DESIGNERS AS CURATORS, USERS AS DESIGNERS: A REFLECTIVE STUDY OF HACKING AND CURATION TO EXTEND INTERACTION DESIGN PRACTICE

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DECLARATION

Designers as curators, users as designers: A reflective study of hacking and curation to extend Interaction Design practice

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This thesis is presented as fulfillment of the requirements for the degree of Doctor of Philosophy, at the University of Limerick, Dept. of Computer Science and Information Systems, Faculty of Science and Engineering. It is entirely my own work and has not been submitted to any other University or higher education institution, or for any other academic award in this University. Where use has been made of the work of other people, it has been fully acknowledged and referenced.

Signed:

______________________________

Nora O Murchú
ABSTRACT

This thesis examines the evolving relationship between users and designers: I examine user participation in design and the changing role of designers in order to elucidate how a new understanding of these roles can transform Interaction Design processes. This research is grounded in the theory of Donald Schön’s notion of the reflective practitioner, in turn casting the act of designing and reflecting as central to the orientation of the research. This work builds on empirical material from an extensive field study that examines a community of open source developers (“hackers”) and presents a series of vignettes illustrating experiential accounts of their practice. I brought this community together through the creation of a festival dedicated to creative re-appropriation of technology called “Tweak”. By reflecting on my own practice of design facilitator for these communities, and by discussing in detail the changing relationship between these actors in design, I propose curating as a methodology of potential use within Interaction Design, whereby designers can act as facilitators to engage users in design, rather than providing them with fixed solutions.
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GLOSSARY OF TERMS

**Design terminology:**

Frame: A frame is an active perspective that both describes and perceptually changes a given situation. A frame is shaped by the long-term collection thoughts and experiences, and through the process of sense making is a way of viewing the world and situations that occur in it.

Role: The customary functions that are performed by an actor in a particular context.

Artefacts: A designed object that is made or given shape by users or designers.

Design process: The activities, development and decision making process that a designer carries out until a solution is found to a design problem.

Open-ended design: A design process in which the activities, development and decision making process is carried out by multiple actors participating in the design process. This can result in multiple solutions to design problems.

Everyday designer: an everyday designer is a creative actor who creates and redesigns artefacts long after these products have left the hands of professional designers.

 Appropriation: The creative act of taking apart the components or functionality of a complete system in order with the intention to reuse and remake it for one’s own use.

Bottom up approach: A design model and decision making process where the solution to a design problem begins by working with a large number of people working together, causing a decision to arise from their joint involvement.
Curatorial terminology:

Media Art: A set of artistic practices that use technology as a primary tool or medium

Curatorial position: The conceptual and political stance the curator takes in relation to the topic they are curating. This stance relates the topic to the artist(s), institution, and intended audience, and is composed of the curator’s thoughts and opinion concerning the topic

Manifestos: A declaration of principles and intentions that describes the ideology behind a set of actions

Curatorial toolkit: A set of tools or methodologies designed to be used together or for a particular purpose. These toolkit are used by curators in order to realise the curatorial stance into exhibitions, workshop, etc

Chapter 5:

Potentiometer: a three-terminal resistor with a sliding contact that forms an adjustable voltage divider

Resistor: is a linear, passive two-terminal electrical component that implements electrical resistance as a circuit element

Capacitor: a passive two-terminal electrical component used to store energy in an electric field

Breadboard: is a construction base for a one-of-a-kind electronic circuit or prototype. It does not require soldering and is reusable

Truth table: a mathematical table used in logic – specifically in connection with Boolean functions
Schematic: A schematic diagram represents the elements of a system using abstract, graphic symbols rather than realistic pictures

LDR: light dependent resistor (LDR) is a resistor whose resistance decreases with increasing incident light intensity

Square wave oscillator: A very basic square wave generator using a CMOS 4011 NAND gate

CMOS: Complementary metal-oxide-semiconductor is a technology for constructing integrated circuits

NAND: This is an AND gate with the output inverted

Basic Stamp: is a microcontroller with a small, specialised BASIC interpreter (PBASIC) built into ROM

Chapter 6:

openFrameworks: is an open source toolkit designed for "creative coding". openFrameworks is written in C++ and runs on Windows, Mac OS X, and Linux

addons: in computing is often considered the general term comprising snap-ins, plug-ins, extensions, and themes for software applications

plugins: a set of software components that adds specific abilities to a larger software application. If supported, plug-ins enable customising the functionality of an application. For example, plug-ins are commonly used in web browsers to play video, scan for viruses, and display new file types

Patch: a Unix program that updates text files according to instructions contained in a separate file, called a patch file. The patch file (also called a patch for short) is a text file that consists of a list of differences and is produced by running the related diff program with the original and updated file as arguments
actionscript: is an object-oriented language. It is a dialect of ECMAScript (meaning it has a superset of the syntax and semantics of the more widely known JavaScript), and is used primarily for the development of websites and software targeting the Adobe Flash Player platform, used on Web pages in the form of embedded SWF files

Processing: is an open source programming language and integrated development environment (IDE) built for the electronic arts and visual design communities with the purpose of teaching the basics of computer programming in a visual context, and to serve as the foundation for electronic sketchbooks

MAX/MSP: a visual programming language for music and multimedia developed and maintained by San Francisco-based software company Cycling '74

API: An application programming interface (API) is a particular set of rules ('code') and specifications that software programs can follow to communicate with each other. It serves as an interface between different software programs and facilitates their interaction; similar to the way the user interface facilitates interaction between humans and computers

Syntax: a set of rules that define the combinations of symbols that are considered to be correctly structured programs in that language

Class: a construct that is used as a blueprint to create instances of itself – referred to as class instances, class objects, instance objects or simply objects

OSC: is a content format for messaging among computers, sound synthesizers, and other multimedia devices that are optimized for modern networking technology

XML: a set of rules for encoding documents in machine-readable form. It is defined in the XML 1.0 Specifications produced by the W3C, and several other related specifications, all gratis open standards
Ascii: The American Standard Code for Information Interchange is a character-encoding scheme based on the ordering of the English alphabet. ASCII codes represent text in computers, communications equipment, and other devices that use text.

Eyes web: Open software platform, developed by Infomus Lab. The software can be used for multimodal tracking and is based on the OpenCV library.

OpenGL: Open Graphics Library is a standard specification defining a cross-language, cross-platform API for writing applications that produce 2D and 3D computer graphics.
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CARRY ON
Fernando Orellana
CHAPTER 1:
INTRODUCTION

1.1 Summary of Research
This thesis explores open-ended design practices whereby the “user” participates in the process of design, thus taking on some of the responsibilities of the designer. In an open-ended design process, the user (a term which I will discuss and redefine later on in this thesis) is actively involved in shaping the outcome of a design process, either by contributing to the designers’ work or by taking on specific design responsibilities. These types of activities take place outside of what is considered a traditional design practice, where the designer specifies the process and the intended use. There is a growing interest within Interaction Design to examine and reflect on this broader role of the user (Hassenzahl, 2001; Hassenzahl, 2004; Sas and Dix, 2009; Wright and McCarthy, 2010; Kaptelinin and Nardi, 2009) and in this thesis I explore how these types of design activities by the user affect and question the role of the interaction designer within the process of designing interactive systems.

I review some of the methodological approaches within Interaction Design that have begun to examine aspects of open-ended design and user participation, and I claim that current methodological tools for allowing users to act in this broader role are limited and lacking when dealing with the full range of issues that the concept of active users presents. Therefore, I propose curating – a novel methodological tool in the context of Interaction Design – as a methodology that could provide a means to facilitate users taking on the role of designer.
Furthermore, I argue that by employing curation as a methodological tool, designers can take on a facilitator role in the design of interactive systems.

In order to conduct an investigation of designers and users in the context described above, I have conducted an empirical study of a particular type of “active user”: I examine hackers, who I see as archetypes of this new model of user/designer. By employing a curatorial methodological approach to the research setting, I develop an account of hackers that is based on the understanding of how their practice is carried out. I compare and analyse their practice through Schön’s theory of the Reflective Practitioner, and in doing this I offer a new perspective on hackers as individuals whose practice of design is akin to that of the professional designer. Previous research (Hartmann et al., 2008; Beveren, 2001; Galloway, 2004) examines their practice as one that is distinguished from the practice of the professional designer; in this thesis I consider that the actions of hackers are comprised of the same characteristics and processes by which we, as professional designers, design. I believe offering this new understanding of hackers, interaction designers can understand and create possibilities as means to further the participation of active users and facilitate collaborative design processes. Additionally, this perspective of hackers allows us to reflect and redefine our own role within the design process.

I explore this approach through an empirical study of three cases, where I provide a detailed account of how I employed practices from curation to create conditions in which active users participated in design activities. This empirical study was conducted during Tweak¹, a digital art festival that focused on the practice of hacking, and which I curated and organised as part of this research. I will discuss Tweak in further detail later on in this thesis. From this setting I present three cases that are significant in illustrating different aspects of hacking practice and that highlight how curating may be employed within Interaction Design.

This thesis has the goal of providing the following contributions for Interaction Design: firstly, I propose curation as a methodological tool within Interaction Design, and I identify the curatorial strategies employed within the context of this research. I describe how this approach facilitated my understanding of hackers as reflective practitioners. I claim that this perspective of hackers has the

¹ http://www.tweak.ie
potential to transform our understanding of active users and allow us to extend the
design process to include participatory design practices by these users. I explore this
through theoretical and methodological reflections on reflective practice and by an
empirical investigation of hackers and their practice. This is done through a case
study, which consisted of data from open interviews with several hackers and
participants and video observation of a workshop that I curated during Tweak. This
workshop, which I discuss in further detail in Chapter 5, was an informal
environment in which hackers taught participants how to hack and build with
electronic components. From this data I selected a number of vignettes that illustrate
the different aspects of hacking practice and present issues related to the concept of
the active user.

Secondly, I probe the practice of hackers in further depth by personally
taking on the role of the hacker and discussing how this practice is similar to that of
interaction designers. This is exemplified through a second case study where I
provide reflections from my own experiences of attending a workshop at Tweak as a
participant. From these reflections, which are discussed further in chapter 6, I
present vignettes that demonstrate the nuances of hacking as a design practice. By
showing the shared themes between both sets of vignettes, I formulate how
designers can take on a position of facilitation and enable the user to partially take
on the role of the designer within an open-ended design process. I explicate this role
of facilitation even further through a third case study discussed in chapter 7, and that
outlines how a role of facilitation can be achieved. Finally, I examine how this
curatorial approach and in-depth understanding of hacking practice can inform our
conceptual understanding of users in an active role. Furthermore, I outline how
curation can be applied as a methodological tool that interaction designers can
employ to provide for the participatory activities of users.

I believe that building awareness and understanding of the design practices of
active users is important so that interaction designers can expand the design process
to include these practices. Moreover, this refined understanding can improve the
Interaction Design process in the context of designing open-ended systems.

In summary, the research questions that this research investigates are:

- Can interaction designers employ curation as a methodological tool, and how
can it be implemented within an Interaction Design context?
- Can a curatorial methodology reveal new understandings about the experiences and practices of hackers?
- How can these understandings inform new ways of working with open-ended design practices and users within an Interaction Design context?

As users partially take on roles, tasks and activities that would have been traditionally in the realm of designers, there is an increasing concern within Interaction Design to extend the discipline’s boundaries to support these practices. In the following sections I will introduce some important issues surrounding my research questions, and show how current research has begun to examine aspects of open-ended design and user participation.

1.2 The expanding role of users in design

Within Interaction Design there has been an increasing attention given to the understanding of users as active participants that are able to reconfigure, personalise and adapt technology to their needs and requirements. Thus, the concept of user has undergone profound changes while simultaneously opening up the design process to a wider range of participatory activities.

As computers are increasingly woven into everyday life, there has been a shift in the emphasis of designing interactive systems for work settings to include home and leisure environments. While there is an established perspective within Interaction Design that examines the way in which users behave and operate, there is a growing interest in how the role of the user has become broader with more degrees of freedom (Hassenzahl, 2001; Hassenzahl, 2004; Sas and Dix, 2009; Wright and McCarthy, 2010; Kaptelinin and Nardi, 2009). This is reflected in a number of design concepts that have expanded the boundaries of what we design for: For example Gaver et al. (2003) illustrate how ambiguity can be used as an alternative framework for design to encourage the user to engage with the designed system (Gaver et al., 2003). Sengers and Gaver (2006) also address the importance of supporting several meanings within the design of interactive systems to allow for multiple interpretations of use (Sengers and Gaver, 2006), while McCarthy and Wright, among others, present a pragmatic approach to designing technology that places users experiences at the centre of the design process (McCarthy and Wright,
This evolution and expansion of Interaction Design point toward a greater user involvement in design and suggest that the domain of Interaction Design has become broader and more personal. Consequently, this has led to a more open process of designing, whereby the designer has less control over how users engage and use interactive systems.

As the contextual boundaries of design are increasingly contested, so are the boundaries between user and designer. Recently, there have been a number of factors that have influenced and shaped the degree of user involvement in design: for example, the rise in popularity of user-generated sites has led to a greater number of users online sharing and producing content (Lin, 2007; Fischer, 2010a), while the influence of DIY practices has lead to users’ involvement in actively reconfiguring and adapting systems to their own needs (Buechley et al., 2009). These practices have led to the emergence of an “active user,” who participates in the design process either by contributing to the designers’ work or actively shaping the outcome of the design. I will examine this further in Chapter 2.

As I mentioned, the concept of the user in Interaction Design has undergone profound changes and evolution, from denoting a passive informant in the process, to referring to an active actor and cooperative constructor (Arias et al., 2000; Atkinson, 2006). For example, in Participatory Design users are involved in a design team and are able to contribute to it; however, they are not recognised fully as designers and “official” designers are still present to coordinate and control design activities. The view of users as having the abilities and freedom to act fully as designers is a new topic in Interaction Design and, therefore, not very well developed; even in literature on open-ended design practices, there is a separation in roles between users and designers. In design concepts such as McCarthy and Wright’s (2004) design for experience framework and Gaver et al. (2003)’s ambiguity as a design resource, there is still an emphasis on the designer’s perspective. While these concepts grant users alternate ways to interact with technology, there is still a focus on controlling and guiding the users’ activities and they are not considered as designers. Furthermore, I believe that there is a gap in Interaction Design literature regarding the conception of a user as an active designer or as an active participant in a design process.

In this thesis, I aim at pushing this area of research forward, and I explore literature within the field of curation that focuses on the role of the curator, and I
identify factors that have contributed to the transformation of the role. Curation as a practice has been influenced by social and technological developments (Krysa 2006). Consequently, the role of the curator has been transformed from a carer of objects to focusing on the processes, systems and the interaction between “multiple agents” (Krysa, 2006: 7). With an increasing number of artists taking on curatorial activities, the practice of curating has been transformed (Baker, 2010; Graham and Cook, 2010). As a result curatorial practice has become broader, more socially engaged, and increasingly collaborative (Graham and Cook, 2010). Within the field, research has focused on this blurring boundary between artist, audience and curator. Thus, in my opinion the field contains many practical insights and reflections on how to expand our own role within an open-ended design process.

As users take on the role and activities of designers, attention to how we understand their role is increasingly important. In this research, I explore the implications of the role of fully active users in the design process for interaction designers. I do so by examining the relationship between users and designers and I present data from a field study that investigates hackers, who I consider to be an archetype of this model of user/designer. By examining the practice of hackers, I believe that we can draw pertinent insights into the practice of designing and could inform a novel perspective of active users.

Hacking within open source communities is seen as “making one’s own world by building on others” (Von Busch and Palmås, 2006), reclaiming and reforming the environment into one which fits with the perspective of the user. Hackers are skilled practitioners in programming software and hacking hardware and their practice is about using parts in unexpected ways or creating new components out of pre-existing ones, all the time maintaining and building on existing functionality of systems. In this thesis, I view hacking as a constructive process and hackers as makers and users of open source technologies. The differing perspectives of hackers are critically examined in Chapter 3 of this thesis. The empirical material presented in this thesis examines the practices and experiences of hackers: I present a series of vignettes illustrating the experiential nature of their practice. Furthermore, reflections on theses accounts are provided and are examined through Schön’s theory of reflective practice.

In order to address my first research question, I introduce curating as a methodological tool that could be employed within Interaction Design. I describe
curation and how this practice has evolved and the key elements from curatorial practice that could be integrated into Interaction Design. I also describe how this curatorial perspective has influenced my understanding of the relationship between users and designers. To do this, I introduce the context in which my case study took place: Tweak, an interactive digital art festival I curated and organised for the duration of my doctoral research. I describe how Tweak allowed me to observe hackers in an appropriate setting for their practice and enabled me to gain a deep understanding of their practice.

I examine the practice of hackers through Schön’s theory of reflective practice, and, in doing this, I present a new perspective of hackers as individuals who are engaged with a deeply reflective practice. To answer my second research question I present a selection of vignettes that explore the experiential nature of hacking. By analysing and understanding these vignettes, I seek to address the gap in Interaction Design literature that conceptualises users as designers, thus bringing forth a novel perspective of users as active participants within an open-ended design process.

While literature in Interaction Design points out the importance of allowing users to design and appropriate interactive systems, there is little to support how this objective can be achieved. If we consider users as designers and therefore design to allow this practice, what are the implications for our role within the design process? What methodological means can we use to achieve this? To address my third research question I present a set of design sensitivities whereby the interaction designer acts as facilitator to engage users in design. I illustrate this approach through a series of vignettes that demonstrate how a practice of facilitation can be put in place. Design as facilitation encompasses an approach to design practice where users and use require a rethink of the relationship between the user and designer.

1.3 Structure of this work
Following this introduction, Chapter 2 presents a critical review of relevant literature regarding the shifting role of the user in the design process and their design practices. I explore how the disposition of design has changed from designing for users to designing for actors (Bannon, 1992; Kuutti, 2001) and reveal the implications of this for a design practice. I also present literature from the field of
curation that examines how the role and practice of the curator has shifted from the care of art objects to focus on the process and practice of art making. I believe this literature contains pertinent insights into how interactions designers could reconsider their own role within an open-ended design process. With this chapter I aim to identify the gap in literature this thesis will contribute to.

Chapter 3 presents an examination concerning the different perspectives on hackers' practices that are prevalent within literature. I explore some of the representations of hackers that are prevalent within literature, and show how these accounts of hacking are related closely to the motivations of the hacker. I discuss Schön’s theory of reflective design, and introduce my understanding of the hacker as a reflective practitioner.

Chapter 4 describes the context and methodology for my research, which has been led by my design practice. I present Tweak, the interactive digital art festival I curated and facilitated. I show that the process I have undertaken can be viewed as a series of experiments in which I have simultaneously framed and resolved the research problem in an exploratory manner. I describe my curatorial position in relation to the conceptual development of Tweak, and how I implemented this perspective using a set of curatorial strategies. I also discuss my empirical and analytical methods, which included video observation, participant observation and semi-structured interviews, and the writing of event logs as a means of stimulating reflection.

The subsequent three chapters draw on Schön’s theory of reflective design and provide a frame in which the activities of the designer can be understood. The workshops embody Schön’s approach of ‘frame experimentation’ for exploring the tacit knowledge of the hacker. In these chapters, I present episodes from three workshops I organised with the collaboration of hackers during Tweak. These workshops provided a means to explore the tacit knowledge and practices of the hacker and discuss a series of vignettes that illustrate the rich experiential accounts of their practice. These episodes are further shaped by reflections on my transition from designer as researcher to designer as practitioner to designer as facilitator. The first episode in Chapter 5 is presented from the perspective of the designer as researcher. The second episode in Chapter 6 sees the designer take on the role of participant and presents reflections from this perspective. The final episode in Chapter 7 observes the designer as facilitator and uses the knowing from the
previous episodes to outline how facilitation can be employed in a design situation. These design episodes show differing ways of perceiving the design process between hackers and designers. Structuring the data in this way explores the reflective capacity of design-oriented research and provides articulation of the actions and understanding that were learned in this process including reflections on my methodological approach. The final chapter draws from the analysis of this data and examines whether the research question was answered and to what extent a contribution was made.
2.1 Introduction
In this chapter, I present a critical review of relevant literature regarding the shifting role of users in the design process and their design practices. I will explore how the role of the user has transitioned: moving from passive recipients to active participants within design processes. I outline some of the contributing factors that have led to this shift and discuss the resulting design challenges that have emerged.

I also examine different design approaches within Interaction Design and present a review and examination of current design perspectives that encompass approaches to design practices, where users and use, take on different roles and responsibilities in the design process. I show how these design approaches differ in their configuration of users and their roles in the design process. These approaches point toward a shift in the conception of users, however, despite this growing trend toward greater user involvement in design, I argue that there still is a gap in literature regarding the conceptual model of users as active designers or active participants within a design process.

In my opinion, there are other models of design practice outside of Interaction Design that can inform our conception of users and be useful if applied within our field. There is a growing body of literature within the field of curation that focuses on the role of the curator, and identifies factors that have contributed to the
transformation of the role. This literature illustrates a level of critique and reflection that, in my opinion, is relevant for Interaction Design. Therefore, in this chapter I examine how the dialogue that is occurring within this field can provide insights for our own role within a design process that is open-ended. In addition, I believe that an examination of this literature can reveal ways of thinking and doing about design, and the nature of participation for users in an open-ended design process.

2.2 Open-ended design approaches within Interaction Design

Design is a growing discipline and is under continuous transformation and negotiation due to influences from current social, political, economic and environmental concerns. User participation in Design is not a new topic, and as a discipline Interaction Design promotes the understanding of users to develop suitable design solutions. Consequently, a wide set of methods and techniques have been developed to aid this process, and, within the last decade, we have seen a shift in practice which has led to the development of concepts and practical approaches that attempt to engage with more holistic and experience-centered aspects of interactions with technology (Gaver et al., 2003; Hassenzahl, 2001; Hassenzahl, 2004; Kaptelinin and Nardi, 2009; McCarthy and Wright, 2004; Sas and Dix, 2009; Sengers and Gaver, 2006). These approaches allow us to discover and learn about possible user experiences and they help designers to “explore possible solutions in an insider fashion, directing ourselves as designers towards more informed design of the components which will contribute to people’s experiences” (Fulton Suri, 2003: 45).

Methodological tools such as cultural probes (Gaver et al., 1999) provide interaction designers with means to gather subjective data from users, whereas scenarios (Bødker, 2000) and personas (Grudin and Pruitt, 2002) can represent rich experiential information. Thus, we have seen an expansion toward increasing the quality of everyday experiences that occur around technologies that include new aspects of human life (Sengers et al., 2009), that broaden and contest the boundaries of design.

Winograd (1997) argues that design focus is moving from the design of interfaces between human and machines to the design of spaces that can support communication between people and multiple forms of interaction (Winograd, 1997). New design approaches have expanded Interaction Design and opened up new
forms of inquiry and methods: furthermore, they allow for users to create meaning and their own interpretation of systems by re-configuring and appropriating these systems to their own needs. In these next sections, I will present a brief review of pertinent perspectives in Interaction Design and design literature that have helped shape and define some understandings of open-ended systems.

