in the design of products and technologies. Most of the discourse related to design stems from the emerging discipline of *Sustainable Interaction Design* (SID) and HCI. I’ve included this body of literature as these studies also look at the role repair and reuse play in prolonging the lifecycle of broken objects. For this reason, I have also included research that looks at how creative communities appropriate and reuse old and broken technology. These are described in more detail below.
Repair in Sustainable Interaction Design and HCI

Within the new and emerging discipline of Sustainable interaction design, repair is discussed generally as a characteristic of sustainability and is often included as an elemental part of design frameworks. For example, Eli Blevis includes repair as part of several principles he proposes for guiding future sustainable interaction design practices (Blevis, 2007). This paper focuses on the following two principles, which he describes as: *Linking Invention and Disposal*—this takes into account the obsolescence of interactive technologies that are either replaced or disposed of due to the adoption of new technologies; and *Promoting renewal and reuse*—the notion that new technology designs must prioritize the *salvaging* of existing objects, as well as the *recycling*, *remanufacturing*, and *reuse* of an object as it is.

There are direct overlaps between the categories discerned from the everyday repair study and Blevis’ rubric for sustainable interaction design practice. His rubric contains 12 different elements for designers to consider within their design process, from which I’ve highlighted the following aspects that have particular relevance to the ways individuals described repairing and reusing their broken objects: *salvaging*—the degree to which an object’s physical and digital materials allow for recovery; *achieving heirloom status*—assessing whether a designed object’s innate value and/or quality motivates prolonged use and preservation, as ownership is transferred to various owners over time; *Finding wholesome alternatives to use*—the degree to which an object can operate without the use of physical resources and at the same time serve the needs of its owners; and *reuse as is*—assessing whether an object can be reused in its current state, including its digital material. Wakkary and Tanenbaum expand Blevis’ framework in their paper *A Sustainable Identity: The Creativity of and Everyday Design* (2009). Here the authors describe how the notion of an everyday designer can be coupled with concepts Blevis describes in (2007), by linking sustainability to the identity the user.

William Odom et al. describe their research on *Personal Inventories* (Odom et al., 2009). This study looks at understanding the motivations behind why people preserve some things and dispose of others (with seeming disregard). The goal of this research is to use the personal inventories framework to inform the design of more durable digital artefacts. The authors also extend Verbeek’s theory on factors of durability (Verbeek,
and propose a useful framework for assessing the degree of attachment individuals have towards their objects. This framework is particularly relevant to this thesis’ findings, as it outlines similar characteristics around the motivations for why people keep their broken objects (refer to Chapters 4 and 5.)

Similar to this research is Huang et al.’s investigations into why people dispose, recycle and/or reuse technologies prone to obsolescence such as mobile phones (Huang and Truong, 2008). This work also provides similar findings behind individuals’ motivations for keeping their old cellphones, where were often driven by their aesthetic qualities and the personal meaning attributed to them. In the case where individuals were forced to replace their phones (due to their network providers renewal contract), participants often kept and stored their phones as back ups and spares for the potential that others could use them.

From a material standpoint, the work of Jung et al. looks at understanding the materiality of digital artefacts for informing the design of technologies (Jung and Stolterman, 2011). In another paper, these authors also highlight the need to look more closely at the notion of reconfigurability – the ability to easily break down and assemble software and hardware components for different purposes of use through the addition and transformation of parts (2011). This work contributes similar insights found within this thesis study surrounding the inability of non-experts to repair their broken digital objects due to their rigid nature and lack of adaptability.

The work of Jaap Jelsma (Jelsma, 2006) highlights a particular body of work in which the recommendations of this thesis counters. In his paper Designing 'Moralized' Products: Theory and Practice, the author suggests using Latour’s notion of script as a way of circumscribing and prescribing an object’s actions of use, which invite certain sustainable behaviours. This thesis looks to argue for a reframe of the use of scripts, where the creative repurposing of technologies is an encouraged form of use. In the context of everyday repair, the repurposing of technologies is a fundamental part of non-experts’ everyday practice and is further more viewed as an inherently sustainable.
**Repair in Product Design**

Research initiatives within product and industrial design look at designing manufactured goods for **disassembly and remanufacturing** once they reach their end of life (EOL). As an example, Takeuchi and Saitou (2005) describe a production algorithm that allows for built-in disassembly through the removal of one or more fasteners. This algorithm, which they refer to as a **multi-objective genetic algorithm**, measures the various components of products so that when objects do reach their EOL, their disassembly maintains the maxim amount of profit and minimum environmental impact (through recycling and reuse).

Shu and Flower (1995) describe the application of a **design-for-remanufacturing** framework, which evaluates the degree to which fasteners and joints may impede the remanufacturing process EOL products. The authors also describe the benefits of remanufacturing as the most optimal alternative to disposal practices. They describe two other alternative practices include recycling for scrap materials and maintenance (which entails repair). The authors also make light of manufacturers incentives for adopting more environmentally sound remanufacturing practices, in light of pending legislature that holds them accountable in the reclamation of their products once they reach their EOL.

**Reuse and Appropriation within Creative Communities**

The last aspect of this literature review describes the proactive ways individuals seek out and acquire old, broken, and disposed objects to put towards their own creative uses. This literature speaks to the notion of **creative repurposing**—a core concept/category discerned within the grounded theory analysis. Throughout the data analysis, it was found that many non-experts collected and transformed disposed and used objects for their own creative use. Here I discuss a few key texts that explore the practices of creative communities and what potential implications these have for informing the design of interactive technologies. These texts also point to an emerging trend within interaction design and HCI that now considers everyday creativity as a key consideration of design.
In a keynote given in 2009, Eric Paulos discussed the rise of the expert amateur and how an emerging subculture of techno-savvy individuals (such as hackers) are finding new ways to repurpose interactive systems and software technologies that go beyond their intended use (Paulos, 2009). Paulos implores that research within the computing community must find ways of accommodating for the ‘rise of the expert amateur’ by creating new discourses around the notions of economy, the environment and other social issues like healthcare and politics for exploring in the design of novel, personal computing systems.

In recent years, there have been many HCI research endeavours that have looked towards online DIY communities for understanding individuals’ creative practice. As a follow up to Paulos keynote, he and Stacey Kuznetsov describe the motivations, practices and tools for sharing DIY practices by non-experts (Kuznetsov and Paulos, 2010). Here they highlight the innate creativity such communities have around the creation, repurposing and repair of old objects.

In 2011, Sunyoung Kim and Paulos presented their research on the techniques and practices individuals employ in their creative reuse of e-waste (Kim and Paulos, 2011). The study was comprised of three different studies; an online survey, observational study of DIY communities online, and an evaluation of the vocabulary framework discerned from the previous two studies. The authors describe the various tactics participants used for prolonging the use of electronic equipment in the form of two vocabulary frameworks—a Design reuse vocabulary and a Reuse composition framework. These frameworks aim to contribute to current HCI practices by identifying the larger issues around e-waste behaviour, as well as foreground salient processes and behaviours involved in the creative reuse of e-waste. These frameworks also provide a design strategy for encouraging everyday designers of varying skill sets to sustain and prolong the longevity of their technologies.

Lastly, Rosner and Bean present their qualitative research on IKEA hackers, describing how understanding hacking can provide HCI with valuable insights around individuals’ creativity and personal identity (Rosner and Bean, 2009). The authors draw implications for the design of interactive tools that empower an emerging generation of creatives.
A Note to the Reader: The Role of the Literature Review

The literature review presented was conducted at the end of this study, keeping with grounded theory’s credo for sustaining a level of theoretical sensitivity during the analysis process. In presenting the literature review first, my intent is to situate everyday repair within the larger body of work while at the same time using it to reflect the interpretations I’ve made around the core concepts and themes that will be discussed in the forthcoming chapters. The purpose of this literature review primarily serves as an ideological premise for sustaining the claims and positions made within my research. Furthermore, this literature review also tries to demonstrate why certain theories were accepted as part of my stance as an interaction designer. While my background in design has inspired the ideological framing of this work, the data analysis and interpretations made of the data have abided by the grounded theory approach for determining core concepts and themes of everyday repair. In the following chapter, I address this issue when describing my use of a constructivist grounded theory approach, as described by Charmaz (2006).

Summary

The area of research surrounding everyday creativity continues to expand as HCI and interaction design initiatives seek to understand the agency and rebellious actions of individuals who adapt technologies trapped in the techno-centric design approach of computing disciplines. This new area of research serves as evidence of a growing recognition for the need to understand what McCarthy and Wright call technology as experience. These new studies also echo the same mantras they outline in their pragmatist approach to understanding the lived experiences of people and how they integrate technologies into their lives. While traditional computing research has been lead by professionally trained experts such as computer scientists, engineers, and designers, we now see greater focus given to the everyday individuals and their creative capacity to adapt, resource and appropriate technologies in ways that best suit their needs. This literature review reflects how social adaptations and everyday creativity provide key insights for interaction design theory, as well as situates this thesis within
the large body of work that strive to inform the design of technologies based on individuals sense of agency and creativity.
Chapter 3.

Methodology

Constructing a Grounded Theory of Everyday Repair

The Grounded Theory Method (GTM)

One of the primary objectives of this research is to construct a theory of everyday repair that provides a holistic account of individuals’ processes, actions and interactions around acts of repair. Grounded theory, or more specifically—constructivist grounded theory, as described by Kathy Charmaz (2006)—was deemed the best approach for reflexively understanding how everyday repair emerged as a socio-cultural phenomenon applied in the context of interaction design. The constructivist nature of my approach underlines how both the research participants and I interpreted the meanings and actions from the data, incrementally building on the theory together. While other qualitative methodologies such as case studies, ethnography, and phenomenology collect empirical data from a wide range of different sources, GTM was better suited for building on my own interpretations and constructing a new theory of repair. Furthermore, grounded theory seemed well suited as an analytical framework for facilitating the data collection and analysis process in a systematic way. By using GTM to develop a new theory on everyday repair, I wanted to shed light on how interaction design can reconsider individuals’ as creative agents in their use of interactive technology through a bottom-up approach.

The grounded theory method (GTM) has been historically used as a means for understanding a wide range of sociological phenomena, including dying in hospitals, the views of pro-life and pro-choice women, and the social pressures of quitting drug addiction (Glaser and Strauss, 1965, 1968; Luker, 1984, Biernacki, 1996). Barney Glaser and Anselm Strauss (1967) first proposed the GTM framework as a systematic
and inductive approach to qualitative inquiry. It is an immersive process where researchers sort, analyze, and code descriptive elements of data that over time lead to abstract theories. It is through the process of memo writing that researchers begin to construct theories around emerging patterns deduced from their analysis (I will describe this process further below). For my purposes, GTM was deemed not only a natural fit for understanding the processes, interactions and actions that make up everyday repair – it also provided a methodological structure for developing a theoretical framework.

**The Constructivist Approach to GTM**

Since its inception, GTM has been adopted and transformed in a myriad of forms, stemming from both quantitative and qualitative disciplines alike. Kathy Charmaz, a renowned theorist of grounded theory and one of Glaser and Strauss' former students, views Glaser and Strauss' analytic methods as a set of “flexible guidelines, not methodological rules” (Charmaz, 2006, pp. 9). My use of grounded theory shares the same epistemological stance as Charmaz. Her adaptation of GTM roots itself in constructivist epistemologies – more specifically, she writes:

“My approach explicitly assumes that any theoretical rendering offers an interpretive portrayal of the studied world, not an exact picture of it. (Charmaz, 1995b, 2000; Guba & Lincoln, 1994; Schwandt, 1994). Research participants’ implicit meanings, experiential views—and researchers’ finished grounded theories—are constructions of reality. In keeping with its Chicago school antecedents, I argue for building on the pragmatist underpinnings in grounded theory and advancing interpretive analyses that acknowledge these constructions.” (pp. 10)

In adopting Charmaz's version of GTM, I’ve leveraged its pragmatist foundations for informing and guiding my analysis based on my own background in interaction design. I have extended Charmaz's GTM approach by focusing on understanding processes and centralizing action as crucial aspects of everyday repair. In this light, it is important for audiences of this thesis to note the pragmatic and constructivist underpinnings of this research are inspired by my previous research on everyday creativity within the context of everyday design (see chapter 1). Though everyday design has inspired my theoretical orientations around understanding everyday repair, I remained true to the methodological and empirical structure of the grounded theory method and had avoided making any pre-conceptions around the categories and
concepts that emerged from my data collection and analysis. In gist, I declare my epistemological orientations here so that readers are clear about the intentions of this thesis.

In the following section I start off by first describing my approach to data collection, which entailed the dissemination of a 3-question email interview to several university list-serves and social networks on Facebook. I provide a rationale for why this was a successful approach for conducting a grounded theory—primarily since it facilitated the acquisition a large number of submissions across a diverse participant group. I also outline the various GTM techniques I employed for conducting my data analysis—specifically using the word-by-word and line-by-line methods described by Charmaz (2006). I follow this with a description of how I discerned emerging concepts through a rigorous comparative analysis of all the participants’ data using techniques such as theoretical sampling, data saturation, and sorting through the process of memo writing.

**Data Collection: The Use of Email and Social Networking Platforms**

One of the main goals of the data collection process was to obtain as many different examples of broken objects individuals repaired and/or kept. There were two main reasons for acquiring these types of objects: the first was to see what kind of approaches people took for repairing their objects and how they went about doing this. Secondly, I wanted to get a sense of what type of objects individuals repaired and if there were any discernable differences amongst them. Most of the interviews were conducted via email and the social networking website, Facebook (through its private messaging affordance) in order to manage the large amount of data in a way that was not intrusive to the participants and yet convenient for them to respond on their own time.

The decision to utilize email and Facebook comes from the emergence of new methods within sociological and anthropological research—namely the rise of virtual ethnography and online surveys that have effectively obtained rich contextual data from participants. Typical GTM approaches for data gathering entail field-notes, interviews, extant records and reports. According to Charmaz, one of the core necessities for
conducting GTM is the acquirement of ‘rich data’ for constructing a deep and insightful theory.

“Rich data are detailed, focused, and full. They reveal participants’ views, feelings, intentions, and actions as well as the contexts and structures of their lives.” (Charmaz, 2006)

In recent years, qualitative researchers have made extensive use of the Internet as a viable way of gathering rich data. In general, new media offers new ways of reaching different populations of research subjects in innovative ways (Hine, 2006). By using email and Facebook, I managed to distribute my initial questionnaire to a diverse and vast number of people, while acquiring multiple responses from each participant over the span of several months. I describe this in more detail below.

The Procedure

The primary medium in which data was collected was through my personal (and secure) email account hosted through SFU Connect. My personal Facebook account (under the alias Leah Maestri) was used as an auxiliary platform for contacting various social networks. There were specific reasons for why I used my personal accounts to attain data. First, my sense was that email and Facebook had become standard forms of communication and seemed to be the most convenient and familiar way to maintain correspondence with participants. These communication platforms not only fit within people’s busy schedules, they also enabled communication at any time during the day when it was most convenient for them. Another reason for using my personal account was to achieve a sense of equality between the participant and myself. That is, I wanted participants to communicate with me as though they were speaking candidly to a friend and not someone who was formally trying to interview them. I also wanted our exchanges to remain personable enough so participant could feel like their thoughts and personal reflections were relevant to my study. Furthermore, by remaining within the context of ‘personal message exchanges,’ I wanted the process of sharing information to feel trustworthy, safe and comfortable. One last reason (and somewhat similar to the first reason) was that I anticipated contacting participants individually over the course of several months and felt that sending messages through email and Facebook were the least intrusive ways of maintaining correspondence. As it turned out, my communications with the majority of participants were carried over the course of a year
and a half, with an average of 3-4 follow up emails exchanged between myself and each participant.

My emails and Facebook messages were disseminated to a wide range of individuals residing within the Greater Vancouver Regional District. Participants varied between the ages 20-65 coming from different professions. A total of P=42 participants submitted responses—22 of which were male, 20 were female. Approximately 22 of the 42 participants were students from a local university in Vancouver with backgrounds ranging from new media, cognitive science, architecture, HCI and design. Out of the total group, 12 participants were located in Montreal and also had background in new media and design. The remaining 8 participants had professions relating to law, music, teaching, and dentistry—2 female participants were home keepers. The total number of objects submitted was approximately N=~120, which comprised of artefacts in various states of impairment and/or repair.

In general, professional backgrounds were noted though they were not prioritized as a defining attribute of everyday repair. My lack of specificity around the type of respondent was purposeful, as I was interested in understanding the diverse ways acts of repair emerged within a wide range of contexts. The types of objects submitted were equally as diverse ranging anywhere from common everyday objects such as mugs, plates and vases, household appliances, to digital electronics such as cellphones, mp3 players and TVs. As I will describe further on, there was a noticeable distinction regarding objects’ digital orientation. Objects participants submitted were both non-digital and digital in nature, though a good majority of the objects were non-digital. I will describe the impact of this distinction further on when describing the techniques of everyday repair discerned from the initial coding analysis.

In my initial message, I introduced myself as a student researcher from a local university who was interested in understanding how people repaired their broken objects. The message included the following three questions:

1. Do you have something that is broken but not thrown away?
2. Do you have something that is broken which you have repaired and is now more valuable (monetary or sentimental) and/or functions better than before?

3. Do you have something that is broken which you are still using or reusing in a new way?

These questions were designed to be open and vague in order to elicit as many different answers around what people thought deemed ‘broken’ and ‘repaired.’ It was also a strategy distinguishing any values individuals associated with these terms. Once a participant responded through either email or Facebook, a quick ‘initial coding’ analysis was conducted on the answers they provided. This entailed writing quick notes and codes in the form of a memo, which then informed my follow-up responses. Depending on how detailed a participant’s response was, follow-up messages included some or all of the following questions:

- **Why did you feel compelled to repair this object?**
- **Can you clarify the nature of an object’s break?**
- **Can you provide more detail on the process of your repair – specifically what made you think of using X material or X technique?**
- **Do you have a picture you can send me of your broken/ repaired object?**
- **What is the outcome/status of your object to date?**

These questions were largely informed by those outlined in Charmaz’s book (2006, pp. 18) to elicit further insights from participants if their responses were found too vague or lacked detail. In general, I assessed a response based on how well it spoke to the participants’ causes, processes, actions, settings, and outcomes. Also noted were the involvement of participants’ friends or family, which provided insights into any possible social dynamics involved in their repair processes.

The following email exchange is an example of a discussion between P23 and myself. Here I tried to get him to expand on his one-word answers by asking pointed
questions about his broken objects and what he planned to do with them. \textit{Note}: Some email content was removed such as the participant’s name, date the email was submitted, and other irrelevant details to keep focus on P23’s response. My dialogue is in \textit{italics}:

Hi Leah,

please [sic] find below the answers to the questions:

\textit{Do you have something that is broken but not thrown away?}

Yes

\textit{Do you have something that is broken which you have repaired and is now more valuable (monetary or sentimental) /functions better than before?}

No

\textit{Do you have something that is broken which you are still using or reusing in a new way?}

Yes

[...]

The thing I am using broken is a laptop. I have one office chair that has been broken but I still did not throw [SIC] it away, although I am not using it. Hope that this helps!

Cheers, [P23]

This email was one of only a few responses that came back as one-word answers. For the most part respondents were quite detailed about how their objects broke, how they repaired them (or left them as-is) and why they were motivated to keep and/or repair them. The goal of my response back to P23 (as was the case with many of the respondents) was to try and have him expand on his answers while maintaining a sense of informality and casualness. Most importantly, I wanted my follow-up to be short and to the point.

Hi [P23],

Thanks so much for responding - it's really appreciated!

I was just wondering if you had a picture of your laptop and office chair? It would be really helpful to know what aspects of these items are broken?

Could you describe briefly why you've kept them and have chosen not to replace them? Do they have a particular kind of value to you?

Thanks again!
Leah

[End of Email]

To which P23 promptly replied:

No problem,

The laptop fell down from my bag several times. The broken aspects are [the] frame around the screen, and the side frame that is part of the cooling device. I have kept the laptop because computers are still expensive (at least the one that I have), I can still use it for the work, and somehow I got used to it. Also, installing everything again on a new computer can be a very tedious task.

The office chair has the cover leather thorn. I have kept it because, when someone comes to my place, and we want to sit together at my desk, I can still use it. It does not have any particular value to me.

Hope that this helps.

Cheers,

P23

The above exchange with P23 demonstrates a couple of methodological aspects. First, it illustrates the typical way in which communication was exchanged, as well as the nature of the dialogue between a participant and myself. It also shows how eliciting responses from a participant often took place in a short amount of time with little inconvenience imposed on the participant. Exchanges like the example above typically took place within the span of a day. The speed and efficiency of these discussions were what allowed me to continue the data collection process over a long period of time, where participants would even be contacted several months later. This was particularly advantageous, as theoretical sampling required further data collection for answering emerging questions over the course of my analysis. I could simply send off an email or Facebook message to participants asking them for clarity around a specific observation or verify questionable interpretations. In the following section, I describe how the data collection process took place in tandem with the data analysis and how alternating between the two processes were vital in abstracting the data towards a theoretical framework.
Data Analysis: Coding for Categories and Concepts of Everyday Repair

Two of GTM’s main analytic techniques are coding and memo writing. Coding is a common method used in empirical research for categorizing data. In GTM, it is the first step in taking concrete descriptions of data and moving them towards abstract concepts. I employed coding to participants’ email and Facebook responses. This process entailed two phases. The first phase included initial coding where initial ideas and concepts are given to segments of the participants’ data, including both their text and images. I will describe this process further on (see The Integrated Process of Coding and Memo Writing). The second phase involved what Charmaz refers to as focused coding – the process of selecting the most salient codes and bridging them together via axial coding—that is, connecting the relationships between core categories and subcategories and mapping these to the larger data set. Another way for making connections between codes was through the process of memo writing – another crucial step in the GTM analytic process for discerning emerging patterns and informing my follow-up questions back to participants. In the following sections I will describe how coding was employed in relation to the participants’ responses and how memo writing helped move the codes towards abstraction.

Coding Text and Image Data

As participants submitted their email and Facebook responses, they were placed in a Microsoft excel spread sheet and listed in the following columns: the participant’s name, participant’s alias (i.e. P1), and object name, and data text (see Table 1 below). A participant's response would include anywhere between 1-10 different examples of objects, each with their own text description. Any images participants included were catalogued in a separate excel sheet and were organized the same way as the text data. I will first describe my process for analyzing the text responses, and then describe how images were analyzed in conjunction with the textual analysis.