Accounts of the evolution of HCI and Interaction Design have identified three successive paradigms that have shaped and defined the field (Bødker, 2006; Harrison et al., 2007; Sengers et al., 2009). These include:

• A human factors approach dedicated to the enhancement of the relationships between man and machine. This paradigm focused on the design, evaluation and fit of interactive computing for human use;

• The cognitive coupling of the users’ mind and computer, and consequently, a focus on how users understood and perceived their interactions with technology;

• The cultural aspects and values surrounding technology and its use. This is related to the emergence of ubiquitous computing, where the user is viewed in a broader capacity and influenced by the settings of use and their relationship to other users (Sengers et al., 2009).

While there is some criticism that these accounts of the discipline are overtly simplistic (Wright et al., 2006), in my opinion, these paradigms are useful in that they show us how the role of the user has developed in the design of interactive systems.

Accordingly, there has been an increasing attention given to the user within Interaction Design, and how they experience and use interactive technologies. This has led to a plurality of perspective on users, and approaches on how to involve users in the design of interactive technologies. Thus, how users experience and use technologies has become one of the central concerns for Interaction Design. Hassenzahl (2011) describes user experience as stories, and states that these experiences are not about technology, but instead are a result of the meaningful appropriations of technology by users (Hassenzahl, 2011). These meaningful experiences are supported by the users’ interactions with technology and thus, are unique to the perspective of the user (Alben, 1996: 14; Law et al., 2008: 2396). In McCarthy and Wright’s formulation, experiences cannot be designed; they can only create a frame for individual experiences with technology (Blythe and Hassenzahl,
2003; Hassenzahl and Tractinsky, 2006; McCarthy and Wright, 2004). McCarthy and Wright assume a dialogical approach, and draw from the pragmatist philosophers John Dewey and Mikhail Bakhtin. They present a framework consisting of four intertwined threads of experience and sense making processes that when viewed and fitted together offer a means to help understand why some interactive experiences are engaging and others are frustrating. Furthermore, this framework provides a theoretical understanding about the sensual and emotional conditions of interactions with technology (McCarthy and Wright, 2004). In addition, they argue that designers should be empathic toward the needs of users, but should always maintain their own perspective as designer:

“Central to the dialogical approach to empathy is the importance of each person engaging from their own perspectives and appreciating the other's perspective as other. In an empathic relationship the 'designer' does not relinquish his/her position to 'become the user', a position from which nothing new can be created, rather the designer responds to what they see as the user's world from their own perspective as designer. By holding onto their own perspective each person is able to creatively respond to the other from their own perspective. In contrast with philosophical debates that have separated the sociocultural and agentive self when conceptualizing empathy, adopting a dialogical perspective does not diminish the importance of individual intuition and agency.” (Wright and McCarthy, 2008: 639)

By becoming empathic to the needs of users, designers can understand the “lived and felt experience” of users and understand how to design for those experiences (McCarthy and Wright, 2004: 23; Wright and McCarthy, 2008: 640; Wright and McCarthy, 2010: 3). This approach to understanding technology allows designers to understand the users interactions as creative and open, and demonstrates the potential of technology to support holistic aspects of every day life.

While user experience has traditionally been defined from the perspective of the individual, Battarbee (2004) presents an approach to user experience design that takes into account collaborative experience or, “design for co-experience” (Battarbee, 2004: 79). Based on an understanding of existing theories and frameworks of users experience, Battarbee (2004) suggests that co-experience responds to how users often make sense of their experiences together, allowing the definition and meaning of the technology to emerge from these shared experience
(Battarbee, 2004: 96). The framework pushes designers to consider all levels of experience when designing (Battarbee, 2004; Forlizzi and Battarbee, 2004).

Another key concept that pushes forward this open-ended approach within Interaction Design is Sengers and Gaver’s (2006) concept for engaging users, and allowing for multiple perspectives and meaning making of systems (Sengers and Gaver, 2006). Sengers and Gaver (2006) relate the interpretation of artefacts and systems directly to how a user will integrate them within their lives. They put forward a set of strategies for designers, and argue that they can be employed to allow users to create their own meaning and interpretation, and therefore, more easily integrate the artifact into their everyday lives (Sengers and Gaver, 2006). Furthermore, they point out how their approach suggests “new opportunities for both design and evaluation” (Sengers and Gaver, 2006: 107). With this open ended-approach, Sengers and Gaver aim to provide a means in which users take on some of the decision making in the design process, and support appropriation by a diverse range of users situated in different contexts. Leaving space for users to interpret the role of the object challenges users and asks for them to reflect and negotiate meaning on their own terms. Höök et al. (2008) state that meaning: “is not something a designer can design for entirely, but instead, is completed, lived, by the person experiencing” (Höök et al., 2008: 649). Consequently, the user becomes a co-creator or active participant of their experiences and solve the meaning of the artefact in relation to their own perspective (Dunne, 2006). The approach detailed by Senger and Gaver proposes that it is not just designers who frame and support experience, but it is also about what users bring to the interactions.

Within Interaction Design, there are a number of design-oriented perspectives that make use of open-ended design elements so that users can engage in a more open flexible manner. For example, Höök et al. (2008) promote open ended, ambiguous, yet familiar, tools for users, so that they are in control and can make their own interpretation of use for the system (Höök et al., 2008: 655). Gaver et al. (2003) propose ambiguity as a resource for design, and assert that in employing the concept of ambiguity we can encourage our users to interpret situations for themselves and to “establish deeper and more personal relations with the meanings offered by those systems” (Gaver et al., 2003: 233). In Reflective Design, Sengers et al. (2005) explore the larger issue of reflective design and encourage designers to design technologies that enable users and designers to critically reflect. By building
objects that invoke reflection, Sengers et al. (2005) argue that unconscious aspects of experience are brought to conscious awareness, thereby making them available for conscious choice (Sengers et al., 2005: 50). By encouraging reflection in design, this makes users consciously aware of their choices and can support new awareness and freedom for users. Hallnäs and Redström (2001) argue that awareness and reflection of experiences are necessary in order to be able to articulate, formulate and express them to others. In “slow” technology design, the authors assert that interactions that occur over a longer timescale allow and encourage users to deepen their engagement with the artefact of system (Hallnäs and Redström, 2002: 106). These approaches illustrate how designing for an open-ended user experience is achievable through a sensitive and skilled way of understanding users.

These approaches, along with others, promote more holistic investigations of lived life, they not only expand the design space that we operate in, but additionally, allow for the engagement of users, and provide them with more degrees of freedom from which to operate and participate. However, while these approaches promote new aspects and values related to the users’ everyday life they do not necessarily allow the participation in the process of construction of artefacts or systems. Instead, the users participation is limited to the interpretation and meaning making aspects of the design, and reflections are made on designers, and for designer’s tools.

In the more traditional user-centered design process there is a separation between users and designers: designers make the decisions and users are passive recipients. However, there are approaches within Interaction Design that attribute more participative roles to users. For example, in Participatory Design both designers and users collaborate in the design process: this approach redefines the role of the designer and promotes participation from users by having them actively contribute and shape the outcomes of the process (Schuler and Namioka, 1993). In a Participatory Design process, users are empowered as co-designers that actively contribute to the shaping of the technology throughout the design process (Greenbaum and Kyng, 1991) and design is understood as completed in use (Balka and Wagner, 2006; Dittrich et al., 2002; Henderson and Kyng, 1991). While this approach offers users new responsibilities, their role is still controlled and authenticated by the presence of a designer. Thus, the view of users is still limited and their design actions only considered valid when they occur within a frame constructed by designers.
Within Co-Design, users are seen as co-designers and actively cooperate and work with designers to build solutions to real life design problems (Sanders & Stappers, 2008). According to Sanders and Stappers (2008) Co-Design specifically addresses the collective creativity that takes place at the beginning of a design process. Within a Co-Design process, designers provide “enabling platforms” that seek to amplify the creativity of everyday people (Manzini, 2007) or ‘convivial tools’ that amplify the analytical thinking and decision-making skills of everyday people (Sanders, 2006). Users participate and contribute to the design process because they are ‘experts of their experiences’ (Sleeswijk Visser et al. 2005), and designers play a critical role in shaping and giving form to this idea. The user plays a role in the development of knowledge, idea generation and concept development. While the approach is opened up to a diverse range of actors and stakeholders, the role of the user is still controlled and influenced by the platforms and the tools provided by the designer.

These design approaches focus on the involvement of the user. However, the role of the user is not to design and innovate, but instead functions as a source of inspiration and knowledge from which the designer can generate new design solutions. In participatory design end-users articulate a problem in their current situation and the designer's objective is to solve the design problem in collaboration with users. In co-designing the position of users move towards the designers to jointly generate and test new prototypes for future scenarios. In experience design the designer aims to provide solution to design problems by empathising with the user by understanding their experiences. These approaches aim to gain insight to the current situation of users. While users are invited and allowed to participate hands-on in research and design activities, there is still a distinction between the roles of designers and users.

In contrast with these approaches, Von Hippel (1988, 2005) suggests that particular types of users – “lead users” – will often innovate and develop new products. He identifies lead users as having two characteristics:

“(i) Lead users expect attractive innovation-related benefits from a solution to their needs and so are motivated to innovate, and (ii) lead users experience needs that will become general in a marketplace, but experience them months or years earlier than the majority of the target market” (Von Hippel, 2005: 22).

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When lead users encounter a problem that cannot be solved with current products or systems, they create innovative solutions or modifications that can inspire future design. Lead users can be invited to help designers to jointly develop improvements to existing products or to develop new products. In this role “lead users” are considered as collaborators or co-designers, and they bring skills and knowledge about future design problems into the development process. In contrast with participatory design where user involvement is considered democratic, the goal in the lead user approach is oriented toward commercial goals (Von Hippel, 1986, 2005).

Löwgren and Stolterman (2004) describe the concept of the “thoughtful designer,” stating that: “good design work is knowledge creation and production” (Löwgren and Stolterman, 2004: 24). They argue that design as a profession is not limited to taking problems as concrete and developing solutions for them, instead designers continuously challenge the problem and their own tools. They refer to use-oriented qualities of digital artefacts that contain a variety of elements that can lead to an understanding of how to create value for users: the user’s motivations for engaging with the digital artifact, the immediate sensation of interacting with the artefact, and the social outcomes of interaction. They also provide two more sets of qualities: one relating to the structural attributes of the artifact as they reveal themselves in use, and another addressing the induction of users’ reflection upon their situation (Löwgren and Stolterman, 2004: 102). This approach emphasises that Interaction Design challenges cannot be solved by applying a certain set of rules to create a solution. Instead, it requires an in-depth analysis of the context, knowledge of the constraints and affordances of the materials, and the continuous understanding of insights gained through the process that allow Interaction Designers to employ a designerly way of creating a solution.

Thus a re-examination of Interaction Design processes is requires, and, instead of supplying solutions to pre-defined problems, a designerly way of working can facilitate the solution of design problems using creative processes (Löwgren and Stolterman, 2004). This means moving away from a traditional model of design to a design process that is open-ended and open to evolution over time. This model of design allows users to make changes to functionality and assign meaning when necessary. Thackara (2005) states that the role of designers is evolving and, instead of being individual authors of objects, they are becoming facilitators of change among
large groups of people (Thackara, 2005). Consequently, the role of designer becomes that of a coordinator of process and a facilitator of user participation. This has implications on how interaction designers perceive users and on the tools they use to design. In the next section, I will address the changing role of the user in more detail and discuss some of the contributing factors that have permitted users to take on new participative and creative activities.

2.3 Implications for the perspective of users in design
Currently Interaction Design research is giving an increasing amount of attention to users and to the ways in which they alter and adapt technologies to their own needs. Kuutti (2001) argues that the concept of the user is strongly tied to how we design systems and, while the concept of the user has enlarged and expanded, there are still key aspects of human nature that are missing from the picture of the user (Kuutti, 2001). The definition of the “user” has evolved considerably from a perspective of passive recipients of technology to a view where they are active and important actors shaping the technology to their own needs (Kuutti, 2001; Wyatt, 2003).

Due to the democratising effect of technology, and open online publishing platforms that have become immensely popular such as Facebook\(^2\), Flickr\(^3\) and Youtube\(^4\), there are increasing opportunities for users to take on the role of creators and publishers as part of their day-to-day Internet activities. These DIY media technologies have given any user with Internet access the ability to become a producer of content in a variety of fields, allowing the user to become independent and self-reliant. Atkinson (2006) argues that DIY activity has given democratic agency to the user, providing them with opportunities to create more personal meaning in their environments while simultaneously opening up the design process to a wider range of participants (Atkinson, 2006).

Arias et al. (2000) argue that one of the fundamental challenges for Interaction Design is to invent and create a culture in which humans can express themselves and engage in personally meaningful activities (Arias et al., 2000). If we examine the implications of this for the design process, a number of issues arise:

\(^2\) www.facebook.com
\(^3\) www.flickr.com
\(^4\) www.youtube.com
firstly, in this “designed culture” users take on activities that allow for participation and meaning-making to occur on their own terms. They become free of the constraints that designers impose and are free to engage and participate at their own leisure. Secondly, this has implications not only for the designers’ role, but also for the tools and techniques employed within the design approach.

Increasingly, users are taking on the role of creators and publishers as part of their daily activities on the Web. Fischer and Scharff (2000, 2010) argue that users are most likely to become designers when they are creating personal and socially meaningful artefacts. By extending design boundaries we can allow users to have more control over their artifacts and provide opportunities to encourage and to support contributions by many people in personally meaningful activities (Fischer, 2010b). Consequently design power is shifted towards the users, allowing them to ultimately act as both designers and consumers of the system and allowing the system to be shaped through real-time use. These shifts in design practice have lead to the emergence of the professional amateur (Fischer, 2010b): an innovative, committed, and networked individual working within open source and DIY communities. Driven by non-experts, this movement embodies creation, sharing and discussion of DIY practices from crocheting and design to robotics and auto repair.

Over the last decade, there has been a renewed popular interest in DIY: the resurgence of making can be traced in magazines such as ReadyMade, Craft and Make, which often promote ideas of bricolage and customisation. These hacking and making cultures offer us an alternative approach to engaging with technologies. Even recently within the CHI community, there has been some discussion of the value of DIY methods and their potential within HCI and Interaction Design (Buechley et al., 2009). Buechley et al. (2009) argue that HCI and Interaction Design communities have yet to embrace the potential or value of DIY methods. They highlight that there has been few attempts to engage DIY communities in dialogue on their practice or to conduct detailed investigation of these groups (Buechley et al., 2009). Kuznetsov and Paulos (2010) describe and detail a number of DIY communities and examine some of the processed that participants in DIY communities engage in (Kuznetsov and Paulos, 2010). However, they do not make
any reflections as to how these practices or communities could contribute to Interaction Design or HCI practice. Instead they just provide an account of some of the communities that are actively engaged in the practice of crafting and making. The model of design in these communities illustrates a design process where appropriation of systems and objects is at the centre of the practice. Participants in these communities have access to a diverse set of tools, tutorials, and access to their peers, and are able to collaborate and communicate despite physical and cultural boundaries. In the following chapter, I examine the participants within these communities in further depth and offer an account of a hacker as reflective practitioner that I believe is of use to Interaction Design. I return to a description of hackers and their practices in Chapter 3.

The design approaches and user activities discussed in the previous sections have clear consequences for design practice: firstly, they call into question the designer’s own role in the design process; secondly, they have implications on the tools and techniques designers employ in their practice; finally, they call into question the nature and model of design itself. In a “traditional” design process, designers carry out a set of actions on a situation or problem that result in a designed solution. They pass this solution on to users, who interact and perform a set of operations prescribed by the functionality of the solution. However, this model of design is becoming increasingly contested as users participate in design processes according to their own needs and requirements. In my opinion, there are useful insights in other fields that can inform these concerns. For example, within the field of curation, the role of the curator has been contested in much the same way as that of the Interaction Designer. Within this field there has been discourse and reflection surrounding the ways in which curatorial practice is both learning from and emerging out of artistic practice. The literature in this field has examined how both the practice of the artist and curator can work collaboratively together and better inform one another’s work. In my opinion, it is these reflections that can offer unique insights for Interaction Design practice and the blurring roles between users and designers.
2.4 Curatorial practices

Historically curation has been seen as a practice situated within the context of a museum, and the emphasis was on the collection, preservation and archiving of objects of art. However, with the broadening of contemporary art practice, expanding art markets, and technological developments (O’Neill, 2007a; Krysa, 2006; Funken, 2004; Von Bismarck, 2004), the practice of curation has expanded to support paradigm shifts, art movements, and differing cultural perspectives. As a result, the role of the curator has diversified from a “behind-the-scenes aesthetic arbiter to a centralised position on a broader stage, with a creative, political and active part to play in the production, mediation and dissemination of art itself” (O’Neill, 2007b: 12). Thus, the curatorial role has shifted from the care of objects to the mediation and framing of art, resulting in “a curator who has a more creative and active part to play within the production of art itself” (O’Neill, 2007a: 15). This shift, alongside the rise in popularity of Biennials, Art fairs, artist led spaces, and technological platforms (O’Neill, 2007a; Krysa, 2006; Stevens, 2005; Schubert, 2000; Ferguson et al., 1996) has given the role “new degrees of visibility and responsibility” (O’Neill, 2007a: 17), and diversifying the practice (Rogoff 2008; Tannert & Tischler 2004).

Consequently the practice of curating has expanded beyond its traditional role to embrace more diverse responsibilities, and ways of working. Krysa (2006) argues, “curatorial work has become more widely distributed between multiple agents including technological networks and software” (Krysa, 2006: 7). Thus, as the role of the curator has changed, the curatorial methods have evolved alongside it. Curators are required to deal with the entire process of curation, rather than fixed artefacts. This presents the role with new challenges, and O’Neill (2009) suggests, “the significance of curating as differentiated from art making, is that it acknowledges cultural production as a field of organisation of emergent and open-ended cultural encounters, exchanges, and enactments” (O’Neill, 2009: 8). Curatorial practice can therefore be seen as an active social process where the curator acts as facilitator of participation between multiple actors and entities.

With a shift away from the didactic model of curating, and toward a more collaborative model where both artist and curator work together, the boundaries between artists and curator have become blurred. Dinkla (1994) asserts that the current role of the artist has changed significantly, and instead of being a
commentator standing outside of society, the artist now takes part in the socio-
technological change and judges from within. As artistic practices have expanded
beyond the boundaries of the creation of objects, and incorporated other practices
including collaboration, editing, and interpretation – some of the work normally
attributed to the role of the curator – a new practice of artist as curator has
evolved. This practice challenges the curatorial process, and suggests that the
separation between the making, production, and distribution of art is increasingly
blurred (Graham and Cook, 2010).

In 2000 curator Penelope Curtis drew on a collaborative curatorial model
and invited artists Tobias Rehberger, Joelle Tuerlinckx and Keith Wilson to work on
a site-specific project at the Henry Moore Institute, a Centre for the Study of
Sculpture in Leeds. The artists participated in the curatorial process, and were asked
to select sculptural works that they felt best responded to what sculpture meant
‘now’. In order to make the exhibition, the curator facilitated dialogue between
artists and took into account their perspective within the curatorial process.
Through dialogue and participation, the exhibition revealed how collaborative
practice has expanded to include democratic means of exhibition making. Thus, the
practice of curation can be seen as open-ended, and the curatorial focus is directed
toward the process of curation instead of the production of exhibitions.

As the interaction between curators, artists and practitioners in other fields
becomes increasingly reflexive, the curator can no longer be defined as a passive
facilitator. This positions curation as a practice that is open-ended, dynamic and
active. Graham and Cook (2010) assert that artist led practices suggest “new modes
for curators”, and “attempts at open systems of curating are becoming increasingly
prevalent, both in the field of new media art, and contemporary art in general”
(Graham and Cook, 2010: 301). Consequently, curators must be open to
participation and become responsive to the needs of the artist. Furthermore, Baert
(1996) argues that curators need to become learners and learn from the experience
of other fields to rethink curatorial practice (Baert, 1996), and understanding the
merging roles of artistic and curator, offers an opportunity as to how the practice
can evolve. Graham and Cook (2010) suggest an alternate perspective of the
practice and argue that curators operate in “modes”, performing different functions
– many of which include collaborative and facilitative practices. Graham and Cook
(2010) argue “with artists, curators, and critics taking on hybrid roles, the solution
to these vicious cycles lies not only in expanding our critical vocabularies but also in developing different modes of curating” (Graham and Cook, 2010: 299).

Curation is becoming increasingly collaborative, and boundaries between artists, audience and other actors in curatorial processes blur. Graham and Cook (2010) state that an in-depth knowledge of art practice, including its characteristics and behaviors presents a means by which curators can make decisions on the best way to curate (Graham & Cook, 2010). Consequently, curators have developed new critical contexts for their work. For example, festivals can deal with emerging work, and short exposure of prototypes, and works in progress; art agencies can respond quickly and commission works to suit a wide range of public contexts; art publishing and broadcast modes can respond to distributive networks and understand the importance of self-documenting projects; Labs and collaborative modes cater toward process-based ways of working by bringing the process of production and distribution to the forefront of curatorial activities (Graham and Cook, 2010). These modes show how curation as a practice has responded to and adapted to blurring roles, collaborative activities and technological developments. Furthermore, they offer opportunities to rethink and expand curatorial practice.

In my opinion, the concern of collaborative modes of production and blurring roles are not exclusive to the practice of curating. As outlined in the previous sections Interaction Design has become increasingly concerned with the roles users are playing in design processes. I believe a curatorial way of thinking and working can offer insights to Interaction Design, and provide a means for the role of the designer to adapt and respond to these concerns. In the following chapters, I illustrate how curation was employed as a methodological tool and influenced the ways of working within the context of this thesis.

2.5 Summary
The positions on the nature of design, on design approaches and on user participation outlined in this chapter set the scene for the issues that will be examined further in the scope of this thesis. They set out the assumptions and perspectives pertinent to design practice and research and, based on this literature review, it is evident that an increasing attention is being given to users within the design process but that, however, the perspectives highlighted here show how there
is still a distinct separation between designers and users who design. The work discussed here shows how designers frame users either in relation to the use or to the meaning of the systems and objects that are designed: these approaches, therefore, still constrict users to a passive role. In addition, the reflections and outcomes of these approaches are directed towards designers and only engage the perspective of the designer.

However, there is a growing perspective within Interaction Design that acknowledges the potential of technology to enable users to act as active constructors of their own experiences of using technology, and that includes their perspectives arising the context of their own life. This thesis aims to contribute to this growing body of research and provide insights into this expanding role of the user and to provide insights into designerly ways of working for Interaction Designers.

In summary, from this review we can identify existing gaps:

- The conceptual understanding of a user who designs is not very deep. While there has been some literature that examines the user in this role, there is no in depth analysis that address or support deep understandings of this role.
- From this, there are a number of implications related to the research methods employed in Interaction Design: I argue that we need to introduce more open-ended exploratory tools that can facilitate a user in this role.
- Subsequently, there are implications for the Interaction Designer’s perspective on the design process: if a user takes on some of the creative practices of the designer there is a definite impact on the way the design process will be viewed. Thus, the perspective on design as being fixed is not applicable and instead we need to develop a perspective of design as a process.