Textual Analysis

The GTM techniques employed for analyzing the text data included word-by-word and line-by-line coding. In most cases, I employed line-by-line coding, which entailed highlighting sentences that revealed participants’ context, process and
interactions. Any word or sentence that described an action and/or process was color-coded and then designated a label. Table 1 below is an excerpt from the spreadsheet used to organize all the participants' text data. The text within the column labeled P2’s Response has been color-coded to highlight different segments I found had an interesting idea or potential for further development. Each coloured segment had a corresponding code, which is displayed in the right column with the same color. (Note: RI, RII, and RIII are shorthand for Response 1, Response 2, and Response 3)

Table 3.1 Sample of Initial Coding of Participant’s Email Responses

<table>
<thead>
<tr>
<th>P2’s Responses</th>
<th>Initial Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>(RI) These spotlights came from my friend’s basement when he was moving out. They were dusty and broken so I polished them and rewired them and now they are our house party lights :) (RII) The spots were just in an old box. I like to build stuff, and they’re real theater spots... that’s grade A junk. Originally I thought I’d recreate a kind of lighting effect I used to have set up in my old apartment, where you put primary colour filters on three spots and aim them at a white wall. They make white light unless you walk between them and the wall, in which case you cast primary colour shadows, and shadows make new colours where they intersect. I only have 2 though, and the acetate filters I bought for them melted :S, so now they’re just lamps. I’m not too much of a pack rat, but I generally pick up interesting throw-aways if I think I can use them for a project. (RIII) I would say that I repaired the lights (some of the wiring was actually broken), but I also restored them (polished them and replaced the filter holders just for aesthetics). I was also using them as floor lamps, but they’re stage floods meant to be hung from a lighting grid, so I guess that’s not what they were designed for. We actually put them in our fireplace because they got so hot!”</td>
<td>Finding and repairing stored/old/dusty broken non-digital / electrical objects.</td>
</tr>
<tr>
<td></td>
<td>Rewiring non-digital broken objects to repair them.</td>
</tr>
<tr>
<td></td>
<td>Collecting and repurposing old broken objects based on personal interests/hobbies</td>
</tr>
<tr>
<td></td>
<td>Creatively repairing an object and failing.</td>
</tr>
<tr>
<td></td>
<td>Repurposing as a repair.</td>
</tr>
<tr>
<td></td>
<td>Augmenting the features and functions of non-digital / electrical objects for creative use.</td>
</tr>
<tr>
<td></td>
<td>Collecting odds and ends from other people.</td>
</tr>
</tbody>
</table>

Once a response was read and coded, follow-up questions were sent back to participants. As email responses were being sent and received, they were coded again
and compared to a participant’s previous response, as well as to those of other participants. As mentioned earlier, there were upwards of 3-4 email exchanges made with each participant, with each response adding further clarity and depth to emerging categories, their dimensions, as well as my own interpretations. I continued to communicate with participants until codes and categories reached a point of saturation in which rich concrete and abstract concepts were formed. I discuss this in more detail further on.

As recommended by Charmaz, the use of gerunds was used as a coding tool for highlighting actions and processes. Gerunds were also a helpful way of maintaining individuals’ perspectives while at the same time enabling me to see the data from different and multiple perspectives. I also tried incorporating in vivo codes—terms used by participants—as another way of aligning the meaning and spirit of their responses with my own interpretations. This is another measure by which I tried to ground my analysis as much as possible. Not all sentences were coded (these are denoted by sentences left in black in Table 3.1) but some were noted in memos for their potential use in future coding.

**Visual Analysis**

Images were an essential part of the data analysis process, as they provided key insights around the materiality, shape, context, break, and the ultimate status of an object. The visual analysis was done in parallel with the textual analysis but was kept as a separate process. All images were embedded in a spreadsheet and were organized according to their respective participant’s text responses. The images were organized this way in order to conduct an adapted form of word-by-word, line-by-line, and incident-by-incident coding. The key purpose of analyzing the images was to try and understand processes of repair from the vantage point of the object itself. Specifically speaking, I wanted to understand what material and aesthetic qualities of the objects affected individuals’ processes of repair.

Analyzing each image started first by an assessment of the participants written response—keywords were color coded and used as markers for discerning the physical and functional aspects of their object(s). Once a thorough reading was done of the text, I began coding objects based on their physical and aesthetic properties based off their
image. Another method I used for coding the images entailed printing each image on an 8.5 x 11 sheet of paper (see Figure 3.1), upon which I used markers to write quick notes and codes directly on the object (see Table 3.2 below).

![Figure 3.1 Paper version of visual analysis coding](image)

There were implicit advantages to analyzing the images alongside the text responses. For one, I could get a sense of the context in which participants kept, used and repaired their object’s context based on the background of the images. Also discerned were the degree to which objects contained electrical and/or digital components. As an example, the materiality, context and digitality of P3’s digital electronics were more discernable from the images he included coupled with this email response. Table 3.2 below is an excerpt of the visual analysis spreadsheet including P3’s submission.

**Table 3.2 Excerpt from Visual Analysis Excel Sheet**

<table>
<thead>
<tr>
<th>Participant</th>
<th>Text Data</th>
<th>Image</th>
<th>Material (codes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P3</td>
<td>Yes, I do have a number of things that are broken but not thrown away. Included in this list is an iPod (3 gen, old school!) that has a failed hard drive… I haven’t been able to throw [them]</td>
<td>![Image]</td>
<td>Plastic, Hardware, Processors (PCB)</td>
</tr>
</tbody>
</table>
away primarily due to the fact that there isn't an easy place to dispose and recycle old electronics. Call it environmental guilt.

<table>
<thead>
<tr>
<th>Fiber Glass</th>
<th>Electronics</th>
</tr>
</thead>
</table>

In my analysis, I gathered that P3’s electronics were typically stored in a plastic bag as a catchall until he was able to figure out how to dispose of them in an environmentally friendly way. I also distinguished initial codes and substantive categories around the electronics’ shape such as flat, rigid, concave, thin, round edges, digital, electronic. As seen in the last column in Table 2, a list (albeit not a very exhaustive one) is tabled with some of the expected materials found in digital electronics. Based on my interpretation of the image above, I found I could focus my follow-up questions back to P3, which entailed asking why he felt he couldn’t repair is digital electronics himself and what he planned to do with them knowing the inherent complexity of their parts.

Another advantage of conducting the visual analysis enabled the development of categories regarding objects’ physical properties that seem to have a significant influence on acts of repair. Categories such as digitality, and materiality were all defined mostly from the visual analysis. As an example, I was starting to see a substantial (and emerging) dualism between digital and non-digital objects that were broken, repaired and/or repurposed. In my constant comparisons of the data I found that very few of the objects were digital electronics while the majority of objects submitted were non-digital with basic electronics (i.e. house hold appliances). These observations were also made explicit based on the frequent accounts of participants repairing and reusing simple non-digital objects such as mugs, versus the lack of instances where participants attempted repairing digital objects such as mp3 players.

This is a methodological consideration I wish to highlight, as these observations would have been difficult to pursue in any depth without referring to the participants’ images. By seeing the materiality and digital nature of the objects, I was able to ground my codes based on the physical properties visible in the images participants provided. Conducting a visual analysis and coupling it with textual data presents an opportunity for applying the techniques of word-by-word and line-by-line coding in new and novel ways.
that give the researcher a sense of the object and participants’ context. In the following chapter, I describe what implications the categories *digitality* and *materiality* have for interaction design.

**Abstracting Descriptive Data Through Memo Writing**

An essential part of GTM is evolving initial codes into more abstract concepts that lead to a conceptual theory. Memos were the primary vehicle in which codes were synthesized, sorted and integrated based on emerging relationships with other codes and categories (also known in GTM as *focused coding*, *axial coding* and *theoretical coding*). Memos were pivotal in critically evaluating my interpretations of data with myself, my colleagues, as well as the participants. They were also necessary for pointing out missing information and glaring assumptions made around participants’ views. As an example, I used inter-rater reliability for analyzing some of the initial data collected for a conference proceeding called *Understanding Repair as a Creative Process of Everyday Design* (Maestri and Wakkary, 2011). In this paper I describe the development of an open code rubric for categorizing the repair of all the participants’ objects. The open-code included the following categories: *degree of repairability*, *degree of digitality* and the *degree of reusability*. These categories were taken from initial codes defined in the early stages of the analysis. Two inter-raters (another research colleague and myself) assessed all the objects to date and assigned them values based on the three categories above. Objects were rated first independently and then together to check for any discrepancies. Discrepancies between the open-codes were discussed until an overall agreement was reached between my colleague and I. While this approach was insightful and interesting observations were made on the digital orientation of the objects, the open code was deemed as a deviation from the traditional grounded theory approach, and was thus, used only as a memo for exploring the processes of individuals’ acts of repair. In short, memos were pivotal in the construction of the core categories and the formalization of a theoretical framework for interaction design. I describe how the use of memo writing was employed in the following subsections.
The Memo Writing Process

According to Charmaz, memo writing: “is the pivotal intermediate step between data collection and writing drafts of papers.” (Charmaz, 2006) In my study, memos took the form of conference papers, presentations, and journal entries. I considered conference papers (and all the drafts that lead to the final product) as memos, as they were mini investigations into specific aspects of the collected data. Conference papers, as well as presentations, that were done during the study were mainly focused on ideas related to the digitality and materiality of broken objects. Here I explored the implications of what these aspects meant for interaction design and how these could inform decision-making processes around the fabrication of digital electronics (Maestri and Wakkary, 2011).

Journal entries were less specific and were used as part of the focused coding process. These memos usually entailed axial and theoretical coding techniques. Journal entries were written in a specific format, each starting with a title that spoke to their overall meaning (usually their designated code name), followed by the date I wrote them. I began my entry by trying to define and selecting categories that described salient processes and the actions they encompassed. GT researchers refer to this as focused coding. In the later stages of my analysis, I began making connections between the category itself and its relationship to other focused categories and their subcategories through axial coding.

Subcategories also emerged from my journal entries through the process of clustering. This process involved grouping codes with other like-codes. I would also seek out relevant examples from participants’ written responses as a way of building up subcategories’ and their characteristics. A last feature of every memo was a list of all initial and focused codes that spoke to the larger category and the subcategories associated with it. These codes were listed according to the participant it was coded from, which allowed me to easily refer back to the excel sheet to verify my interpretations. The memo below shows an excerpt of a journal entry I wrote related to the motivations individuals had for keeping their broken objects (Note: some content was removed for brevity, as denoted by […].).

Memo 2 - Motivations for keeping and acquiring broken objects
February 28, 2012

**Working Definition:** This category speaks to the reasons for why people are compelled to keep broken objects without necessarily attempting to fix them. Like the category *MOTIVATIONS FOR REPAIR*, reasons can stem from practical, sentimental, emotional and moral values.

It is important to keep the distinction clear between these two categories, as there were fundamental reasons for why individuals felt they couldn't repair their broken objects. Some reasons were based on the fact that they just didn't have the resources to and opted to use the object as is. **Possible subcategory?**

P1: "My lap top. What a piece. But I still use it because I can't afford to get a new one and it has become a handy accessory for work, beyond social networking."

[...]

Some participants stated also shared these sentiments around a lack of resources, but that they intended to repair their objects in the future, as the following participants stated in their email responses

**Possible subcategory?**

P5: "Broken blackberry bold 9700 - this blackberry is [sic] a gift from my dad last year to help communicating [sic] in long distance (Canada - Indonesia) [sic] since blackberry offers plan of free messaging. [sic] However, it was broken because I accidentally put it into water. [sic] I keep [sic] this blackberry as a memory and still believes [sic] that this phone can be fixed when I am going [sic] back to Indonesia. There are more electronics [sic] stores in Indonesia where you can guarantee that everything is possible to be fixed [sic] :P"

More observations needed?

**Emerging categories from initial analysis (taken from Memo 1):**

Keeping digital and electronic ‘odds and ends’ due to lack of environmentally friendly disposal and/or recycling options. (P3)

Keeping an object out of necessity (P4)

Keeping something because its newly acquired (P4)

Looking for a way to keep something broken by making it better. (P4)

**P5 keeps these objects and intends to repair them based on these reasons:**

Keeping a broken non-digital object because it's vintage. (P5)

Keeping a broken non-digital object because it was hand crafted. (P5)

[...]
As shown by this excerpt, I started to define categories based on the evidence of initial codes discerned in both the textual and visual analyses. I began questioning the relationship the category had to another similar category *Motivations for Repairing Broken Objects*, and in a sense, was able to define it apart from this category. This critical analysis was an essential part for understanding possible overlaps with other categories, understanding their properties and characteristics, and identifying gaps in the analysis. Memos were the last step in assessing whether I had achieved theoretical saturation. There came a point in my analysis where it was evident I had refined the majority of the categories and properties based on the coherence of the larger theoretical framework—all categories and concepts had attained a level of depth that was sufficient enough for laying out a plausible theoretical framework of everyday repair.

As I will describe in the following chapter, the larger theory of everyday repair makes light of the following aspects: everyday creativity as evidenced by non-experts actions; the causal conditions of repair and their adaptations; attributes of the context, actions and interactions related to repair (what I term as *techniques*); and lastly, the outcomes of everyday repair techniques.
Chapter 4.

Grounded Theory Analysis: Findings Part 1

Introduction

In this chapter I describe the initial coding phase of the data analysis. As mentioned in the methodology chapter, this phase entails the employment of word-by-word and line-by-line coding. These grounded theory techniques were used for distinguishing emerging patterns within the text and visual data. Initial coding is an important step in the grounded theory process, as it takes inventory of all the data while shaping preliminary codes and concepts towards core theoretical concepts and themes (this will be described in the next chapter as the focused coding phase.) More specifically, this chapter is meant to give an account of the multiple codes that had first emerged during the textual and visual analysis as a means of understanding the trajectory of everyday repair themes and core concepts.

My approach to conducting the initial coding process was aligned to grounded theory’s focus on processes—specifically the actions people do as a result of their situations and needs. In this chapter, I describe the everyday repair processes that first emerged, what conditions prompted them, and what the outcomes of these processes were. These three aspects had become the fundamental dimensions for understanding non-expert repair, or what I describe as themes of everyday repair. I will from now on refer to these themes as conditions, processes and outcomes. In the following sections, I describe the categories that emerged as part of these themes—namely what participants constituted as broken and repair, what motivations prompted acts of repair, the techniques and processes employed by non-experts for repairing/resolving their broken objects, and the common outcomes that resulted from everyday repair techniques and processes. I will also describe the various examples of objects that were
generated from participants’ submissions and the initial codes that materialized through the line-by-line and word-by-word analysis. The examples presented throughout this chapter are excerpts from the excel spreadsheet and were chosen to demonstrate a key aspect of repair. I conclude with a summary of these initial findings, which will be expanded on in the following chapter.

Understanding Conditions, Processes and Outcomes of Everyday Repair

The point of entry for analyzing the text and visual data started with a focus on understanding non-experts’ processes of repair. In classic grounded theory, emphasis is placed on understanding participants’ actions and processes (Charmaz, 2006). Hence, this aspect of GT was well suited for developing a theoretical framework for interaction designers—specifically through understanding the creative and unique ways non-experts’ deal with repairs when considering the design of interactive technologies. More specifically, I wanted to know why non-experts felt compelled to repair their objects, how they employed their processes, and what happened as a result of their actions. What started to emerge were three main themes of everyday repair—namely conditions—that is, the factors that instigated people to do acts of repair; processes—the actions and sequence of actions individuals employed in repairing and/or resolving their broken objects; and outcomes—the resulting state of an object as a consequence of repair processes.
While the notion of process is a concept prescribed within GT, the conditions and outcomes had naturally emerged on their own based on the participants’ submitted data. Some early patterns around the causes and outcomes of repair processes had started to emerge as shown in Figure 4.1 above. For instance, codes that suggested the notion of repair conditions were based on the ways participants’ deemed objects as broken, delineating factors that lead to repair processes. Further conditions started to emerge based on patterns around participants’ motivations for repairing objects. These encompassed sentimental, ethical and practical reasons.

In terms of processes, I started listing the various techniques participants executed for repairing their objects. It seemed only natural that the consequences of their efforts emerged as another theme of repair, which I categorized as outcomes. These included objects’ restoration, repurposing and state of disuse. In short, these initial codes started to shape a more holistic picture of what everyday repair entailed. In the sections that follow, I describe the conditions, processes, and outcomes of everyday repair in terms of the initial codes and categories that resulted from this first phase of
Conditions of Everyday Repair

Conditions of everyday repair, as mentioned previously, entailed situations and contexts that prompted individuals into action. From a design point of view, this was a necessary aspect of repair for informing how design might accommodate for these conditions with respect to interactive technologies. In this section, I highlight the various ways participants deemed their objects as *broken* (as a condition of repair), and how these served as motivations for resolving an object’s break. Here I highlight the typical characteristics participants’ described, which comprised of less conventional notions of the term broken. I then follow this discussion with how an understanding of brokenness can lead to further inquiries around understanding motivations behind repair.

What Consitutes Broken?

The most common impairments detected from the data were physical impairments that were often coupled with (and had caused) functional impairments. Physical impairments were coded based on any damage inflicted on the material form and appearance of objects. Functional impairments were defined as any restriction on an object’s ability to carry out its intended purpose and/or utility. In total, physical breaks constituted 35 out of the 142 objects, while functional breaks were detected in 29 of the total objects submitted. The remaining objects were counted as having both a physical and functional break. Note that these numbers are not statistical figures, but rather serve as numerical representations that reflect the frequency of these types of breaks.

As an example of a physical and functional break, the table below is an excerpt from an email response from P15. Here he describes his roommates cracked bowl and its ability to still remain functional despite it leaking slightly. My assigned initial codes are shown in the right column:
Table 4.1  Initial Coding of P15’s Email Response (Excerpt)

<table>
<thead>
<tr>
<th>P15’s email response</th>
<th>Initial codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>My roommate has a bowl (for eating, not serving) that is cracked, leaks a little (just barely), and is generally about to die. […] We use it all the time. When we stack the bowls in the cupboard, the nearly broken bowl is always near the top, so it’s always one of the first ones we grab.</td>
<td>Assessing the degree of brokenness.</td>
</tr>
<tr>
<td></td>
<td>Using a broken object the most frequently.</td>
</tr>
<tr>
<td></td>
<td>Deeming an object broken due to it being cracked.</td>
</tr>
<tr>
<td></td>
<td>Using a broken object as-is due to its ability to carry out its function.</td>
</tr>
</tbody>
</table>

Figure 4.2  P15’s roommate’s cracked bowl

This excerpt speaks to the physical impairments of the bowl (denoted by the text in red), but also the degree to which its perceived state was deemed ‘nearly broken’ (highlighted in orange.) In this case, the codes attributed to P15’s description alluded to its remaining functional capability (green text), as well as to the perceived broken state of the object resulting from its crack.
Another attribute of broken included objects that no longer functioned as they were intended. Using an unusual example, P8 describes how he considered his staircase as broken based on it being blocked off from the upper level floor presented in the table below:

**Table 4.2 Initial Coding of P8’s Email Response (Excerpt)**

<table>
<thead>
<tr>
<th>P8’s email response</th>
<th>Initial codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>I also have a staircase that's been closed off and I wanted to use it as storage. [...] It used to be a functional staircase, but a new floor was added at the top of the staircase, blocking it off. So as a staircase, it no longer functions, and as a storage space, it's very difficult to use. So, sure, I could see that as being &quot;broken&quot;. [...] A little creative re-engineering later, I re-built some ikea storage units to work in the staircase.</td>
<td>Challenge as a way of invoking creative actions.</td>
</tr>
<tr>
<td></td>
<td>Adding materials/structure to an unusable space to make it usable again.</td>
</tr>
<tr>
<td></td>
<td>Space is broken due to it no longer being usable.</td>
</tr>
</tbody>
</table>

![Figure 4.3 P8’s closed off staircase transformed into storage space](image)

My discussions with P8 regarding how he perceived his staircase required several exchanges, as he wasn’t quite sure whether he did consider it as ‘broken.’ The excerpt above shows how he rationalized it as broken based on it no longer functioning
as intended. As such, I had coded his text to encompass his process and techniques (in red text), and the final assessment of his staircase as broken (shown in orange text). Consequently, this example was highlighted in my analysis as an interesting discussion point for unveiling the boundaries of brokenness and what falls outside of that realm.

In another example, P34 described her cracked red bowl and dysfunctional cellphone as not broken based on them still being useful.

Table 4.3  Initial Coding of P34’s Email Response (Excerpt)

<table>
<thead>
<tr>
<th>P34’s email response</th>
<th>Initial codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Although to be honest, I don’t personally consider [the bowl and cellphone] as ‘broken’ yet (since they still have the potential to be useful) merely waiting for me (or my boyfriend) to repair them.]”</td>
<td>Deeming something not broken based on its potential to still be used.</td>
</tr>
</tbody>
</table>

Figure 4.4  P34’s cellphone that only works when opened at a 30-degree angle

Even though P34’s bowl had a crack in the bottom and her cellphone could only work if opened at a 30 degree angle (it was a flip-style phone), she perceives their state as not broken given that they can still serve out part of their functions. This highlights
another interesting aspect of repair, in that participants differed in how they saw objects as broken, ultimately affecting how they resolved their objects issues. P8’s and P34’s examples were two of many objects that underlined the array of perceptions around the idea of broken and what it entailed based on their intended or unintended functionality.

To summarize, the most salient initial codes that constituted the notion of broken encapsulated both functional and physical damage. More specifically, broken was synonymized with the trait unusable and dysfunctional. Objects were also described as being difficult to use as a delineating factor of broken, mostly affecting people’s expectations around their quality of performance. Broken also encompassed aesthetic damages, including characteristics such as being worn out, incompatible and/or old. As an overall observation, these initial codes pointed to the degree of severity broken objects’ were deemed to possess based on their functionality and physicality. The assessment of a break’s severity of course varied amongst participants. In general, cases where functional impairments were present primarily instigated acts of repair, as objects’ functionality were often needed to carry out daily tasks and routines. Over the course of the initial coding process, the notion of broken was beginning to emerge as a fundamental part of individuals’ motivations behind their everyday repair actions. More specifically, it was becoming apparent that objects’ broken states instigated individuals into finding a solution that satisfied their needs and feelings around their objects. In the following section I describe the various codes that highlight participants’ motivations and how these had prompted acts of everyday repair.

**Motivations Behind Everyday Repair**

The concept of motivations speaks to the reasons why participants were prompted to repair and/or keep their broken objects. These motivations stemmed from a range of different reasons including practical needs, sentimental and emotional feelings, as well as ethical values. The following examples describe some of the initial codes interpreted from the data, which give an overall sense of why people were driven to repair and/or resolve their broken objects. I should note that the use term resolve appears intermittently over the course of my discussion. This word, unlike repair, is used as a broader term for encapsulating not only instances of repair, but also acts
where objects were transformed to assume a different purpose as a way of extending their lifecycle.

I start my discussion with a few examples of how sentimental values were attributed to broken objects. Such artefacts were often given to participants as gifts, heirlooms, or were instilled with participants’ personal memories. In the following excerpt, P5 described her attachment to a pair of broken earrings she bought while in Australia, keeping them based on the memory of that trip.

**Table 4.4 Initial Coding of P5’s Email Response (Excerpt)**

<table>
<thead>
<tr>
<th>P5’s email response (excerpt)</th>
<th>Initial codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>This is [SIC] one of the most lovable earrings that I have. [SIC] I bought it [SIC] during my own trip to Australia. The vintage and hand made art pieces become the reason why I keep it [SIC]. Additionally, the memories of my trip are attached to this [SIC] earrings, which make it has [SIC] lots of personal meaning for me. I am going to glue the broken part and hope to be functional as [SIC] used to. [SIC]</td>
<td>Keeping a broken non-digital object because it's vintage.</td>
</tr>
<tr>
<td></td>
<td>Keeping a non-digital broken object because due to memories and personal meaning.</td>
</tr>
</tbody>
</table>

**Figure 4.5 P5’s broken vintage earrings from Australia**

As P15 describes in the excerpt above, she assigns value to her earrings based on the fact that they were bought on a trip and had valued their *hand made* and were *vintage* characteristics—properties I coded as being personal and aesthetic factors
(represented by the red and orange text). Similar to P15’s case was P38’s recounting of her motivations behind fixing her donkey figurine:

Table 4.5 Initial Coding of P38’s Email Response (Excerpt)

<table>
<thead>
<tr>
<th>P38’s email response (excerpt)</th>
<th>Initial codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have a little donkey that was bought on a trip to Greece. While I was cleanup [SIC] the shelf where &quot;donkey&quot; is [SIC] sitting, I accidently made it fall on the ground.</td>
<td>Meaning attributed to an object based on where it came from.</td>
</tr>
<tr>
<td></td>
<td>Meaning is attributed to an object based on the memory of where it came from.</td>
</tr>
</tbody>
</table>

In P38’s case, she attributed value to her donkey figurine based on where she bought it. In such cases, it was inferred that memories were a fundamental part of why meaning and value were attributed to objects from foreign places, as denoted by the two codes in red.

Other motivations stemmed from participants’ time and financial investments. More specifically, significant investments and the degree to which something was newly acquired provoked individuals to think about how they could repair their objects in order to avoid getting a replacement. P4 talks about how she was determined to fix a desk she bought that came with legs that were too short.

Table 4.6 Initial Coding of P4’s Email Response (Excerpt)

<table>
<thead>
<tr>
<th>P4’s email response (excerpt)</th>
<th>Initial codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>[...] It is not thrown away because it is the only one I have and I bought it like that. I arrived in Vancouver without any furniture, and needed a desk. I went to a second hand furniture store and saw only the top. The salesperson told me that it had regular legs, so I just said ok, bought it, and waited for it to be delivered. When I put the legs and the top together, I realized it was to short and broke my back over it for a week or two. Since I just bought it, I didn't want to buy a new one, and looked for a way to make it better. [...]</td>
<td>Keeping an object out of necessity</td>
</tr>
<tr>
<td></td>
<td>Keeping something because its newly acquired</td>
</tr>
<tr>
<td></td>
<td>Looking for a way to keep something broken by making it better.</td>
</tr>
</tbody>
</table>
For P4, the next course of action was not to find another desk to make up for the shortcomings of her newly acquired one. Rather, the immediate next step for her was to find a solution for fixing the situation since she just bought it. These codes are noted by the *orange* and *blue* text.

Also interesting were the motivation some participants had for repairing other people's objects based on their *personal interests*. For instance, P2 describes his acquirement of a friend's set of spotlights based on his hobby for acquiring old items.

**Table 4.7  Initial Coding of P2’s Email Response (Excerpt)**

<table>
<thead>
<tr>
<th>P2’s email response (excerpt)</th>
<th>Initial codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>These spotlights came from my friend's basement when he was moving out. They were dusty and broken so I polished them and rewired them and</td>
<td>Acquiring and repairing old/dusty broken non-digital / electrical objects from other people.</td>
</tr>
</tbody>
</table>
now they are our house party lights :) […] I like to build stuff, and they're real theater spots... that's grade A junk. Originally I thought I'd recreate a kind of lighting effect I used to have set up in my old apartment. […] I'm not too much of a pack rat, but I generally pick up interesting throw-aways [sic] if I think I can use them for a project.

<table>
<thead>
<tr>
<th>Collecting odds and ends from other people.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collecting and repurposing old broken objects based on personal interests/hobbies</td>
</tr>
</tbody>
</table>

Like P2, other participants also described their hobbies of collecting and repairing old and broken objects. In such cases, motivations were coded as personal interests, which starts to describe the role creative communities play in the restoration and repurposing of vintage objects.

There were also observations made around the social dynamics that speak to non-experts’ conditions and processes. The code Depending on Others was created to highlight the degree to which other non-experts were involved in the repair of their broken objects. In some cases individuals relied on friends to show them how to repair and repurpose their objects. Others depended and assumed their partners and friends would do the repairs for them. Consequently, objects remained in a state of impairment over an extended period of time while individuals waited for the objects to be restored. Otherwise, individuals said they felt forced to repair their objects themselves out of frustration. Such was the case for P11 and her waiting for her boyfriend to fix a broken cupboard door in the kitchen:

**Table 4.8  Initial Coding of P11’s Email Response (Excerpt)**

<table>
<thead>
<tr>
<th>P11’s email response (excerpt)</th>
<th>Initial codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>We do have a broken cupboard door in our house that has been sitting there for weeks now due to a procrastinating boyfriend. I’ll be fixing it myself soon. […] It remains unfixed to this day.</td>
<td>Procrastinating to repair something.</td>
</tr>
<tr>
<td></td>
<td>Being provoked to fix something because someone else won't do it.</td>
</tr>
<tr>
<td></td>
<td>Broken object remains broken to this day.</td>
</tr>
</tbody>
</table>
As indicated by the initial codes, P11’s frustration around the door not being fixed yet by her boyfriend had prompted her to think that eventually she’ll have to deal with the break herself. This highlights the degree to which everyday repairs involve not only the actions of a sole owner, but that they are handled in a social network of multiple individuals.

The last aspect speaks to the ethical values participants described for keeping and repairing their objects. Environmental awareness played a particular role for motivating acts of repair and avoiding disposal. As P3 and P31 describe below, they felt compelled to keep and restore their broken items based on their awareness around sustainability issues:

**Table 4.9  Initial Coding of P3’s Email Response (Excerpt)**

<table>
<thead>
<tr>
<th>P3’s email response (excerpt)</th>
<th>Initial codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>[...] I do have a number of things that are broken but not thrown away. Included in this list is an iPod (3 gen, old school!) that has a failed hard drive. I also have a number of old electronic odds and ends that I haven’t been able to throw away primarily due to the fact that there isn’t an easy place to dispose and recycle old electronics. Call it environmental guilt.</td>
<td>Keeping digital and electronic ‘odds and ends’ due to lack of environmentally friendly disposal and/or recycling options.</td>
</tr>
</tbody>
</table>
As P3 and P31 were the only two participants who described, their motivations for keeping and repairing their broken objects based on their awareness of what impact their disposal would have on the environment. There were however, many cases where participants did not attempt any acts of repair and had instead opted to just keeping and/or using their objects in their current broken state based on their attachment to them. Keeping and using a broken object were an intrinsic part of everyday repair processes and also spoke to motivations entailing personal, ethical and practical needs.

Overall, the most salient initial codes derived around motivations of everyday repair speak to emotional and sentimental meaning objects are attributed over time. These stem from individuals’ memories and experiences with their objects, as well as the invested time and resources they put into them. Other key factors include the actions driven by hobbies and interests, as well as by values grounded in sustainable
awareness. While sustainability was only detected in two participant responses, this aspect seemed important enough to recognize as an aspect of everyday repair.

**Summary**

In sum, the initial codes and categories defined as part of conditions of everyday repair entailed two distinct aspects: the recognition of an object’s broken state (as delineated by functional and physical impairments), and secondly, the personal, practical and ethical values rooted in individuals’ motivations for repairing their broken objects. The examples above illustrate how the recognition of brokenness push individuals to act based on their motivations, mainly as a way to sustain their objects longevity. In the following section, I describe how these motivations drive processes of repair and the patterns that emerged around the types of techniques non-experts employ.

**Processes of Everyday Repair**

This aspect of everyday repair encompasses the various dimensions regarding how non-experts do their repairs—namely the techniques and strategies they employ when repairing their objects. This aspect also highlights the materials and tools that facilitate non-experts’ processes. The initial codes discussed in this section look at three emergent concepts: the instinctive and actionable ways individuals dealt with their broken objects; the common physical attributes present in objects that helped facilitate repair techniques; and the ways non-experts assessed the quality of their broken and repaired objects through a subconscious, yet reflexive manner. I first start with a description of how techniques and processes were initially coded, followed by a description of the various physical materials and degree of digitally discerned from the visual and textual analysis. I then conclude with a discussion of how the participants reflected on their process by assessing whether the quality of their repairs met their needs and satisfaction.

**Techniques**

According to many of the participants, the processes by which they tried to resolve their broken objects were often done without them being entirely conscious of
their actions. This was made apparent during many of my email discussions when participants were asked to think about why they used a certain material or employed a certain approach to repairing and/or repurposing their object. I interpreted many of these processes as unpremeditated and instinctive, as often participants had trouble describing how or why they did what they did, or where they learned their technique. Some participants alluded to learning from previous experiences or that their process was inspired by an incident they remembered. For example, when asking P13 how he thought of using his broken hockey stick to replace his broken window stoppers, he replied with the following response:

Table 4.11  Initial Coding of P13’s Email Response (Excerpt)

<table>
<thead>
<tr>
<th>P13’s email response (excerpt)</th>
<th>Initial codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>I knew I was going to use a piece of wood for fixing the window problem and was going to use any piece of wood I could find. I don't know what triggered me to use the hockey stick though, it wasn't that I saw it then decided to use it. I kept the broken hockey stick in my garage for a while thinking I could use the wood for something in the future and see it every now and then. Perhaps that is why I remembered it</td>
<td>Informing a repair by looking for materials that serve similar functions and affordances. (ie. Using wood).</td>
</tr>
<tr>
<td></td>
<td>Resourcing broken objects that are stored around the house for future use.</td>
</tr>
<tr>
<td></td>
<td>Serendipitously finding a solution to repair by coming across them in memory.</td>
</tr>
</tbody>
</table>

Figure 4.9. **P13’s broken hockey stick used as a replacement window stopper**

What I wish to emphasize in P13’s response is how he had a solution in mind for repairing his broken window stoppers but without really knowing how he was going to do
it. More specifically, P13 came across his solution almost serendipitously, when he found his broken hockey stick in his garage. Not only did he recognize the potential his hockey stick had for resolving his broken window stoppers, he in essence repurposed it to serve a new role as a replacement window stopper. P4 also seemed to serendipitously come across her inspiration for resolving her ‘too-short’ desk while walking back home.

Table 4.12 Initial Coding of P4’s Email Response (Excerpt)

<table>
<thead>
<tr>
<th>P4’s Email Response (excerpt)</th>
<th>Initial Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>One day, while walking home, I found a man redoing is front patio with bricks. I asked for extra ones, and he gave me 4. After a very long and painful walk in the rain, I was finally able to make my table comfortable and useful.</td>
<td>Serendipitously finding a solution to repair through other people's materials.</td>
</tr>
</tbody>
</table>

In P4’s case, her solution to repairing her desk was not premeditated. Rather, her solution was found while engaging in her daily activity of walking home. Recognizing the stackable qualities of the bricks, she used them as resources for augmenting the height of her desk. This act of resourcefulness had become a common trait of everyday repairs, as other participants also resourced unique and unintended materials for resolving their objects breaks.

In other cases, solutions stemmed from being culturally and/or instinctively known. For instance, glue was a common material many participants resorted to for repairing objects with parts that had broken off. Such was the case for P31 and his broken spatula:

Table 4.13 Initial Coding of P31’s Email Response (Excerpt)

<table>
<thead>
<tr>
<th>P31’s Email Response (excerpt)</th>
<th>Initial Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gluing [the spatula] was the easiest solution and I did not think about any other. We do not cook as much in summer time….. I do not think we did use it but we did not replace it. It is more difficult to use in its ‘original purpose’ but it is more useful as an [SIC] ‘heavy-duty’ instrument.</td>
<td>Using glue as a go-to, easy solution.</td>
</tr>
<tr>
<td></td>
<td>Knowing glue is a solution to a repair when something has come undone.</td>
</tr>
</tbody>
</table>

Glue seemed to be the go-to material for most broken objects that sustained physical breaks, particularly in cases where an object’s component had fallen off and
required adhering. Other materials like glue, such as tape and other adhesives seemed to characterize the tacit knowledge that many non-experts had in the repair of their objects. It can be inferred that these materials have become such a familiar tool for ‘fixing’ broken objects that they are taken for granted as an intuitive solution.

A last strategy I will highlight describes how participants iteratively approached a repair. As an example, P11 describes how her boyfriend first tried using the cracked waste collector of their juicer before realizing it was necessary to find a replacement:

**Table 4.14 Initial Coding of P11’s Email Response (Excerpt)**

<table>
<thead>
<tr>
<th>P11’s Email Response (excerpt)</th>
<th>Initial Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ok, well I asked him his thought process behind the plastic bag and I wasn't far off -- I guess he originally tried to use the broken waste collector (only a man!) and shockingly it didn't work-- threw fruit chunks out all over the place. That's where the plastic bag idea came into his head. He did mention that it's great b/c it requires no clean up, and was nice and easy.</td>
<td>Trying to use a broken part to see if it can still work.</td>
</tr>
<tr>
<td></td>
<td>Trial and error.</td>
</tr>
<tr>
<td></td>
<td>Using a replacement part that works better than the original broken part.</td>
</tr>
</tbody>
</table>
Figure 4.10  *P11’s use of a plastic bag as a replacement waste collector for her juicer*

As P11 describes, her boyfriend first tried using the cracked waste collector to be sure that it was no longer viable to use. In trying to find a quick and easy solution, P11’s boyfriend resorted to a plastic bag that had similar features to that of the waste collector. After trying it once, the plastic bag was deemed an effective solution to the problem. This iterative approach was common among many other participants’ in what I later refer to as the process of trial and error. As I describe further on, this process highlights the ongoing nature of everyday repair and the multiple outcomes that may result until a repair is deemed satisfactory.

In sum, the above processes and techniques begin to describe how everyday repairs are performed by non-experts. Key initial codes entailed the thought processes behind repair actions such as imagining solutions and knowing based on instincts. Other salient codes spoke to the common techniques employed by participants—namely adhering, repurposing and resourcing. While these notions give an initial description of the different techniques non-experts employ, I will describe these in the next chapter as being part of two parts of a unified process. Specifically, these processes will fall under
the categories *conceptual processes*, which entail the thought processes behind everyday repair, and *actionable processes* – practices that encompass the execution of actions based on conceptual processes. I will leave this discussion for the moment and move on to initial codes that speak to the materials and tools used by participants for facilitating everyday repairs.

**Materials and Tools of Everyday Repair Processes**

As mentioned in the methodology chapter, the categories derived around objects’ physical attributes were based on the images participants submitted in their email responses. By conducting a visual analysis, I discerned keywords that described objects’ physical materials, shape and digital orientation. The emergence of physical attributes became a prominent concept throughout the course of the analysis, as certain object types facilitated acts of repair more easily than others. This became an important point of inquiry, as the fabrication of objects stood as a delimiting factor in facilitating everyday repair. The observations described in this section highlight how the digitality of broken objects (that is, the degree to which an object is composed of digital parts) surfaced as a strong barrier to repair and repurposing. I also discuss how materials enabled repair actions based on their capacity to adapt, transform and be reused towards different contexts of use.

**The Digitality of Broken Objects**

Through the course of the initial coding phase there were noticeable distinctions between objects that were digital in nature (i.e. mp3 players and laptops), and objects that had no digital components at all (i.e. mugs, plates, furniture, and clothes.) Even more contrasting were the number of instances individuals attempted to repair objects that were non-digital compared to those that were digital. In fact, none of the objects deemed digital were repaired or repurposed, as participants described not knowing what to do with them other than keep them in the hopes that they might work again. For the most part, the majority of objects submitted were non-digital, totalling 111 of the total objects submitted. Non-digital objects were characterized by the absence of digital components, but also comprised of a few basic materials and some containing electrical functionality. That is (crudely speaking), they could be plugged into an electrical outlet and carry out motorized functions. A typical example would be household appliances
like P11’s juicer or P15’s popcorn maker. Below is an excerpt of P15’s visual analysis (see Table 4.15).

**Table 4.15  Visual Coding of P15’s Image Submission**

<table>
<thead>
<tr>
<th>Participant</th>
<th>Text Data</th>
<th>Image</th>
<th>Material (codes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P15</td>
<td>I have an old popcorn popper that I've had forever. It originally came with a little metal dish to melt butter in. The idea was that as the popcorn pops, the hot air runs under the dish and melts the butter. That dish has been missing for years. Instead, I have a sheet of aluminum foil over the hole where the dish goes. (If you don't cover the dish, the popcorn shoots out the hole and gets all over the kitchen.) In one sense, it's now less functional, since I have to melt the butter in the microwave. In another sense, I've fixed a safety problem: The dish would get darn hot, and I remember burning my fingers on it when I was little.</td>
<td><img src="image.png" alt="Image of P15's popcorn maker" /></td>
<td>Plastic</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Electric</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Modular Parts</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Hard</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cavernous</td>
</tr>
</tbody>
</table>

The materials of objects were largely influential on processes of repair, as well as in cases where they could facilitate acts of repurposing or replacing. Individuals often facilitated their techniques using simple materials like wood, metal, and plastics. For the majority of digital objects (which out of the total 120 objects, only 9 were deemed digital), their material nature included a combination of virtual, electronic and non-digital materials. Most of the digital objects were rigidly fabricated with parts that were hard to access without having specific tools. Furthermore, all of the digital objects contained complex hardware responsible for driving their functionality, such as print circuit boards (PCB), microprocessors, and miniature hard-drives. It should be noted that though various codes were made around the multiple parts of digital technologies, these codes
were not meant to be an exhaustive list. Rather, these codes were to provide a more meta-level understanding around the complexity of repairing digital electronics and how their materials impeded acts of repair.

Any attempts of repairing and/or repurposing digital objects were practically non-existent. There was however one case, where P20 described his intentions disassembling his digital printer towards some creative use but was prevented from doing so based on the rigidity of the printers physical structure (coded in green):

Table 4.16  Initial Coding of P20’s Email Response (Excerpt)

<table>
<thead>
<tr>
<th>P20’s Email Response (excerpt)</th>
<th>Initial codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have a broken printer that I am planning to take apart and dissect it. I may find uses for it later on but I haven’t gotten around to taking it apart yet. I was going to throw away my printer anyways so I might as well try to see what I can find interesting inside. So far I am not having much success pulling it apart because of the specific type of screws that they used in assembling the printer. I am looking up for helpful instructions/demos at the moment to see what I can do. My primary motivation for doing this is due to the fact that one of my friends is really into hands-on and DIY things so he always posts pictures of his in-progress car parts and such on Facebook.</td>
<td>Keeping a digital electronic to hack it.</td>
</tr>
<tr>
<td></td>
<td>Dissecting a broken digital electronic for creative DIY use.</td>
</tr>
<tr>
<td></td>
<td>Keeping something around for potential future use.</td>
</tr>
<tr>
<td></td>
<td>Dissecting a digital electronic to explore different uses for its parts.</td>
</tr>
<tr>
<td></td>
<td>Hacking broken objects due to being inspired by others DIY practices.</td>
</tr>
<tr>
<td></td>
<td>Digital objects that are hard to disassemble.</td>
</tr>
</tbody>
</table>

P20 also describes is intentions of taking apart his printer based on his interests in DIY projects. He again, represents a class of non-experts that look at repurposing broken and obsolete objects based on their own personal interests.

The virtual qualities of digital objects’ proved to be a fundamental barrier to repair, as functional aspects are materialized, so to speak, through virtual representations such as icons. In this regard, virtual features and attributes had no way of physically lending themselves to non-expert repair, as was the case with P16 and the large, dead pixel hole situated in the middle of her cellphone’s LCD (see Figure 4.11 below.) Conversely, non-digital objects’ functional parts are often represented as mechanical and physical manifestations, such as buttons, cogs, engines, or levers—these are tangible objects that can be manipulated in instances where repair is needed.
Though the same can be said for digital electronics and physical parts such as processors and motherboards, they still require a level of expertise and tools that go beyond the non-experts level of know-how.

![Figure 4.11](image)

**P16’s cellphone with large dead pixel hole**

There were some observable advantages to the multi-functional and virtual aspects of digital objects that actually sustained their usability, despite having broken parts. P1 and P23 describe how they still continued to use their laptops, despite their physical and functional impairments.

**Table 4.17  Initial Coding of P1’s Email Response (Excerpt)**

<table>
<thead>
<tr>
<th>P1’s Email Response (excerpt)</th>
<th>Initial codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>My laptop. What a piece. But I still use it because I can’t afford to get a new one and it has become a handy accessory for work, beyond social networking.</td>
<td>Continuing use of broken object because of financial cost.</td>
</tr>
<tr>
<td></td>
<td>Continuing use of broken object because it is still useful.</td>
</tr>
</tbody>
</table>
While P1’s and P23’s laptops sustained both functional and physical impairments, both participants continued to use them as intended. Both cases also demonstrate that when financial investments are significant and the replacement of an object is too costly (i.e. condition of repair), individuals will resort to working around their dysfunction and continue using their object as-is. While some participants voiced their preference to continue using their impaired digital electronics, obsolescence was often imminent, forcing individuals to store their objects until they could figure out a solution to revive them.

In the following section, I describe how participants assessed the quality of their repair actions in instances where they did found ways of resolving their objects.
Assessing Repair Quality

A fundamental part of everyday repair processes speaks to the reflexivity of participants when resolving their broken objects. Participants would often describe their satisfaction or dissatisfaction with their repairs, remarking on the degree of success and/or failure of they achieved. Because the notion of quality assessment had emerged as an interesting phenomenon during the analysis, I found myself asking participants to remark on whether they were happy with the outcome of their repairs in follow up discussions. Participants’ reflections and sentiments were catalogued and coded for, in which patterns were determined around qualities they constituted as a ‘successful’ or ‘satisfactory’ repair.

A useful method for determining a participant’s satisfaction was based on how they judged the final outcome of their repair process. Positive terms such as ‘comfortable’ or ‘usable’ were noted and grouped apart from other words that had more negative/dissatisfactory terms, such as ‘frustrating’ or ‘less functional.’ For instance, satisfaction and a degree of success were discerned from P4’s description of how she repaired her desk with short legs:

Table 4.19  Initial Coding of P4’s Email Response (Excerpt)

<table>
<thead>
<tr>
<th>P4’s Email Response (excerpt)</th>
<th>Initial codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>After a very long and painful walk in the rain, I was finally able to make my table comfortable and useful.</td>
<td>Assessing quality of repair based on comfort.</td>
</tr>
<tr>
<td></td>
<td>Assessing quality of repair based on usefulness.</td>
</tr>
</tbody>
</table>

The terms ‘comfortable’ and ‘usable’ were highlighted as P4’s assessment of her desks current state and how her solution had augmented the object in way that made it comfortable to use. The following excerpts present more examples of participants’ assessments of their repaired objects.