In the following chapters I will address these issues in more detail. In Chapter 3, I will discuss the practice of hacking and put forward an understanding of a hacker as a reflective practitioner: it is this perspective of a hacker that I will argue is pertinent for Interaction Design and holds insights to a model of a user who designs. In Chapter 4, I will examine curation as methodological tool and describe how it was employed within the context of this thesis.
DIALOGUES OF NOISE
Maximo Recio
CHAPTER 3:
THE HACKER AS REFLECTIVE PRACTITIONER

3.1 Introduction
As noted in Chapter 1, it is necessary to conduct a more thorough investigation concerning the understanding of hackers in this thesis and to examine the different perspectives on hackers’ practices prevalent throughout literature.

From a review of literature on hacking, it is evident that there are a number of differing perspectives on hackers and their practice: throughout this literature hackers have been identified in turn as artists, makers, political activists, and criminals (Von Busch and Palmås, 2006; Denning, 1996; Denning, 2000; Levy, 1984; Moilanen, 2005; Taylor, 2005; Rist, 1998; Thomas, 2002). While these accounts certainly enrich our understanding of hackers, they also lead to certain ambivalence about the term. Literature discussing the topic tends to view the practice as either constructive or destructive: however viewing the practice in this rudimentary manner overlooks the cultural significance of computer hacking. In this chapter I move beyond this dichotomous view and argue that, in order to understand the significance of hackers and their practice for Interaction Design, we need to re-examine and clarify how we see these individuals in a design setting.

I provide a brief a historical account of the ‘true hacker’ and the ethical philosophy that underpins the practice. I then examine previous literature and discuss how this research has developed classifications of hacking based on different
hacking activities: hacktivists are seen in terms of their socio-political strategies; crackers are considered to have malicious or a devious intentions; makers are considered to be curious hobbyists and experimenters. By examining three diverging strands of hacking practice – hacktivism, cracking and open source makers – I discuss how empirical studies conducted on hacking are focused on understanding and classifying the practice in terms of the values and motivations of hackers. I believe that introducing to the Interaction Design community a concept of hacking that is based on a motivational perspective is of little or no merit due to the diverse nature of the practice. Furthermore, I believe that a motivational account of hacking limits our understanding and omits pertinent aspects of hacking ethos and the cultural significance of the practice. Rather than seeing hackers in terms of black and white or the motivations behind their actions, I offer an alternate view of hacking based on an examination and understanding of their actual process and practice.

Finally, in this chapter I discuss Schön’s Theory of Reflective Practice, which provides a framework for understanding hackers as reflective practitioners. Given the widely developed account of reflective practice within Interaction Design, it is this perspective of hacking that is discussed in detail in this thesis. This understanding of hackers is grounded in and guided by an awareness of the nature of the practice and provides us with a means to appreciate how they experiment, enquire and evaluate in the context of their activities. In addition to this, I also discuss the implications, methodological concerns and pertinent aspects of hacking that can be employed within an Interaction Design context.

During the course of this research, I have explored literature from several different areas including: Cultural Studies (MacKenzie and Wajcman, 1999), Science and Technology Studies (Turkle, 2005; Law, 1991; Latour, 1999), Curation (Krysa, 2006), HCI (Buechley et al., 2009; Wang and Kaye, 2011; Dix, 2007), CSCW (Brown and Barkhuus, 2007; Ducheneaut, 2005) and Design Studies (Galloway, 2004; Hartmann et al., 2008). The breadth of the literature presented here illustrates the many differing perspectives from which hackers can be analysed and understood. In addition to examining literature from these fields, I also have explored texts from a multitude of online hacking sources including forums and websites (Raymond, 2004; DaMe, 2002). Although these resources do not qualify as peer-reviewed academic references, their inclusion in the thesis is important as this material represents an
account of hacking from the hackers' community point of view. This point of view offers unique insights on how the community is defined and understood by its own members.

The overall objective of this chapter is to discuss the perspective of hackers as reflective practitioners and hacking as a unique activity of inquiry and action. This perspective is based on a fundamental understanding of what hacking means and is largely influenced by both the empirical accounts of hacking practice produced from this research and texts produced from the hacker community. This novel understanding of hackers as reflective practitioners, seen through Schön's theory of reflective practice, is of particular relevance to Interaction Design as it allows for a philosophical and methodological understanding of what constitutes the discipline of hacking. Furthermore, this perception of hacking is an understanding that is grounded in and guided by a sufficient comprehension and acceptance of the nature of the practice. This contributes to my one of my main arguments: that this view of hackers can be used to inform and develop a model of users as active participants within an open-ended design process.

3.2 The origins of hackers and the ethical codes of their practice
The meaning of the term hacker has undergone a number of transformations over time. While hacking is largely synonymous with computing as a result of the broad misuse of the term, the definition of what constitutes hackers and their practice is somewhat disjointed and instead refers to a diverse community engaged in a wide range of activities (Rodgers, 1999). As I mentioned above, there are perspectives of hackers as criminals, political activists, artists and DIY enthusiasts (Denning, 1996; Florin, 1985; Levy, 1984; Moilanen, 2005). According to Post (1996) the term hacker more accurately describes the activity involved in the practice rather than reflecting any of the differences in those individuals engaged in the activity (Post, 1996). In this section, I provide a short account of the origins of hackers and the ethical code that is intertwined with their practice. By examining previous research, I illustrate through different subgroups of hackers how this practice has evolved from its roots into distinctive hacking practices. Furthermore, I argue that literature that discusses these subgroups of hackers have classified their activities in terms of values and motivations thus omitting pertinent aspects of their practice.
The true hacker was a pioneering computer enthusiast of the earliest days of computing: these individuals experimented with the large mainframe computers that belonged to the Power and Signals Group of MIT's Tech Model Railroad Club, and devoted their time to the creative exploration of computers (Levy, 1984). Furthermore, they had an insatiable curiosity and thirst for knowledge about how computers worked. In this world, a hacker was a good programmer who could create hacks – smart manipulations of existing code – and believed in the “hacking way of life”: modifying and reusing code was not only a way to engage and manipulate systems but also represented a way of life that came with a philosophy, an ethic and a dream of freedom (Levy, 1984). Hacking has its’ own internal structure, procedures, activities and components that are embedded within the practice. For hackers, the aim is to explore systems, push them beyond their functional limitations, mastering a system and fundamentally involves a belief in “freedom and voluntary mutual help” for your fellow hacker (Raymond, 2001: 197).

The key principles of the hacker ethic promote sharing, openness, free access to computers, and a belief that computers can be the basis for beauty and for a better world (Levy, 1984). Sharing within the hacking community extended from the open atmosphere and informal access to resources at MIT (Levy, 1984) and it is common practice for hackers to share their expertise through the writing of open-source code and facilitating access to this information (Florin, 1985; Raymond, 2001): “Hackers believe that essential lessons can be learned about the systems – about the world – from taking things apart, seeing how they work, and using this knowledge to create new and more interesting things” (Levy, 1984: 24). This, for hackers, requires free access to information and knowledge sharing, and if these are restricted, then the ends justify the means to make it unrestricted so that improvements can be made (Brand, 1985). When these principles are not present, hackers tend to work around them: for example, when the computers at MIT were protected either by physical locks or login programs, the hackers there systematically worked around them in order to have access to the machines.

Levy (1984) articulates that criteria such as age, sex, race, position, and qualification are deemed irrelevant within the hacker community: hacking skill is the ultimate determinant of acceptance. Hackers appreciate innovative techniques which allow programs to perform complicated tasks with few instructions (Raymond, 2001). Hackers consider well-written code, which is carefully arranged is an object
of beauty and during the early days of hacking learning to create programs that used the least space was a competitive activity amongst many hackers. Furthermore, these manipulations demonstrated the prowess and skill of hackers who deliberately pushed the limitations and boundaries of the technology.

Levy describes the primary hacker objective was to teach society that “the world opened up by the computer was a limitless one” (Levy, 1984: 30). The first generation of hackers felt that computers had enriched their lives, given them focus and made them feel empowered. Moreover, they believed that everyone in society could experience this power and that if everyone could interact with computers in the way that they did, then the hacker ethic would spread through society and thus improve the world.

This overview presented here shows an individual whose actions are practices are concerned with democratic access to information and the promotion of access to this information. Furthermore, there is an inherent ideology within the practice that views computers as empowering and as mediums of promoting these ideals. This definition of hackers accurately reflects a general set of moral commitments that is still in practice, as it currently exists. However, the actual realisation of these principles has undergone transformations over time and thus taken on multiple forms. The practice of the true hacker has lead to new technological, social and political practices: from the global production of free and open source software to the subversive pranks of underground hacking, the practice has expanded and converged with broader political and cultural processes and redefined itself into different subcategories that share different parts of the original true hacker ethics. In the next section, I present and examine three of these differing modes of practice – hacktivism, open source software and cracking – and illustrate how these modes are shaping and expanding the definition of what constitutes hacking. My aim is to illustrate the diversity in the practice and explicate how understanding hacking practice as a diverse activity can provide us with a richer account of the practice which is continually undergoing transformation and reconfiguration from the influence of cultural and political issues.

3.2.1 Hacktivists & the politics of hacking

As outlined in Section 3.2, the hacker ethic comprises of the belief that all computers should be accessible, information should be open and free, that no
central authority should exist to control things, and that computers can change society in a positive manner (Levy, 1984). As hacking has evolved over time, there are an increasing number of socially and politically conscious hackers who have begun to utilise their technical skills to promote political causes (Taylor, 2005). Hacktivism is commonly described throughout literature as the merger of hacking and activism: a practice that “looks beyond technology” and concerns itself with a critical resistance that is motivated by a social and political agenda (Denning, 2000; metac0m, 2003; Moilanen, 2005; Taylor, 2005). It includes a wide range of activist web-based activities including culture jamming, electronic civil disobedience and satirical interventions. Manion and Goodrum (2000) argue that one of the key influences in the development of the movement can be attributed to the resistance to “the commodification of the Internet at the hands of corporate profiteers and violations of human rights at the hands of oppressive governments” (Manion and Goodrum, 2000: 14). As discussed in the previous section, hackers firmly believe that in order for society to progress and be free, the access to information and knowledge should be free. Any institution or government that prohibits this access is removing one of the fundamental human rights. Thus, these governments and institutions become “fair game” for hackers to remove this restriction through technological means. Hacktivists see themselves as political activists who promote political and social issues. Furthermore, they see themselves as technological liberators and believe that technology is a means by which they can promote their political and social causes and take on institutions of governments whose actions they see as obstructing human rights.

Hacktivism as a term is loaded with controversy, and throughout literature has been labeled as technivism, e-activism and cyber-terrorism. This labeling has lead to a negative portrayal and misunderstanding of the practice as one that is inherently unethical or illegal (Wray, 1998; Ruffin, 2002; Denning, 1996; Denning, 2000). For example, Denning (2000) classifies politically motivated computer activity as being either activism – “normal, non-disruptive use of the Internet” – or hacktivism – “the marriage of hacking and activism... with the intent of disrupting normal operations but not causing serious damage” – or cyber-terrorism – “the convergence of cyberspace and terrorism... politically motivated hacking operations intended to cause grave harm such as loss of life or severe economic damage” (Denning, 2000: 241) This rudimentary view of hacktivism only serves to marginalise the practice as
unethical and furthermore, it undermines the work of those who use technological means to promote social change and political reform. By omitting nondestructive interpretations of the practice, Denning further enforces this perspective by discussing the potential of hacktivist methods to evolve in a way that could cause grave harm (Denning, 1996). This perception of hacktivism, as one, which is unethical, illegal, destructive, and corrupt, is actively promoted by mainstream media and has resulted in a public perspective that all hacktivism is criminal and something to be feared. This is not only an inaccurate reflection of the practice, but it also serves to undermine the actions of hacktivists as a valid form of protest. In reality this negative portrayal of hacktivism is more suited to the activities of crackers – a subgroup of hackers I discuss and describe further in Section 3.2.3.

In contrast with this perspective, a more recent examination of hacktivism as a constructive and legitimate form of political protest has begun to emerge in literature. Levesque (2006) argues that the actions of the hacktivist educate the public about social and political issues at hand and help out those in need. He asserts that placing them in the same category as cyber terrorists ignores an important intersection between people, politics and technology (Levesque, 2006). Wray (1998) describes hacktivists as socially and politically engaged citizens, who purposefully perform acts of electronic civil disobedience in response to actions and policies of governments and corporations they feel to be corrupt and oppressive (Wray, 1998). Through their actions, they challenge and expose what they consider events of censorship, corruption or oppression. To counteract negative perceptions of their activities hacktivist groups – such as the Cult of the Dead Cow (cDc), the Electronic Disturbance Theater (EDT) and the Electro-Hippie Collective – regularly use manifestos and press releases as a means of making their intentions clear and further promoting their political causes. For example, in 1998 the Electronic Disturbance Theater, in solidarity with Mexican Zapatistas, conducted “virtual sit-in’s” to target the Mexican government, White House, Pentagon, School of the Americas, and the Frankfurt and Mexican Stock Exchanges. Their aim was to bring to the world’s attention the plight of Indian rights in the Mexican State of Chiapas. They set up a website where the download of FloodNet – an automated java applet that would reload the targets website several times per minute – was made freely available for others to download and participate in the virtual occupation of the websites. Denning argues (2000) these attacks were unsuccessful because they did not do any
severe damage to any of the targeted websites (Denning, 2000). However, the objective of the group was not to do damage, but to highlight the cause of the Mexican Zapatistas and to target the entities that the Zapatistas felt were responsible for the plight of the people of Chiapas in Mexico. This analysis serves to highlight the disparity between the media representation of the practice and how the community itself perceives the practice.

In order to obtain a truer picture of the nature of hacktivism, it is necessary to examine the practice from the perspective of the hacktivist; through an examination of manifestos and hacktivist declarations, it is evident that for hacktivists there are identifiable boundaries to what constitutes the practice. According to Oxblood Ruffin (2002), one of the founders of the Cult of the Dead Cow:

"For the past four years the cDc has been talking about hacktivism. It's a chic word, beloved among journalists and appropriators alike. Yet the meaning is serious. Our definition of hacktivism is, "using technology to advance human rights through electronic media." Many on-line activists claim to be hacktivists, but their tactics are often at odds with what we consider hacktivism to be.

From the cDc's perspective, creation is good; destruction is bad. Hackers should promote the free flow of information, and causing anything to disrupt, prevent, or retard that flow is improper. For instance, cDc does not consider Web defacements or Denial of Service (DoS) attacks to be legitimate hacktivist actions. The former is nothing more than hi-tech vandalism, and the latter, an assault on free speech."

(Ruffin, 2002)

For hacktivists there are distinct traits from which the practice is constituted: hacktivists promote themselves as socially and politically conscious individuals that attach themselves to protest movements. There is an ethical code of conduct that underpins the practice that promotes nonviolent applications of technology. In order to prevent misunderstanding of their actions, hacktivists clarify themselves through manifestos and press releases that explicate the motivation and reasoning behind their actions. From their perspective, hacktivists see themselves as social and political liberators and agents. They take on the causes of those who they see as

http://www.theregister.co.uk/2002/04/19/waging_peace_on_the_internet/
being oppressed and act as digital collaborators on their behalf and take on governments, institutions and companies who seek to oppress them (Halbert, 1997; metac0m, 2003). Their aims and objectives are to highlight these social and political causes to a broader audience in the hope that this gives exposure to the cause. Furthermore, they endeavor to promote positive change through ethically motivated actions.

The disparities in which hacktivists and their actions are perceived and how they perceive themselves are in stark contrast with one another. From the perspective of the hacktivist, their practice is a nonviolent and critical way of thinking and acting which is supported through an electronic means. In addition, they view the Internet as a space in which citizens can share and protest their concerns over violations of free speech or obtain information about social and political injustices. Although these views of the hacktivist presented here are in contrast with one another, I believe that by understanding the perspective of hacktivists as they define themselves, we are offered a critical lens from which we can enlist a more accurate understanding of the practice.

3.2.2 The open source hacker

In the early days of computing, commercial software was a rarity. The majority of software development was carried out in academic and corporate labs and as part of their research culture; the developers often gave and exchanged software for free. These early actions set the foundation for the Free Software Movement, which was founded by Stallman in an attempt to promote the values of reciprocity, pedagogy and scientific openness. Stallman developed the operating system UNIX, and through the implementation of GNU Public License\(^9\) (GPL) it allowed him to retain copyright of his code and distribute it freely providing all of its users did so as well. Stallman was a hacker and believed that to impede the creation and spread of knowledge was fundamentally unethical. Hence the creation of this movement reflected this ideology and ensured that software created under these licenses could not be monopolised. This view is widely established and expected in many of today’s open source communities.

Creators of Open Source Software (OSS) and their communities place an emphasis on values of freedom and democracy and central to this practice are qualities of sharing and pedagogy. The aim is to produce software through the distribution of code to a community that is able to review and improve it. While there is a focus on access to information, there is a secondary focus in creative manipulations of code to produce artistic results. Members of OSS communities often see themselves as artists and their code as craftsmanship in which they imbue software with a unique element of themselves (DiBona et al., 1999; Hartmann et al., 2008; Beveren, 2001). This open source hacker sees their technical activity as an avenue for highly creative forms of expression and this has lead to many creative programming communities such as processing\textsuperscript{10}, Arduino\textsuperscript{11} pd\textsuperscript{12} and popular software initiatives such as Mozilla\textsuperscript{13}. Through the creative hacking of these software and hardware languages, hackers in these communities have developed applications that control devices such as toys, home appliances and robots.

The open source software movement embodies the true hacker ethic in that it allows for free and unlimited access to information. Thus, the perspective of the open source hacker that emerges here is that of an individual who creates useful knowledge combined with a drive for self-expression and self-cultivation. As members of creative communities, there is an underlying awareness and respect for the creative endeavors of others: those who program the code and those who pursue the creative applications and uses of the software. Thus, there is an unwritten understanding of support and appreciation for one another’s work. In 2009 Chris O’Shea – a leading member of the open source software community openFrameworks – created an interactive artwork “Hand from Above\textsuperscript{14}” where a giant hand on a screen would poke, stretch, and tickle passersby. A year later, a communications agency, space150\textsuperscript{15}, collaborated with Forever 21\textsuperscript{16} and produced an interactive billboard with a concept that was starkly similar in nature to Chris’s work. When videos of the interactive billboard emerged, a heated online debate ensued where

\begin{itemize}
  \item [10] http://processing.org/
  \item [12] http://puredata.info/
  \item [14] http://www.chrisoshea.org/hand-from-above
  \item [15] http://www.space150.com/
\end{itemize}
members of these creative communities spoke out on behalf of Chris and the appropriation of his artwork.\footnote{http://vimeo.com/12855619} Due to the support and views of many interactive designers and artists, space150 made a public apology to Chris and have since cited his work as the key influence in the production of their interactive billboard. These communities are an essential component of the open source hacker and not only serve to facilitate communication between members, but also provide an audience to view and appreciate finished applications and clever manipulations of code.

3.2.3 Cracking for the Lulz

Within mainstream media, the term hacker is often used to refer to a malicious security cracker and hacking is portrayed as an unethical practice where individuals are engaged in criminal activity: crashing systems and violating people’s privacy by obtaining private information. Icove et al. (1995) state this is an inaccurate portrayal of the practice by the press and instead refers to crackers (Icove et al., 1995). As outlined in Section 3.2 the term hacker emerged from an academic subculture in MIT and referred to programmers who experimented with mainframe computers. For many within the hacking community, crackers are intruders who deliberately break into computer systems with malicious and criminal intentions (Raymond, 2001; Denning, 1996). Crackers use their knowledge of computers to commit a multitude of computer crimes ranging from disruption of services, fraud, theft, destruction of property, violation of privacy, and cyber terrorism (Cronkhite and McCullough, 2001; Denning, 1996). To exercise their computer skills, crackers overcome obstacles such as firewalls, password-protected networks and secure areas. Not surprisingly, crackers often brag and show loopholes in the site to Webmasters, thus proving that they are better technically than those who manage the website. Those within the hacking community dissociate themselves from the cracker: hackers are driven by a curiosity to find ways to overcome the limitations of the system, whereas crackers are driven by the intent to break and crash systems. In short “hackers build things, crackers break them” (Raymond, 2001: 196).

For example the hacking group LulzSec\footnote{http://twitter.com/#!/lulzsec}, who have claimed responsibility for several high profile hacks including attacks on the Daily Mail, the CIA, Sony pictures, the Bethesda Game studios network, and many more, describe their main...
motivation as to having fun by causing mayhem and often state they perform these hacks for the “lulz”\(^\text{19}\). While they claim their behaviour is in the public interest, they have at times released email addresses and passwords belonging to “innocent users of the internet” from hacked databases and posted them online via their Twitter accounts and website. At the root of the hacker ethic is a mistrust of authority and bureaucracy: however, while the stance of crackers and their practice is antiauthoritarian, their actions are considered as unethical within the hacking community. Hackers believe that any authority that prevents the free exchange of information poses boundaries and can be perceived as a threat. However, for the hacker there is a distinction between the individual and the corporation and the ethics of the hack.

In contrast, crackers are individuals who attempt to penetrate security systems either for fun or technical attacks designed to make systems malfunction or fail. Their practice is akin to that of the hacker and similarly involves breaking and entering systems. However, unlike their counterpart the hacker, the nefarious and illegal nature of their activities ensures that within hacking communities they are seen as outsiders or deviants of the practice. Furthermore, due to the unlawful nature of their actions, they often conceal their identity and go to great means to protect it. This serves to set them even further apart from their hacker and hacktivists roots. Crackers have their own sense of ideals and justice and declare them publicly online. For example, the website pastebin\(^\text{20}\) has been one of the core dumping grounds for high profile cracking groups such as Anonymous and Lulzsec, who often paste text files describing their agendas and activities. While the motivations are sometimes clearly articulated in online manifestos, the wider hacking community does not support the means by which they achieve them.

The perspectives presented here highlight the diverse nature of hacking. By presenting this comprehensive review of the multifaceted nature of the practice, I aim to illustrate through examples an overview of the diversity of the practice. From this review it is evident that there are important similarities that connect each of these practices – the themes of free speech, meritocracy, privacy and power of the

\(^{19}\) [http://www.webcitation.org/5zZgZGcO3](http://www.webcitation.org/5zZgZGcO3)  
individual reoccur throughout each example. Furthermore, it is evident there are
distinct motivations for the spread in hacking practice. Hacktivists aim to promote
political issues online and in contrast open source hackers use software and
hardware to creatively express themselves. From the examples discussed in this
section I have illustrated that each aspect of the practice embodies different
components of the original hacker ethic.

The perspectives presented here are interpretations from literature that are
based on understanding the values and more importantly the motivations of various
groups of hackers. In addition, I have shown that classification of whether one is a
cracker or one is a hacktivist is primarily due to the motivations and ethical
behaviour of the individual. While these perspectives are pertinent for other areas of
research, in an Interaction Design setting it is unclear what these perspectives can
clarify for the context of our research. In contrast, within this thesis I discuss
hackers as reflective practitioners and examine the practice of hacking with the goal
of understanding their process. In addition to presenting overviews of Schön’s
theory of reflective practice, I compare and examine hackers’ practice through this
theory. Moreover, I argue that this perspective of hackers, which is based on an
understanding of their process and thus as a reflective practitioner, offers interaction
designers a unique way of conceptualising users as active participants within an open-
ended design process.