Table 4.20  Initial Coding of P6’s Email Response (Excerpt)

<table>
<thead>
<tr>
<th>P6’s Email Response (excerpt)</th>
<th>Initial codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>For the dress shoes, I ended up using fabric glue and it worked wonderfully for the first few times I wore them.</td>
<td>Assessing quality of repair based on how well it worked.</td>
</tr>
</tbody>
</table>
**Figure 4.13** P6’s repaired (now broken again) dress shoes

**Table 4.21 Initial Coding of P11’s Email Response (Excerpt)**

<table>
<thead>
<tr>
<th>P11’s Email Response (excerpt)</th>
<th>Initial codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>The &quot;waste collector&quot; for our juicer broke, so [my boyfriend] puts a plastic bag in its place to catch all the fruit spit-outs. It actually works pretty slick b/c we can just pull the bag off and toss it, w/o any clean up! […] He did mention that it's great b/c it requires no clean up, and was nice and easy.</td>
<td>Assessing quality of repair based on how well it worked.</td>
</tr>
</tbody>
</table>

**Table 4.22 Initial Coding of P19’s Email Response (Excerpt)**

<table>
<thead>
<tr>
<th>P19’s Email Response (excerpt)</th>
<th>Initial codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>[The window crank] used to be really tricky to open and would wobble around and sometimes get stuck. So I took it apart completely, replaced the bolts that fasten it to the wall, cleaned it, oiled all the parts, and put it back together. It now cranks smoothly and is much nicer to use.</td>
<td>Assessing quality of repair based on how nice it is to use.</td>
</tr>
</tbody>
</table>
Figure 4.14  P19’s successfully repaired window crank

The above participants all used positive adjectives for describing the outcomes of their repairs, delineating a certain level of satisfaction. The following excerpt describes the assessment of participants’ aesthetic quality, as was the case for P33 and his pre-owned rocking chair:

Table 4.23  Initial Coding of P33’s Email Response (Excerpt)

<table>
<thead>
<tr>
<th>P33’s Email Response (excerpt)</th>
<th>Initial codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>The bamboo stems were broken. They were made to solidify the structure. Thanks to Super Glue, the sad story of this second hand chair (found in the street) has turned out happy! The rocking chair looks like brand new now.</td>
<td>Assessing quality of repair based on how close object looks like new.</td>
</tr>
</tbody>
</table>
Some participants also critiqued their repair jobs based on the positive and negative affects they had on the objects’ value. As in the case of P15's popcorn maker, he assessed the success of using tin foil as a replacement for his missing butter dish and how this affected the appliances overall functionality.

### Table 4.24  Initial Coding of P15’s Email Response (Excerpt)

<table>
<thead>
<tr>
<th>P15’s Email Response (excerpt)</th>
<th>Initial codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>In one sense, it's now <strong>less functional</strong>, since I have to melt the butter in the microwave. In another sense, I've <strong>fixed a safety problem</strong>: The dish would get darn hot, and I remember burning my fingers on it when I was little.</td>
<td><strong>Assessing quality of repair based on its degree of functionality.</strong></td>
</tr>
</tbody>
</table>

In general, there were two main codes around quality assessment discerned from these observations that in the next chapter I will discuss in further detail. These included assessments based on objects ability to carry out their intended functionality, and their aesthetic quality.
To summarize the findings around processes of everyday repair, I have outlined some of the key findings around techniques, materials and the assessment of quality. I describe the instinctive, and often subconscious, ways participants approached repairs, as well as how the material aspects of objects themselves facilitated non-experts techniques. Furthermore, I describe everyday repair processes as ongoing, where individuals reflect and assess the degree to which their repairs meet a desired level of satisfaction. In the following section, I describe how these categories play a larger role in the outcomes of everyday repair and how assessments of quality are directly correlated to ongoing processes of repair.

Outcomes of Everyday Repair

Initial codes around repair outcomes had emerged based on participants’ descriptions of how objects turned out as a result of employed techniques and processes. Over the course of several email discussions, participants described how some of their objects had moved towards either being restored, repurposed, or rendered as unusable / obsolescent. In the following sections I give examples of these specific outcomes and their associated codes.

Restoration, Repurposing and Obsolescence as Outcomes of Repair

Many of the objects originally submitted had taken on several outcomes over the course of the study. In some cases, repairs took a long period of time before participants felt compelled to take action, thus they were given the distinction ‘obsolete’ until their state was changed months later. There were also several instances of repaired objects getting lost or displaced, despite the care and time participants invested in repairing them. Furthermore, while some individuals cared enough to keep and or repair their objects, others wound up ultimately losing interest in them later down the road. In this regard, everyday repair seemed to possess a kind of unpredictability around the ways people attributed value to their repaired objects. As in the case of P12, he describes how he had finally re-glued his cracked rice bowl after keeping it for some time, but then wound up losing it in the end.
For the most part, the *obsolescence* of objects and their imminent replacement was often an outcome many participants described as unfavourable based on their attachment to their objects. As mentioned in the previous section, the replacement of obsolete objects was often prolonged until the object could no longer serve its purpose. In the case of P16 and P34, neither participant wanted to replace their broken cellphones and chose to continue using them in their broken state until they were rendered unusable.

### Table 4.26  Initial Coding of P16’s Email Response (Excerpt)

<table>
<thead>
<tr>
<th>P16’s Email Response (excerpt)</th>
<th>Initial codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>The LCD is broken and there’s a big black ‘bullet hole’ on the screen. It’s been like this for about a year now and I am making a bunch of spelling mistakes in the first part of my messages but I’m still using it. I’ve had my phone for 5 years now and I still like using it. Everything still functions. This flip phone was one of the few things I’ve purchased on my own and I spent some time looking for it and got it flown from Hong Kong for it to be in my hand. I have been considering getting a new cellphone but even if I do, I’ll be storing this with my gadget pile.</td>
<td>Using a broken digital object along with its dysfunction for a long period of time.</td>
</tr>
<tr>
<td></td>
<td>Using a digital broken object as is due to its ability to carry out its function in limited ways.</td>
</tr>
<tr>
<td></td>
<td>Keeping a broken digital object due to time, personal and money investments.</td>
</tr>
</tbody>
</table>

### Table 4.27  Initial Coding of P34’s Email Response (Excerpt)

<table>
<thead>
<tr>
<th>P34’s Email Response (excerpt)</th>
<th>Initial codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>[…] my beaten up pink cellphone whose screen solely lits up at a 30 degrees angle […] Weirdly enough I have been using this flip style cellphone till last month (and only because I was offered a brand new cellphone that actually didn't require some crazy move to read the screen. I must say I am a bit sad about it and would have keep using it till it died on me for good) I am keeping it as a spare phone (the reason being its sentimental value: this phone has travelled with me all over Europe).</td>
<td>Replacing a broken digital electronic as a result of being given a new replacement.</td>
</tr>
<tr>
<td></td>
<td>Preferring to use a broken digital object till it dies than using a new replacement.</td>
</tr>
<tr>
<td></td>
<td>Having feelings of sadness in instances where broken objects are replaced.</td>
</tr>
</tbody>
</table>
In both P16’s and P34’s case, their motivations for sustaining the use of their broken cellphones were driven primarily by their attachments to them. Also, both participants attributed value to them based on the history they had using them in foreign places. In many ways, their motivations are what prolonged their use and prevented their disposal. Such outcomes were common for digital electronics where participants would continue using them till they could no longer function, and then store them as keepsakes.

One key observation of everyday repair outcomes was the ever-evolving transformations objects undertook. As mentioned previously, participants would iteratively try different techniques to resolve their objects state or what I formally coded as the process of trial and error. In a sense, trial and error was also seen as an outcome of repair, as participants would continually resolve their objects’ impairment until some level of satisfaction was achieved. In this light, repairs extended over a long period of time while individuals continually used them, reflected on their quality, and reiterated on repair techniques till they came to some resolution.

In general, the restoration of objects was an outcome that emerged in instances where participants had attempted to rebuild the aesthetic features and/or functional attributes of objects back to their original state. These attempts, were of course, varying in success and quality, as described in the following examples:

**Table 4.28 Initial Coding of P19’s Email Response (Excerpt)**

<table>
<thead>
<tr>
<th>P19’s Email Response (excerpt)</th>
<th>Initial codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Another thing I’ve repaired is a mug, which got cracked in the dishwasher. It’s meaningful because Jess and I got it in PEI at a little pottery shop and both really like it. [...] Now, even though it’s imperfect, it has a bit of history and is more valuable to us. Like we rescued it!</td>
<td>Attempting to restore a cracked object.</td>
</tr>
<tr>
<td></td>
<td>RESCUING a broken object by repairing it.</td>
</tr>
</tbody>
</table>
Figure 4.16  P19’s rescued mug that was glued back together

Table 4.29  Initial Coding of P32’s Email Response (Excerpt)

<table>
<thead>
<tr>
<th>P32’s Email Response (excerpt)</th>
<th>Initial codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have had this headset for a very long time […] on one of the earpieces; the holding branch broke for some reason. I was able to tape it back together so that the earpiece sits well on my ear when I’m listening to my music. Otherwise it would stay loose and basically not do the job.</td>
<td>Using tape to repair a broken non-digital object.</td>
</tr>
<tr>
<td></td>
<td>Restoring the function of a broken object.</td>
</tr>
</tbody>
</table>

For P19 and P32, their objects served a specific function thus driving non-experts to restore them. In both cases, the objects’ repairs were easily achieved using common materials and tools like glue and tape. Depending on the degree of resolve (or lack there of), participants would make further attempts to repair their objects’ unsatisfactory state or leave them as-is. As in the case of P28, he describes his repeated attempts to repair his favorite fan, which despite its persistent state of impairment, he insisted on keeping due to his attachment to it.

Table 4.30  Initial Coding of P28’s Email Response (Excerpt)

<table>
<thead>
<tr>
<th>P28’s Email Response (excerpt)</th>
<th>Initial codes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

77
Using glue to repair/restore non-digital / electrical broken object.

Using the same materials to repair a broken non-digital object over and over again.

Keeping an object based on its aesthetic style.

Sometimes a little bit of proper (!) glue can save a broken item. I have a fan that’s been fixed 4 times now. (3 times glue, 1 time rewired) And I just can’t get rid of it because it’s fashioned in an old manner and looks like it came from steampunk universe. There are of course lots and lots of those household items that are just not worth saving and they’re easily replaced. Its something sentimental about those “specially” fashioned items, that is worth saving them.

The last outcome I will describe looks at the transformations broken objects underwent as participants’ attempted to sustain their purpose by adapting and augmenting their functional and physical parts. The initial code creative repurposing had emerged based on the high number of instances participants resorted to when appropriating their broken objects. This code had brought up many questions around what individuals constituted as a repair or what could also be interpreted as a modification. In the following examples, I draw on the accounts of participants who did see repurposing as a form of repair, based on their ability to make their objects functional again.

In the case of P2, he described how he repaired of an acquired set of stage lights by repurposing them as floor lamps:

<table>
<thead>
<tr>
<th>P2’s Email Response (excerpt)</th>
<th>Initial Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>I would say that I repaired the lights (some of the wiring was actually broken), but I also restored them (polished them and replaced the filter holders just for aesthetics). I was also using them as floor lamps, but they’re stage floods meant to be hung from a lighting grid, so I guess that’s not what they were designed for.</td>
<td>Repurposing as a repair.</td>
</tr>
</tbody>
</table>

P2 regarded his efforts as an act of repair, as well as an act of creative repurposing. This was based on the fact that the stage lights were not meant as floor lamps and that he also restored (i.e. polished and replaced) some of their parts. Another example of creative repurposing includes P22’s transformation of her old climbing rope,
which she deemed broken based on it no longer being safe to use. In order to sustain its use, she had transformed it into a doormat.

Table 4.32   Initial Coding of P22’s Email Response (Excerpt)

<table>
<thead>
<tr>
<th>P22’s Email Response (excerpt)</th>
<th>Initial Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>I do feel like I have repaired it in the sense that it is functional again, though it is used in a way that is different from before. To get into the semantics of it - I feel that modifying the rope would require actually changing its state in some way? Like removing the core and doing something different with the outside sleeve of the rope? I don’t feel that it is possible to repair the rope for climbing purposes (for safety…) and it is tied into knots most of the time in fully-functional use. So that maybe by permanently keeping the rope in knots, but not climbing with it, it is in a sense repaired?</td>
<td>Repairing a broken object by repurposing it.</td>
</tr>
<tr>
<td></td>
<td>Modifying means changing a physical property of an object.</td>
</tr>
<tr>
<td></td>
<td>Deeming an object repaired based on its ability to carry out its natural function - not its designed intended function.</td>
</tr>
</tbody>
</table>

Figure 4.17   P22's climbing rope repurposed into a doormat

According to P22, she saw her actions as a process of repair based on the fact that the climbing rope's intended form (as a rope) was still carried through in its new form
as a doormat. Based on these examples, repair took on many forms that went beyond restoration to encompass any method that would ultimately sustain the longevity of an object regardless of its original intent.

**Summary**

This section provides an overview of the initial codes regarding outcomes of everyday repair. I describe these outcomes as directly influenced by the motivations and techniques of non-experts, as well as by the inherent material properties of objects themselves. Also highlighted are observations regarding how repair outcomes often take place over a long period of time and how these are influenced by individuals’ assessment of quality. Depending on the level of satisfaction a repair achieves, the state of an object can drive further repair actions and result in multiple outcomes. These outcomes encompass anything from obsolescence, restoration and creative repurposing. The take away I wish to emphasize regarding outcomes is variety of consequences repair actions can entail, particularly in case where objects are creatively repurposed, which further expands the boundaries of what everyday repair entails. More specifically, restoration and the creative repurposing of broken objects provide evidence around what people consider being a repair and also how it embodies creative action.

**Conclusion**

In sum, this chapter starts to look at the emerging themes and concepts discerned from the 120 submissions of broken, repaired and repurposed objects. The core themes discussed center on the notions of everyday repair conditions, processes and outcomes, which are further explicated through the description of initial categories derived from the data. Through a series of email discussions and comparative/inductive analysis, observations pertaining to the dimensions of everyday repair point to the following key aspects: how people think of something as broken, how the recognition of a break serves as part of individuals’ motivations to repair and/or storage; the various techniques and strategies participants’ employ for resolving their objects based on their materiality, digitality and use of common day tools; and lastly, the outcomes that can result from participants’ techniques and strategies and how these begin to re-construct a
different notion of repair. In this light, I begin to expand the boundaries of repair, which go beyond restoration and encompass the creative repurposing of objects as a means of sustaining their use.

The findings that resulted from this first phase of the analysis provide a crucial first step in the development of a theory of everyday repair. Specifically, these initial observations serve as guidelines for the second wave of inquiries that included subsequent email discussions with participants. The observations made here helped direct my focus on understanding how notions of broken and motivations play a crucial part in spawning creative action. They also highlight the resourceful ways individuals attempt repairs over time. While key insights are defined here, the following chapter will draw further connections and relationships between the conditions, processes and outcomes through the process of focused coding. More specifically, I describe how these codes are clustered and abstracted towards a more tangible theoretical framework for interaction design.
Chapter 5.

Grounded Theory Analysis: Findings Part 2

Introduction

In this chapter I give an overview of how the initial coding of the key themes of everyday repair—namely conditions, processes and outcomes—were abstracted into more conceptual categories through the process of focused coding. Here I describe the core categories and concepts that pertain to each of these themes, starting first with an overview of the categories that constitute conditions of everyday repair. These aspects include non-experts various motivations of repair and the perceptions of broken that instigate repair actions. The second theme will look at processes, entailing a more concise view of the various factors that constitute non-experts techniques, as well as an account of codes that were newly discovered through this second phase. This aspect also looks at the object-to-subject relationship, specifically in how broken objects compel creative actions based on their materiality and the ways they facilitate creative actions. Lastly, I give a more concrete overview of the various concepts discerned around outcomes resulting from both conditions and processes and how these drive further repair actions from individuals.

The specific grounded theory techniques used as part of the focused coding phase included memo-writing, axial coding and the use of diagrams for visually mapping categories and subcategories. Here I describe how memos served a key part in organizing my interpretations of the data. They also helped inform follow-up questions with participants by pointing out gaps in the data that needed further investigation. Memo writing, axial coding and the use of diagrams also helped to cluster initial codes into emerging categories and concepts, from which a bigger picture of everyday repair materialized. In using these approaches, initial codes and concepts were moved further
away from the specific concrete examples towards more holistic views of conditions, processes and outcomes. As part of my discussion, I will include key excerpts and diagrams that unpack my interpretations of the data, which were fundamental to the development of the theoretical framework.

Each section of this chapter will focus on one of the central themes of everyday repair, specifically the conditions, processes and outcomes. The organization of each section will give a break down of their composite concepts, categories and subcategories. I start each discussion first with an overview of the core concept that emerged through the focused coding phase. This is then followed by a description of the categories that make up the core concept, along with their associated subcategories. For each category I also describe the process of moving initial codes to focused codes through the process of memo writing, axial coding and theoretical sorting. I conclude with an overall summary of the analysis findings that set the foundation for the next chapter’s discussion. The concepts and ideas explored in this chapter ultimately serve as a baseline for understanding everyday repair as a theoretical design framework.

**Theme: Conditions of Everyday Repair**

There were multiple factors discerned from the initial coding analysis that highlighted why non-experts were provoked into action. These conditions largely stemmed from individuals’ motivations as well as by how they perceived states of brokenness in their objects. These observations served as a first point of inquiry for determining how and why individuals felt compelled to employ various acts and techniques for resolving their objects. I also started recognizing that the way individuals perceived something as broken largely influenced their overall repair process. In this section I describe three specific dimensions behind instigators of repair. They included the following core categories: Attributes of Broken—this entails an account of the different properties that constitute something as broken and the various perceptions associated with a break; and Motivations Behind Processes of Everyday Repair — encompasses why people feel compelled to keep, restore and/or repurpose their objects; and lastly.
Concept: Attributes of Broken

The code Attributes of Broken was abstracted as a core concept based on the initial codes that encompassed any description of a break. Because there was an apparent distinction between objects that sustained physical and functional breaks, initial codes were broken down further into two categories called Physical Impairments and Functional Impairments. The figure below gives a visual representation of this axial code:

![Diagram of Attributes of Broken](image)

Physical Impairments was one of the first patterns to emerge based on the material and aesthetic breaks sustained by 36 of the 120 submitted objects. Initial codes that spoke to the various degrees of objects’ physical breaks included more aesthetic/material damages. The clustering of initial codes such as chipped, ripped, fell off, dented, cracked were clustered under the following subcategories: damaged physical materials and impaired physical qualities. The former speaks to the breaks objects sustain to their physical materials (i.e. a cracked mug), which may have impact on its overall functionality. The latter speaks to an object’s aesthetic impairments that don’t necessarily affect its ability to function, such as a scratch on the surface of a vase or statue.

The category Functional Impairments encompassed what individuals perceived as objects whose component parts could no longer carry out their intended purpose. Through memo writing, it was recognized that Functional Impairments could be further synthesized to the following two subcategories for encompassing the various degrees of

Figure 5.1 Axial code for Attributes of Broken
disuse. They were abstracted as follows: *obsolete*—this entailed objects that were no longer wanted, old, out-dated or unused based on their antiquity and ease of replacement; and *dysfunctional*—this describes an object’s inability to operate properly or as intended (though may be able to carry about some degree of functionality.) Again, I emphasize that although these codes are part of a vocabulary that constitutes brokenness, obsolescence and dysfunctionality were subject to interpretation and thus were not always seen as broken. Figure 5.2 below shows how these categories are mapped through axial coding.

![Diagram of Attributes of Broken with Subcategories]

**Figure 5.2  Axial code for Attributes of Broken with Subcategories**

Since physical impairments were so closely tied to functional impairments, perceptions around physical impairments were also determined based on whether objects could still be usable. For instance, objects that were rendered physically impaired due to human error were not necessarily considered broken, but were rather seen as objects that could be used in other ways. There were a lot of disparities on what people considered broken which required further data collection and analysis on my initial interpretations throughout the study.

A memo I wrote reflected on the constitution of broken, taking some of the key discussions I had with a few of the participants as fuel for thought. The following memo excerpt tries to reconcile the various perceptions of broken by taking P15’s example of his use of his roommate’s mis-cut piece of plywood for a project of his own. Though it couldn’t function as intended, P15 did not regard the piece of wood as broken:

[Memo Excerpt]
It seems I assumed wrong in interpreting [P15’s] use of his roommate’s piece of plywood. In a recent email exchange with him, I asked whether he felt the piece of wood could be thought of as broken. He replied: “Something mis-cut is absolutely not broken. It just hasn’t yet shown how it will be useful.” Originally I thought since it was intended to be a keyboard tray and was cut too short, it was in a sense broken. This was the rational other participants had described when thinking about their objects as broken. Why is it different in this case? He brought up the notion of scrap as another class of object that isn’t necessarily broken, but that materials with such states of disuse are kept and saved all the time with the intention of being repurposed in creative projects. There are creative communities that get together to share these kinds of materials....

[End]

It is interesting to note that while P15 regards scraps as a particular type of material that goes beyond the notion of broken, scraps still provoke creative actions from individuals to reuse and repurpose these materials. In this regard, the use of the word broken may be a semantic consideration, as what results are still creative actions for resolving states of obsolescence and dysfunctionality. In this regard, broken in the context of everyday repair can be reconsidered to include the unpreferred states that trigger creative actions, which move objects towards reuse and/or repurposing.

**Concept: Motivations Behind Processes of Everyday Repair**

Two concepts had emerged over the course of the focused coding analysis that spoke to the motivations behind everyday repair. These included Motivations for Repair and Motivations for Keeping and Using Objects as-is. These categories shared direct overlaps with each other, as reasons for why participants felt compelled to keep their broken objects were also primary reasons for why they were motivated to repair them. These two concepts help describe the iterative nature of everyday repair, as objects that are kept in their broken state are often resolved later in time when a solution comes to an individual’s mind. Here I will briefly describe the axial coding process of both these categories.

**Core Categories of Everyday Repair Motivations**

Initial categories discerned around participants’ motivations included sentimental value, emotional feelings, personal attachment, heirloom status, and gifts. These codes were further synthesized to fit within the categories of Practical, Personal and Ethical, as
these encompassed the sentiments, emotions and fulfillment of needs objects served within the lives of individuals. These aspects were also the site in which I could understand how meaning was attributed to broken objects and how this had compelled creative actions. The axial code that represents these categories and subcategories is visualized in the following diagram (Figure 5.3):

![Axial code for Motivations of Everyday Repair](image-url)

**Figure 5.3  Axial code for Motivations of Everyday Repair**

In the following sections I will expand briefly on each of the three categories and their respective subcategories.

**Subcategories of Practical, Personal and Ethical Motivations**

*Practical* motivations encompassed the functional aspects objects served in facilitating participants’ daily needs. Many objects were kept based on their potential to be used in the future and were seen as necessary for facilitating individuals’ daily activities. The subcategories *Potential for Future Use* and *Necessity* were derived based on the initial codes around participants’ needs of a broken object. Another fundamental aspect around the practical necessity of objects spoke to the personal investments individuals placed in their broken objects. Over the course of my analysis, I clustered time, emotional and personal investments under the larger category of *Significant Investments*.  

87
Personal motivations included initial codes that spoke to individuals' interests, sentimental and emotional attachments to their objects. This category also entailed the personal preferences individuals had in the acquirement of broken objects. Initial codes defined during the analysis alluded to all these aspects, but were later synthesized into the following key subcategories: Sentimental—this comprised of codes that spoke to individuals emotional attachments to their objects; Aesthetics—this included the subjective preferences individuals had towards an object's style, look and other physical qualities; Interests—entailing the ways people tried to resolve their broken objects based on their interests in them (some of which they actively sought out as part of their hobbies); and lastly, Significant Investments was also included within personal motivations, as time and emotional investments were largely related to people's personal attachments.

The last category, Ethical, represents the environmental awareness some individuals described as reasons for why they felt compelled to either keep and/or use their broken objects as is, or were motivated to find solutions towards their repair based on their Interests in sustainable issues. Based solely on the data collected, sustainability issues were the only ethical motivations that surfaced. Thus the subcategory Sustainability was defined, also drawing from the personal motivations of Interests individuals had as part of their ethical values (refer to Figure 5.4 below.)

There were some codes that were only germane to the concept of Keeping and/or Using Broken Objects As-is. These entailed the following patterns: Preservation of Scars—here participants described their fondness towards their objects' broken parts, as they often represented its history and the experiences they had with them; Still usable—describes situations in which objects have dysfunctional parts but are kept based on their ability to carry out necessary functions; and lastly, Depending on others—this category included instances where broken objects were often kept in their broken state due to individuals' dependence on friends and/or family members to repair them. The axial code visualization that encompasses all these categories and subcategories is presented in the figure below:
Summary

In summary, the core categories related to everyday repair conditions are illustrated here in more concrete terms, abstracting categories and subcategories that explain the dimensions of broken and how these affect and are tied closely with the practical, personal and ethical motivations of non-experts. Based on memos written, new categories emerged that spoke to new aspects of motivations – namely how individuals celebrated the broken aspects of their objects and how these reflected their own identity (as represented by the code *Preservation of Scars*). The dependence non-experts had on others was another by-product of the focused coding phase. Through follow up discussions with participants, it became clear how networked repairs were part of a social practice. As I describe in the following section, the influence of others also resonates in how individuals think of repairing their objects. Furthermore, I discuss how the core motivations and attributes of broken outlined above also influence the execution of techniques and processes of repair.

**Theme: Techniques and Processes**

In the previous chapter I mentioned the concepts *conceptual* and *actionable* processes that speak to the thought processes and actions (i.e. doings) of non-experts. In this section I describe the focused coding of techniques and processes that distinguish how individuals dealt with their broken objects. Here I use the terms
techniques and processes interchangeably, as both terms refer to the actions, and sequence of actions that mark identifiable beginnings, ends, and any actions in between. More specifically, these processes highlight the conscious and subconscious ways individuals dealt with their broken objects. I will expand on these concepts further and explicate their various dimensions as part of a unified process. Furthermore, I will address how materials and tools that help facilitate non-experts approaches to repair and repurposing of broken objects.

Concepts: Conceptual and Actionable Processes

In trying to distinguish the implicit and instinctive nature in which everyday repairs occurred, I defined several categories that spoke to the thought processes participants alluded to in our discussions. These processes, which I refer to as conceptual processes and techniques, were categorized under the following focused codes (generated from an initial set of codes): Having a Vision in Mind, Knowing from Personal Experience, Resourcing and Serendipity, and Trial and Error. Codes were then defined to describe the ways individuals executed their thought processes—namely their doings and actions. Thus, I began clustering initial codes under the category Actionable Processes and Techniques. Figure 5.5 below shows a simple representation of the axial codes for these concepts. Not that the bi-directional arrows indicate how the two processes influence and perpetuate each other over time.
In the following sections I describe each process in further detail, specifically looking at the various subcategories they each entail.

**Conceptual Processes and Techniques**

In my follow up emails to participants, I would often ask how they thought about resolving their broken objects (i.e. *How did you think of using X material or approach?*) Observations previously mentioned in chapter 4 included descriptions of participants already knowing in their mind how they would resolve a situation, though they couldn’t remembering how or why they executed it the way they did. Also, participants would serendipitously come across objects or materials needed for proceeding with a repair. For such instances, I defined the subcategory *Having a Vision in Mind*, entailing the ways in which individuals imagined how to resolve a situation in either a conscious or subconscious manner.

Another type of conceptual process involved the ways individuals implicitly knew how to resolve their objects based on having seen a solution executed by someone else. Participants also mentioned having learned a technique at some point during their life. Thus the subcategory *Knowing from Personal Experience* was defined to entail the embodied knowledge individuals had around resolving a break and/or dysfunction.
Resourcing and Serendipity was a subcategory distinguished based on the ways individuals recognized the potential use of materials within their everyday settings. Participants also recognized similar properties in unique materials for resolving their broken object’s part—such as in the case of P11 and her boyfriend’s use of a plastic bag for replacing their juicer’s cracked waste collector. This category really speaks to the degree of familiarity individuals have regarding the materiality of their non-digital objects, which were easily replaced by other everyday materials.

The last conceptual process discovered in the focused coding phase is defined as Trial and Error. In the previous chapter I had mentioned this process involving the ways individuals incrementally tried out various methods and approaches to resolving their objects until an optimal solution was reached. In a trial and error approach, individuals will repair their objects over an extended period of time, as they test the efficacy of their solution, often having to re-address a repair again later down the road. In many cases, individuals first tried using their broken object as-is before looking for a solution to solve the problem.

Actionable Processes and Techniques

There were more codes derived for actionable processes during the focused coding of the text and images, which weren’t apparent during the initial coding phase. In the last chapter I had described participants employing common approaches like gluing, sewing, and taping. In this second phase of the analysis, I had placed these codes under the category Adhering to describe the general process of sticking broken parts back onto their original substrate. What had also been recognized through the focused coding phase were actions around cutting, taking apart, and disassembling. I had clustered these under the code Deconstructing.

Other processes observed entailed the repurposing of scrap pieces of material that were rendered either obsolete or unusable. These actions were placed under the subcategory Salvaging, as the repurposing of scraps was an inherent part of appropriating broken objects’ parts. Salvaging was closely related to the code Jury-rigging, which described the ways participants tried repairing their objects by using only materials that were close at-hand. Resourcing is similar to the code Jury-rigging, but speaks more to the thoughtful and pre-meditated ways participants found materials for
properly repairing their objects (i.e. going to the hardware store to buy a proper screw made for an object, as opposed ripping it off of another object.)

Other actionable techniques included: *Reconstructing*—the process by which participants disassembled and reassembled objects to repair and/or repurpose them; *Replacing*—entailing the substitution of broken parts with others like-parts in order to restore an object’s use; *Transforming*—the ways participants changed the physical and functional attributes of their broken objects towards new purposes; *Augmenting*—the addition of features and attributes for improving an object’s use; and lastly, *Expert Repair*—resorting to an individual with a professional level of expertise for repairing a specific object. Though only two participants mentioned this last approach in their submissions, I included it as an interesting aspect of everyday repair, albeit a rare occurrence. The figure below shows the axial representation of both conceptual and actionable processes, and how they sit in relation to each other (Figure 5.6). *Note:* for simplicity sake, I had left out connections between techniques and processes in the diagram below, and will expand on these relationships in the following chapter. Also note that the subcategory *resourcing* is circled in red, as it is seen as a property of both conceptual and actionable processes.
Understanding the processes of human actions and thinking only describe part of the everyday repair story. Understanding how processes and techniques were facilitated based on the material aspects of the objects themselves were another important facet that encouraged and/or dissuaded participants from repairing objects. In the following section I will describe the key attributes of materials that contributed to the processes of everyday repair based on their physical characteristics.

**Concept: Physical Attributes of Everyday Repair**

As mentioned in the previous chapter, the categories discerned around objects’ physical attributes were derived from the images participants submitted in their email responses. By conducting a visual analysis, I attributed keywords to objects’ that described their physical materials and digital orientation. The emergence of physical attributes became a prominent concept throughout the course of the analysis, as it became more evident that certain objects’ materials facilitated acts of repair better than others. The observations described in this section highlight how the digitality of broken objects (that is, the degree to which an object depends on digital components) stands as a strong barrier to repair and repurposing. I will also discuss the emerging subcategories of materials that enabled acts of restoration and/or repurposing based on their capacity to adapt, transform and be reused in different contexts of use.
The various initial codes were clustered and further abstracted as attributes that facilitated everyday repair techniques and processes. Consequently, the materiality and digitality of objects were categorized under the following four subcategories: *Flexible Materials*—the ability of an object’s parts to bend, twist and warp to accommodate its intended functions or entirely new ones; *Deconstructable Materials*—the ability to take apart (including puncturing, cutting off, reducing, etc.) a broken object’s parts in order to create entirely new structures or systems. (This has similar qualities to flexible materials but focuses more on the reclamation of parts to facilitate an object’s use); *Modular Materials*—the capacity of an object’s component parts to be repurposed for the replacement of another broken object’s similar parts. These parts can be either made for it (standardized components), or jury-rigged from other objects; and lastly, *Simple materials*—materials that consist of few components including its physical dimensions, fabrication and functionality. Figure 5.7 shows the axial representation of physical attributes as part of everyday repair techniques and processes. They are also incorporated as conditions of everyday repair, which prompt or stunt creative actions.

![Axial coding of Physical attributes of Everyday Repair](image)

**Figure 5.7  Axial coding of Physical attributes of Everyday Repair**

**Concept: Assessing the quality of a repair**

The final category of everyday repair techniques and processes speaks to the ongoing progressions repairs take on in light of non-experts continual assessment of their objects quality. These are usually based on the degree to which they satisfy individuals’ own needs. There were two subcategories defined in the initial codes, which include *Assessing Repair Quality Based on Adequate Functionality* and *Assessing Repair Quality Based on Restored Aesthetics*. Again, the process of quality assessment is a fundamental part of understanding the iterative manner in which repairs happen, as
techniques are tried and outcomes are evaluated. Through focused coding, the assessment of repair quality primarily comes down to an object’s aesthetic quality and/or the degree to which it can still perform its needed function (Figure 5.8 below).

![Figure 5.8 Axial code of Assessing Quality](image)

**Summary**

In this section I described how initial codes around everyday repair techniques and processes were synthesized through the process of focused coding. A more in-depth analysis had resulted in the emergence of new codes and categories that weren’t originally seen in the initial coding phase, particularly around the actionable processes that encompassed repair techniques. This second round of coding had further synthesized the physical attributes of materials that facilitate repair, as well as geared them towards interaction design and how flexible, modular, deconstructable and simple materials can be used as inspiration in the fabrication of interactive technologies. Furthermore, in providing a more succinct account of individuals’ processes behind quality assessment, designers can also anticipate the iterative ways individuals evaluate their objects’ quality and fit both aesthetically and functionally.

In the last section below, I describe how these processes play a larger role in the outcomes of everyday repair and how assessments of quality fuel ongoing processes of everyday repair.
Theme: Outcomes of Everyday Repair

In this section I expand on the various outcomes discerned from the data analysis that entail the different states objects achieve as a result of participants’ techniques and processes (or lack their off). Here I define the focused categories Obsolescence, Kept and/or Used As-is, Restored, Low Quality Prompts Further Action, and Creatively Repurposed. These categories emerged as the most common patterns through the focused coding analysis (see Figure 5.9 below for axial coding of these outcomes). As part of my discussion, I will highlight the key aspects that further explicate to the boundaries of repair—specifically, what participants felt did and did not constitute a repair during this phase of the analysis. By providing my own reflections on participants’ submissions (from memo excerpts), I begin building on the outcomes of everyday repair that encompasses restoration, modifications, and creative repurposing.

Figure 5.9   Axial coding for Everyday Repair Outcomes

Categories of Everyday Repair Outcomes through Focused Coding

The initial codes described in the previous chapter had largely remained the same through the focused coding phase. Obsolescence was a common outcome of everyday repair and was further abstracted to entail objects deemed no longer usable or able to sustain their owner’s satisfaction. Though this outcome resulted in the
discontinued use of broken objects, individuals often resorted to storing them in case they or someone else found a way of making them work again. Similar (and sometimes contrary) to obsolescence was the category Kept and/or Used As-is, which encompassed individuals’ continued use or the storing of broken objects where no repairs were attempted. More specific to the ‘Used As-is’ part of this category, objects’ perceived as still usable involved individuals having to work around their broken parts to continue using those that were still functional.

The category Restored speaks to the more conventional sense of repair, which included the restoration of objects back to their original and intended state. Though this was a common observation of many of the submissions from participants, outcomes often lead to objects being Creatively Repurposed towards other contexts of use. These two categories had surfaced many questions around the boundaries of repair and the underlying assumptions around what constitutes the repair of broken objects. In the following section I describe the implications of the dual relationship these categories have and how this serves as an important consideration for both understanding everyday repair and the design of interactive technologies that allow for creative repurposing.

**Concept: Repair, Modification and/or Repurposing?**

Participants’ submissions that entailed the creative repurposing of broken objects fuelled a series of follow up discussions with participants. Consequently, I had written several memos that tried to understand what role creative repurposing served in the larger picture of repair. It was clear that repurposing and associated acts of modifying were a fundamental part of everyday repair, and thus became a major focal point in my analysis. The following memo describes the key questions I wrestled with during the focused coding phase. Here I use an example from the data to illustrate the central role creative repurposing played in understanding the creativity of repair processes:


Through the course of our analysis, we came across various examples of objects that didn’t seem to fit the conventional sense of the term ‘broken.’ Objects that were considered ‘repaired’ also seemed to
border on the line of being a modification. [P15’s] example of the mis-cut piece of plywood had us reconsider broken to entail either of the following scenarios: (1) an object that is physically impaired (i.e. cracks, tears, dents, etc.), or (2) an object that no longer meets its expected functionality.

To illustrate our point further, we use P8’s example of his ‘broken’ staircase and how some house renovations rendered it as an unusable space in his house:

   P8: I have a staircase that’s been closed off and I wanted to use it as storage […] It used to be a functional staircase, but a new floor was added at the top of the staircase, blocking it off. So as a staircase, it no longer functions, and as a storage space, it’s very difficult to use. So, sure, I could see [the staircase] as being ‘broken.’ […] A little creative re-engineering later, I re-built some Ikea storage units to work in the staircase.

Was P8’s staircase transformation into a storage space a repair or modification? Does a space actually break? At what point do we consider an object (or space) broken if only part of its functionality no longer works? Are the alterations of an unusable but fully intact object-space mean it’s just been modified and not repaired? Are these situations then what we know as appropriation?

P8 considered his staircase ‘broken’ because it no longer functioned as a usable pathway for accessing the top floor to his apartment. We can also see the same issue with the mis-cut plywood – it was deemed broken because it could no longer fulfill its intended purpose as a keyboard tray. If a lack of functionality were a primary delineator for something being broken, would P15’s monitor riser be considered broken since it could not hold his computer monitor? Is the addition of the plywood its appropriation and the addition to the riser a modification?

Given these questions, we believe there are strong correlations between repair and the appropriation of objects in the home. More specifically, we see the impairment of objects as an instigator of creativity that prompts home dwellers to think about alternative uses for their broken or unusable objects.

[End]

This memo begins to tackle the differences between acts that encompass 'repair' and 'modification' and how the two can both stem from objects that are deemed broken, leading to either their restoration or repurposing. This again brings up the question of what constitutes something being broken and whether this state leads to unexpected outcomes such as objects’ adaptations and appropriations. Are there real differences between what is considered a repair and what is considered a modification? Does this have implications for the design of interactive technologies that assume repair is based
on restoration, and yet miss out on the opportunity to appropriate them? These questions present real opportunities for designers to anticipate the multiple trajectories an object can undergo, which can be further fuelled through an understanding of non-experts’ motivations, how they recognize the adaptability of an object’s material, as well as how well an object lends itself to ongoing processes of repair and creative repurposing.

**Summary**

To summarize, this section begins to unveil the correlation between perceptions of broken (as described by the concept *Attributes of Broken*) and how this state can instigate outcomes of restoration, adaptations, transformations, and appropriations. It is in this regard that I argue for a reconstruction of our understanding of repair that involves a better understanding of individuals’ innate sense of creativity based on their capacity to resolve and adapt the use of their objects through their own sense of agency. Furthermore, it is important to consider that while objects may be rendered obsolete, they are still kept and used based on individuals’ motivations. This presents both an opportunity and key insight for interaction designers, as non-experts are willing to hold onto their objects (specifically digital electronics) in the hopes that they will find a solution to resolving their state of brokenness. The digitality of objects still remains unresolved, as the attributes outlined here address only physical materiality. In this regard, digitality presents itself as a barrier to non-experts and their basic techniques for addressing these types of breaks. Consequently, the attributes presented here stand as a first step in understanding how to facilitate non-experts’ repair techniques and highlight a major consideration for design moving forward. I expand on this point further in the following chapter.

**Conclusion**

This chapter expands on the findings previously outlined in chapter 4, namely how the process of focused coding surfaced new categories and subcategories that added further insights into everyday repair themes. Through the use of axial coding, conditions, processes and outcomes of everyday repair are visualized to give a more
concrete picture of what each aspect entails and how their respective categories and subcategories interrelate. Memos were also incorporated to show how my own interpretations of the data had lead to decisions around code inclusions and exclusions, which further defined categories and their relationships to their core concepts. It would be wrong to suggest that the initial coding phase was a distinct procedure set apart from the focused coding phase outlined here. Rather, the findings and techniques described in these two chapters really try to foreground how GT methods enabled further discoveries over the course of the study and how concepts and categories changed as new observations were made. This is the strength of GT—it allows for continual interaction with the data, participants, as well as with the ideas and interpretations that I had made as the principal researcher. In the following chapter, I will discuss how the these final observations work as part of a larger theoretical framework for interaction design and how the relationship between concepts, categories and themes can be understood as a type of everyday practice.
Chapter 6.

Everyday Repair Framework and Discussion

Introduction

In the previous two chapters, I described the various dimensions of everyday repair according to the conditions, processes and outcomes they entail. In this chapter, I discuss how these dimensions fit within a theoretical framework for interaction design, specifically outlining the categories and subcategories that describe the common practices of non-experts when repairing and repurposing their objects. I follow this with a description of how these dimensions interrelate and influence each other over time in the form of a qualitative description. A visual representation of this description is also provided as part of the theoretical framework, emphasizing how the process of everyday repair is an ongoing process influenced by motivations, attributes of broken and the assessment of quality.

The second half of this chapter includes a discussion of the implications everyday repair has for everyday design and interaction design. First, I more broadly situate the everyday repair framework by integrating it with the concept of everyday design, highlighting how repair shares and contributes to similar concepts proposed in previous publications (Wakkary and Maestri, 2007, 2008, 2010). In situating everyday repair as a contributing theory of everyday design, I discuss how the notions of substitutability, materiality, emergence, adaptation, resourcefulness and quality play out in the ways people try to resolve their broken objects through on-going use, or what we also refer to as design-in-use in the context of everyday design. Secondly, I describe what new insights everyday repair contributes to everyday design, which underlie the relationships individuals form with their objects that influence creative actions. I end this discussion with considerations for interaction design, specifically in how current
discourses might reframe the way designers design technologies that accommodate non-experts dispersive practices. This discussion foregrounds the need for designers to reconsider the material choices used for fabricating interactive technologies’ that facilitate the adaptation, repurposing and repair of objects’ physical and digital components.

A Design Framework of Everyday Repair

The last chapter summarized the outcomes of the GT analysis in which core concepts, categories, subcategories and themes were defined regarding the motivations of non-experts, the techniques and processes they employ, the physical attributes of materials that facilitated repair, as well as the outcomes of non-experts’ repair processes and techniques. Emphasis is placed on the processes and techniques of non-experts, as these serve as insights for designers when anticipating how objects’ lifecycles are sustained through sequences of actions, as mediated by physical attributes over time. These are highlighted as the conscious and subconscious (or instinctive / unprenamitated) ways individuals deal with their broken objects.

The following tables encompass the design framework of everyday repair. Listed within each table are the key concepts, categories and subcategories of everyday repair themes, as described in the previous chapter. The first table outlines the multiple motivations behind everyday repair; it addresses two dimensions of motivations that explain why participants kept their broken objects (as-is), and why they were compelled to execute actions to repair them. Keeping objects as-is and doing acts of repair shared common motivations, however there were further rationales for why individuals kept their broken objects as-is (these are outlined as the last three elements in Table 6.1.)

Table 6.1 Motivations of Everyday Repair

<table>
<thead>
<tr>
<th>Motivations for Repairing and Keeping Objects as-is</th>
<th>Subcategories</th>
<th>Description</th>
</tr>
</thead>
</table>

103
<table>
<thead>
<tr>
<th>Motivations for Keeping Objects As-is (only)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preservation of scars</strong></td>
<td>This motivation speaks to the symbolic value broken components can attain like those of a scar that give character and meaning to a broken object. These scars often represent an object’s history and individuals’ personal experiences with the object, thus individuals’ keep them as memorabilia.</td>
</tr>
<tr>
<td><strong>Still Usable</strong></td>
<td>Motivations for keeping a broken object as-is can be based on its ability to carry out its intended or needed purpose. Such objects are kept until they can no longer function properly or are rendered as dead.</td>
</tr>
<tr>
<td><strong>Depending on others</strong></td>
<td>This category entails situations in which broken objects are kept in their current state due to an individual’s dependence on a friend and/or family member to repair them in the near future.</td>
</tr>
</tbody>
</table>
This next table outlines all the focused codes regarding what individuals’ deemed broken and how these added further dimensionality to the conditions that prompted acts of everyday repair. For designers, these attributes can help anticipate the various situations in which individuals perceive physical or functional breaks (or a combination of both). Designers can accommodate for such instances through material choices and techniques (these are outlined in the tables that follow Table 6.2). Table 6.2 below shows both the categories of broken attributes, which include the subcategories physical materials, aesthetic qualities, dysfunctional parts, and obsolescence.

**Table 6.2 Attributes of Broken as Conditions of Everyday Repair**

<table>
<thead>
<tr>
<th>Broken Types</th>
<th>Subcategories</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Impairments</td>
<td>Physical Materials</td>
<td>This type of physical impairment includes those such as cracks, dents, rips and other impediments on objects materials.</td>
</tr>
<tr>
<td>Aesthetic Qualities</td>
<td></td>
<td>This break type is not unlike physical breaks, though it speaks more to impairments that ruin or lessen the quality of an object’s outward appearance.</td>
</tr>
<tr>
<td>Functional Impairments</td>
<td>Dysfunctional parts</td>
<td>An object’s dysfunctionality encompasses break types where parts or the entire object does not work as intended, thus affecting its performance and purpose of use.</td>
</tr>
<tr>
<td></td>
<td>Obsolescence</td>
<td>An object deemed obsolete often occurs when it either has ‘died’ or is replaced by newer objects.</td>
</tr>
</tbody>
</table>

The next two tables present the two types of techniques and processes (i.e. Conceptual and Actionable.) The first set (Table 6.3) describes how thought processes surface in the minds of individuals’ when approaching a repair – referred to as conceptual processes and techniques. Designers can try to utilize these categories for imagining how non-experts tackle a break through creative problem solving.

**Table 6.3 Conceptual Processes and Techniques of Everyday Repair**

<table>
<thead>
<tr>
<th>Technique Type</th>
<th>Description</th>
</tr>
</thead>
</table>

105
Having a vision in mind
This entails individuals’ ability to imagine how to resolve a situation in either a conscious or subconscious manner. Often individuals will come across a material similar to the one they’ve had in mind for resolving a break and will use them based on their original vision.

Knowing from personal experience
This process speaks to the tacit knowledge individuals have around resolving a break and/or dysfunction based on previous experiences. These solutions usually come to mind due to having seen it before from someone else, or they were learned at some point during their life. (As an example, gluing and sewing are common practices non-experts use for repairing cracked and/or torn objects.)

Resourcing via Serendipity
This technique speaks to ways individuals recognize the potential use of materials within their everyday settings for repairing their objects. Often times, individuals may recognize similar properties in a unique material for resolving a broken object’s break. Such a scenario is typical with non-digital objects whose physical materiality and properties are familiar to their owners and thus, can be replaced by an assortment of other everyday materials.