3.3 The reflective practitioner
According to Schön, the reflective practitioner – the true expert in the field – is an
individual who is both engaged in practice and at the same time can articulate exactly
what they are doing and thinking. Within the design community, Schön’s reflection-
in-action is an important design model that describes practitioners’ ways of
approaching ill-defined problems (Schön, 1983). The process has three phases:
framing involves understanding and defining the problem; acting aims to transform
the current situation to a better one, or to learn more about the situation; reflecting
looks back on actions to assess their consequences and implications. The process is
an iterative “conversation” (Schön, 1983), with moves from framing to acting to
reflecting, and sometimes back to major reframing.
Reflection-in-action is a dynamic process: as practitioners act, their sense of the whole is changed and as they make new sense of the whole, they change their actions accordingly. Schön calls this “back talk,” which is the situation’s “response” to the acts carried out by the practitioner. Reflective practitioners are able to handle situations characterised by uniqueness, complexity, and conflicts because of their ability to reflect-in-action and consequently are able to make sense of situations they have never met before due to a process of negotiation between reflection-in-action and “back talk” (Schön, 1992; Schön, 1983).

Schön states that past experiences of reflections-in-action allow designers to construct meaning in new design situations. These reflections-in-action link old experiences to new situations by allowing the designer to consider the similarities or resemblances between them. This process of negotiation and reframing allows designers to uncover the relevant facts within each new situation they encounter (Schön, 1983; Waks, 2001). Schön says this framing approach is central to reflective thought:

“When a practitioner makes sense of a situation he perceives to be unique, he sees it as something already present in his repertoire. To see this site as that one is not to subsume the first under a familiar category or rule. It is, rather, to see the unfamiliar, unique situation as both similar to and different from the familiar one, without at first being able to say similar or different with respect to what. The familiar situation functions as a precedent, or a metaphor, or... an exemplar for the unfamiliar one” (Schön, 1983: 138).

In addition, he discusses the concept of surprise: a surprise is sometimes caused by a situation which the designer has not encountered previously and thus has no experience to draw on to support reflection-in-action. The surprise is a unique encounter that causes the practitioner to pause and experiment within the situation. This converts tacit knowing-in-action into explicit knowledge for action and leads to on-the-spot experimentation. This results in the designer either achieving the result they require or encountering another surprise. Schön describes this process as the performer responding to the situation and the situation ‘talking back’ to the designer, triggering the designer to reframe the problem – “a reflective conversation with a situation” (Schön, 1992: 4).
3.3.1 Reflection in action

The concepts of reflection-in-action and reflection-on-action are central components of Schön’s Theory of Reflective Practice. As described in the previous section, reflection-in-action refers to a reflective conversation with the materials in the design situation and is based on a sense of the design situation as a whole (Schön, 1983; Schön, 1992):

“The practitioner allows himself to experience surprise, puzzlement, or confusion in a situation which he finds uncertain or unique. He reflects on the phenomenon before him, and on the prior understandings, which have been implicit in his behaviour. He carries out an experiment which serves to generate both a new understanding of the phenomenon and a change in the situation” (Schön, 1983: 68).

Schön states past reflections-in-action allow designers to construct meaning in design situations, providing connections between their old experiences and their new situations. In contrast, reflections-on-action are reflections that occur after the situation has been resolved. These reflections-on-actions are critical to the designer and they explore the reasoning and motivations behind their experimentations they undertook within the frame.

3.3.2 Frame Experimentation

Schön sees design not only as problem solving but also as continual problem finding and states that designing is a way of dealing with messy situations (Schön, 1983). The reframing process that designers undergo is a key component to revealing the pertinent facts about the situation. Furthermore, Rittel and Webber (1984) assert that "the process of formulating the problem and conceiving a solution (or re-solution) are identical" (Rittel and Webber, 1984: 137). Through a process of frame experimentation, practitioners discover new meaning within the frame by eliciting “back talk” from the situation. Skilled designers learn to listen to this back talk and respond by reframing the problem. Through the process of frame experimentation, the designer arrives at their result. Within this process, the designer derives new experiences and methods that extend their capabilities (Atwood, 2002). The design situation is not only shaped by the designers’ experimentation but also by listening to the “back talk” received from the materials and constraints and affordances of the frame.
Schön understands design as a process of discovery and the development of meaning within a framework that provides a space for designers to construct a situation. This conception of design dictates that design is learned through practice and that it relies on the designers’ experiences to distinguish what are the pertinent facts for the situation.

3.4 The reflective practice of the hacker
In this section, I describe the practice of hacking in relation to the Schön’s theory of reflective practice as described in the previous section. According to Schön, the designers’ knowledge is tacit: it is embedded in our actions of doing and our understanding of the material we use when we are dealing with a design situation. Furthermore, we perform a series of reflections-in-action that allow us to make sense of the complex situations we encounter in our practice. When encountering a surprise we establish a frame and perform a series of experimentations that elicit “back talk” from the material. Skilled designers are able to interpret and listen to this “back talk” and adjust their actions to trigger a response from the frame. If another surprise is encountered, the designer re-frames and performs new experimentations until they receive suitable “back talk” that allows them to arrive at a result. According to Schön, this process of reflection-in-action and frame experimentation is the key to which practitioners deal with messy design situations. In my view, the process by which the hacker arrives at their intended outcomes is similar.

Schön states that design is a learning practice: knowledge is derived from carrying out the physical actions of the practice. Within hacking, the approach is similar: hackers learn from their active participation within different frameworks. For example online website provide resources and tutorials which guide novice hackers in their initial approach to learning the practice. By carrying out these activities, hackers begin to expand their knowledge of the practice. Furthermore, online tutorials also provide the novice hacker with a reference from which they can compare their progress. By actively carrying out these instructions, hackers begin to construct their own internal tacit knowledge from their learning experiences. In addition, these experiences allow the hacker to become proficient in a kind of reflection-in-action that serves to promote their understanding of the materials they use and situations they encounter.
As a hacker comes across situations, they develop their knowledge and understanding of their practice. Eventually, this knowledge becomes familiar to them and gradually they formulate it into their practice and convert it to tacit knowledge. For example, when hackers learn code, there is a logic that is inherent within the structures of programming languages. As a hacker learns these structures, they become familiar with the process of implementing them in the code they write. Eventually this logic becomes second nature or tacit knowledge to the hacker and ceases to require thinking about and becomes systematic of their approach. As hackers encounter situations and carry out tasks and approach problems, this tacit knowledge is converted to knowing-in-action. Knowing-in-action is a type of knowledge that is revealed through the execution of tasks. As hackers form new experiences, they build on their tacit knowledge and employ knowing-in-action to carry out the necessary tasks.

When a hacker encounters a surprise – where the expected outcome falls outside of their knowing-in-action – the hacker employs reflection-in-action. Reflection-in-action is about challenging our preconceived notions of our own practice and about rethinking the design situation that we have encountered. Inherent in hacking is an approach to technology that approves and recognises clever manipulations of code that show workarounds or solutions to problems. When hackers encounter a surprise, they revert to tinkering and experimenting with the constraints of the situation. Thus, they employ a set of actions that elicit “back talk” and allow them to alter and shape their actions until a satisfactory outcome is achieved. This tinkering and experimenting approach is indicative of hacking and comes as a natural response to “back talk” or surprises they may not have encountered before.

Hackers continuously push the boundaries of technology, testing its limitations by performing experiment after experiment that not only serve to build their understanding of their practice but also familiarise them with their materials. Thus, when it comes to conducting a conversation with the materials, where the hacker is receiving a response from the medium, it is straightforward for them to understand what is happening or what they have done and further support their decision making process. Furthermore, they are continuously participating in a reflection-on-action process. Within hacking practice, the hacker often steps back to reflect on the finished code or object, changing his interpretation of the object. The
hacker may then make a conscious decision to apply a new action, changing the outcome of his result. In addition, it is evident from documentation of resources and tutorials that hackers are able to go from reflection-in-action to reflection-on-action. These documentations, which are freely available online, also illustrate how hackers can transform tacit knowledge to explicit knowledge in the language of their own practice.

Schön defines reflective practice as the ability to reflect on action and engage in the process of continuous learning. In this section, I have described how hackers actively participate in the process of learning by negotiating through a practice of experimentation and tinkering. This practice is supported through their knowledge of their materials and their experiences from their actions of doing and thinking. Furthermore, I illustrated how hackers, similarly to designers encounter surprises within their practice. These surprises allow hackers to build frames and draw on previous experience in order to overcome the situation and attempt to resolve it. Finally, I showed how hackers actively engage in a process of reflection-on-action and frequently document their experiences for others to learn from. These documentations illustrate the hackers’ capability to convert their tacit knowledge to explicit knowledge. In addition, the tutorials and resources found online with their websites and forums show a language that is indicative and commonplace within their own communities.

3.5 Summary
On the surface, hacking seems a “messy and wicked” situation (Cross, 2006; Schön, 1983; Thackara, 2005) without tools or techniques that could constitute a design practice. However, by understanding hacking as a reflective practice, hacking can be seen as a unique activity of inquiry and action. Furthermore, this conceptual understanding of hackers allows us to view the practice in terms of the process of their practice: it thus illustrates the practice as a well-grounded and rich set of design methods and techniques that are appropriate to the needs and desires of hackers.

While there has been a growing interest in the application of open source methodologies and philosophies within Interaction Design (Dix, 2007; Atkinson, 2006; Buechley et al., 2009; Fischer, 2010b; Galloway, 2004; Hartmann et al., 2008), the contributions that have been made have discussed the application of these
methods and philosophies for design methods rather than developing a conceptual model of users who design. Instead of examining the ways in which we can incorporate hacking into our own design practice, I am arguing that hackers and their practice of design can aid us in the development of an appropriate model for users as designers: in this model, I consider users as practitioners who design according to their own needs and desires. However, by framing users as practitioners, we are faced with new design complexities when engaging with this design situation.

Understanding hackers as reflective practitioners can provide us with an approach to grasp the complexity of this design situation: rather than attempting to engage users by understanding their motivations, we can aim to support and facilitate the process by which they design. This requires an in-depth understanding of the nature of hacking: a practice that in my opinion is more suited to describing how users actually engage in design. Given that in this design situation users take on a role in which they design, our Interaction Design process needs to focus on supporting the users in this role. In Chapter 2 I have shown that while there has been some research in Interaction Design that have examined alternate ways of viewing design processes (Gaver et al., 2003; Sengers and Gaver, 2006; Dix, 2007; Sas and Dix, 2009), there has been very little development in methodological tools that could support these theoretical developments. For example, Gaver et al. (2003) put forward ambiguity as an alternative framework for design to encourage the user to engage with the designed system (Gaver et al., 2003). However, while Gaver et al. (2003) offer analytical accounts of how ambiguity operates, they fail to address how this concept can be employed using methodological techniques or tools. In this work, I address this lack of tools and techniques by introducing curation as a methodological tool to be employed in this complex design situation. I will discuss this in greater detail in subsequent chapters.

This chapter presented an investigation into the understanding of hackers and examined the multiple perspectives from which the meaning of hacker has been understood in literature. I discussed the origins of the term hacker and the ethical philosophy that underpins the practice. By illustrating through descriptive examples – hacktivism, open source and cracking – I have shown how this practice has diverged into diverse activities. I showed how literature discussing these practices has based their interpretations on the understanding of motivations and values of the different
subgroups. Instead of understanding hacking in terms of motivation, I examine the practice using Schön’s theory of the reflective practitioner. By understanding hacking as a form of knowing and the practice of hacking as a series of frame experiments, this chapter presented the hacker as an individual who is emerged in a reflective practice. Furthermore, I argued that thinking of hackers as reflective practitioners portrays hacking as a unique activity of inquiry and action. This perspective is based on a fundamental understanding of what hacking means and is of particular relevance to Interaction Design as it allows for a philosophical and methodological understanding of what constitutes the discipline of hacking. This concept of hacking is an understanding that is grounded in and guided by a sufficient comprehension and acceptance of the nature of the practice. In addition I argued that this view of hackers could be used to inform and develop a model of users as active participants within an open-ended design process.

With the following 4 chapters, I move on to the empirical part of this work by presenting and discussing data documenting hackers’ practices and collected during Tweak. In Chapter 4, I will describe the methods I have utilised to gather the data and to establish a curatorial frame to the workshops. This will be followed by the three case studies in – respectively – Chapter 5, Chapter 6 and Chapter 7.
TRANSIENT MAINSTREAM
Peggy Syllopp + Giovanni Longo
SPECIOUS DIALOGUE
Julie Freeman
CHAPTER 4: METHODOLOGY

4.1 Introduction

In this chapter, I describe the methodology and detail the empirical techniques I employed during this research, including the curatorial frame that formed the basis of my practice-led approach.

The theoretical framework of this thesis is grounded in Schön’s theory of Reflective Practice, and provides a model from which I conducted and reflected on my own practice as curator and informed the ways in which I carried out this research. It also provides a means for understanding the activities that occurred within the framework of the case studies described in Chapters 5, 6 and 7. Here, I discuss more specifically the features and implications of my methodological choices. In particular, I discuss the curatorial process, and describe the nature of this approach. I also explain how this curatorial perspective informed both my choice of methods, my ways of thinking and doing, and the construction of the contextual setting of this research.

I present the research setting: three workshops conducted between 2008 and 2010 within the Tweak Festival, where the methodologies presented in this chapter were employed. By creating this appropriate frame through Tweak, the events that occurred within the framework of the workshops unfolded in a realistic manner. This was an essential part of my approach, for I believe that when users
take on the creative activities of designers, they do so of their own accord. As stated in Chapter 2, when these design activities take place, they occur outside the confines of a traditional design process. Therefore, it was necessary that the environment and framework in which I constructed this research was an appropriate space where these types of activities could occur. Due to the rise in popularity of hacking culture, public events such as festivals, talks and even conferences are becoming more commonplace. These events celebrate different aspects of the culture: for example, Bent festival celebrates circuit bending and its related creative practices; Dorkbot celebrate “people doing strange things with electricity”; and Ars Electronica examines the influence on technology on society. For hackers, these events are spaces of convergence, discussion and allow them to meet face-to-face with one another. They also serve to bring public focus and attention to the critical thinking and creative art making aspects of the practice. Even though a large portion of the practice occurs online, members within the community often organise events and workshops to promote and celebrate their practice. Thus, the creation of Tweak for the setting of this research can be seen as realistic because it offers hackers a space to meet and exhibit their practice to a wider audience.

I also describe the data gathering techniques I employed to document the workshops. Such techniques also provided a means to reflect on my own practice as curator and design facilitator. Finally, the chapter concludes with a summary that discusses how the approach, discussed in this thesis, informed both my analysis and narrative accounts of practice that are presented in the subsequent Chapters 5, 6 and 7.

4.2 Applying Reflective Practice
In this section, I revisit reflective practice and explicate how Schön’s model of design informed my methodological approach and provided a frame in which I reflected on my own activities as curator and researcher. It was through an exploratory process

21 http://makerfaire.com/
22 http://www.thishappened.org/
23 http://www.ted.com/talks
24 http://bentfestival.org
25 http://dorkbot.org/
26 http://www.aec.at
of perceiving, reflecting, structuring, and problem solving that I was able to generate new insights and understandings.

At the outset of this research, I began a process of developing design ideas that could be addressed through the practical work of curation. As a model of design, reflective practice places an emphasis on the dynamic and unfolding nature of design: it focuses on the actions of the practitioner and describes the unconscious means by which they design (Schön, 1983). In my role as curator, I created a set of workshops that were designed to uncover new understandings of hacking practice and to reveal new opportunities for interaction designers. Schön states that in frame experimentation, an initial idea is explored, which allows the practitioner to begin a dialogue with the frame (Schön, 1983; Schön and Rein, 1994). Each case study discussed in this thesis represents a frame experiment that I undertook during this research. Through the realisation of and reflection on these frame experimentations, I gained new experiences and knowledge, which in turn led to new design concerns and finally to the development of new design understandings. Furthermore, I acquired skills and experiences while carrying out and performing actions within this frame, which in turn informed the development of the next frame (Atwood et al., 2002; Waks, 2001).

Schön's model of reflective practice provided me with a methodology and a guide to understanding and analysing the activities that occurred within the workshops, in addition to supporting reflection on my own ways of thinking and doing. Within the context of these frames, I uncovered surprises and engaged in a ‘reflective conversation’ where the materials of this frame elicited ‘back talk’ (Schön, 1983; Schön, 1987). Upon reflection and examination of the frame, I uncovered new meanings and understandings, which in turn catered for the reframing of the situation from multiple perspectives. These framing and perspective are further discussed in Chapters 5, 6 and 7 of this thesis, where I discuss the frame experiment from the perspective of researcher, participant and finally facilitator. In the next section, I discuss in detail the curatorial approach I employed within my research.

4.3 Curation as Methodology
Traditionally, the curatorial role is acknowledged as a form of social practice, where the curator manages and creates connections between people, objects, and
environments, while relating these relationships to wider social structures and contexts (Kreps, 2003; Lichty, 2002; Robins, 2005). Curation is fundamentally a creative practice where curators position themselves at an intersection between their intended audience and the frameworks they create. These frameworks are the result of the curator’s personal interests and critical inquiry, which forms an original concept to be displayed for interpretation and participation by actors outside the curatorial process. Thus, the practice and process consists of a constant negotiation between thinking, doing, and reflecting that results in the structuring and positioning of objects within a public frame. Furthermore, curators have an in-depth knowledge of the objects and experiences that constitute these frames, which are formed by an enquiry and critical examination of the elements of their frame.

Curators have within their repertoire a number of creative methods, tools and techniques that they employ as part of their practice. Furthermore, there is an emerging model of practice that use information technologies such as the internet, software and networks as an integral part of the curatorial process (Krysa, 2006). Technologies such as Web 2.0 and related social networking tools – such as wikis, blogs, and online social networking platforms – provide a means by which they can engage in dialogue with their audience and situate their process within a structure that engages directly with all actors, including the artists and audience. Because I aim to reveal through practice how curation can be employed within an Interaction Design context, I grounded the research using an innovative methodological approach that aimed to situate the “messy design problem” in an appropriate setting. This appropriate setting consisted of a series of workshops I organised during Tweak. As part of their practice, hackers often organise workshops to teach others how to hack and experiment with open source software and hardware. This gives hackers the opportunity to demonstrate their knowledge and allows them to interact and engage directly with participants. Thus, the workshops I created as part of my research were seen as realistic and appropriate for hackers to join and operate in. I deliberately chose to create a series of workshops, rather than attending ones which were organised by others for two reasons: firstly, by organising the workshop, I ensured I had some degree of control over the situation. This allowed me to develop and embed my research agenda into the frame of the workshop. Secondly, playing a key role in the development of the workshops permitted me to create a more natural environment; one of the concerns I had in
attending workshops organised by other hackers and curators was that I would have been introduced to participants as a researcher, which may have influenced the behaviour of those within the workshop.

4.4 Curatorial Position
The curatorial position in this research is influenced by the online and offline practice of hackers operating within open source communities. My work as curator of Tweak is focused on these activities, and is combined with a long interest in technological developments. O’Neill (2006) describes the curator as being in a constant state of “becoming”, and in my role as curator of Tweak I found my work continuously negotiated and transformed by my knowledge of the practice. Initially, my understanding of the practice was heavily influenced by own participation within an open source community (I discuss this further in Chapter 5.2), and the first edition of Tweak responded to this experience. As curator, I sought to provide public access to the concepts, beliefs and practices of hacking communities, and to represent these communities through a diverse range of events such as exhibitions, workshops, curatorial texts, and manifestos. Prior to planning Tweak, I have spent time researching publications, websites, and forums that were dedicated to not only the art practices of these communities, but also the theoretical and critical discourses that surround the practice. In addition, I attended talks, festivals and cultural events that explore diverse aspects of the practice. Thus, my curatorial position is one that is empathetic towards the position of the hacker and I take on their philosophies as my own in the production of the festival.

As an independent curator, I was not formally employed with any particular institution such as a museum or an art gallery, and thus, I enjoyed the freedom to research my own interests and opportunities with various partners and collaborators. I secured funding through an assortment of independent funding bodies that included the arts office in the University of Limerick, and the Arts Council, Ireland. While these funding bodies had certain stipulations over placement of logos and press credits, they did not specify how funding could be spent and consequently, I was free to research and produce new curatorial work related to hacking practices.

To expand and build a broader understanding of hacking practice, I implemented a curatorial toolkit that consisted of a set of interlinking components.
to engage with hackers and the audience of the festival. This toolkit guided my curatorial decision making process and allowed me to translate and communicate my understanding of the practice. It also ensured I remained flexible in my approach and provided a means by which to expand and evolve in my role as curator. The curatorial toolkit consisted of attention to the following component in the development of each case study:

- **Texts & Manifestos:** The concept for the festival was developed through research. Once the idea was fully researched a manifesto was drawn up for the festival and texts were used to communicate to the audience about the themes and ideas being explored. It was essential that these manifestos and texts responded to the philosophies of these communities.

- **Engaging hackers and participants:** The curatorial position in this research emphasizes with the position of the hacker. Thus, in order to engage in dialogue with hackers and the intended audience of the festival, I adopted the online resources of these communities. These included forums, mailing lists, websites, and blogs that were related to the practice. Using these resources I advertised the festival open calls, and engaged in discourse with participants.

- **Space:** Once the general concept of the festival had been established, a list of suitable spaces was drafted for each event. As an independent curator I wished to respond to the non-institutional nature of hacking and consequently selected spaces that were not normally used as gallery or exhibition spaces. It was also essential that the aesthetic of the space selected lent itself to hacking activities

- **Aesthetic Identity:** Given that public nature of the festival, it was essential that the identity drafted for print, and online media responded to both the practice of hacking and participation. As curator I wished to make the festival as engaging as possible for non-technical participants. Thus, I aimed to reflect this in the aesthetic identity of various media.

- **Philosophy and concepts:** As discussed in Chapter 3 the practice of hacking is underpinned by a philosophy and a set of ethics. As the curator of the festival I ensured that any of my decisions responded or engage with some aspect of hacker philosophies. For example the access to events and workshops were free.
This toolkit facilitated a holistic way of thinking about my role, and allowed me to establish methods and approaches that were symptomatic of hacking practice. By using this curatorial toolkit, I was able to test my methods and reflect upon my approach. Moreover, by placing equal emphasis on the importance of thinking, doing and reflecting, I established a way of working that aimed to generate new insights to hacking, and present new curatorial representations of the practice. These strategies are reflected through the three cases studies present in the subsequent chapters.

4.5 Appropriate research settings
In the period 2008 – 2010, I organised 10 workshops that were focused on teaching open source hardware and software to participants. These workshops provided me with a frame to conduct my investigation where the practice of hacking unfolded naturally.