Trial and Error
This process speaks to the ways individuals incrementally try out various methods and approaches until an optimal solution is reached for resolving a break. In a trial and error approach, individuals will repair their objects over an extended period of time, as they test the efficacy of their solution and often have to address a repair again. In many cases, individuals will first try to use their broken object in its broken state before looking for a solution to solve the problem.

The second part of techniques and processes describe the actions and doings involved in acts of repair, as prompted by conceptual processes. These are referred to as actionable processes and techniques (Table 6.4 below) characterized by actions that look to restore and creatively repurpose objects deemed broken. In the context of interaction design, designers may find these most helpful for informing the fabrication of technologies that accommodate for the reactive and resourceful ways non-experts deal with an object’s physical and/or functional break(s). As I describe further on, these technique can be used in combination with each other, along with a combination of conceptual processes and techniques.

Table 6.4 Actionable Processes and Techniques of Everyday Repair

<table>
<thead>
<tr>
<th>Technique Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salvaging</td>
<td>This process entails the repurposing of scrap and obsolete objects to be used towards new contexts of use. The degree to which a part can be salvaged is based on the ability of the object to be adapted and transformed (its physical material), the simplicity of the material itself, as well as the extent to which an individual understands how to manipulate the material itself.</td>
</tr>
<tr>
<td>Adhering (Gluing, Taping, Sewing)</td>
<td>This entails the use of materials such as adhesives, extensions and/or connectors for restoring parts of broken objects.</td>
</tr>
</tbody>
</table>
Table 6.5 below lists key physical attributes that were fundamental to facilitating the repair processes above – these aspects really highlight materials that were present in objects where acts of resolution and/or appropriation where observed. These physical attributes not only speak to the material qualities of the broken objects themselves, but also of the tools individuals used for repairing broken objects. This again may be particularly helpful for designers as they anticipate the various actions individuals employ and the common tools used for executing their actions. For instance, the use of tape was used a flexible and deconstructable material, as well as a tool for adhering and binding broken aspects together. Likewise, a torn shoelace also has flexible qualities that individuals’ can repair simply by tying its two ends together.

<table>
<thead>
<tr>
<th>Physical Attributes</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>etc.)</td>
<td></td>
</tr>
<tr>
<td>Jury-rigging</td>
<td>This process speaks to repairs done only by using tools and resources that happen to be on hand. This category is similar to resourcing, though its delineating feature speaks to the creative ways individuals’ make-do with objects in their immediate surroundings.</td>
</tr>
<tr>
<td>Resourcing</td>
<td>Unlike the category above, this process speaks to the ways individuals purposely seek out materials that are appropriate for resolving broken and/or dysfunctional parts of an object.</td>
</tr>
<tr>
<td>Deconstructing</td>
<td>This entails the technique of disassembling an object to take away its broken and/or dysfunctional part(s). This process may also involve further ‘breaking’ of an object to facilitate its use in modified and constricted ways. This technique is also associated with reconstructing, as the disassembling of an object enables an individual to reconstruct it back to its original purpose, or towards new contexts of use.</td>
</tr>
<tr>
<td>Reconstructing</td>
<td>This technique entails the reassembling of a disassembled object to resolve its broken and/or dysfunctional features. Reconstruction will often lead to the repurposing of an object towards new purposes of use.</td>
</tr>
<tr>
<td>Replacing</td>
<td>The substitution of component parts to sustain an object’s use. Parts can be resourced from other ‘like-parts’ or from objects that are completely unique.</td>
</tr>
<tr>
<td>Transforming</td>
<td>Changing a broken object’s physical parts and/or functionality by altering their intended purpose.</td>
</tr>
<tr>
<td>Augmenting</td>
<td>The technique of adding more features and/or properties a broken object to improve its use.</td>
</tr>
<tr>
<td>Expert Repair</td>
<td>Resorting to experts whose profession entails the repair of a specific object types. (A repair shop is a prime example of this.)</td>
</tr>
</tbody>
</table>
Flexible Materials

The ability of an object’s parts to bend, twist and warp to accommodate its intended functions or entirely new ones.

Deconstructable Materials

The ability to take apart (including puncturing, cutting off, reducing, etc.) a broken object’s parts in order to create entirely new structures or systems. This has similar qualities to flexible materials but focuses more on the reclamation of parts to facilitate an object’s use.

Modular Materials

The capacity of an object’s component parts to be repurposed for the replacement of another broken object’s similar parts. These parts can be either made for it (standardized components) or jury-rigged from other objects.

Simple Materials

Materials that consist of few components. This takes in account a material’s dimensions, substance, and functionality. The least complex these aspects are, the easier they facilitate creative repair and/or repurposing.

The next table outlines the ways techniques and processes are continually assessed and evaluated by non-experts. These were based primarily on the degree to which an object could serve out its intended function, as well as how well a repair resolved any aesthetic damage. For designers, this part of the framework may serve as a reminder of how non-experts prolong the use of their objects and what aspects they look for when deciding on whether to restore them, repurpose them, replace them, or dispose of them altogether. This process also determines whether further repair techniques are necessary, resulting in either immediate action or for non-experts to defer any resolve at a later time.

Table 6.6 Assessing the Quality of an Object’s Repair

<table>
<thead>
<tr>
<th>Physical Attributes</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessing Functionality</td>
<td>This processes describes an individual’s often-subconscious evaluation of an object’s performance, as well as the degree to which it can still carry out its expected purpose.</td>
</tr>
<tr>
<td>Assessing Aesthetic Quality</td>
<td>The assessment of an object’s aesthetic quality entails the restoration of an objects appearance that meets up to its owner’s standards and satisfaction.</td>
</tr>
</tbody>
</table>
Finally, the last table lists the typical outcomes of repair resulting from the techniques non-experts employ (Table 6.7 below). Though these outcomes were defined based on the current state of the participants’ objects at the time of submission, they were not finite. Consequently, an outcome of a repair can spawn further repair processes and techniques over time, based on their assessment of quality (mentioned in the above table (Table 6.6)).

**Table 6.7 Outcomes of Everyday Repair**

<table>
<thead>
<tr>
<th>Outcomes types</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Object is obsolete</strong></td>
<td>Objects deemed obsolete no longer sustain their use or purpose. Though this outcome results in the discontinued use of broken objects, individuals often resort to storing them in case they or someone else can find a way of making them work again.</td>
</tr>
<tr>
<td><strong>Object is kept and/or used as-is</strong></td>
<td>Entails individuals’ continued use of their broken objects where no repairs are attempted. Objects’ are perceived as still usable, as individuals simply work around aspects that are broken.</td>
</tr>
<tr>
<td><strong>Object is restored</strong></td>
<td>Objects that are deemed restored include those whose intended use/purpose is returned back to a state that is sufficient to the individual. Associated techniques range from <strong>augmenting</strong>, <strong>salvaging or transforming,</strong>.</td>
</tr>
<tr>
<td><strong>Object is creatively repurpose</strong></td>
<td>The repair of objects often leads to their repurposing for other contexts of use. Most of the techniques are commonly associated with this outcome include, specifically <strong>replacing</strong>, <strong>augmenting</strong>, <strong>transforming</strong> and <strong>salvaging</strong>.</td>
</tr>
<tr>
<td><strong>Low Quality prompts further Techniques and Processes</strong></td>
<td>This outcome is a result of the ongoing assessment of an object’s general state of being. If quality is deemed low or does not meet up to an individual’s standards, further repair techniques and processes may ensue.</td>
</tr>
</tbody>
</table>

Though the above tables give a summary of the key categories and subcategories involved in everyday repair, they still do not fully describe how the interrelationships among these factors perpetuate and influence each other over time. Many elements within a table can overlap and/or occur in tandem with others, prompting several processes to happen all at once. Some repairs can end in one or two outcomes resulting over an extended period of time. The terms in the above tables will be expanded on in terms of their relationships to each other in the following section.
A Qualitative Description of Everyday Repair

The motivations of non-experts are primary drivers for instigating conceptual and actionable processes of everyday repair. In most cases, these motivations are driven by individuals’ sentimental attachments to their objects, as they often originate as gifts from others. Personal motivations (as outlined in table 6.1) entail personal attachments rooted in one’s own identity and values. These may include an individual’s interests, hobbies and preferences in physical/experiential aesthetics. In cases where investments are a factor, individuals will find ways of keeping and/or repairing their objects to avoid the costs of investing in a replacement. This is especially true of digital electronics where a substantial amount of both time and money are spent in personalizing the technology to serve fundamental routines, needs and activities.

Observations around individuals’ ethical values also play a role in everyday repair. These mostly center on the growing awareness individuals’ have around the harmful disposal of broken objects. This awareness motivates individuals to keep their objects in case they can find a way to sustain their longevity later down the road. Personal interests, ethical values, and/or preferences in appearances can be combined or exclusive, depending on an individuals’ relationship to their object. In most cases, individuals grow more attached to their objects through on-going use and by the role they serve within their everyday settings. They become an integral part of their everyday experiences and are instilled with their owner’s unique sense of history, social network and personal identity.

In situations where an object’s state of brokenness is recognized, individuals are forced to contemplate the object’s future. Individuals may begin to envision a solution to resolving their object’s break, in which case they may ask themselves the following questions:

- Perhaps I can just tape X back on?
- What do I have around that I can use to fix it?
- Maybe I should just keep X around till I figure out what to do with it?
- Could [Person X] fix it for me? He/she knows about these things.
After determining a course of action, conceptualizations and the execution of repair actions work in parallel with each other (and not discreetly). Each process is a part of a reflexive (although often subconscious) process. This overall process, which features motivations, techniques, physical attributes and outcomes, speaks to the various factors that encompass the creativity and instinctive knowledge inherent in everyday repair. For example, an individual’s spontaneous conceptualization for resolving an object (i.e. of having a vision in mind) can often be coupled with the actionable processes of jury-rigging and resourcing materials that are situated within their everyday settings.

This process also depends on the recognition of what physical material attributes their broken object possesses in facilitating a repair. These materials are a key factor in everyday repair, as individuals typically seek out and resource materials close at hand. Repair processes are reactive, incremental, and take place over an extended period of time. Depending on the degree to which an object facilitates quick resourceful fixes, the outcome of a repair, (i.e. obsolescence, restoration, etc.), may require further action if an unsatisfactory level of quality is the result of their actions. An individual may leave the object in its current state (i.e. impaired) until another solution emerges down the road.

Another key dimension of everyday repair is the social dynamics that influence and perpetuate individuals’ actions. In this light, the relationships people have with others create an embedded network of ideas and shared understandings around the reactive and impromptu nature of everyday repair. These ideas are fostered through individuals’ dependence on others and are often implicitly distributed through learning, seeding further repair actions in ones’ self and others over time. While these learned solutions remain tacit and operate subconsciously to the individual, they are referred to both on a conceptual and actionable level. A lack of understanding (or lack of access to those who have specific knowledge and/or expertise) for resolving a broken object often renders the item as obsolete or in a constant state of brokenness.

**A Visual Map of Everyday Repair Aspects**

In order to effectively visualize the relationships between motivations, processes and outcomes, below is a visual map that illustrates the nexus of everyday repair
themes, concepts and categories (see Figure 6.1). Note that this visual map excludes subcategories as a way to keep the visualization simple. This map takes inspiration from Glaser and Strauss’ notion of a \textit{conditional matrix} (Charmaz, 2006), showcasing the themes, core concepts and categories discerned in the GTM. These aspects are taken from the elements listed in the above tables (refer to Table 6.1 - 7 for category descriptions.)
Figure 6.1  The interrelationships of everyday repair conditions, processes and outcomes
In sum, the diagram presents the network of core themes and categories that perpetuate the iterative nature of everyday repair. The core concepts *Attributes of Broken* and *Motivations of Everyday Repair* are placed at the top of the diagram to represent the typical ways in which processes and outcomes are instigated. The process of everyday repair begins with the condition *Attributes of Broken*, as it is in the recognition of an object deemed impaired or dysfunctional that repair processes and outcomes happen. Below these two concepts is the axial coding for the concept *Physical Attributes*, which shows how the materiality of objects also serves as a condition of repair. Notice that the red dotted arrows between these three concepts are bi-directional, implicating that these categories may re-surface as a new factor at any given time during the repair process. Motivations, attributes of broken, as well as the attributes of physical materials altogether prompt non-experts to expedite some course of action, as indicated by the horizontal red dotted line and arrow pointing down towards the axial coding for the concept *Techniques and Processes*. This axial code represents a critical point in the repair process. Here is where decisions around what actions and/or conceptual processes an individual employ are dependent on their level of competence and basic skills for dealing with a type of break, and to what degree they are motivated to repair their object. The axial codes *Assessing Quality* and *Repair, Repurposing, Modifications* (as outcomes of repair) are placed in the lower portion of the diagram. This visually represents how the above conditions and processes influence outcomes.

Once techniques and processes are employed on an object, the result may result in its obsolescence, restoration, and/or repurposing. At this point, non-experts may choose to assess the quality of their repair outcome, prompting further techniques (again, note the bi-directional red arrows between *Techniques and Processes*, *Assessing Quality*, and *Repair, Repurposing, Restoration*.) An individual may also reflect on their motivations again for repairing and/or keeping their broken object, as well as try and understand the nature of the break and what other possible materials can be used to improve their object’s state. The red arrows located on the far right and left of the diagram indicate this cyclical process, implicating the non-linear iterations involved in everyday repair. I emphasize again that the placement of all the elements in this diagram are meant to visualize the nexus of factors that flow between actions, perpetuating each other in an ongoing manner. In sum, the motivations drive processes
and techniques, in which the resulting outcomes can perpetuate further conditions, driving actions all over again in an iterative fashion.

In the following sections, I refer to the existing theory of *everyday design* to describe how specific relationships between conditions, processes and outcomes share overlaps with the everyday repair framework described above. I explain how the notion of a non-expert parallels the notion of an everyday designer, creating a useful lens for constructing a new conception of the end user in interaction design. I also describe how the notion of *design-in-use* has similar implications and dimensions to the iterative, ongoing processes, techniques and outcomes of everyday repair, as they emerge in instances of objects’ adaptations, resourcefulness and assessments of quality.

**Discussion**

For the remainder of this chapter, I discuss how the framework of everyday repair extends and adds to existing observations made in our previous observations of everyday design, as well as what implications everyday repair has for interaction design. This discussion is separated into three parts. In the first part, I discuss how everyday repair overlaps with the everyday design framework. I specifically look at how previous patterns of everyday design are visible within the processes and outcomes of everyday repair, as well as how the iterative nature of repair and design-in-use share similarities based on individuals assessment of quality. I follow this section with a discussion of how everyday repair provides new insights into the processes of everyday design—namely how repair materializes based on reactive and unplanned situations. I also highlight the ways individuals build relationships with their objects, adding further insights into the creative actions of everyday designers. Lastly, I address the implications everyday repair has for interaction design by describing how designers can rethink how to design for non-experts’ everyday competences and skills as part of everyday repair practices.

**Understanding Repair as a Creative Process of Everyday Design**

The inherent creativity of everyday repair has direct parallels with previous observations found in the everyday design studies published in (Wakkary and Maestri, 2007, 2008, 2010). As mentioned in the literature review chapter, we describe *users* as
a type of designer—someone who remakes and modifies artefacts and systems through
the process of *design-in-use*. There are similarities between the repair processes of
non-experts and those of everyday designers who engage in processes of design-in-
use. These similarities are based on the ways participant groups both explored
alternative uses for objects that were deemed unusable, lacked fit, or were broken.
Furthermore, there are distinguishable synergies between the conditions, processes and
outcomes of everyday repair and those of the everyday design frameworks previously
published in (Wakkary and Maestri, 2007, 2008, 2010). In (Wakkary and Maestri, 2007,
2008, 2010) we describe patterns of everyday design as acts of everyday creativity. We
also highlight the incremental adaptations everyday design systems undergo through the
notions of *materiality* and *substitutability*. I will describe the parallels between the two
studies using the four key aspects of everyday design; these include *resourcefulness*,
*adaptation*, and *quality*, and the notion of *materiality-substitutability*.

In (Wakkary and Maestri, 2007, 2008) we described *resourcefulness* as the
appropriation of artefacts and systems for serving new purposes in the home. I see
flexible, deconstructable, modular and simple materials as key considerations that
facilitate acts of resourcefulness. In the context of everyday repair, resourceful
behaviour can be seen in the example of P6's sunglasses, where she used another pair
of sunglasses' screws to fix them.

P6: "[My sunglasses were] missing a screw at the time of purchase so
I took a screw from another pair of sunglasses (as I didn't mind
breaking it for this pair), and now it is all in one piece. I wear it
whenever it's sunny while driving, even if it's not summer anymore.
[...] For the sunglasses, I took the screw from the brown ones at the
top to put together the red ones. Unfortunately recently [sic] the
hinge of the red one broke, and I really love this pair so I'm hoping to
find one that's similar to screw on - or maybe go to a repair shop."
Figure 6.2  *P6’s sunglasses repaired via acts of resourcefulness*

Resourceful behaviour was also noted with P11’s waste collector replacement in which a plastic bag was used for her juicer. This was also the case with P15’s use of aluminum foil to properly cover his popcorn popper. P15’s reuse of his roommate’s broken piece of plywood was also resourced as a platform for his monitor riser. What I wish to highlight here is that the need for repair often prompts resourceful actions that lead to creative outcomes that are unique to individuals’ needs and situations.

In terms of adaptation, there are various manifestations of adapted objects in situations where broken parts are augmented, jury-rigged, deconstructed and transformed to serve new needs. This was particularly obvious with P22’s climbing rope rug and P13’s transformed hockey stick into a “window-stopper.” Again, these adaptations were made possible through simple functional and physical properties of individuals’ broken systems and artefacts.

Repair is also seen as a process of quality assurance that along with design-in-use compels people to explore and understand an object's materiality and its potential
Quality can be seen most prominently in examples where substitutions and reclaims were made with broken objects. As we describe in (Wakkary and Maestri, 2010), materiality-substitutability is a necessary factor that extends the use of artefacts and systems by resourcing other objects and adapting them based on their simple functionality. Again we see this in the example of P11’s use of a plastic bag for catching all the excess fruit parts from her juicer. This solution not only repaired the situation with the cracked waste collector, it also simplified the process of cleaning up. It can be assume this system has a high degree of quality given P11’s continual use of plastic bags when using her juicer.

Quality of an everyday design system, however, is subject to constant change and thus the success of an adaption, appropriation, and repair is always under scrutiny. As described throughout this thesis, quality assessment is an integral part of everyday repair, as people continually evaluate the degree to which their outcomes had met their own expectations, as well as those of others. We also saw this as a fundamental aspect of everyday design where a lack of quality perceived within a system often lead to continual acts of adaptions and even creative repurposing.

Given the conceptual overlaps between repair and the everyday design framework—specifically in how they explain the relationship between processes and outcomes of everyday repair—everyday repair can be used as a lens for understanding everyday creativity in different contexts. This is particularly evident in situations where modifications and appropriations occur as means of sustaining the longevity of objects. More specifically, repair can be seen as a higher level of creativity that directly contributes further insights into the process of everyday design. It is recognized that there’s still more work to be done in making the distinctions clear in how repair fits in relation to things deemed appropriated and/or modified. Ultimately, the findings of this thesis offer provocative insights to current discourses around designing technologies toward appropriation and the inherent creativity of everyday designers.

**Everyday Repair’s Contributions to Everyday Design**

While there are distinct overlaps between the everyday repair and everyday design frameworks, the observations of everyday repair provide new insights to
everyday design theory. Retrospectively, most of the focus of everyday design looked at the ways family members organized their daily activities and routines, as well as how systems and artefacts emerged for communicating and facilitating family members’ needs (Wakkary and Maestri, 2007, 2008). It was found that family members often planned their actions around the organization of their schedules in relation to other family members’ activities. In some cases, these plans were subject to less than preferred situations that appeared sporadically (not unlike instances where objects break) but for the most part, we found that participants had the space and time to address these situations. Conversely, observations of everyday repair concentrated on the objects themselves and the processes of non-experts in dealing with their state of brokenness. These situations emerged spontaneously, creating inconveniences to non-experts’ daily routines and activities. In short, these situations were often unforeseen, unplanned and mostly unwanted. Consequently, observations of everyday repair contribute further insights to everyday design by foregrounding the ways individuals handled and reacted to their objects’ breaks. These ultimately revealed individuals’ attachments to their objects, how consequential they were in facilitating their daily activities, as well as reflected their motivations for resolving their broken objects’ quickly.

The reactive ways non-experts dealt with their broken objects also highlight the relationships they built with them over time and how these perpetuated creative actions. More specifically, this thesis provides insights into how non-experts’ motivations spurred further actions based on their unique needs and situations. Whether motivations are based on personal interests—as was the case with P2 and his curiosity in repurposing people’s obsolete objects—or ethical values—as demonstrated by P3 and his motivations for storing his obsolete electronics rather than disposing of them—these revelations provide further context as to why individuals resort to different techniques of everyday repair. This was seen in P4’s resourcing of someone’s extra bricks in order to extend and keep her newly purchased desk. This study also shows how they build relationships with their object, as evidenced by P6’s determination to repair her broken sunglasses based on their aesthetic quality. These observations echo those of Odom et al.’s findings around individuals’ rationales’ for keeping or disposing their objects (Odom, 2009), though this thesis unveils the various ways in which these motivations materialize and how they influence repair techniques and processes. Furthermore, this study also
reflects how individuals’ determine the final outcome of the object itself. For instance, P11’s continued use of plastic bags as an effective replacement for her juicer’s cracked waste collector demonstrates the high degree of success a repair outcome can entail.

In sum, the motivations of non-experts and their perceptions of broken provide further insights into the contextual factors that prompt creative actions of everyday designers. In this regard, the everyday repair framework adds further dimensionality to everyday design theory by revealing individuals’ attachments, values, and personal interests. As I describe in the following section, motivations and perceptions of broken can be used as lenses for understanding why non-experts employ certain approaches to repairing their broken objects. As I explain below, the overlaps and contributions of this thesis with everyday design imply considerations and directions for interaction design, which focus on designing towards non-experts level of everyday practice, competences and skills.

**Designing Towards Non-experts’ Dispersive Practices of Repair**

The overall contribution of this thesis to interaction design discourses centers on providing an understanding of non-experts’ everyday practices as a means of designing interactive technologies that accommodate for creative actions of repair and repurposing. The everyday repair framework highlights the basic low-level techniques and processes of non-experts that, for the most part, are learned through experience and by shared understandings of how others repair things. Furthermore, understanding non-experts practices of repair can benefit design based on the conditions that prompt creative actions, as well as by the outcomes that result from their processes, which compel further iterative actions.

In chapter 2, I introduced key practice theorists whose analytical frameworks were extended to frame how non-experts carry out everyday repair as a type of practice. Of particular relevance is Theodore Schatzki’s notion of dispersive and integrative practices (Schatzki, 1996). As noted earlier, dispersive practices entail those that are widely spread across various populations and social groups. Competences and skills are primarily linked through individual's shared understanding of others’ practices. Integrative practices, on the contrary, are those found in more specific organizations and
domains of social life and are bound by rules and end goals, and also through shared understanding.

Understanding everyday repair as a type of dispersive practice can be a helpful lens for interaction design, as it frames non-experts’ level of expertise based on their rudimentary competences and skill sets. More specifically, it characterizes how individuals recognize and are familiar with objects’ materials, the use of a few basic everyday tools, as well as the employment of low-level skills such as joining, deconstructing and bending. Non-experts’ knowledge and expertise are also rooted in their shared understanding of how they and others around them resolve breaks. As was often the case with digital technologies, non-experts found they lacked the ability to repair them given their complex material and functional attributes. Consequently, individuals’ often resorted to storing their broken objects or asked others to resolve them in cases where objects were deemed too rigid or inflexible. For instance, Keeping objects as-is was an outcome that was most visible in the case of digital technologies that encompassed a high degree of complex and rigid material structures. Furthermore, the tools necessary to fix complex electronics also proved to be a barrier to many non-experts, where abilities and know how went beyond the their skill levels. Another common approach, which speaks to Schatzki’s emphasis on the social aspects of practice, were non-experts’ reliance on other non-experts to repair their broken objects. Individuals often resourced other non-experts’ higher levels of expertise. Subsequently, they found they needed to rely on others’ acquired skills instead of resorting to more ‘integrative’ practitioners, like those who work in repair shops.

In thinking of everyday repair as a dispersive practice, interaction designers can approach their design by first considering the material fabrication of interactive technologies that map to the basic competences and skill levels non-experts’ encompass. More specifically, the physical attributes of flexibility, modularity, deconstructability, and simplicity can help designers anticipate the relationship between the creative actions individuals impose on the objects they use, and how the physical attributes of these objects facilitate their design-in-use – particularly in instances where repair is a consideration. To illustrate this point, the following example demonstrates how a non-expert repaired his broken headphones through the use of simple and flexible
materials—specifically, he used an old expired credit card and electrical tape for reinforcing the headphones overall structure.

![Headphone repair using expired credit cards and electrical tape.](https://picasaweb.google.com/dmaranan/Jerryrigging?feat=flashalbum#5566932613349931330)

**Figure 6.3** Headphone repair using expired credit cards and electrical tape.  
(https://picasaweb.google.com/dmaranan/Jerryrigging?feat=flashalbum#5566932613349931330)

What this example highlights are two points; first, that the use of simple and flexible material attributes are successful in the repair of physical and functional breaks. The second point addresses the lack of compatibility physical repair attributes have when translated to virtual breaks typical of digital electronics. In this regard, the repair of digital *materiality* remains an open question and largely unresolved when designing towards the everyday practices of non-experts. The lack of capability non-experts have in dealing with their digital objects' breaks may require a reconceptualization on the part of interaction designers when contemplating scenarios where repair and/or repurposing is a viable (and often necessary) option.
In light of the above example, I propose the following questions as key considerations for interaction design moving forward:

- How can designers rethink the materialization of digital components so that non-experts can employ their own low-level techniques for repairing their digital electronics?

- What does materiality mean in the context of the digital and virtual realms? More specifically, what attributes do digital components take on and how can these be mapped to non-experts practices of repair?

- Do the techniques bending, cutting, disassembly, salvaging, etc., serve as a step in the right direction for informing design practice?

- What does the attribute simple mean in terms of providing non-experts with a sense of familiarity similar to that inherent in physical materials?

In summary, this section outlines critical questions regarding the design of interactive technologies that accommodate non-experts’ repair practices. As a first step, this thesis provides insights into the basic approaches individuals employ when resolving and/or repurposing their broken objects and how these can inspire new approaches to the conceptualization and production of interactive technologies. As mentioned above, there still remains a lack of resolve around how to implement the techniques, processes and physical attributes outlined in the everyday repair framework—particularly with regard to objects’ digitality. This lack of clarity does however, provide directions for future research, particularly studies that look at how to materialize the virtual aspects of technologies using the framework proposed as a set of guidelines. In this regard, the everyday repair framework is mainly descriptive for design researchers and rather points to possible directions for future explorations. My own future work looks to explore these notions further, looking specifically at how both the digital and physical materiality of objects instigate non-experts actions around the creative repurposing and repair of objects, and how these aspects prevent such acts altogether.
Conclusion

This chapter describes the various interrelated factors that propel and instigate actions of everyday repair. Highlighted are the key aspects of everyday repair taken from the grounded theory analysis that show how the conditions, processes and outcomes work in conjunction with each other. To extend the findings of this study, I describe the parallels this research has with the everyday design framework. More specifically, I draw connections between the concepts, categories and subcategories of everyday repair and specify how they share common attributes with everyday design’s concept of design-in-use. This is evidenced in the ways individuals strive to achieve a level of quality that is satisfactory to their unique needs and situations. I also remark on how aspects of design-in-use share processes and techniques of everyday repair, namely acts of transformations/adaptations, resourcefulness and quality assessment. These overlaps provide further evidence of how creativity manifests in the actions of non-experts and everyday designers, particularly in instances where objects are deemed broken and require creative actions around their repair.

The everyday repair framework also provides new insights for everyday design that highlights the ways individuals’ build relationships with their objects based on their motivations and personal experiences with them over time. These insights add another layer of context when trying to understand what instigates specific actions individuals employ in resolving their objects. Lastly, I conclude with a discussion of how everyday repair can be thought of as a dispersive practice. I propose that designers use the notion of dispersive practice as a useful lens for understanding non-experts’ basic competences and skill sets, which can inform material choices that facilitate repair once a technology reaches the end of its lifecycle. I conclude this chapter with future considerations for interaction design—namely, how further work is needed for understanding how design can facilitate the repair of objects’ digitality. In proposing the everyday design framework, it is my goal to highlight gaps in current design practices that need to reconsider how design deals with the repair of digital technologies, prompting future research within interaction design.
Chapter 7.

Conclusion

Summary of Thesis

In post-mortem, this thesis provides a holistic account of the ways non-experts repair their broken objects, grounded in the perspective of interaction design. Through a constructivist grounded theory approach, the final outcome of this work is a theoretical framework for interaction designers that highlights the creative and resourceful ways people approach the challenges of dealing with broken objects. While these situations are mostly undesirable and irritating at best, they do provide a useful lens for understanding the ways people manage their everyday situations. I refer to this ‘management,’ if you will, as everyday creativity—the pragmatist notions of one’s doings and undergoing’s.

I argue that by understanding this type of creativity, it presents opportunities for designers for taking a different approach in the design of interactive technologies that accommodate for the ways individuals regularly adapt, modify and appropriate the objects around them to suit their unique needs and situations. In this light, individuals can be thought of as creative agents in the lifecycle of the technologies they own. This was ever so evident in the observations made of the participants of this study who not only restored their broken objects through acts of repair, but also extended their lifecycle by creatively repurposing them towards different contexts of use. Ultimately, this thesis is one of many undertakings that looks at evolving the identity of the user to one of co-designer—specifically speaking, where authorship of an object is also placed in the hands of everyday people, ultimately giving them control over how an object’s purpose plays out in various contexts, situations and even lifecycles. It is my hope that the everyday repair framework proposed in this thesis stands as a first step for provoking a
paradigm shift around designing towards non-experts’ everyday practice, which is fuelled by creativity and their own sense of agency.

While the findings derived from the grounded theory approach provides some theoretical value, the particular way in which the methodology was used in this study presents some new considerations for those interested in appropriating the grounded theory method for design research. The longitudinal and diverse range of observations made around non-experts’ repair processes were made (effectively) possible through the use of social networking applications (i.e. Facebook) and email. This approach is different from most grounded theory studies, where interviews and discussion groups are typically conducted face-to-face and in-situ with participants. Though there was no face-to-face contact made with the participants in this study, I contend that the data collected over the span of a year and a half was still rich enough to employ traditional techniques of grounded theory, such as line-by-line and word-by-word coding. The nature of online communication also allowed for many discussions with participants over an extended period of time, thus allowing for impromptu opportunities to follow up with participants regarding their broken objects and their evolving state. I outline some of these considerations further on. (See section Limitations and Considerations.)

Through inductive and comparative analysis, three major themes of everyday repair emerged for framing everyday repair—conditions, processes, and outcomes. Each of these themes encompassed core concepts, categories and subcategories that described the various dimensions of everyday repair. Everyday repair conditions entailed individuals’ motivations and perceptions of what they deemed as broken. The material attributes of broken objects also constituted a condition of everyday repair, in which case they either facilitated or prevented repair acts. All these conditions had impact on non-experts’ processes – that is, the conceptual and actionable techniques they imposed on broken objects in the hopes of resolving their breaks. The outcomes of everyday repair entail a variety of consequences, all of which non-experts assess based on their unique needs, satisfaction with the outcome itself, and motivations. One of the major takeaways of this work lies in the revelation that repairs are not static and are rather iterative, taking place over an extended period of time. This is a key consideration for design, particularly when anticipating the (inevitable) end of a technology’s lifecycle.
and what individuals can do with them if they should wish to restore their purpose, or appropriate them for some other use.

There are several implications this research has, specifically for adding to existing theories in everyday design and in the larger context of interaction design. To address the former, the findings of everyday repair add further insights into the practices of everyday designers. Here I address how there are direct overlaps between the two theories, namely in the resourceful, adaptive ways individuals use and repurpose their objects through design-in-use. In this regard, the everyday repair framework provides further evidence for everyday design in its goal to reconsider individuals as a type of ‘everyday designer’—someone who actively adapts and modifies artifacts around them based on their changing contexts and needs (Wakkary and Maestri, 2007, 2008; Wakkary and Tanenbaum, 2009). Furthermore, the findings of everyday repair contribute further observations regarding the creativity of everyday designers, specifically around the relationships they build with their objects over time, and how their attachments and values influence the process by which they repair and repurpose their objects.

Lastly, I conclude this thesis with considerations for interaction design moving forward, championing the need for design to be inspired by non-experts dispersive practices (Schatzki, 1996) as a way to inform the material fabrication of interactive technologies that accommodate for creative repair, adaptations, and repurposing. While the everyday design framework highlights key considerations around the use physical materials, there is still more work needed in determining digital materiality and how these can facilitate non-experts’ low-level, basic expertise in the repair and repurposing of interactive technology’s virtual parts.

In the following section, I highlight the limitations and considerations of this study, and how these stand as possible directions for future research.

**Limitations and Considerations**

In light of the theoretical concepts described in this thesis, here I describe some of the limitations and considerations of the study and how it can be iterated on in future
work. Grounded theory, as a methodology, is an ever-evolving analytical framework in which its epistemological boundaries are under continual scrutiny by qualitative researchers of diverse fields (Charmaz, 2006). I submit again that the process by which observations were made in this study, specifically on non-experts’ repair processes, reflected my own values within the context of interaction design, utilizing the philosophy and core techniques prescribed by Charmaz (2006). In leveraging her concept of constructivist grounded theory, I re-appropriated her analytical framework in a way that suited my own research pursuits, particularly towards interaction design goals. In light of this stance, it is here I wish to highlight some key considerations.

**Participants**

Like all qualitative research studies, the researcher is challenged to find participants to collect data from in a way that can be sustained over a long period of time. This prompted my use of social networking applications like Facebook and email. As I described in chapter 3, my choice of using mediums like email, had allowed me to collect a large amount of data from a sizeable number of people. It is this study’s strength, and by some qualitative research standards, may be seen as its weakness as well. Some may argue that a level of in-situ observation would add further rigor and depth to the data collected and I submit that in future research, a combination of both face-to-face interviews and the online methods used here could add further context to the interpretations made during the analysis phase.

**The Rigor of the GT Analysis**

As those familiar with qualitative research may already expect, coding the data was not a linear process as perhaps suggested by the initial coding phase and focused coding phase described in chapters 4 and 5. As Charmaz describes, the GT method is a messy and non-linear process (2006). In many instances, the initial coding of the data happened at the same time as the focused coding—sometimes even in reverse as participants submitted new data that forced me to re-frame and reconstruct initial interpretations. There were times I had to re-do the analysis of the initial codes, especially where I recognized I had forced my own ideas on participants views, thus re-building some of the focused codes. As an example, this was the case when I had
assumed P15 had regarded his mis-cut piece of plywood as ‘broken’ – leading me to construct notions around broken that were not necessarily true. This again, is not so much a limitation of my study, but a consideration of the GT process that is common to all qualitative research.

Another consideration around my study findings is rooted in my use of memos as a beacon for finding the gaps in my interpretations. When gaps in the data presented themselves, these then prompted and guided my line of questioning in further email discussions with participants. While answers to my follow up questions could be easily answered via email, some questions required more in-depth conversations. As an example, I found could get a sense of a participants’ context of use regarding a broken object when looking at the images of their objects, though I often had to infer the location and routines of individuals, as well as the ways some objects were used on a daily basis. This again highlights how more face-to-face contact with participants could ground observations around non-experts’ repair processes. In sum, there were moments along the analysis where inferences were made with submissions that had little text or visual data, though these were accounted for as much as possible through a series of email discussions with either the participants whose accounts lacked depth, or were derived through other participants’ examples that were similar. The limitations of using a strictly online method can be augmented of course with in-situ observations and interviews (as most GT studies are done). I sustain, however, that the ease with which data was submitted, collected, analyzed and further validated via online discussions in this study was a beneficial aspect of the method.

**Future Work**

Charmaz describes a successful grounded theory “*lies in [its] flexibility and that one must engage the method to make this flexibility real.*” (Charmaz, 2006, pp.178) In short, a strong grounded theory provides insights to other contexts, in which a theory or framework can be appropriated for other research endeavours. While I hope this is true for any reader who happens to pick up this thesis (i.e. beyond my supervisory committee!), I myself plan to further refine, adapt and evolve the everyday repair framework in future investigations into everyday creativity. As previously mentioned in
chapter 6, there are several directions this research can delve into. Here I highlight some of the concepts and ideas I have entertained while writing this dissertation—these all look at how creative actions manifest in the everyday and their potential for informing interaction design. I outline these directions in the following sections.

**Exploring Everyday Creativity in Sustainable Interaction Design**

Another context for extending the framework of everyday repair lies in current discourses within Sustainable Interaction Design and HCI. More specifically, there is synergy between non-experts’ repair processes and outcomes that share overlaps with Blevis’ framework on guiding future sustainable interaction design (Blevis, 2009). For instance, in his paper (2009) Blevis outlines two key aspects of his sustainability framework; *Linking Invention and Disposal*—that is, taking into account the obsolescence of interactive technologies that are either replaced or disposed of due to the adoption of new technologies, and *Promoting renewal and reuse*—the notion that new technology designs must prioritize the salvaging of existing objects, as well as the recycling, remanufacturing, and reuse of an object as it is. Everyday repair may be a useful lens for understanding how individuals ‘innovate’ new ways of avoiding the disposal of their objects through their reuse and appropriation.

This framework also adds further perspective on the sustainable practices of everyday people, which echoes similar observations discussed by Pierce and Paulos’ research (2011). In their paper they describe how sustainable conservation practices of individuals were often conducted without individuals intending to be sustainable. As described through this thesis, a key outcome of everyday repair is the creative repurposing of objects as a means of sustaining their longevity. In appropriating broken, dysfunctional and obsolete objects, I see value in pursuing future work that looks at how acts of creative repurposing can contribute further understanding into the inherent ways individuals exercise sustainable behaviour, thus questioning how interaction design and HCI should intervene.

As a segue from this last point, I would like to investigate how non-experts’ creative and instinctive practices may contribute further insights into discussion of the design of sustainable technologies. There is a corpus of work within HCI that looks to
negate the unintended use of sustainable technologies as such actions are seen as disruptive and deviant to the intentions inscribed by designers, resulting in the failure of the technology to encourage users to be more sustainable. One approach, as described by Jelsma (2006) looks at enforcing intended behaviour through a more holistic understanding users’ cognitive models, or by what he describes as an understanding of user logic—“the consistent whole of heterogeneous rationales that consumers mobilize in their interaction with scripts in everyday practice.” The research I propose here would counter this approach by looking at how an understanding of individual’s creative practices can inform the design of sustainable technologies, which encourage people to understand and be conscious of wasteful energy and/or product consumption based on the ability to adapt and creatively repurpose them towards new contexts of use.

_Understanding the Practices of Creative Communities (like DIY)_

A second area of research could look at extending the strategies and techniques described in this thesis and compare them to the creative actions of whom Paulos and Kuznetsov refer to as _amateur experts_—individuals who are often involved in DIY communities. Unlike the non-expert, the amateur expert actively seeks to repurpose (or hack) technologies towards new purposes and contexts of use. An example community would be like Hack a Day (hackaday.com), a blog group dedicated to showing the latest hacks in technology.

This research would highlight the ways individuals seek improvements in quality as an integral part of such communities, as members share how they’ve salvaged old electronics by finding other accessible parts that improve the way they work. As an example, the hack below demonstrates an easy way of utilizing an old alarm clock LCD by using common electronic circuits and arduino (see Figure 7.1) (http://hackaday.com/2011/02/10/driving-a-salvaged-lcd/). The programming allows these readily available displays to be used in many new ways. This hack is part of a tutorial/proof of concept that teaches individuals how to _drive_ the basic functions of an LCD. The author provides a break down of the LCD’s basic properties and components for individuals to consider when repurposing salvaged LCDs. (http://arduino.cc/forum/index.php/topic,51464.0.html).
Understanding the techniques of creative communities, as demonstrated by the example above, can also contribute to an emerging theory around how to extend technology’s lifecycle through the adaptions and resourcing of salvaged obsolete technologies, as well as the common ways they articulate the materiality of digital components in their own work.

**Understanding the Creative Agency of the Physically Impaired**

Another potential area for future research looks at informing Universal design (UD) practices based on a qualitative understanding of how those with physical impairments adapt and appropriate the artefacts and systems around them to suit their unique needs. Similar to this research is Ana Correia de Barros et al.’s work in understanding how stroke victims adapt and create their own assistive devices in the home to serve other needed functions (De Barros et al., 2009). This proposal differs from more recent studies, which claim the most effective method for informing UD is by characterizing the various levels of users’ capabilities based on models like the inclusive design cube (IDC), elemental resources model (ERM), and capacity-demand theory (CDT) (Keates & Clarkson, 2011; Persad et al., 2007). These models help predict users’ performance based on sensory, motor and cognitive capabilities, as well as map these
capabilities in relation to the larger populace so that a product's design serves the majority of users without unnecessary exclusion.

It is my view that primary use of analytical models like IDC, ERM and CDT enforce a constricted and binary view of users as either capable or incapable of using a technology based on quantitative-based metrics. My own explorations would look at how a more comprehensive approach to UD would augment the current quantitative based methods mentioned above. More specifically, this research would extend current UD theory by providing a deeper sociological understanding (through an ethnographic-grounded theory approach) of how those with impaired motor capabilities creatively and resourcefully adapt their artefacts in their everyday settings. The central question of this proposal would be; “how can understanding the creativity and resourcefulness of those with motor-impairments inform universal design methods and practice?” Furthermore, the everyday repair framework defined in this thesis could provide some insights into the differences between the practices of non-experts (when dealing with broken objects) compared to individuals dealing with physical impairments, thus augmenting the existing framework to accommodate for the creative techniques and processes of the physically impaired.

In sum, the end goal of this research would be to construct a new identity of the physically impaired that describes users as proactive agents who adapt and modify everyday artefacts in new and unintended ways despite their diverse and unique capabilities. This would add further dimensionality to this thesis work, specifically in informing interaction design that design towards everyday practices and considerations around materiality. This work can also add to current discourses that look to re-conceptualize the user to someone who embodies creative agency, leading to more comprehensive UD practices.
References


Appendices
Appendix A.

Example of Email Discussions with Participant P15

Below is a transcript of an email correspondence between P15 and myself. [Note: Responses are in the order of most recent to oldest.]

From: [15]

Subject: Re: Help needed for Study – RepairED

To: Leah Maestri [Personal Email]

Hi, Leah

You can absolutely ask me more questions; I'm glad I can help.

[P15]

On 2012-03-12, at 2:36 PM, Leah Maestri wrote:

> Hi [15],
> > This is so awesome! There is so much here I can work with. It's been so tricky finding the line between what people regard as a repair and what people deem as 'broken.' Regarding your answer below, I think more questions will come up as I go through and do a thorough analysis your thoughts. Do you mind I email you again if a question arises?
> > Thanks so much again for your response - I really think the notion of "scrap" is interesting and I know I'll have some more questions around that.
> > Best,
> > Lee
> > ---- Original Message ----
> > From: [15]
> > To: Leah Maestri [Personal Email]
> > Sent: Thu, 08 Mar 2012 00:59:12 -0800 (PST)
> > Subject: Re: Help needed for Study - RepairED
> >
> > Hi, Leah
To answer your questions:

Something mis-cut is absolutely not broken. It just hasn't yet shown how it will be useful. When I moved up to Canada, I put a lot of my stuff in storage, and got rid of a lot of my supplies for future craftiness. I miss having the tools & supplies to re-purpose old objects.

And now that you've got me thinking about this again, there are a lot of things coming to mind, and not in any sensible order. So bear with me:

The first is Scrap, a nonprofit in Portland that sells supplies for creative and artistic re-purposing. The things they sell aren't necessarily broken, but definitely surplus (e.g., a barrel full of unused wine corks). But there's also plenty of obsolete things you could buy – I remember bins of old AOL CDs and floppy disks. It's a wonderful source for projects. I'm bringing up Scrap partly because it's awesome in its own right (I should make sure [Phil] and [Martha] know about it...) and also because it leads into the next story.

So Portland has an annual tradition called the Bunny on a Bike ride. On Easter morning a bunch of people dress up as rabbits and go for a bike ride. There's a potluck at the end. My plan one year was to go to Scrap and get supplies for making bunny ears. Except nothing at Scrap was speaking to me to be bunny ears. They did, however, have a barrel of miscellaneous wooden boards (possibly mis-cut pieces from other projects); I got two thin planks and made a cross (for the Easter theme). Also, a cute guy asked me out on the bus ride home.

And speaking of Scrap, there's also a good story (too embarrassing to tell over e-mail) about the time I went there to make a halloween costume and a six-year-old girl helped me make a fairy costume.

A few months later, I nearly got to re-purpose the planks again. There was a different ride with a theme of "come as your favourite XKCD character." I thought of this strip, and figured I could show up wearing one of the boards (not as a cross). Sadly, though, I didn't make it (there was another, better ride at the same time).

And speaking of bikes, re-use of broken materials is rampant among cyclists. Especially old inner tubes; once they're too punctured to be patched up anymore, they get re-used as tie-downs. Some people make arts and crafts out of old tubes. I used to have a bracelet made out of an old tube, metal snaps, and a piece of transparent plastic with a bird on it. (I may still have the bracelet somewhere.) There are inner tube belts. I've even seen instructions on how to make harnesses for sex toys out of tubes & other bike parts.
> One time, I was in an accident and broke my wrist. It hurt bad enough that I needed a splint. My old Scout first aid guide ended the section on splints with: "Look around you now. What do you see that you could use as a splint?" The first things I saw some were some old inner tubes and my big allen wrenches (about 10mm thick by 10-15cm long). So that's what my splint was made of. The next day, the doctor at the clinic was so impressed he stopped the exam to show my splint to the other doctor.

> Back in Portland, I used to volunteer with a nonprofit that accepts old donated bikes and puts them back into the community. (I fixed a lot of kids' bikes that we gave away to low-income families.) Not every donated bike is worth saving, so we'd disassemble them to recycle the metal and toss the plastic. In the process, interesting parts would sometimes go home with the volunteers. I got a rack for my bike that way, as well as a comically-large rear reflector. Sometimes, we'd re-purpose frames, too. We kept the bikes to be torn down outside in a pen, and theft was a problem. Scrap metal thieves would take them, depriving us of the recycling money. So one of the employees built a roof for the pen out of old bike frames welded together.