As part of my curatorial approach, I set about creating an appropriate frame where the activities of hackers could be explored and examined; thought was given to every aspect of the workshop, including where it was advertised (blogs, forums, etc), to the physical setting it was conducted in, the tools and materials that were provided and the content of the workshop. Furthermore, I considered it essential that the philosophies of openness and democratic access that underline these communities were reflected in the structures of these workshops. Consequently, participation was free and open to any individual regardless of background or technical competencies. Thus, these workshops became a frame in which I could develop an understanding of the activities of hackers, and also a space in which the practice could naturally unfold.

The experimental approach I undertook for this thesis was based on my intuition and ideas as a curator as much as inspired by established theories and methodologies. Methodologically, the thesis aims to investigate complex and messy design situations and, in borrowing from curation practices, I undertook a design process where participants, designers and hackers entered into a mutual and equal relationship, and the dialogue between these collaborators influenced the final outcome. Also by creating an appropriate setting for the research, I was able to participate within the workshop, engaging directly with participants and hackers. Due
to this direct engagement, I gained an in-depth understanding of the practice and witnessed first hand how the practice unfolded.

The workshops were a form of frame experiment: involving people in an open but structured frame allowed for the exploration of design responses to situations generated by activity in the workshop. Each of the iterations of Tweak and of the workshops arose from reflection and examination of the previous edition. In addition, I also included reflection and examination of my active participation within the workshop where I carried out different roles. These workshops acted as a methodological framework that situated my research activities within a public context and through which the outcomes could be evaluated. In order to gather data for analysis and understanding, I utilised a number of methods – participant observation, video observation and semi-structured interviews – to document the activities that occurred within all the workshops. In the next section, I describe how these methods were employed specifically within each case study.

4.6 Empirical methods
For me to manage the dual curator-researcher role it was important to have an accurate data gathering process that allowed for capturing the workshop from different perspectives and the new knowledge as it emerged. The three workshops I describe here were organised in cooperation with hackers from creative open source communities including Arduino27, processing28, pd29 and openFrameworks30. They provided the research setting in which I conducted my empirical investigation into the practices and experiences of hackers. My aim here is not to present an overview of the affordances and constraints of each particular method, as such methods are well-known within the literature (Bernard, 1998; Bogdan and Biklen, 1982; Bryman, 2001; Bucher et al., 1956; Buur et al., 2000; Cohen et al., 2000; Corbetta, 2003; David and Sutton, 2004; DeMunck and Sobo, 1998; DeWalt and DeWalt, 2002; DeWalt et al., 1998; Erlandson et al., 1993; Ezzy, 2002; Geertz, 1973;
Goffman, 1963; Hammersley and Atkinson, 1996; Knoblauch et al., 2006; Kvale, 1996; Le Compte and Preissle, 1993; Marshall and Rossman, 1989; McCall and Simmons, 1969; Patton, 2000; Sacks, 1984; Strauss and Corbin, 1990). Instead, I will describe the ways in which they were employed with the context of each case.

In Figure 4.1, we see a visual representation of the activities carried out in each case study. Each case study was constructed using a curatorial approach and within the frame of the workshop, I carried out a number of research methods including video observation, note-taking, participant observation and semi structured interviews. Figure 4.1 illustrates that the outcomes from the case studies in this research, which is discussed in subsequent chapters, underwent the same methodological processes. However, the framing approach that I took to constructing and participating within the workshops, varied from case to case. This differing perspectives that each case study was constructed from, allowed me to examine the research concerns outlined in Chapter 1, from a number of different perspectives. Thus, in my opinion, the research that is presented in this thesis gives a broader account of the issues outlined in Chapter 1 for Interaction Design. These perspectives and framing approach are discussed in further depth in Chapters 5, 6 and 7.
4.6.1 Case 1 - Workshop: Build and Bending with Electronic Circuits

In this case, I address the first of my research questions as outlined in Chapter 1: to understand the perspective of hackers as reflective practitioners and examine the ways in which this view of hacking could be relevant to Interaction Design. I approached this frame as researcher and employed participant observation, video observation and semi-structured interviews in order to gain a deep understanding of the nature of hacking and its practices. The workshop was led by two hackers and attended by 10 participants with varying degrees of technical competence. In this case study, I employed participant observation and video recording as my key techniques.

Participant observation, which is widely used within many disciplines, provides a way of “active looking, improving memory, informal interviewing, writing detailed field notes, and perhaps most importantly, patience” (DeWalt and DeWalt, 2002: 7). Furthermore, it allowed for an examination of the activities and behaviours of both the participants and the hackers in the setting of the workshop (Bernard, 1998; McCall and Simmons, 1969). This method allowed me to document the perspective of the hackers conducting the workshop and also permitted my active engagement in the activities carried out (Mac an Ghaill, 1996). In addition to providing insights into hacking practice, it also allowed me to understand the “physical, social, cultural, and economic contexts in which study participants live” (Schensul et al., 1999: 14), giving me a nuanced understanding of context that emerged from personal experience. Within the workshop, participants were instructed on specific tasks and were given mini exercises to complete. During these tasks I would question participants on how they were dealing with each task. When I observed behaviours outside of these activities, I would observe and note what was taking place and then proceed to question the participant on what they were doing. Through this process of observation, note taking and probing I was able to build an understanding of the workshop from my own perspective and also from the perspective of the participant.

In addition, I videotaped the workshop using two cameras. The first remained stationary for the duration of the workshop, and the second I used to document close up activities that I considered interesting or pertinent to the research setting. During my participant observations, I kept the second camera close at hand and used it as needed. This second camera was used when I interacted directly with
participants, and allowed me to capture and record visual and audio documentation of my interactions for analysis. By employing video observation as a method, I obtained an accurate account of the activities that took place within the workshop (Buur et al., 2000). After the workshop, I watched the recording and made additional notes. I then began to reflect on the notes that I had taken during the workshop and used them in conjunction with notes taken when reviewing the video. This process was repeated a number of times to ensure I had captured accurately the events that had taken place. This process allowed me to create thick descriptions of relevant episodes in the form of “vignettes” illustrating significant activities that took place.

In Chapter 5, I analyse and discuss the data in detail, and describe the perspective of the hacker that emerged. Furthermore, I discuss how these vignettes guided the development of the semi-structured interviews that I conducted with hackers following the workshop. These interviews aimed to explore the key issues and themes that emerged from the workshop and prompted the hackers to elucidate the nature of their practice further (Corbetta, 2003; David and Sutton, 2004). In addition, while uncovering the meaning of their experiences, I detail the understanding of what occurred from the unique perspective of the hackers (Cohen et al., 2000).

4.6.2 Case 2 - Workshop: Understanding computer vision in openFrameworks

Within the second case study, I address my second research question: to understand the experiences and practices of hackers in further depth, showing how these understandings could inform a novel perspective of users as active participants. In this case study, discussed in Chapter 6, I took on the role of the hacker and actively participated in the workshop. Thus, I approached this frame as a participant and the reflections and vignettes presented in Chapter 6 are described from this perspective. Participant observation was again my key research technique, and I used this method to become part of the workshop and observe the behaviours and activities from this perspective (Fine, 2003). In addition, I employed a process of self-reflection and by participating and reflecting on my activities during the workshop, I developed a rich understanding of what it meant to be a participant within the workshop (Ratner, 2002). I employed a cameraman to record the workshop and capture the activities that occurred; this allowed me to focus my attention on the activities that occurred
in the workshop, instead of concerning myself with the operation of the video camera. I instructed the cameraman to capture an overview of the workshop and to focus on activities and dialogue between hackers and other participants in the workshop. When reflecting on my data and notes from the workshop, I used the video data as a visual document for the vignettes described in Chapter 6 (Collier and Collier, 1986).

From the initial examination of the data collected, I developed a first set of assumptions. Reflecting on these initial outcomes enabled me to create a semi-structured interview that sought to examine these outcomes and the larger cultural significance of the practice. Conducting these interviews with different hackers allowed me to explore the unique perspective of hacking in relation to their lives and to uncover the meaning of their experiences in relation to their practice. The semi-structured approach I took to interviewing allowed me to question each hacker on the nature of their experience, thus I uncovered a wide range of phenomena related to the experience of hacking. In addition, I aimed to bring into the open the ways in which hackers made sense of what they are doing, by questioning and probing how hackers comprehended themselves and their own situation.

4.6.3 Case 3 - Workshop: Hacking and Building with e-waste

In this case study, I examine how the practice of curation can inform methods and ways of working within Interaction Design. I employed a curatorial approach that was reflective of the entire research process, including the previous case studies. In Chapter 7, I illustrate how curation can be employed within an Interaction Design context. Moreover, my aim in Case 3 was to show curation as a way of working, in addition to a way of thinking and being that can clarify the messy situations of everyday life. The reflections from this case study are presented and analysed from the perspective of curator and facilitator.

The nature of this approach sought to consolidate and connect the interactions, dialogues and activities that were observed in the previous case studies. During the workshop, participant observation and video recording allowed me to engage appropriately with the research setting, while clarifying the research findings through interactions and interviews with the participants. In addition, the video observation allowed me to record the key activities that took place within the workshop to “frame the design problem and impose order on the complexity of
everyday life” (Buur et al., 2000: 21). Upon completion of the workshop, a series of semi-structured interviews were again conducted with participants. Through these interviews, I gained insight into how the participants perceived and interpreted their experiences of the workshop. Furthermore, they allowed the diverse views and opinions of the participants to be probed and discussed in further detail, while providing a means to “gather descriptions of the life-world” of the participant with respect to the curatorial approach (Ezzy, 2002; Kvale, 1996; Rubin and Rubin, 1995).

4.7 Summary
In this thesis, I combined established research methods with a curatorial approach, which formed the basis of my practice-led approach. This approach is practically realised and carried out through a series of frame experimentations that sought to frame and simultaneously solve the situation of recording and interpreting the practice of hackers. This exploratory approach consisted of a number of consolidated research methods including video observation, participant observation, and semi-structured interviews. However, these methods were employed within a workshop constructed using a curatorial approach that sought to situate the research setting within an appropriate frame. In the following three chapters, I elucidate the nature of this approach and describe in detail the practical work undertaken within each of the frame experiments. Chapter 5 discusses the first of these frame experiments and the activities and observations are recorded from the position of designer as researcher. From an analysis of the vignettes presented in Chapter 5, a number of observations are made about the perspective of hackers as reflective practitioners. Subsequently, in Chapter 6 I reframe the design situation from a different perspective and participate in the activities of the workshop. The data discussed in this chapter allows me to build an understanding of a model of user who designs and develop design sensitivities towards this model of user. Finally, in Chapter 7, I discuss in further detail these design sensitivities and illustrate how a curatorial approach can support them.
5

CHAPTER 5:
CASE 1: EXPLORING HACKING FROM A DESIGNER-RESEARCHER PERSPECTIVE

5.1 Introduction

In this chapter, I will describe the first case study and exemplify the research objectives and curatorial processes that guided and shaped its development.

As mentioned in the introduction to this thesis, this research was conducted during Tweak, the interactive digital art festival I curated and organised; this led to the empirical work being conducted over three years (i.e. three consecutive editions of Tweak), and included a number of related activities – such as exhibitions, musical performances, cinema screenings, and talks – that explored the multi faceted nature of hacking practice. Thus, the fieldwork featuring in this chapter, and subsequently in Chapters 6 and 7, was not solely guided by a research objective, but was also influenced by a curatorial process. With Tweak, I aimed to provide a space to feature the cultural practices of digital artist and hackers. Furthermore, I intended to create an open environment, which encouraged participation and allowed for an informal setting where partakers could learn and expand their knowledge of hacking. Tweak not only acted as a methodological framework, situating the research within a public context, but also provided a reflexive medium through which the subsequent curatorial processes and research outcomes were evaluated in a consistent manner.
Given that this research has dual facets – the research questions that drive the work and the inquiry procedures used to pursue it – I undertook an experimental approach, as described in Chapter 4, Sections 4.3 and 4.4, which allowed me to respond to situations and events occurring throughout the duration of this research. The case study I discuss here was the first frame experiment I undertook to investigate the practice of hacking. My specific goals were:

- Gather insights into the nature of hacking and examine the way in which hackers experience and carry out their practice.
- Reflect on and provide an interpretation of the knowledge applied and developed by hackers as they conducted the workshop.
- Understand the ways in which hackers explicate this knowledge to participants in the workshop.

I initially approach the research setting as an outsider to the community of hackers, and thus the data presented in this chapter is interpreted and developed from my perspective of design researcher.

In Chapter 2, I have argued that current literature in Interaction Design lacks methodological tools that support users in their role as designers, and in this thesis I propose curating as a novel methodological tool that can be applied within an open-ended design process. In Chapter 4, I outlined the fundamental characteristics of curation, and in this chapter I elucidate how these characteristics informed my design process. I described how I utilised curation to develop a frame from which I could observe and interpret the actions of hackers and participants attending the workshop. The main objective of employing curation as a methodological tool was to create an appropriate context in which the skills, attitudes, and communication processes of hacking could be observed and understood.

I will describe and discuss in detail the workshop and I will outline the curatorial frame upon which it was constructed. I will also detail its structure and content. I will then present the main findings and observations as a series of vignettes that illustrate the experiences and practices of hacking. In addition to the observations from the workshop, I also discuss relevant highlights from interviews conducted with hackers. The findings and interpretations presented here aim to deepen the understanding of the thinking processes, assumptions, and situations that sustain the practice of hacking. Therefore, this chapter is not just a description of the practice observed, but also of the beliefs and values that shape the hackers behaviour.
and the setting within which the research occurs. Finally, this chapter concludes with a discussion and evaluation of both my research objectives and curatorial methodology, and suggestions are made toward the research and curatorial process applied for the second case which follows in Chapter 6.

5.2 Designer/Researcher and Curator: discussing perspectives
In this section, I describe and discuss the research objectives that shaped the first frame experiment. As outlined in the introduction to this chapter, the key factors that I aimed to explore were as follows:

- Gather insights into the nature of hacking and examine the way in which hackers experience and carry out their practice.
- Understand the ways in which they explicate this knowledge to participants in the workshop.
- Provide reflection on and an interpretation of the knowledge applied and developed by hackers as they conducted the workshop.

I aimed to uncover how hackers understood their own practice, and how they developed their process of learning through a range of reflective experiences. Furthermore, I aimed to understand how this implicit knowledge could be made explicit through interactions and dialogue with participants within the workshop. I aimed not only to uncover what was happening within the workshop, but also the constraints that both enabled and supported the practice as it occurred.

As outlined in the introduction to this thesis, this research was conducted within the context of Tweak, an interactive digital art festival I established in 2008 that featured workshops, exhibitions, musical performances, and other events. One could argue that I needn’t have organised a festival to investigate these practices and that instead I could have conducted virtual ethnography (Hine, 2000; Domínguez et al., 2007; Wittel, 2000) on forums and websites, or solely organised workshops and achieved similar results. However, my argument is that situating the research within the context of a festival provided a frame for my research to be conducted in a realistic situation. Events similar in nature to Tweak frequently occur all over the world; the culture and practice of hacking is widely celebrated through festivals,
talks, workshops, and meetups. Festivals like MakerFaire\textsuperscript{31} in the United States, and Transmediale\textsuperscript{32} in Berlin are becoming more prominent and are thought highly of within hacker communities. Thus, for a hacker, participation in an event of this nature increases their public profile and also places a public lens on their practice. By developing a festival that was similar in nature to MakerFaire and Transmediale, Tweak offered hackers another public forum in which they could partake and meet one another. The organisation and examination of the workshops supported both my research questions and my methodological approach; furthermore, they acted as an open space in which participants could learn and engage in dialogue with others. This is important because, in my opinion, conducting an analysis on digital content only omits rich characteristics of the practice and of lived experience. I believe that only certain aspects of the practice occur and can be documented online and that the majority of the practice occurs in the day-to-day creative activities of the hackers’ lives. Organising a festival felt like a more suitable frame for engendering the practices I wanted to examine and developing a deeper understanding of hacking culture. The active participation by hackers and participants in these workshops also contributed to the reflections on both my research process and my methodological approach.

My first interaction and experience with open source communities was during my Masters thesis, and it was from these initial exchanges that I developed my curatorial interest on the practice. This preliminary foray into hacking provided me with an appreciation of the practice, and it also presented a starting point from which the festival developed. This initial introduction afforded me with experience to reflect on and something that I aimed to reenact for participants who attended the workshops in the festival. Additionally, I developed an interest in the practices of digital artists who are hackers, in their critical approach and the artistic intentions behind their work. Linking both these interests and experiences together led me to develop Tweak, and my research being conducted within this framework; I wished to establish a platform from which participants could empower themselves and learn more about hacking culture.

\textsuperscript{31} http://makerfaire.com/
\textsuperscript{32} http://www.transmediale.de/
With these intentions in mind, I began to plan the first edition of Tweak, and aimed to reflect these influences through the aesthetics, design, and the structures in the festival. I sought to define a platform, to use as a foundation from which I could gain unique insights into the practice of hacking. Within Tweak, I aimed to examine both the artistic and technological aspects of hacking, illustrating to the public how these aspects were intertwined and influenced by one another. By defining Tweak as a platform, I claim first that the festival was a space where interesting technological things could happen; and secondly that it was an open, transparent space whereby, dialogue between hackers and the public could take place.

I began to plan for Tweak in March 2008, and by securing funding through different sources, I was able to develop a program including an exhibition featuring eight artists and nine workshops. Additionally, I organised a set of talks and two musical performances by various artists. In my role as curator, I set out to create an open transparent space in which the practices of hackers were provided for. I initially developed a manifesto for the festival where I described the aims of the festival to be:

“...A new interactive art and live electronic music festival... Its aim is to promote understanding of the use of technology within our culture and to explore contemporary issues (social, economic, psychological, aesthetic and functional).... Tweak examines the growing impact of digital technologies in the creation of art and aesthetic experience. Providing a space for digital artists to redefine the nature of technology within our lives, the festival intends to create public awareness of the complex nature of technology and explore the relationship technology has to our lives.”

In this manifesto, I established the premise of the festival and outlined the types of activities that would take place. I intentionally used general keywords to ensure that a broad cross-section of hacking practice could be explored rather than examining one particular aspect. For example, Node is a festival that focuses solely on artistic projects that utilised the visual programming language vvvv. Also, by using the term “digital artist” instead of hacker I avoided any negative connotations associated with the practice.

33 [http://www.tweak.ie/2008/index08.html](http://www.tweak.ie/2008/index08.html)
The festival's program was curated from an open call for submissions, a copy of which can be found in Appendix A of this thesis. As part of my curatorial methodology, I used online platforms and networking tools to engage and interact with both hackers and with the audience I wanted to attract to the festival; the call was circulated through online forums and blogs, allowing the actual content of the festival to be created from the community itself. Workshops were chosen from submitted proposals for their artistic merit and their relationship to the curatorial theme I had in mind. It was also essential to represent a broad cross-section of the practice, and thus I chose a selection of workshops whose topics covered: electronic hacking, software programming, visual mappings, and the application of open source methodologies to non-technological domains. The aim was to communicate to the festival audience the diverse nature of hacking in order for participants to contextualise it within their everyday life. In my role as curator, one of my key objectives was to provide a space that could support the interactive and participative practices of hacking, while communicating an accurate reflection of what the practice is composed of to the festival’s audience. I worked closely with the hackers who were conducting the workshops to provide for their needs and to create an open, transparent space. Furthermore, in keeping with the hacker ethic and philosophy described in Chapter 3.2, participation in workshops and the related activities was either free or at a minimal cost (e.g. enough to cover the cost of material used in the workshop, but without generating a profit).

Prior to the commencement of the festival, I worked closely with a graphic designer\textsuperscript{36} to create a recognisable identity and aesthetic for the festival. Together, we brainstormed and discussed how hacking could be translated into a visual design. One of the key considerations for the visual identity was to promote the meaning-making activity of the practice and a positive perception of hackers. This brainstorming session resulted in a logo, printed posters and a website that were used to disseminate information about the festival. The visual identity composed of a set of components:

- A color palette of turquoise, yellow, fuchsia and grey to communicate a playful, fresh aesthetic (Meggs, 1992).

\textsuperscript{36} The graphic identity of Tweak was developed in collaboration with www.pygment.com
- A set of graphic components, which represented different aspects of the festival.
- Ambiguous photo imagery (taken by both myself and the graphic designer) of old buildings and objects to communicate a meaning of structure, construction and repair.
- The font Helvetica to reflect feelings of neutrality.

Through combinations of these components, the logo, print posters, and website were developed to create an upbeat visual design that played a role in mediating the visibility of Tweak to the public.

The logo, as seen in Figure 5.1, used a color palette of fuchsia, yellow and grey and consisted of text that communicated clearly the idea of the festival. This logo was used on the website and printed posters, and was also placed on all documentation (press releases, curatorial statements or open calls) for the festival.

For the background of the website, I used photographs suggestive of the building and construction aspects of hacking. Overlaying this imagery were colorful graphic icons, which were designed to promote a playful experience. This dynamic and engaging atmosphere was also evident in the design of the printed posters – seen in Figure 5.3 below. The graphical components were used to represent different aspects of the festival: a selection of musical symbols represented the performances, a robot holding a paintbrush signified both the artistic and technological nature of the exhibition, and finally, a set of electronic tools was used to correspond to the constructive and building aspects of the workshops.

The final component of my curatorial process was the selection of suitable spaces to hold the festival events in. As a curator, it was my responsibility to

37 Documentary on the font Helvetica found online at www.helveticafilm.com
support the artistic and technological expressions of hackers. Thus, the setting was essential for the creation of an atmosphere that conveyed this. For the workshops, I approached the Limerick School of Art and Design and asked whether they could host them. My motivation for doing so was double: Firstly, I wanted to promote the notion that the workshops were open to all regardless of the background of those wanting to participate, and I wanted to associate the workshop and hacking with the artistic meaning making aspects of the practice. It was also crucial that the workshop not to be seen in only a technological light. Secondly, when viewing the space, I thought that the aesthetic of the room lent itself to the nature of hacking: the room was large, had a high ceiling, and was covered in paint splatters. There was an air of experimentation and rawness to it that I felt echoed the sentiments and open-ended nature of hacking. The components and strategies, described in this section, were an integral part of the curatorial process I undertook in the organisation and development of Tweak. As a curator, I recognised that my approach consisted of a number of elements, and that interactivity between these elements allowed me to facilitate and frame how the festival was accessed by both hackers and by the festival audience. Furthermore, I drew from hacker ethics and principles in terms of the decision-making process and collaborating processes. From the outset, Tweak was a
collaborative open process: open calls were aimed at enabling participation and collaboration from the hacking community. In the next

Figure 5.3: Print posters used for Tweak 2008

section, I move to discussing examples of empirical data from a workshop that focused on circuit bending and the building of musical synthesizers from electronic components.

5.3 Workshop: ‘Build and Bending with Electronic Circuits’
This workshop offered participants an introduction to making music using basic electronic components. It was a practical, hands-on workshop whereby it was assumed that participants had no technological background. The hackers who taught the workshop – Mark and Stewart38, two Noise Music artists - guided the participants through a series of sound-producing electronic construction projects including the construction of a “Victorian synthesizer” – an oscillator with a speaker

38 All names in this thesis have been changed. Any further mention in this thesis of a name of a hacker or of a participant will be of fictional names to conceal their identities.
and battery – and a basic oscillator circuit that could be controlled by a wide range of sensors including potentiometers and photo-resistors. Participants were also introduced to circuit bending – the creative rewiring and short-circuiting of battery-powered devices to create sounds – and were asked to bring with them a range of old electronic toys and musical instruments that could be used for this purpose. The workshop had a fee of €10 to cover the cost of materials but the participants were supplied with all the electronic components necessary for the workshop.

In total, 10 participants (8 students and 2 professionals) attended the workshop. Each of these participants had varying backgrounds and technical expertise. From these 8 students: 4 had an art background, 2 had an engineering background and 2 had a music technology background. Thus, the level of expertise ranged from Beginner to Intermediate, with 3 of the participants having previous experience with electronic components.

Figure 5.4: Participants were arranged in a circle facing one another

The hosts began the workshop by providing a general introduction to theory of electronic components, and then detailing the activities that would follow. Participants were arranged in a circle facing one another and were each given a breadboard, resistors, wires and amplifiers before the workshop proper started. During the workshop, the participants built various oscillating circuits with variable potentiometers, LDRs and CMOS and NAND chips. They also constructed a
modulating oscillator circuit and rewired some electronic toys for circuit bending. Throughout the duration of the workshop, participants were introduced to the theory behind electronic components and were given advice on where to buy the “most interesting” components for building oscillating circuits. Furthermore, the historical and cultural aspects of the practice were discussed, giving participants a context to which they could associate the circuits they built during the workshop. The hackers conducting the workshop also discussed their own musical practice, describing in detail how they employed these circuits into their own performances. Therefore, the workshop not only taught participants how to build small circuits, but also gave them an insight into the culture behind the practice.

During the workshop I observed and took notes, in addition I also video recorded the workshop using two video cameras. One of these cameras remained stationary and focused on the hackers leading the workshop. I used the second video camera hand-held to capture close ups of different activities that I observed during the workshop. I also conducted a number of informal discussions with both hackers and participants at the end of the workshop. In the next section, I present an analysis of excerpts from this data and, in particular, comment on instances from the video data organised in vignettes. The vignettes will consist of a sequence of stills (extracted from the video data), a transcription of the conversation and a description of the broader context in which the episode occurred. Using the language from Schön’s theory of Reflective Practice, these detailed descriptions are organised thematically and provide a frame for reflection on the activities conducted during the workshop.

5.3.1 Making tacit knowledge explicit
Schön refers to tacit knowledge of skills as “knowing in action”: “We reveal it by our spontaneous, skilful execution of the performance, and we are characteristically unable to make it verbally explicit” (Schön, 1983: 25). One of the issues I wanted to explore was how hackers conducting the workshop would communicate to participants the intricacies of their practice. The following vignette exemplifies how the hackers engaged participants in a process of learning and reflection using

39 Quote from hacker during the workshop when describing which components would yield the most interesting results for making oscillating circuits.
different materials and techniques. Mark begins the workshop by ensuring that
everyone has the necessary equipment to participate. In front of each participant are
a breadboard, a CMOS chip, a resistor and a capacitor. There are also toolboxes
containing different lengths of wires. He starts off by explaining that they will be
building an “extraordinary Victorian synthesizer, a process that we will be going through
step by step by step, but don’t worry you’ll all be fine”, he says glancing around the room,
“I’ll just explain the theory, but there is nothing too terrifying” - reassuring those who are

Figure 5.5: Vignette 1 – Hacker shows participants a hand drawn sketch of
truth table and a circuit diagram

feeling beginner’s jitters. Mark then reaches for a paper sheet – a large A0 sheet that
he found in the room prior to the workshop: on this he has sketched a truth table
and the schematic for a NOT gate (figure 5.4). Placing it in front of him on the desk,
he addresses the workshop “Imagine an electronic component, imagine right, if you give
it on its’ input 5V, the output is below that, this is simply called an inverter and it’s like
performing a logical operation. It’s like saying [emphasises] NOT. Whatever I’m given, I’m
going to give you the opposite. So imagine a little component that does that, you feed some
high voltage into it and it gives you a low voltage out. So let’s represent that component like this”, picking up the piece of paper, Mark shows his sketch to the participants, ensuring that everyone can see the sheet, he points to the truth table and says circling A on his sheet: “where A which we have labeled as an input can either be high or low and it’s output is then” points to NOT A making a circling action on the sheet “NOT A, which is either high or low”. Pausing momentarily, he looks up and glances around the room “right is everyone ok with this? Can we all imagine an electronic component that does this? Something high goes in, something low comes out, something low goes in something high comes out. The opposite!” He glances around the room looking for a response to ensure that everyone can understand what he has just said. The participants nod and Mark continues to explain further: “Ok now imagine, taking the output of that electronic component and putting it back to its input. OK? So we start off with a high voltage, I get an output of a low voltage and that goes back into the input, I now have a low voltage as an input and get a high voltage as an output, [emphasizes] that gets fed back to the input and so on. So such an electronic component, that does such an operation, feeds output back to it’s input, it’ll oscillate, it’ll oscillate between its’ maximum and minimum between 1 and 0. OK? Now in the trade, this is known as a square wave oscillator. You’ll find square wave oscillators in synthesizers, and they make a big throaty noise, and if you use them at very low frequencies they produce clicks and pulses. If you have a bunch of them, they produce rhythms and at higher frequencies [interrupted by a sound from one of the electronic toys]. They produce sounds like that”.

In this episode, Figure 5.5, Mark is explaining the theory behind a NOT gate and a square wave oscillator to make the theoretical principles behind the NOT gate accessible, describing it with everyday language. His deliberate use of informal language makes the material less daunting for participants who are not necessarily very familiar with the technology being used. His vocabulary – “imagine”, “little” - engages the participants’ interest and allows them to construct an alternate perspective of the technology, one that is less overwhelming. He uses the same approach in his presentation of sketches: instead of providing participants with technical drawings, he uses hand drawn sketches to illustrate the truth gates and circuit diagrams. This serves to reduce the boundary between the participant and the material being taught during the workshop. Furthermore, he communicates the theory in a clear, coherent and deliberate manner. In this vignette, we see him repeating the same information a number of times; he does this to ensure
participants form a knowledge base from which they can build and learn. In providing clear accessible instructions to the participants, he ensures they have a clear understanding of the sounds in the synthesizer are being produced.

In the next vignette, Figure 5.6, Mark is instructing participants how to build a small feedback circuit: as he instructs the participants he simultaneously builds a circuit while describing out loud his actions. The participants interpret these instructions as they build the same circuit: for example for each action that Mark took, he would describe in detail what he had done. He would also demonstrate and show to participants each component he was using.

Mark starts off by describing the chip that the participants have in front of them and instructing where they should position it on their breadboard: “Ok the first thing – your chip needs power. Now we won’t connect it fully up just yet, but we will connect the earth up, which is the…[pause]… [Demonstrating and holding the clip and battery up for the participants to see] If you put on your little clip onto your battery like that, and then take the black one, and put your black wire not in the bottom row but the row above that and put it right away to the right hand side…”

The participants then applied what they had heard and repeated the same action, while Mark watched and ensured that each participant had performed the action correctly. The demonstrations were given to the entire group of participants, but each participant concentrated on their own individual tasks. While they were engaged in each task, Mark would oversee their actions and assisted any participant who had a query.

When instructing the participants Mark would use informal language and describe in clear and concise detail his actions but he allowed participants to interpret these instructions in their own way. In the next example we see Mark describe his set of actions: “Ok so take a jump wire and put it in column 10 and leave it hanging, it’s basically the bottom left most pin, you’re making a connection there, so stick it in and leave it hanging… Take a couple of jump wires, the medium length, a couple of them. One of these put into column 11… and the other end into column 12, it can be pretty much wherever appeals to you and then you’ll have a couple more hanging. So one end of the jump wire into column 11, one end of the jump wire into column 12”. When
one of the participants is confused or has difficulty understanding the instructions, he questions Mark and asks for further clarification: “is that two new wires or bridging?” Mark responds by demonstrating the circuit he has built (Figure 5.6), assisting the
participant in the process of reflection-in-action. The participant looks at the circuit and sees what Mark has built and then returns to his own circuit to complete the instructions.

Describing aloud the instructions necessary to complete the action ensured that participants received the correct information at the appropriate moment in their activities. Furthermore, Mark offered information when needed that was applicable to the situation at hand. By using a combination of techniques – demonstrating, informal language and explicating clear instructions - Mark articulated his tacit knowledge of building circuits in a comprehensible manner for the participants to interpret and form their own understandings of what they were building.

5.3.2 The value of experimentation
In these vignettes, I describe the participant’s reflections in action during the workshop. In Chapter 4.3, I discussed Schön’s theory of reflective practice, where reflection-in-action describes a means of practice, which employs knowing in action: the practitioner applies this tacit knowledge until they are confronted with an unknown situation – a ‘surprise’ – that moves them from knowing-in-action to reflection-in-action. Experimentation is one of the key activities that the practitioner implements to facilitate reflection-in-action.

Schön states that there are three forms of experimentation – exploratory, move-testing and hypothesis that are essential to the process of, reflection-in-action. The vignettes described in this section illustrate the experimentations that participants engaged in throughout the workshop.

In Figure 5.7, vignette 3, one of the participants has just completed building a square wave oscillator circuit. The circuit consists of capacitor, a potentiometer and a CMOS NAND gate. These components are inserted into a breadboard and using jump wires are connected; the circuit is also connected to a loudspeaker and powered by a 12V battery. Mark facilitates the construction of the synthesizer by leading the participants through a series of instructions: “Go round to the top of your chip and stick it [the jump wire] into column 10. You should be able to adjust the frequencies using the potentiometer”. Having completed the circuit, the participant hears glitchy sounds from the loudspeaker. Satisfied that he has built the circuit
correctly, he starts to experiment with the sounds by adjusting and turning the knob on the potentiometer. He notices that this action is not affecting the sounds from the amplifier. Puzzled, he starts to inspect the circuit, examining each connection to check if any have come loose. He pushes and presses each connection to ensure they are connected correctly into the breadboard. He tests with the potentiometer again and still there is no change in the sound. He turns his attention to the battery source: holding the battery between his middle finger and thumb, and he squeezes the connection (see Figure 5.7). Simultaneously, he starts to turn the knob on the potentiometer to see the effect it has on the sounds: “It just has a mind of his own, it goes away and then it comes back”. There is still no change in the sound and he describes the issue as “odd”. He looks at another participant on his right hand side to see if she is having similar problems. He compares his circuit to hers and notices he is missing a connection with a jump wire. He inserts the missing wire, and as he twists the knob on the potentiometer, the sounds from the amplifier change.

Figure 5.7: Vignette 3 – Participant holds the battery clip onto the battery, whilst varying the resistance using the potentiometer to see the effect on the sound output
In this vignette, the reflection-in-action is driven by the participant experimenting purely to see what effect it has on the circuit. This experimentation occurred at the beginning of the workshop, and, at this early stage, the participant was familiarising himself with the different components and their relationship to the sounds from the loudspeaker. When his actions did not result in a change, he checked the connections and tried to correct the ‘surprise’ by holding the battery clip in place. When he deduced that the battery clip was not the problem, he compared his circuit with another and discovered a jump wire was missing. After inserting the missing jump wire he experimented with the potentiometer further.

![Figure 5.8: Vignette 4 – Participant plays with the potentiometer, bringing it closer to the distortion pedal to see how the sound is effected](image)

In Figure 5.8, the participant is experimenting with his built circuit. Having gathered sufficient feedback from his initial interactions with the circuit to obtain an understanding of its qualities, he began to demonstrate purposeful experimentation. By adjusting the knob on the potentiometer, he intentionally explored the relationship between these adjustments and the resulting sounds. He then moved
the potentiometer towards the loudspeaker to see if he could generate feedback or if his action would have an effect on the sound output. Through these interactions

Figure 5.9: Vignette 5 – Participants play with torches and the LDR to see the effect on the sound output
he learned that by changing the resistance of the potentiometer he can control and vary the sound. This experimentation allowed him to develop knowledge that he could reflect on and reuse at a later stage.

In vignette 5, (Figure 5.9), the participants have substituted the potentiometer in their circuit with an LDR. The resistance of an LDR is controlled by the amount of light it receives. Reflecting on their previous experiment with the potentiometer, the participants know that changing the resistance can alter the sound from the synthesizer. Participants take out small pocket torches that they carry with them and direct the beam towards the LDR: this action causes the pitch of the sounds to change from high to low. This purposeful experimentation allows the participants to reflect on the way the experiment has gone and also affects their next move.

In vignettes 4 and 5, we see how participants carry out both exploratory and move-testing experiments according to the knowledge and techniques they learned earlier in the workshop. As the workshop progressed, Mark would instruct or provide the participants with additional skills, as they were needed. In addition the participants mimicked one another’s behaviour and freely shared any discovery they made. These vignettes illustrate the participants’ ability to exercise their tacit knowledge and reflective thought as they examined the nature of the synthesizer as they built it. The participants applied actions to the circuit to control the sounds from the synthesizer. Using their understanding and tacit knowledge of the different components they deliberately experimented with the sounds produced from the circuit.

In the next vignette (Figure 5.10), the participants have swapped the capacitor in their circuit with a higher value capacitor: Mark addresses the workshop, “The little orange thing that you connected in earlier, that is a capacitor, the one that Stewart is giving you now, substitute that and see if it effects the pitch. It certainly should but see if it affects it in a way that you like.” The participants substitute the capacitor and ranges of noises are heard from the circuits. Mark encourages the participants to experiment: “You’ll find these circuits are very sensitive. You can touch them and things will change. Don’t be ashamed, you know, feel up your circuit, see what happens, see what the sensitive parts are and also consider putting something like extra jump leads in. So you can actually touch and connect through your hands different parts of the circuit”. Understanding the importance of experimentation in the process, Mark
encourages participants to lower their inhibitions and to fully explore all aspects of
the circuit in their pursuit of different sounds. The participants then all partake in an

Figure 5.10: Vignette 6 – Participants perform a concert with one another using the
techniques they have learned in previous experimentations
impromptu jam session, each playing their synthesizer, whilst experimenting and exploring the ways in which they can produce different sounds. The participants thus implement the skills and strategies that they have gathered in the previous forms of experimentation and employ them to produce sounds. In Figure 5.10, we see one of the participants has inserted two potentiometers into his circuit and is manipulating the resistance to control the sound. Also, illustrated in this vignette is a participant cupping his hand over the LDR to influence the emitted sounds.

In these vignettes, we see participants employing reflection-in-action as they experiment and explore the synthesizers they have built. These reflections are motivated by their desires to control and manipulate the sounds in a way that pleases them. Through a set of actions and techniques learnt throughout the duration of the building exercise, they find their own ways and means to play with the sounds. Furthermore, these vignettes illustrate that reflection was an ongoing practice that supported the participants’ progress throughout the workshop.

5.3.3 The experience is not just in the making

In addition to providing the participants with the theory and skills to build and control synthesizers, Mark and Stewart also provide them with insights from their own experiences to illustrate their practice of use to the participants. In Figure 5.11 Stewart is explaining how the synthesizer that the participants have built can be extended for musical performance. Stewart describes himself as a sound artist and tells the participants how he is always looking to think of new ways that he can control different components. He describes his main motivation for doing so: “I think the main thing of how it leads on from this, what we have been doing here is kind of the physicality of touching the stuff and moving about with it. The whole point of my performance is to – I mean it’s not overly sophisticated technology – I’m just using what we have been using here and a few other bits… But it is basically to get away from the kind of traditional sort of sitting there with a laptop or with a synth”. Stewart finds laptop performances “uninteresting and boring”, and sees electronics as a means by which he can create an interesting experience for the spectator. By adding his body to the circuits he introduces “new and different ways” of controlling these components. He describes to the participants some of the different ways he has explored with these
controls: “I try to think of different ways to make these circuits and put these controls somewhere else to make for an interesting performance and what I’ve done is basically a mess of wires, but with the LDRs, I was using a strobe light to trigger them. So I thought I would stick them on my hands, so I could move around. I bought some water irrigation tubing from Wilkinsons – it isn’t too great because you have long bits of wires. Then I would stitch the tubing to my clothes and have the LDRs in my palms. The other piece of equipment is an accelerometer, which measures movement – forward and back, left and right. So I thought that was quite interesting and I thought well I move my head quite a lot during my performance so I’ll stick it on my head. It’s basically the same components that we are using here and the chip is a programmable chip, a basic stamp, which I program on the computer and then use the components to manipulate it later on. So you can have a look if you like. I think the main thing is to think of new ways or different ways to actually control what you are making as well, instead of just having it in a box”.

Figure 5.11: Vignette 7 – Stewart shows participants his synthesizer that he uses for his musical performances

As Stewart describes how he has modified the circuits for his own performance, the participants edge forward and inspect his work: he shows them the tubing and the accelerometer for further inspection. By showing participants his
work, he provides them with insights into how they can expand and develop what they learnt in the workshop for alternate contexts. Furthermore, he provides them with inspiration for ways in which they might develop their own techniques and ways of working with electronics. This illustrates how “out of the box” thinking can get around imposed constraints of the materials being used.

5.4 Reflections
At the beginning of this chapter, I outlined my research concerns, which I aimed to explore within the frame of this workshop. In this section I provide reflections on these objectives, as well as reflection on the role of curation as a methodological choice.

Schön argues that knowledge is generated during practice – “the characteristic mode of ordinary practical knowledge” (Schön, 1983: 54). This kind of everyday knowing comes from being open to the experiences of the world and recognising that knowledge is a detailed account of the actions, appreciations and understandings that were applied or developed in the process (Schön, 1983). When looking at the knowledge applied and developed by the participants whilst partaking in the workshop, the vignettes presented in the previous section examine the reflective nature of hacking practice and highlight how this is naturally embedded with the practice.

In these vignettes, we also see how the participants and hackers engaged in dialogue with one another, developing a shared language that they employed to complete the different tasks throughout the workshop. This informal and shared language facilitated how hackers and participants interacted with one another and also allowed the hackers running the workshop to make their implicit knowledge clear for the participants. These clear instructions allowed participants to build a knowledge base from which they experimented and employed reflection-in-action during the course of the workshop. We also saw how this allowed participants to explore, discover surprises, reframe, and find solutions to the surprises.

Each of the examples portrayed significant activities and actions of participants, illustrating the context and the interactions that supported how they participated in the workshop. Furthermore, they show how the participants used the tacit knowledge they learnt in the workshop to develop a set of procedures and
skills. This tacit knowledge was then used to exercise intuitive, creative, reflective thought, whilst examining the characteristics of the electronic circuits that they were building. Using this knowledge, they were able to continuously experiment in different ways depending on how they wanted to manipulate the sounds emerging from the circuits. Through these vignettes, we can see clearly how they employed reflection-in-action throughout the duration of the workshop.

Finally, the last vignette illustrates how hackers demonstrate to participants how the practice is contextualised culturally. Furthermore, it provides inspiration for participants to expand and develop the practice for their own means and interests. This final vignette also illustrates how the hackers employ the same experimental approach to developing and testing new ways to house and control the different components.

Considering my curatorial goal to organise a workshop where both participants and hackers could interact, this setting allowed for observation and analysis of the dialogue and interactions that occurred between participants and hackers during the course of the workshop. As outlined in Section 5.3, my curatorial process was intentionally open-ended and I sought to create an accessible, transparent space that was open to all regardless of background. Furthermore, I wished to explore the artistic meaning making aspects of hacking and engage participants in this process: to do so, I worked collaboratively with hackers to establish the content and structure of the workshop. As a curator, I ensured there were sufficient structures and resources in place to support the needs of both hackers and participants for the workshop.

To facilitate the production of the workshop, it was necessary to engage in a dialogical process with hackers. Thus, I became more acquainted with the practice of hackers as I developed new perspectives of the practice. By reflecting on my exchanges with different hackers, I built an understanding of the practice and their beliefs that was based on the messiness and complexity of everyday contexts. Consequently, the hackers began to view me as a collaborator in the process, and I saw my role to be becoming that of catalyst of activities and curator of a process rather than of a fixed event. I felt that this open approach allowed me to work closely with the hackers and permitted me to glean greater insights into their practice. For example, prior to the first edition of Tweak, as a curator I was concerned with presenting finished objects during the exhibition. It was through my
interactions and observations of various hackers that I begun to appreciate the rawness of the hacking process, and I began to see the artistry behind the finished exhibition and in the inner workings of the medium.

I also felt that by taking this approach, I was able to understand the process of how hackers worked. In looking back over video data, I felt that hackers took a layered approach to developing knowledge and to call on different resources at different times. In examining my curatorial frame for the workshop, I felt that the structure I employed in the workshop lacked the support for this: for example the hackers teaching the workshop would introduce different skills or information as the workshop progressed. I saw this as a layering process and felt that I needed to support this further in the next set of workshops.

In addition, I received feedback from participants who attended the workshops: the feedback was extremely positive and most respondents remarked on the festival as being “cool and very interesting.” However some participants felt that the workshops were too short, and they wanted more introductory workshops that could help them build their knowledge base.

One of my concerns as a curator was to create an open space that could support participants from a broad range of backgrounds: I was successful in this endeavor, and participants who attended the workshops had backgrounds in art, computing, music, engineering, and some were simply members of the public who were generally interested in the subject area. Moreover, when I asked participants what they thought of the layout of the workshop, they described it as being conducive to collaborative activities. One participant stated: “I liked the way in that the spaces were set up in kind of that it was a big loop and everyone was wandering around, looking at each other and helping each other out and whatever. Kind of like “oh this isn’t working, oh it’s this and this” – that was kind of cool”. From this feedback and many similar comments, I saw that the way that I had laid out the workshop supported the actions of the participants and allowed them to collaborate and interact with one another. Furthermore, it showed that the informality of the space and that the workshop itself was not intimidating, even given the technological nature of the workshop.
5.5 Probing deeper

Reflecting on the data presented in the previous section, I felt that a deeper examination of the practice was necessary. From this data, it is clear that analysing hacking in terms of Schön’s theory of Reflective Practice is fitting and allows us to understand how hacking as a practice is constituted and performed. However, I felt that I was “missing” something in my data, and thus, I begun a series of semi-structured interviews with hackers. In these interviews, I aimed to examine the reflective nature of the practice in further depth, and gain insights into the experiential qualities of hacking.

The excerpts from the data that are presented in this section are taken from interviews conducted with two hackers – James and Rob. James describes himself as an artist who employs technology within his artworks. He views technology as a means to an end, and states that the technology is not the focus in his artwork. Rod describes himself as a hacker and a programmer: for him, hacking is a way of life, and he is consistently looking for new domains and contexts where he can collaborate with artists and non-technical people. The interview with James was conducted face-to-face in an informal environment and the interview with Rob took place via Skype.