> There's a whole subculture of freak bikes, which is about taking existing bikes (often low-quality department store bikes that can't be fixed "properly"), hacking them apart, and welding them together in weird ways. Tall bikes are the most commonplace example. But you can also make bikes with extra-long forks, with pivots in the frame so they sway side-to-side, with reversed steering, etc.

> One more story about the bike nonprofit: So they used to have this meal filing cabinet where the bottom drawer was hard to open. The staff started using a crowbar to open it. After the cabinet had been thoroughly abused, me and this other volunteer Ollie got asked to fix it. The rollers were all broken, and we had to scour the shop to find replacement parts. I wish I remember what we used – something tiny and plastic.

> Even with the new rollers, the drawer didn't fit because the frame of the cabinet had been bent from the crowbar. We had to bend the frame back into place. Ollie asked one of the other volunteers, a mechanical engineer, for advice. The ME told us where to hit the frame with a big hammer. We didn't have a big hammer. We did, however, have a supply of bike frames that people outside were tearing down. So Ollie and I found a frame from some 1970s steel behemoth and used that as a hammer, smacking the cabinet with the head tube (that's the part of the frame below the handlebars and above the front wheel).

> After our modifications, the filing cabinet opened and closed again. Not perfectly, but OK. Much better than before. The repair lasted a few months, before one of the staffers replaced the filing cabinet.

>
When I was little – maybe five or six – my dad had finished a woodworking project, and I was entranced by the idea that things could be made instead of bought. So after he finished his "real" project (and I have absolutely no idea what project that was; something long forgotten), he helped me make a project out of the scraps and mis-cut pieces. I made a little toy barge that's still at my parents' house somewhere.

And after all that, I'll get around to your second question: I don't think of the monitor riser as being repaired, because it's unstable. The mis-cut board has a larger area than the footprint of the monitor riser. I had to carefully place the board and monitor so the monitor wouldn't tip over. And if something came down hard on the front of the board, the monitor could tumble down. So it won't really be repaired until that's solved. But I've also been living with it that way for over a year now...

Thanks for the opportunity to reminisce. Let me know if you have questions about any of this.

On 2012-03-02, at 10:07 AM, Leah Maestri wrote:

Hi [15],

I hope this message finds you well! I have been heads down trying to write my thesis and it's been a slog. [...] [Deleted text – personal content]

I've had to redo a lot of my analysis around my repair study and had come across your submission. I have two questions related to your roommate's mis-cut piece of plywood. I hope you don't mind taking the time to answer it? If not I understand, I know you're busy too.

Questions are:

Do you think that something being 'mis-cut' renders it as 'broken'?

Do you think that by repurposing it the way you did (as a flat surface for your monitor riser), that you have in a sense repaired it? Or do you think of it more as a modification?

That's all. If you can describe whatever you think about these questions please let me know. Any answer will be insightful.

Have a great weekend!

Lee
Original Message

From: [15]
To: Leah Maestri [Personal Email]
Sent: Thu, 21 Oct 2010 12:50:07 -0700 (PDT)
Subject: Re: Help needed for Study - RepairED

Hey, Leah

The lamp used to be Grandma's, yeah. It had sentimental value; that was why I was hanging on to it. I really don't remember how it ended up by the door. It might have been that I put it there to remind myself to fix it someday. (I did that with some other projects; that spot by the door turned into the home for things that I meant to get to someday.) The use as a coat rack wasn't intentional, it just sort of happened. I would have 3 or 4 coats piled up on top of the rack (more if I had friends over).

I also don't remember why I decided to use tin foil on the popcorn popper. I remember trying to make popcorn once without the butter tray, and popcorn got all over the kitchen. Aluminum foil might have been the first thing I tried.

My roommate Shane (the one who owns the bowl) liked the ornamental pattern on the bowl. Shane refuses to use the bowl; our other roommate (Chantelle) uses it a lot and I use it sometimes. The amount of leakage is pretty small, so you can just clean it up with a napkin, or keep a plate under the bowl. We were just talking about this the other day. I had made some pasta with a thin sauce. Shane was doing a project that was taking up the entire dining table, so I couldn't eat there. I was going to eat in the recliner chair, but I didn't want to spill on the fabric, (partly because of leakage, but partly just regular bowl spillage) so I ate on the floor.

So the piece of wood got put in the corner, between the dining table and the kitchen cabinet. I didn't think about using it for the monitor riser for over a month. I'd bought the riser, and meant to return it, but didn't get around to it until the 30 days had passed and I couldn't return it to Staples. Then I was having a conversation with Shane that went something like this:

Shane: "I don't know why I've been keeping this piece of wood next to the table."

[P15]: "Isn't that one of the drawers from the cabinet? That you took out to make room for tall stuff?"

S: "No, it's the old keyboard tray from my desk."

[15]: "Oh, yeah. So why the hell have we been keeping that?"
After a pause: "Oh, I know what I can use it for."
And then I tried putting the board on the monitor riser.
I’ll try to get you a sketch of the lamp sometime.
Take care

On Oct 20, 2010, at 10:47 PM, Leah Maestri wrote:

[15], you rock!

This is by far one of the best responses I've received so far. SOOOOO interesting!

I hope you don't mind but there's some things I'm wondering about...

Your old lamp - this used to be your grandma's? Did this too have sentimental value when you were using it at your Portland residence? What made you decide to put it next to the door? Did you intend to use it as a coat-rack or did this kind of evolve by accident?

For your popcorn popper... how did you decide to use tin-foil? It seems like a simple solution, but your thought process is what interests me. How old is the popcorn machine? Did you ever think about replacing it?

Love the cracked bowl! Based on my interpretation, it's as though there's a ritual around eating out of this bowl and that involves the bit of leakage... is that correct? When you say your roommate likes the pattern, do you mean the pattern design on the bowl, or the actual use of it?

The riser for your computer screen: Where did you keep that piece of wood before you found a new use for it? Was it near by and you decided it would help out the situation with your monitor? It's a great and creative solution!

And yes... I'd keep that rocking chair too. Looks uber-comfy. :)

Thanks again for your response and I hope you don't mind answering the above questions.

See you around school!
Lee

----- Original Message ----- 
From: [15]
To: "Leah Maestri" [Personal Email] 
Sent: Wednesday, October 20, 2010 10:23:16 PM
Subject: Re: Help needed for Study - RepairED

Hey, Leah

Here are some rambling anecdotes that come to mind:

At my apartment in Portland, I had an old lamp that used to belong to my grandma. It was a floor lamp, about four or five feet tall, and the light clamped onto a pole. I don't have a picture, but could draw you a sketch if you wanted. The important parts are that it was broken, and that the top of the lamp was a pole. I'd put it near the doorway to... I don't remember why I put it there. But for years and years I used it as a coatrack. I finally got rid of it when I moved up here. (I made a few attempts at fixing it, but didn't get very far.)

Another thing of my grandma's I'm hanging on to is her old recliner chair. A few years ago, it stopped reclining. (Some of the metal bushings wore out, so the parts no longer move smoothly.) It's still a comfy chair to sit in, so I want to keep it. (Also, it has sentimental value.) At my old apartment, I was always having to tell people it doesn't recline, usually after they had trapped themselves. (To be precise, it reclines okay, it just doesn't want to return to the upright position.) At my new apartment, I solved the problem by putting it up against the wall. Now it doesn't afford reclining, and nobody gets trapped.

I have an old popcorn popper that I've had forever. It originally came with a little metal dish to melt butter in. The idea was that as the popcorn pops, the hot air runs under the dish and melts the butter. That dish has been missing for years. Instead, I have a sheet of aluminum foil over the hole where the dish goes. (If you don't cover the dish, the popcorn shoots out the hole and gets all over the kitchen.) In one sense, it's now less functional, since I have to melt the butter in the microwave. In another sense, I've fixed a safety problem: The dish would get darn hot, and I remember burning my fingers on it when I was little.

My roommate has a bowl (for eating, not serving) that is cracked, leaks a little (just barely), and is generally about to die. When he moved in, he kept it because he likes the pattern. We use it all the time. When we stack the bowls in the cupboard, the nearly-broken bowl is always near the top, so it's always one of the first ones we grab. (In the photo, the cracked bowl is the second from the top.)
When my roommate got his desk, he went to Home Depot to get some plywood to make a keyboard tray, but he cut the plywood too small and couldn't use it. We kept the board around for months, for no particular reason. Then I got a monitor riser for my desk. Except my monitor has an enormous footprint and didn't fit on the riser. I ended up putting the mis-cut plywood between my monitor and the riser, and now the monitor is at the right height. (You can see the feet of the riser underneath the plywood.)

Good luck on your study!

On Oct 19, 2010, at 7:36 PM, Leah Maestri wrote:

Hi,

I am running a study as part of my thesis. This study is fairly simple and quick to do - any participation would be greatly appreciated.

I am interested in understanding how and why people repair broken objects in their home. The questions I would like you to answer are:

Do you have something that is broken but not thrown away?

Do you have something that is broken which you have repaired and is now more valuable (monetary or sentimental) /functions better than before?

Do you have something that is broken which you are still using or reusing in a new way?

If you can answers these questions and possibly *include a picture of the broken item* as an attachment that would be extremely helpful. I know it's mid-term time, so I'm grateful for any response!

All the best,

Leah
Appendix B.

Initial Coding Excel Spreadsheet (Excerpt)

Figure B.1  This is an excerpt of the initial coding excel spreadsheet showing participants’ names (blacked-out for identity protection), alias (i.e. P#), and text response (color coded.) Initial codes are below (separated in two columns to show two rounds of initial coding.)

<table>
<thead>
<tr>
<th>Participant Name</th>
<th>ID</th>
<th>Object(s)</th>
<th>Object Type (1)</th>
<th>Participant Response</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P1</td>
<td>Ladder (open)</td>
<td>Electronic Digital</td>
<td>My buddy. What a pass. But still use it because I can’t afford to get a new one and it’s become a heavy necessity for work. Beyond social networking.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lamp light</td>
<td>Electronic Non-Digital</td>
<td>(P) I got a ladder from a friend, and I know. But I put it back together some day. (P) I know, the ladder can only be used with other metal rods and I never used that neighbor’s. No second value naturally. (P) I never used it and put it back together. Although, did use it last week before a year ago. I went to that house when moved out.</td>
</tr>
<tr>
<td></td>
<td>P2</td>
<td>Stage lights</td>
<td>Electronic Non-Digital</td>
<td>(P) We put these spotlights on my friend’s basement when he was moving out. They used to be duty &amp; shine so I gave them to me and never used or too much I put them aside. I put them actually to a storage place. But now, I have used this for a sweet spot-lights. (P) It was also used as a storage place, but now I have used it on stage.</td>
</tr>
</tbody>
</table>
|                  |     | Film Cans | Non-digital | (P) I don’t know how much this helps you, but I found this when I survived yesterday!2/3: 12:30. Some film containers that I was using was on the shelf. I had this for 12 years! Now I know that this is a great way of keeping a piece of news changing抬起。有了一个电话我可能会知道。 

However, the container has been better days as it is. Though, the type of everyday use for the past few years. Have been bought to have expended along its side and bottom and I don’t care what happened after all. (P) I don’t know how much this helps you, but I found this when I survived yesterday!2/3: 12:30. Some film containers that I was using was on the shelf. I had this for 12 years! Now I know that this is a great way of keeping a piece of news changing抬起。有了一个电话我可能会知道。 

However, the container has been better days as it is. Though, the type of everyday use for the past few years. Have been bought to have expended along its side and bottom and I don’t care what happened after all. (P) I don’t know how much this helps you, but I found this when I survived yesterday!2/3: 12:30. Some film containers that I was using was on the shelf. I had this for 12 years! Now I know that this is a great way of keeping a piece of news changing抬起。有了一个电话我可能会知道。
**Figure B.2  Initial codes (associated with above image, Figure B.1)**

<table>
<thead>
<tr>
<th>Codes</th>
<th>Code II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dropping object because of its dysfunctionality.</td>
<td>Leaving a broken digital object as is</td>
</tr>
<tr>
<td>Continuing use of broken object because of financial cost.</td>
<td></td>
</tr>
<tr>
<td>Continuing use of broken object because it is still useful.</td>
<td></td>
</tr>
<tr>
<td>Broken object is used in its current state.</td>
<td></td>
</tr>
<tr>
<td>Intentions to repair non-digital and electrical object in the future.</td>
<td></td>
</tr>
<tr>
<td>Using glue to repair non-digital / electrical broken object.</td>
<td></td>
</tr>
<tr>
<td>Feeling neutral about a non-digital / electrical broken object's state.</td>
<td></td>
</tr>
<tr>
<td>Collecting odds and ends from other people.</td>
<td>Inheriting junk from others.</td>
</tr>
<tr>
<td>Finding and repairing stored/old/dusty broken non-digital / electrical objects.</td>
<td>Acquiring and repairing old/dusty broken non-digital / electrical objects from other people.</td>
</tr>
<tr>
<td>Rewiring non-digital objects to repair them.</td>
<td>Creatively repairing an object and failing.</td>
</tr>
<tr>
<td>Repurposing non-digital / electrical objects for unintended purposes.</td>
<td>Collecting and repurposing old broken objects based on personal interests/hobbies</td>
</tr>
<tr>
<td>Augmenting the features and functions of non-digital / electrical objects for creative use.</td>
<td>Repurposing as a repair.</td>
</tr>
<tr>
<td>Collecting odds and ends from other people.</td>
<td></td>
</tr>
<tr>
<td>Collecting throw aways for creative use.</td>
<td>Creatively repurposing non-digital / electrical object for unintended purposes.</td>
</tr>
<tr>
<td>Repurposing non-digital objects for unintended purposes.</td>
<td></td>
</tr>
<tr>
<td>Breaks resulting from using a repurposed non-digital object for a long time.</td>
<td>Using repurposed objects that become broken / worn out.</td>
</tr>
<tr>
<td>Using a broken object as is</td>
<td>Keeping a digital object broken because of its failed component.</td>
</tr>
<tr>
<td>Using tape to repair a broken non-digital object.</td>
<td>Preventing disposal of a digital object due to environmental guilt.</td>
</tr>
<tr>
<td>Repurposing something broken.</td>
<td>Keeping digital odds and ends.</td>
</tr>
<tr>
<td>Repurposing broken non-digital objects for unintended purposes.</td>
<td></td>
</tr>
<tr>
<td>Non-digital objects are deemed broken based on chips.</td>
<td></td>
</tr>
<tr>
<td>Repurposing non-digital objects based on their inability to carry out their intended function.</td>
<td>Deeming a non-digital object broken due to it being chipped.</td>
</tr>
<tr>
<td></td>
<td>Deeming an object broken due to it not being usable anymore.</td>
</tr>
</tbody>
</table>
Appendix C.

Visual Coding Analysis Examples – Paper Form

Below are images of the paper version of the visual analysis coding.

Figure C.1 Visual analysis coding of P19’s broken skylight crank and mug (above two images) and P20’s broken printer (bottom image).
Figure C.2  Visual analysis coding of P16’s broken objects. NOTE: Bottom image is struck through, as it was ultimately deemed not broken.
Figure C.3 Visual analysis coding of P8’s retrofitted desk and repurposed staircase storage space.
Visual analysis coding of P7’s broken figurine that was glued back together.
Appendix D.

Memo: Assessing Quality of Repair

The following text is a memo I wrote on February 28th, 2012 regarding my interpretations to date on how participants assessed the quality of their repairs. I have kept the initial formatting, colored text, and font as it appeared in the memo to reflect the actual format of the document itself (written in Text Edit.)

Text highlighted in red, underlined or bolded were meant to highlight key ideas and notes to myself during the focused coding phase.

Memo 4 - Assessing the quality of a repair

February 28, 2012

Working Definition: This category speaks to the ways individuals continually assess the success and/or failure of their repaired objects. This category also has undercurrents of the same creative process as those studied in our everyday design project -- specifically in that through use of an object, people can assess whether an object meets an individual's standard.

Participants were asked whether they were satisfied with their repairs, thus this information was not unsolicited. The ways in which the participants spoke about their satisfaction were catalogued for understanding what aspects people look for in the 'quality of a repair' and what parts didn't constitute a successful repair.

[This can be seen as an outcome of repair where by individuals assess the quality of their solution and whether it meets their needs / satisfaction. If a repair doesn't, this may prompt further action.]

This category may need further evidence, but I inferred an individual's satisfaction with their repaired object based on the way they described the final outcome of the repair and gleamed for key words such as "comfortable," or "usable."

Researcher's note: I emphasize that this code had emerged through the statements of participants who candidly offered their happiness around their repair job.
For instance, after P4 was able to collect enough bricks to extend her desks leg length, she states: "After a very long and painful walk in the rain, I was finally able to make my table comfortable and useful."

Such statements infer satisfaction, however implicitly.

Some participants were more explicit about their assessments of their repair job.

P5: "For the dress shoes, I ended up using fabric glue and it worked wonderfully for the first few times I wore them. As you can see, one of the straps have come out so I plan on gluing it back together." [We can assume from this statement that the strap that's come loose was not one of the glued/repaired straps.]

P11: "Ok, I found another ghetto invention in our house! The "waste collector" for our juicer broke, so Ben puts a plastic bag in its place to catch all the fruit spit-outs. It actually works pretty slick b/c we can just pull the bag off and toss it, w/o any clean up! I guess he originally tried to use the broken waste collector [only a man!] and shockingly it didn't work-- threw fruit chunks out all over the place. That's where the plastic bag idea came into his head. He did mention that it's great b/c it requires no clean up, and was nice and easy."

P19: "It [the window crank] used to be really tricky to open and would wobble around and sometimes get stuck. So I took it apart completely, replaced the bolts that fasten it to the wall, cleaned it, oiled all the parts, and put it back together. It now cranks smoothly and is much nicer to use."

P33: "The bamboo stems were broken [on my rocking chair]. They were made to solidify the structure. Thanks to Super Glue, the sad story of this second hand chair (found in the street) has turned out happy! The rocking chair looks like brand new now!"

P35: "For the broken shelf, we prefer to keep it like that as we can put our files vertically inside the shelf. I don't want the shelf to be back, it's more convenient like that, i can store more things!"
P38: "The neck and one ear broke [on my Donkey Figurine]. I went to the nearest hardware store to find a glue that could fix donkey. I finally manage to fix donkey! (RII) [Satisfaction with repair?] Really Satisfied, he’s almost new :-)

P42: "I have a 20 years-old sofa that i got back from my parents. They wanted to throw it away but I just moved in my first own apartment so it was perfect for me! After all this time, this leather sofa had an old worn brown colour. It was not very modern for my apartment so I had added a black sofa cover on it + 2 nice cushions. After that, it was like a brand new sofa. Still nicer than before and it was a sentimental object as i grew up with it!"

In P11’s case we can begin to see that working ‘slick’ and making cleaning up easy are ways of assessing the degree to which their repair job was successful. Success can also be attributed to the fact that a repair technique is used over and over again, despite the repair coming undone.

P28: "I have a couple of old books, and by old i mean VERY old, from ~1800. They have been restitched, reglued, then restitched and reglued again and again, but they still hold up."

P28 also describes his many attempts at fixing his favourite fan and despite having little success, still keeps it.

"Sometimes a little bit of a proper(!) glue can save a broken item. I have a fan thats been fixed 4 times now. (3 times glue, 1 time rewired) And i just cant get rid of it because its fashioned in an old manner and looks like it came from steam-punk universe."

Some participants also critiqued of their repair job based on the positive and negative affects it had on the objects value. As in the case of P15’s popcorn maker, he assesses the success of using tin foil as a replacement for his missing butter dish and how this affects the appliances overall functionality.

"In one sense, it's now less functional, since I have to melt the butter in the microwave. In another sense, I've fixed a safety problem: The dish
would get darn hot, and I remember burning my fingers on it when I was little."

P15 also offers the same critique of his repair of his grandmother's reclining chair. "At my old apartment, I was always having to tell people it doesn't recline, usually after they had trapped themselves. (To be precise, it reclines okay, it just doesn't want to return to the upright position.) At my new apartment, I solved the problem by putting it up against the wall. Now it doesn't afford reclining, and nobody gets trapped."

P19: "She [my wife] was very disappointed when [the mug] got broken in the dishwasher, so I glued it back together. Now, even though it's imperfect, it has a bit of history and is more valuable to us. Like we rescued it!"

P22: "Also it does function quite well as a rug. I think it would be nicer as a middle-of-the-room large area rug than a doormat (it's not the easiest thing to clean/shake out without needing to tinker with the shape a bit) and it does feel good on bare feet. :)

P26: "I had to fix my shower head. It's not really more valuable nor functions better, but hey... I don't smell anymore!!! :P"

People also described when they felt the repaired an object the wrong way or 'improperly', suggesting they were not satisfied with their repair job and that it may been a failed attempt at fixing the problem.

P18: "[...] The decorative buckle on my bikini. Plus I glued it wrong. Twice."

P19: "The strap on my laptop bag is broken: the buckle continually comes undone and falls open (meaning the bag falls off my shoulder). It's been like that for at least a year. I 'fixed' it by tying a big knot in the strap above the buckle. So I haven't properly repaired it but the quick fix was good enough that it's lasted for a long time (even though the knot is kind of uncomfortable)."

P31: "Unfortunately, it was I who tried to repair [the spatula] using fast glue. I realized too late that the piece was upside down. Maybe it is a little bit
more valuable because now it shows to everybody who comes in our kitchen that I am a clumsy. :)

P32: "One of those three stools is broken, the wooden links holding the legs together are unglued and so when we sit on that particular stool, the links fall or separate. Its very aggravating. But I keep plugging them back in (without gluing them for lack of effort) and the stool stays there because its part of my three stool set and the set goes with my extended breakfast counter."

What is interesting in P32's case is that even though the plugging-in of the stool branch keeps coming undone, it's easy enough to do and keep doing to satisfy a repair attempt, despite it being so 'aggravating.' Also in the case of P19, his tied is bag strap to the buckle to quickly fix his strap, however improperly in his eyes. Because the solution fixed the negative outcome of the strap coming undone (and then falling to the floor) he seems willing enough to put up with the discomfort for the time being. This may just highlight the fact that people are inherently lazy and a quick fix will always win over a proper fix if it means investing less time.

**FOCUSED CODES:**

1- Quality of repair dependent on restored functionality

2- Quality of repair dependent on restored aesthetics

3- Low quality repair assessment prompts further action

--------------------

Emerging categories from initial analysis

- P11: Attributing success to a repair based on its ability to restore functionality. - 1

- P19: Repair is deemed successful based on it being nicer to use. - 2
- P28: Using the same materials to repair a broken non-digital object over and over again. [Not part of this category] - this could be 3

- P33: Repairing objects is like a happy ending story. - 1

- P33: Satisfaction from repair stemming from it looking as good as new. - 2

- P33: Attributing success to a repair based on its new functionality. - 1

- P35: Assessing the value and success of a repair job. - [Core category]

- P38: Feeling satisfied with a repair based on it looking like new. - 2

- P42: Deeming a repair job successful based on the broken object looking like new. - 2