5.5.1 Knowing your subject inside and out

In this excerpt, I query James on the importance of knowing code. My aim was to uncover the relevance of this knowing to his practice. I wanted to explore how he connected the material to the process of how he works:

“"It’s a means to an end, if the code works, I don’t even think about it. It does take a certain amount of understanding to know what to grab from the code. That I wouldn’t have arrived at if I wouldn’t have years back tinkered and made my own code, these days I don’t do it at all anymore, I tell my students now you can’t hack without a base, without knowing what to look for in the code… [He continues] A lot of people are good coders, but there is another group of people who are quite good with the application of the programming. A lot more people are getting involved with the application side of the software and are developing artworks, applications, toys etc to demonstrate the potential of these languages. This is just as important, unless you see how it’s applied it really loses, or it does not really have
any meaning. For me, it’s a tool. It’s a means to an end and a tool, and it’s a tool that – and I think that’s why I’m not involved in the community – it’s a tool I’m not interested in developing. Using the woodworking paradigm, the table, saw, I’m not like [talking to himself] well… you’re not going to make this better so, I just cut the wood and I move on. Processing is the same for me, I cut the virtual wood, and then I can finish the project”.

In this excerpt, we see how James contextualises the knowing of code within his own practice. At the start of his practice, he actively learnt how to code, however, he has now built up a knowledge base of code and instead of spending time coding, he uses his tacit knowledge of coding to glean what he needs from open source forums and online tutorials. However, he attributes this way of thinking and doing to understanding the basics of coding, and asserts that without a knowledge base it is impossible to develop a practice. Furthermore, it shows that he views two distinct ways of working with open source software and hardware: the members who are fascinated by the inner workings of code and those who build applications using the code.

5.5.2 The meaning is in the making

In the previous excerpt, we saw how James distinguishes himself from those who code: he differentiates himself from others and feels that his practice is unique. From his perspective, his treatment and understanding of software is unique and the applications he makes responds to the materials he uses:

“I like to think that what I’m doing I’m just making poems in the software. If it’s an interesting poem it catches people’s imagination… the possibility of the tool is the beautiful thing about it. Especially with Processing, because that’s the one area I am working. It is such an easy interface that you can make anything you can think of really, within a couple of hours without having to dive too deeply into you know the architecture of the software. There are limitations, but I feel like less is more, so I approach it like that, it is the less technology the better, but definitely, there is a certain amount of experience with the technology. With processing, when I am thinking of a new idea, I am thinking oh yah! I can probably plug in this and that with processing to get me to a certain point. The latest piece I just finished – Beta – I just had some components in the studio, I was playing with them, I didn’t even
have electricity, I was literally playing with toys, ideas were coming from this playing, and they were being bolstered by Processing. Processing was the conceptual tool and shape. Once I started it was so easy, most of it is all in the head”.

For James, the ideas and artworks he produces are “poems,” and they are produced from the “back talk” he receives from experimenting with his materials. He feels that he is guided by this back talk, and for him his solutions are derived from this reflective conversation with the materials he uses. Experimentation is a key part of his process, which he describes as “playing” and it is through this experimentation that he arrives at the solutions for his artwork. Furthermore, we see that he understands the affordances and constraints of the materials he works with, and understands how to manipulate it in accordance with his own needs.

5.5.3 Looking for new contexts and applications
In this excerpt, Rob describes the mindset behind his practice. We see how he views open source as a way of life and that this way of life is not solely tied to software and hardware, but instead is embedded within the everyday. We also see how he views the relationship between hardware and software and how each are linked and should be viewed as a whole, rather than separate components:

“I started making little games, but since the hardware was constantly crashing, I would even break apart my hardware to make my own coding system. So, I started to program at the same time I started to play around with hardware, so I never really learned just specifically one language, but always the combination between software and hardware. I don’t think that hardware and software should be seen, as two separate things I mean it’s like, a human being without a soul. It’s not two separate things it’s always one… I really like to combine software and hardware in the core of what I am trying to make whether it is product or performance. I learned both things at the same, and maybe that’s why I am working a lot with software and hardware. Open sourceness is not the products but the mindset of how you look at things, you know, if you know how to break things apart and make something else, for me that is open source. I made this little robot a little while ago for my 3 year old nephew it would say some stuff like “can u give me a kiss” and when he did give him a kiss that’s the magical moment, not the code behind it,
that’s the goal for the purpose, and when I reach that goal it’s the most satisfying in the whole process”.

Rob is driven to find new uses for software and hardware he works with: for him, the purpose of open source technology lies in the “magic moments” he can create for people - It is these experiences that drive him, and give him satisfaction. Additionally, he describes hardware and software as one thing, and views the relationship between both as important. His knowledge and understanding of both software and hardware allows him to create new uses and applications for these technologies. Moreover, this knowledge, allows him to continually explore and find new contexts for what the materials he uses.

5.5.4 The exhibition of ideas and hackers

In this excerpt, Rob describes how he often works with other hackers as a design team to deliver solutions for clients. He describes what is important to them when they work together:

“For us we care about the result… A lot of people using free software or open source software sometimes have a political approach. Many people, it’s not a negative position, these guys I respect but they have a political approach, maybe a philosophical approach. You have to work on Linux because this way you don’t use a closed system and everyone can participate. It’s a point of view I respect totally, but we view the thing differently, in the way that what matters more is the result. For us the important thing is the result. The software we use is on Windows, so we are not going to say oh we are not using it because it is only on Windows. You know what I mean? We don’t care; the important thing is the end result. We just want to entertain people. Of course it is better if software is free and everyone can participate etc. Some users of these open source software have a political agenda. It is a different kind of approach and it is not that we don’t waste time on that, but we aren’t in this kind of reflection. We would rather entertain people; entertain ourselves so we don’t have to hide ourselves. We want to be seen as entertainers”.

Here we see how Rob and the other hackers he collaborates with are driven to be entertainers; they want to receive credit for their ideas from other hackers and from
the public who are exposed to them. By developing uses for software and hardware that are publicly displayed, Rob and his collaborators place themselves at the focus of their work. This exhibitionist nature of their personality motivates them to create work that is developed for public exhibition.

5.6 Discussion

These informal interviews highlighted the rich experiential nature of the practice and how it differs significantly from each individual. The open source technologies that hackers use in their practice allow for multiple viewpoints and understandings on how the technology should be used. Furthermore, these excerpts illustrate how different hackers are motivated in different ways and have different processes when it comes to using these technologies within their work. However, there are similarities in their approach – they aim to use their practice to create uses and applications that are meaningful within the context of their own lives and the lives of others.

Reflecting on the vignettes and interviews carried out in the first case study encouraged me to consider hacking in a different light, and I began to question my understanding and my approach to investigating the practice. As the rich complexity of the practice began to unfold, I began to understand the reflective nature of the practice. However, I realised that the subtleties of the practice should be experienced in order to understand them further. Consequently, I reframed the design situation in order to reveal new details, understandings and knowledge about the practice. Thus, in the next case study I participated in the frame to gain new experiences from my own practice as a hacker. By participating in this frame, I aimed to develop understandings of the strategies that hackers would employ in their practice. Furthermore, I aimed to become sensitive to the needs and requirements of their practice through a more engaged and reflective personal approach.

5.7 Summary

In this chapter, I presented the first case study documented during this research. I described the research objectives and the curatorial process, which guided the development of the case. I described the dual faceted nature of this research and the experimental approach I took to pursue it.
I presented vignettes that examined the different nuances of hacking practice and I illustrated how the reflective nature of hacking is naturally embedded within the actions of the practice. The vignettes were drawn from data where as a researcher I observed and recorded the interactions, which occurred during the workshop. In addition, I provided reflections on the research and curatorial concerns, which where introduced at the beginning of this chapter. The understanding that emerged from this case study very much informed my research direction and future curatorial ideas. In the next chapter I discuss how these reflections guided and influenced the next case study.
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CHAPTER 6:
CASE 2: THE EXPLORATION OF HACKING PRACTICE
FROM A DESIGNER-PARTICIPANT PERSPECTIVE OR
BECOMING THE HACKER

6.1 Introduction
In the previous chapter, I presented a selection of data collected in the first case study: the vignettes illustrate the reflective nature of hacking and highlight the nuances of the practice. Further examination of and reflection on these vignettes reveal the rich and complex nature attributed to the practice and show that the practice and experiences of hackers cannot be simply translated into generic design requirements for employment within Interaction Design: a deeper understanding of the practice is required for this purpose.

In the second case study described in this chapter, I aimed to probe and examine the practice of hacking in further depth. Consequently, I took on the role of hacker and actively participated in the workshop. By putting myself in this role, I wanted to understand the social and cultural world of hacking from the perspective of the hacker, also by familiarising myself with both the hackers and participants who attended the workshop. My focus was to understand and to experience events in the ways hackers would, and by placing myself “in the shoes” of the hacker I experienced
firsthand how hackers approached and interpreted their own practice. In this chapter, I provide reflections on the messiness and complexity associated with the practice. The understandings that emerge from these reflections are shaped by my experiences that occurred within the workshop. This reframing from the perspective of participant allowed me to formulate new understandings that are uniquely tied to this perspective.

One of the objectives of this thesis is to introduce to Interaction Design a novel perspective of users as active participants within a design process. As stated in Chapter 1, viewing the “user” as a participant in the design process, someone who takes on some of the responsibilities of the designer, affects and questions the role of the designer. I consider hackers as archetypes of this model of user/designer and believe that the practice of hacking can provide a means by which we can understand this role and design new contexts that allow a diversity of decisions and explorations for users and participants. Furthermore, it promotes a dialogue that leads to an informed appreciation as to how design practices can evolve. An understanding of this new model of user is critical for expanding design practices and developing new means to collaborate with users.

In this chapter, I describe and discuss in detail the workshop that serves as the second case study in this research. I also outline the curatorial frame upon which it was constructed and detail the structure and content of the workshop. I then present my findings and observations from the workshop as well as insights from a second series of interviews conducted with hackers.

In examining my own practice as a hacker, I build a deeper understanding that is formed from my experience of the research setting. Finally, I conclude the chapter with a discussion and evaluation of both my research objectives and curatorial methodology. This self-reflection allows me to articulate and describe the experiences from “the inside” – the activities I underwent as a hacker – and devise a set of design sensitivities for inspiring ways of thinking about users.

6.2 From the perspective of designer as participant
Within this case study I probe and examine the practice of hacking in further depth. In this case study, I deliberately chose to describe a workshop that was focused on
software. My aim was to show that hacking, as a practice was reflective, regardless of the materials hackers would work with.

As discussed in Chapter 1 and Chapter 2 of this thesis, the role of the user has broadened and, in certain design settings, the user can take on some of the design responsibilities of the designer. This merger of user and designer roles, whilst empowering for the user, questions the role of the designer. In my opinion an understanding of this merged role is critical for the development and evolution of design practice in Interaction Design, and by examining my own experience of participating in the workshop I sought to understand how users and designers can collaborate and work with one another.

As I mentioned, I took on the role of hacker and actively participated in the workshop discussed in this chapter. By positioning myself in this role, I aimed to gather insights on the perspective of the hacker, and understand their diverse decision making process and the exploratory nature that underpins their practice. Furthermore, actively engaging in a real time scenario helped me to analyse and examine the aspects of why and how hackers ‘function’.

As discussed in Section 5.6, there is a social and collaborative nature associated with hacking: often the ideas and practices of hackers are shaped through dialogue with other hackers both in online and offline contexts. This aspect of the practice can only be perceived and realised through active participation and interaction. Thus, as a participant in the workshop, I became acquainted with other participants and with the hackers who instructed the workshop. In terms of my research, this aspect of the practice is of equal importance to developing an understanding of the process of hacking: it allowed me to develop a more holistic understanding of the practice that was formulated by experiences and relationships.

In the previous case study, participants in the workshop worked with electronic components and other hardware including old electronic toys and musical instruments. In the second case study, the workshop focuses on the software platform openFrameworks\(^{40}\): I intentionally chose to describe a workshop dedicated solely to software, thus relating the reflective nature of the practice to the approach and process of hacking as opposed to relating it to materials that hackers use.

\(^{40}\) http://www.openframeworks.cc/
6.3 Developments in the curatorial understanding of hacking

In the previous case study, one of the phenomena I observed was the structured and layered approach to developing knowledge that was embedded within the practice of hacking. The hacker instructing the workshop would introduce the theory to the participants in a step-by-step process: firstly he introduced the concept of truth gates and described how the gate, which the participants were working with, behaved in this manner. Throughout the workshop, Mark would then introduce new pieces of knowledge to the participants as they needed them, building on the previous elements.

I also witnessed how hackers were able to relate different types of knowledge to one another: for example, during an interview I conducted with a hacker, he described how he would “try and hack his teachers mind” and break it apart into components, the information he needed for tests. The hacker would describe how he would use the same approach to hacking in his everyday life, drawing on knowledge from his experiences of using open source software. Thus, in my role as curator my objective was to embody the methodological processes of hacking in the aesthetic, the design and structures of the festival.

The second edition of Tweak took place during September 2009. The festival followed the same format as the previous edition. In addition to the exhibition, workshops, musical performances and talks, I introduced a full cinema programme, a listening post and a student showcase. The introduction of these components to the festival aimed to illustrate to the public the diversity of hacking and how it can be applied across different contexts. It also illustrates the far-reaching influence of the practice culturally: as curator I aimed to draw attention to the vibrant nature of hacking and showcasing the different aspects of the culture allowed the audience to embed their understanding of the practice in an everyday context.

In total, the festival consisted of an exhibition featuring ten artists, three workshops, a cinema programme featuring twenty-one artists, four nights of musical performances, a listening post, which was installed in the exhibition space, and a student showcase that exhibited the work of three students from the hosting Universities (University of Limerick, Limerick School of Art and Design, and Tralee Institute of Technology). The festival was yet again curated from an open call for submissions, where artists and hackers could submit artwork and a statement they considered relevant to the theme of the festival. The call was placed online and
featured on blogs and relevant websites such as we-make-money-not art\textsuperscript{41}, rhizome\textsuperscript{42} and neural\textsuperscript{43}. A copy of this call can be found in Appendix B of this thesis. The statement for the festival called for works and workshops that responded to:

“…Digital technology has become a medium that has redefined the arts broadening horizons and changing practices. New works that explore interactivity and the possibilities opened up by multimedia and electronic technologies to create immersive experiences bring physicality and play to the digital medium.

We call for submissions from artists and designers whose work has been labeled as ‘new media’, ‘physical computing’, ‘tangible interfaces’, ‘digital media’, ‘techno craft’, amongst other titles, which attempt to define the field\textsuperscript{44}.”

The calls led to over 350 submitted proposals in total, and each selected entry was carefully chosen for their relation to the overall curatorial objectives and theme.

![Figure 6.1: Logo for Tweak festival in 2009](image)

In addition to developing the curatorial theme for the festival, the visual identity\textsuperscript{45} also developed through the logo, printed posters, badges and the website.

These components were used to conceive the structured “way of thinking” associated with hacking and the componential nature of the practice, and the intention was to present a clean and structured aesthetic that contained different components interlinked to one another. The logo, as seen in Figure 6.1, was designed to be playful and embody the actions of the word tweak. It was important

\textsuperscript{41}http://www.we-make-money-not-art.com/

\textsuperscript{42}http://rhizome.org/

\textsuperscript{43}http://www.neural.it/

\textsuperscript{44}http://www.tweak.ie/2009/exhibition.html

\textsuperscript{45}The visual identity of Tweak 2009 was developed in collaboration with www.pygment.com
to communicate to the audience that tweak was a setting where new meanings could be built and emerge. The goal was to express the process and actions of hacking and also to communicate to the audience that there was no limit to what you could hack or ‘tweak’.

Hacking is by nature a collaborative practice and the process often relies on the close interrelationships between groups of participants: these groups work closely together to develop code and documentation that support the activities of their communities. Typically this code and documentation are structured in a clear comprehensible manner in order to enhance the collaborative and participative nature of these communities. To incorporate this aspect of hacking into the identity of the festival, I designed the website in a clean and structured manner (see Figure 6.2), I used neutral colors and implemented an easily navigable design. It was important for the visitors of the website to be able to easily browse the site for information pertaining to the festival. In addition to planning a minimal design, I also wanted to integrate the exploratory nature of hacking into the Website: therefore when the users would interact with the website, by clicking on links or hovering over images new information would be revealed. For example, in Figure 6.2 there

Figure 6.2: Index page of 2009 Tweak website
are links to social networking sites on the left hand side of the screen; when the user of the website would hover with their mouse over these links, the images would change color and reveal the true image. In addition, I incorporated Javascript carousels that would reveal and hide information at the click of the mouse. By integrating these components into the website I aimed to convey to users of the site the exploratory nature of the practice and to establish how through interacting, new perspectives can be revealed. Another key aspect of hacking practice, which was revealed through an examination of the first case study, was the hackers’ ability to relate different components together, which were not normally associated with one another. This shows hacking to be a form of creative thinking, whereby the hacker has the ability to build bridges and links between these components and construct new meanings from them.

In the first workshop, I witnessed how hackers would configure and build new forms in an exploratory manner. Using the printed posters I aimed to convey the componential nature of hacking in the design: Figure 6.3 shows the primary poster used to advertise the festival. It consists of the logo and a series of words, which communicated what the festival comprised of. This design illustrates to the viewer that Tweak included distinct components that formed different aspects of the festival. Figures 6.4 and 6.5 show the distinct identities for the opening night, two different musical nights and talks. Although each poster has its own distinct design, the viewer can understand and perceive the relationship between them.

The final component of my curatorial approach was the selection of suitable spaces to hold the festival. This time, I approached the School of Architecture at the University of Limerick to request permission to use St. Munchins Church for the workshops. The Church, located in Limerick City, was on loan to the School from the Limerick Civic Trust and had recently been renovated by the 4th year architecture students as part of their final year project. The students had built

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46 Unfortunately, due to a scheduling conflict, the space that I used for the first set of workshops was unavailable. Also, given that the visual identity of the festival had been redesigned, I thought that reflecting this in the selection of a new space for the workshop was necessary.
Figure 6.3: Print poster used to advertise Tweak 2009
Figure 6.4: Printed posters advertising the opening night and noise night

Figure 6.5: Printed posters for musical performance and talks
makeshift seating and lighting from wood, they had also constructed notice boards, which were suitable for projecting onto. The church had high ceilings and an unfinished raw aesthetic to it, which I thought was suitable for the workshop to take place in. The space had a makeshift atmosphere: I felt the repurposing of the space, from church to design studio was indicative of the actions and processes of hackers and thus echoed my curatorial goals. Furthermore, it was a space that reflected building and making: the chairs, tables and notice boards were comprised of wood and were "just made": if a participant needed a seat, they could simply construct one from two pieces of wood that were designed to slot together.

Overall, my goal as curator at this time was to represent the structured way of learning that hackers applied in their practice. Moreover, I wished to communicate, to the festival's audience, how hackers would interlink and bring together different components of knowledge in their pursuit of hacking. The festival was curated from open calls – a process reflective of open source culture, which allowed any participant to contribute to any aspect of the festival. This was a conscious attempt to curate the festival in a democratic manner and explore new ways of engaging users while working collaboratively with hackers. In the next section I discuss data from the second case study – a workshop that focused on computer vision using the software platform openFrameworks.

6.4 Workshop: Understanding computer vision in openFrameworks

This workshop provided participants with an introduction to the openFrameworks (OF) platform. The workshop was suitable for individuals with no OF experience but some basic understanding of scripting languages such as Processing or Flash was required. The hackers – Steve and Andy – instructed the workshop, guided the participants through a series of exercises that introduced C++, familiarised them with the OF platform and provided a basic introduction to computer vision and its applications. Similarly to the first workshop, the OF workshop had a fee of €15 to cover costs.

OpenFrameworks is an open source toolkit designed for 'creative coding': it is a collection of software libraries integrated together as a software framework. It does not include its own programming language like Flash or Processing, but instead programs for OF are written in C++. The library is designed to work as a general
purpose ‘glue’, wrapping together several commonly used libraries under one interface: openGL for graphics, rtAudio for audio input and output, free Type for fonts, freeImage for image input and output, Quicktime for video playing and sequence grabbing. The code is designed to be both cross-platform (PC, Mac, Linux, iPhone) and cross-compiler. The API is designed to be minimal and contains very few classes and functions; the code in these functions has been implemented so that within the classes there is minimal cross-referencing – making it easy to appropriate and extend.

In total 18 participants (16 students and 2 professionals) attended the workshop. Of the 16 students, 8 had an art background and no programming experience, 3 had a computer science background, 2 had a music technology background and 5 had a multimedia background. Of the 16 students only 5 were proficient in programming. Therefore, the level of expertise ranged from newcomer to advanced. Prior to the workshop, participants were asked to install openFrameworks and the necessary compiler on their laptops and to bring them with them on the day.

The hosts began the workshop by providing an in-depth explanation of the openFrameworks platform including its history, structure and application. Participants were arranged in around a large table, facing one another as seen in Figure 6.6, and were each provided with the necessary software for their laptops’ platform. At the beginning of the workshop the participants completed a series of examples that familiarised them to the operation of the library and acquainted them with computer vision. The hackers also discussed the OF website, forum and wiki, and encouraged participants to register and become involved in the community. The hackers also described their own experiences of using the software and provided some video examples of applications of the software; Steve informed the participants that the workshop would provide them “their view of computers and vision tracking”. This provided the participants with an insight into how the hackers integrate the platform into their own perspective and how it may be appropriated in several artistic situations.

As outlined in the introduction to this chapter, I actively participated in the workshop. I performed a dual role: I joined in the workshop as participant and I observed and took notes as researcher. In order to focus on my participation in the
workshop, I employed a cameraman to video record the workshop. I instructed the cameraman to capture the actions of the hackers conducting the workshop and

![Figure 6.6: Participants were arranged around a large table facing one another](image)

close ups of the participants’ activities during the workshop. After the workshop I conducted informal interviews with both hackers and participants. In the next section, I provide reflections and interpretations of the knowledge gained while participating in the workshop: I present an analysis of this data and comment on episodes from the video data. The vignettes described here are accounts of my own reflections in action that occurred during the workshop: these episodes will be organised thematically, using the language of Schön’s reflective practice and will provide a frame for reflection on the activities conducted during the workshop.

### 6.4.1 Materials & making with the immaterial

Schön describes the design process as a “reflective conversation with the materials of the situation” (Schön, 1992: 4): the designer enters a dialogue with the materials of the situation, making tentative moves in the process, and the materials “talk back” constraining and shaping subsequent moves. In this workshop, participants are introduced to openFrameworks – an open source toolkit for coding in C++. The immateriality of software does not lend itself to being physically manipulated; however, Löwgren & Stolterman (2004) argue that software can be considered a
material of design and has its own design qualities that can be constructed and altered (Löwgren and Stolterman, 2004). In these vignettes I illustrate the “talk back” of software, explicating how working with software shaped and guided my movements. I also describe the constraints and affordances of immaterial code that can lead to reflection-in-action.

OpenFrameworks is comprised of several software libraries that are integrated through a framework and controlled through a programmable interface. The interface allows users to manipulate code and shape and change the interactions supported by the software. Using a mouse and keyboard, users can interact, manipulate and shape the aspects of the design, including color, speed, interaction, shape, etc.

The following vignette illustrates how the hackers conducting the workshop demonstrated to participants the materials of the software application that can be used to manipulate and control aspects of the design.

Steve is running openFrameworks on a Microsoft Windows laptop, which is connected to a projector; his screen is projected onto a board to the left of where I am sitting and is visible to everyone in the room. He begins by establishing the programming ability of the participants of the workshop and asks “how many of you know programming or have used openFrameworks?” Myself and four other participants raise their hands. He glances and asks “anyone else? Ok so we are going to explain what is openFrameworks, how it works, then we are going to explain some little tweaks, some little things you can do for C++, - it’s not super easy to program, so these will advance you in small. Then we are going to introduce you to computer vision, perhaps some of you – how many of you have already programmed in actionscript, processing, MAX MSP…” Four others and myself raise our hands again. Steve looks worried and asks, “How many of you have no programming at all?” The remaining participants raise their hands and he begins to look nervous. He carries on “so we are not going to spend too much time explaining how to program but instead we will go introduce some examples, or the examples we are going to make, we will give you the code so that you can understand in a way, or know what is going on more or less, but these things are going to sound very strange without knowing programming. I suppose it’s better to give you some examples and try to explain, rather than focus on how to code”.

He starts to describe the interface explaining the basic program structure. Steve opens the program on his laptop and his screen is projected behind him and
acts as a reference for what he is explaining: "So we are going to show first the basic structure of openFrameworks. Does anyone have a problem with installing oF, like the environment Xcode? So everyone has his or her environments working? In your platform you will find some examples in the apps directory. So in the examples file we are going to open up the graphics example. So in the platform you have there, you will find a project file in Windows and Linux it will be a cpp file and xcode has a file called xcodeproj.” I open XCode on my laptop and browse through the openFrameworks folder looking for the example Steve is discussing. He continues: “So if we load the file desktop we see there are two files – desktop.h and desktop.cpp. In C++ there is a special feature, which I will explain later… So lets go to testApp.cpp…” He pauses for a moment, and reflects on what he is doing “No wait lets go to testApp.h, it’s easier to see. So here

![Image of XCode project view]

Figure 6.7: Vignette 8 – A basic example of openFrameworks interface

...you see, the standard layout for openFrameworks, first you see setup(), update() and draw(). When an openFrameworks application runs, it goes through the code in a loop, so it repeats the same sequence of instructions. So setup() is where you do all the initialisation of your code for your program. If you want to draw for example a circle and you want that circle to be 10 by 10. In setup() is where you are going to tell that this

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variable is going to have a certain size, the radius will be size 10, etc. That function is only going to be called once at the beginning of the program. That’s where for example if you are using a camera, in `setup()` is where you’ll tell the camera how many frames, what resolution or if you have a midi file, `setup` where you can open that file and wait. Then `update()` takes control, `setup()` is run only once, `update()` is run in an infinite loop that will continue until the application ends. So everything you do during the life of the application is in these two functions”.

Here Steve outlines the basics of the application view of an openFrameworks program: he explains clearly the distinctions between the different components of the system to show how to manipulate and control each part. Each of the basic functions operates in a different way and therefore requires different approaches to manipulate them. By clearly explaining the differences between `setup()` and `update()`, it allows for participants to understand the inner workings of the functions and how they could be manipulated. Although the techniques for writing code in each are the same, I begin to understand the difference in handling each of the functions. The structure and behaviour of the functions determine the manner in which they should be handled. In explaining and demonstrating the different behaviours of the core functions of the program, Steve shows how the material of the software can be bended and shaped according to the needs and wishes of the participant.

In this next vignette, as seen in Figure 6.8, I demonstrate my understanding of the inner workings of the program and manipulate the material to control the outcomes. I had previously learnt C++ during my undergrad studies and, while I have some previous experience with the language, I have never coded with openFrameworks prior to the workshop. At the beginning of the workshop, Steve and Andy informed us of the structures of the application, giving details of the libraries that it supported and what each of these libraries were used for. They also described the difference in how the platforms operated and how to add these libraries to your program. They also showed how to open the example applications and recommended both the website and wiki for further information and tutorials.

Steve and Andy have just finished explaining how to install and compile openFrameworks; they have also explained the libraries the platform support and
where to access documentation to learn more about the functionality of the platform. Steve addresses the workshop, describing his actions as he does them. His laptop is connected to a projector and displays his screen on a makeshift board.
behind him. He looks to his computer and then up towards the workshop: “So now we are going to build an example—something super basic—a circle that I will make grow with the keys and make it move with mouse drag. So first of all any time I am making things move from left to right, I need some sort of variable so that I can be writing +1,+1,+1,+1, etc. So I need some sort of value that I can be mapping from frame to frame and for that I need to create a variable in the .h file”.

On screen he opens the .h file and starts to type: “Here in the .h file at the end of the—under the functions that are already there go to the last line and create an int counter”. Gesturing with his hands he continues, “this variable is going to control my circle going from left to right and now I’m also going to make it grow—if I push a key it is going to go up and if I push a key it is going to go down. So I need another variable for that and I will create a variable called radius”. He continues to edit the .h file and adds in the additional code. All of the participants mimic and copy his changes. Steve finishes his editing and continues, “So these are the variables that I will use in the application. So now I will go to my application (the cpp file). Normally you have to do some modification. In C++ it’s super important that any variable that you make has a value. The first thing that we do in an openFrameworks application: every time that you set up a variable that you define and create in the .h file, it has to get a value because if not, it’s very probable that the application will crash. If you create a variable first thing give it a value. If you for example have a program with a variable that is not initialised you have a very big chance that you are going to crash the program. So first thing I’m going to do is to give some value to the variables I’ve created. So the radius of my circle is going to be 10, and the value for counter is going to be 0. Now I need the circle to go from left to right so I’m going to be using the counter of the circle to set the x position of the circle. So in the update() function I’m going to say counter equals counter + 1”.

At this point both Steve and Andy both stand up from their seats and walk around the space, checking on the participants who are less experienced with coding. I browse through the openFrameworks example folder and open the emptyExample.xcodeproj and double click on testApp.h. I edit the code and add int counter and int radius, just as Steve has demonstrated. I open testApp.cpp and in the setup() function I set the radius to ten and the counter to zero. I then add the counter code to the update() function. At the same time Steve points out: “instead of writing counter = counter +1, we can
use a short cut and say counter++. So in `draw()`. I’m going to draw my circle using the function `ofCircle()` and the circle actually receives 3 parameters, one is the x co-ordinate, the second is the y co-ordinate and the last is the radius. So the x co-coordinate is going to be my counter, the y I suppose is going to be 200. So let’s run it and take it for a spin. It will ask you to save your file. If it complies you should see something like this”. I look up to the projection and I see a white circle moving from left to right on the screen. I add the additional code to the program and press Build and Run that compiles my program. I wait for the program to compile. When it finishes I notice that it has failed to compile correctly. In the lower right hand side of the interface there is an alert indicating an error (Figure 6.9). I double click on the error and the debug screen pops up. I see the error message `Expected ‘;’ before ‘)’ token. I return to my testApp.h file and notice I had omitted a ‘;’ after my radius declaration and at the end of the `ofCircle()` function. I make the corrections, save the program, and compile it again. The program runs and I see a small white circle move from left to right on my screen.
I begin to look around and notice that the hackers are talking to the other participants who have no programming experience. To my right, two participants – Brad and Eoghan (who I am familiar with) are talking about a project made with openFrameworks that Brad has seen. I see Brad’s screen and notice that his circle is moving from the top of the screen to the bottom. I decide to examine my code again and edit the `draw()` function – the `ofCircle()` function receives 3 parameters, all of which are floats – x, y and radius. The position on the screen is determined by x and y. I change the values and instead of passing the value of counter to x, I pass it to y (Figure 6.10). I run the program again and see the circle move from the top of the screen towards the bottom. I then return to the `testApp.cpp` file and edit the radius value to 100. I run the program again and I see a large white circle moving from the top of the screen to the bottom. Steve starts to address the workshop again, I quickly return my program to the same condition as his, and return my attention to him.

```
void testApp::draw(){
    ofCircle(200, counter, radius);
}
```

Figure 6.10: The code to move the circle from the top to the bottom of the screen

In this vignette, Steve and Andy describe to the workshop the structures and the manner in which openFrameworks operates. By aiding the participants in their understanding of how the framework functions, they provide techniques to shape and mold the immaterial software to our needs. This vignette shows how I actively shaped the outcomes of the software: while experimenting with the `ofCircle()` function, I make an error in the code and the software ‘talks back’ to me, guiding me in my process and facilitating my reflection. Every material has its constraints and affordance and this vignette shows how the immateriality of software has its own set of affordances and constraints that allow users to shape it to their own needs and requirements.
6.4.2 Dealing with surprises

Practitioners apply tacit knowledge-in-action, until a ‘surprise’ causes the practitioner to move from unconsciously applying actions to consciously applying actions. Schön suggests that when actions are interrupted by a surprise the practitioner will perform a reflective conversation with the situation that causes them to reframe their actions until they achieve the desired result. According to Schön these actions convert tacit knowledge into explicit knowledge, giving rise to on the spot experimentation. In this vignette I illustrate surprises I encountered when working with code and I show how these surprises allowed me to improvise and experiment with the code.

During the workshop, Steve and Andy explain that there are a number of examples that accompany openFrameworks when you download the application. As Steve discusses some of the work that artists and hackers have made with the application, I begin to browse through the examples folder. Steve is showing videos to the participants and, as I am familiar with the work he is showing, I take advantage of the time to investigate one of the examples further. While browsing and exploring the examples that are in the folder, I compile each one to see what the outcome of the program is. After compiling each example, I return to the geometryShaderExample. I’ve always had a long term interest in the aesthetics

Figure 6.11: Output of geometryShaderExample
of geometry in particular vertices and triangles. When I run the program called geometryShaderExample, it outputs a series of lines that are joined in a triangular and whose direction is controlled by the mouse (Figure 6.11). I am immediately drawn to this and decide to experiment further with the code. I return to the code and open testApp.cpp for further examination. I quickly browse the code and decide to alter it to display a triangle that changes color at the press of a key. To achieve this, my first step is to change one thing and then examine the outcome: I aim to test each of the prewritten parameters to see what part of the outcome it changes. I examine the setup() and look at the parameters: I recognise ofBackground(50,50,50); – this controls the background color. I randomly change the color to ofBackground(250,160,50) and recompile the program. The background of the screen has changed from dark gray to a bright orange (Figure 6.12). Satisfied with the outcome, I return to the code and decide to change the size, thickness, and color of the vertices. By examining the code I deduce that the

size of the vertices is controlled by the code float r = ofGetHeight()/2; and I change it to float r = ofGetHeight()/4 so that the vertices are halved in size. In draw() I change the thickness to 10 and I see a function glColor3f(1,1,1), which I infer controls the color of the vertices and

Figure 6.12: Outcome of changing the background color
randomly change it to glColor3f(4,4,6). I compile the program and see the
changes I have made (Figure 6.13). Satisfied with my progress I decide to change the
color of the vertices using a key. In the code I find keyPressed(int key) and
add a line of code that changes the vertices if the key 'f' is pressed (Figure 6.14). I
compile the code, and I press the key 'f'. There are no changes to the vertices.

```c++
// testApp::keyPressed (int key)
if (key == 's'){
    doShader = !doShader;
}
if (key == 'f'){
    glColor3f(14, 14, 14);
}
```

Puzzled I return to examine my code. glColor3f(GLfloat red, GLfloat
green, GLfloat blue) is a function that takes in 3 float values. In the
testApp.h file I add a float z and set the value. In the keyPressed() function I add code to change the value of z when the key 'f' is pressed. I save my
new program and then recompile it and the compiler returns another error. I return

to my program again and try altering it again. It returns the same error. I turn to one of the other participants – Brad – on my right and explain my problem to him. We look at the program together and I show him how I’ve edited it and what I want to do. He looks confused and makes a suggestion – telling me to declare char f in testApp.h. At the start of the workshop Steve and Andy had taken us through an
eexample where they had made a circle grow by pressing a key. Recalling this, I tell Brad that there is no need to, as the value of the keys are passed to the key pressed function so there is no need to declare it. He looks confused and says, “I’m not sure, I’m not great with C++”. I look at the program again and decide on another approach. I create three variables: float a, float b, float c, and I assign them values. In my keyPressed() function I change the value of the variables as seen in Figure 6.16. I compile the code again and this time the program
compiles. I press the key ‘f’ and the colors of the vertices change color (Figure 6.17). Finally my program behaves in the way I want it to, and I show my solution to Brad.

Within this episode, we see how I employed reflection-in-action to overcome a surprise I encountered in my exploration of the program. These reflections-in-action are guided by my motivation to shape the program to my own requirements. Reflection is an active process of examining one’s own experience in order to explore it in greater depth. Developing the ability to explore – in this scenario, the understanding of code and the application openFrameworks – opens the possibility of learning through our experiences. A surprise creates an experience for learning through reflection, and in this example I illustrate how this surprise allowed me to analyse my actions and reframe my approach. Furthermore, I draw on my previous understandings and experience with coding and I draw on those experiences, and employ a set of actions and techniques that allow me to edit the code and shape the desired outcome. This is further supported through the ‘talk back’ received from manipulating the material, which in turn supports how I frame my inquiry and approach. In this vignette we see how a surprise leads to reflection and the structures that supported the reflective activities.
6.4.3 Dialogue and Interactions

Schön describes dialogue as a reflective conversation between the designer and the artefacts that they are making (Schön, 1983). It signifies the exchanges that occur around the activity of making, which influence the emergence of an artefact. In this vignette I describe the dialogues and interactions that take place between the hackers conducting the workshop and myself, other participants and the materials used during the workshop. Therefore, the making activities I engage in within the frame of the workshop are shaped and guided by these dialogues and interactions. I also discuss the importance of the hackers facilitation and show how this supports the reflections-in-action I perform during the workshop.

During the workshop there would be a number of pauses, where the hackers teaching the workshop would examine the progress of the participants in order to establish 'how they were getting on.' It was during these pauses that most of the dialogue took place between another participant – Brad and myself: Brad and I would discuss our actions, intentions and our understanding of the code and the content of the workshop. Moreover, we would assist one another in overcoming ‘surprises’ and constraints that were uncovered in our explorations of the application. If something arose that was unclear, we would often work and collaborate with each other to discuss and ‘trash out’ our understanding. In addition to discussing the code and the activities of the workshop, we also described projects we had seen prior to the workshop that had been constructed with openFrameworks and discuss about how these applications had been made.

Steve and Andy have just finished explaining the openCV example that comes with openFrameworks. They have described in-depth the functions in the code and their uses. They have also shown how the program can track colors, faces, and even detect if a hand is connected to an arm. They also discuss in detail the computer vision add-on, and describe the capabilities of the library including edge detection and contour mapping. They show the constraints of the example, and at the end of the explanation of the example, Steve and Andy tell the workshop how to alter it to use the webcam attached to their computer. Brad and I quickly finish the exercise and I notice that Steve and Andy are engaged in discussion with the other participants, assisting them with their coding. I turn to Brad and ask him if he knows anything about color tracking. He replies: “I’ve done it before in MAXMSP, but not in openFrameworks. It’s not the most difficult thing to do though. We could easily change this
code and make it track a color. It seems like it shouldn’t be too hard and if we get stuck we can ask Steve or Andy. Will we give it a go? They are going to be ages with the rest of this lot!” I reply: “Yeah sure, so will we just get it working before we do anything fancy like mouse movement or key detection?” referring to the exercises we explored earlier in the workshop. At that moment Andy walks by and we get his attention: “we want to do some color tracking, so we’re thinking about modifying this example…” Andy sits down beside us and explains to us some of the functions we’ll need to call to get us started: “OK so, you’ll need to call some other functions – I can go through it now with you if you like?” Brad responds: “Well it’d be cool if you could start us off a little and then we’d like to do it ourselves. If we get stuck we’ll ask you but I’d prefer to do it myself for the majority of it”. He turns to me and says: “What do you think?” “Yup”, I respond, “I’d feel the same, and I’d like to try it before being told how to do it. I’ll learn more that way”. I turn to Andy and say: “If we get stuck though we’ll ask”. Andy smiles and says: “Cool, yeah. It’d be good because I can help the others with a bit less experience, [emphasises] a lot less experience. Ok to get you started, you’re going to need to call the following functions

- ofCvColorTrack(), this is the main object.
- ofCvColorTrack.findColor(int red, int green, int blue) - this is how you tell the tracking object what color to track and you can instantiate multiple trackers, each with different color targets.
- ofCvColorTrack.update(ofCvColorImage input) - lets you feed a CV image to the color tracking object, thus, updating it and
- ofCvColorTrack.setTolerance(int tol) - this is how you set the tolerance for what is/isn’t your color. Ok so those are the basics. Do you want me to explain how to design the structure of the program?” Brad turns to him: “No we’ll be ok from here, sure we’ll shout if we get stuck we’ll shout. Cheers for that”. Andy nods and returns to another participant who is struggling with the code. I turn to Brad: “Ok so lets start by designing the structure – picking out what we should put in each of the functions, like if we Figure out what we have to setup and put in the .h file first”. Brad replies: “Cool yeah. Go for it. Here, I’m going to do the code on my laptop too because I want a copy of the code too”. Brad and I open our .h files and we start to discuss the best way to implement the structures. We find ourselves at slight odds as where to start: I recall an example in Processing, I had tried out a few weeks prior to the workshop and I recall that Steve had said earlier that Processing resembled openFrameworks in the way that the programs where structured. I pull up the other program and we look at the
code together: Brad points out that instead of looking at Processing, we should look at the openCV example that comes with the applications. We open the files and run them and decide to edit the opencvHaarFinderExample to track

![Image of code snippet]

Figure 6.18: The setup() function to color track objects that are red

a color instead of a face. Also, we quickly decide that we will change tact and instead of coding the .h file first that we will code the .cpp file. We agree that it makes more sense to worry about the declarations in the .h file later because we can add them as we go along. It seems a more logical way to code given that we are unsure of what our main .cpp file will include. Given that there is a red cup in front of us, which I am drinking coffee out of, we decide to track the color red. The cup is small and easy for us to test with, given its solid color, rather than tracking our clothing or a piece of paper.

We start by setting up our program, defining the background and the width and height of the windows that we are going to use. Examining the application examples shows us that we need to define and allocate memory to the different screens we want to see. We use .allocate(int w, int h, int type) to define the different screens we want to use. We declare it for a number of different screens using the syntax seen in Figure 6.18.

Satisfied with our progress, we jump to the draw() function and change the code from .allocate() to .draw() so that the output draws our
screens. We also want to be able to see that where the red object is in our screen, Brad decides to add some code that will place a red circle on any object that is red that is within view of the camera (Figure 6.19). We start to discuss how we will track the red objects and what we need to code to help us. Realising we had no understanding of how to implement the rest of the code, we start to look through the other examples and begin to copy and paste parts of code to our program, to try and experiment.

At this point, Andy walks by and checks on us. He looks at the code we have written and tells us that we can track the red dots in our code by looping through all the pixels in the frame returned from the camera, and look for pixels that match. This will return the co-ordinates for the dots: “This is useful when say you want to draw something where you are tracking or for anything really. It’s good to know where exactly you are in the frame, even or simple things like thresholding”. I turn to him and ask: “What do you mean by thresholding?” He explains, “Ok you need a function that will take an image, and then return a binary image – where red will be white and the rest will be black. So to achieve this thresholding, we’ll need to use the HSV color space, instead of the more common RGB color space. In HSV, each “tint” of color is assigned a particular number – in openFrameworks we call it the Hue. Then there is the “amount” of color is assigned another number – the Saturation and then finally we have the brightness of the color is assigned another number – the Intensity. So with all these values, we can have a single number – hue for the red object despite multiple shades of red – all the way from
dark red to a bright red”. He sits down beside us and begins to code with us, explaining his actions as he types: “Firstly, we have to convert the image into an HSV image. But we want to keep the original image intact, for other uses. So we duplicate it. The image is originally stored in the RGB format, so we convert RGB into HSV. Then we’ll have to create a new image that will hold the thresholded image and do the actual thresholding”. Andy starts to code and adds: “So we have our reference image and we need to have a threshold so that we can capture a broad spectrum of red. If you consider any pixel – all three values of that pixel – H, S and V, in that order get a value of 255 at that corresponding pixel and this is repeated for all pixels. So what you finally get is a thresholded image and finally, the last thing we do is release the temporary image and return the thresholded image”.

Andy continues to help us complete the remainder of the code, explaining his actions and demonstrating how to complete our program. At the end of the explanation he compiles the code and shows the tracking by holding the red cup up to the camera and shows how it is recognised by the software. He then describes his latest artwork, which uses face tracking to control the movement of the installation. He points out how we can extend the program we have built even further by drawing with the tracked object or using the tracked object as an input to control something.

In this vignette, I have illustrated how dialogue helped to motivate the ideas for our design goal. Furthermore, we saw how Andy intervened and assisted us further by clarifying the concepts behind the application and helping us build an understanding of the software by demonstrating how to shape the code. As the dialogue continued, it influenced the outcomes and guided the development of our program. In addition, it shows how we integrated insights from the hackers conducting the workshop – Steve and Andy – who provided tips from their own experience of working with the software to facilitate our understanding and thus influencing the emergence of our artefact. By using the language of code and explaining how the code operated, we developed a shared language between software, hacker and participant that informed our understanding and was employed to complete our task outlined in this vignette.
6.5 Reflections on the second workshop

In the introduction to this chapter I outlined a number of research issues that this case study investigated. In this section I provide further reflections on the episodes from the second workshop I have presented and outline how they relate to my research and curatorial objectives.

Schön (1983) states that reflection-in-action is the ability of professionals to ‘think what they are doing while they are doing it’ (Schön, 1983: 26). He regards this as a key skill and asserts that the only way to manage the ‘indeterminate zones of (professional) practice’ is through the ability to think on your feet, while applying previous experience to new situations (Schön, 1983). This is essential for the work of the professional and requires the capability of reflection-in-action (Schön, 1992; Schön, 1983; Schön, 1987). Furthermore, he conveys the structures that can support the activities of the professional and engage them in a reflective practice.

The vignettes presented in this chapter highlight the structures that are inherent with the practice of hacking that promote reflection-in-action and are employed by hackers in their process.

The ‘Reflective Practicum’ is “a setting designed for the task of learning a practice” (Schön, 1983: 37): this is where a student will learn by doing, with the help of coaching. The practicum is reflective in that it helps students become proficient in a kind of reflection-in-action, and, when it works well, it involves a dialogue of coach and student that takes the form of “reciprocal reflection-in-action” (Schön, 1983). In these vignettes, we see how the workshop is a setting in which the participants, the hackers and the materials are engaged in a dialogue with one another and where the participant can learn by experimenting. The workshop in this setting is a space where the hackers can share examples and experiences of using the application – openFrameworks - and it acts as a foundation in which the theoretical framing of these activities can be embedded. Finally, it is an informal space in which participants can experiment and learn alongside their peers. These types of spaces allow participants to analyse their own experiences, developing knowledge through a series of experimentations.

Reflection-in-action is a reflection that occurs whilst a problem is being addressed, in what Schön calls the ‘action-present’: it is a response to a surprise – where the expected outcome is outside of our knowing-in-action. Reflection-in-action is about challenging our assumptions and about thinking in a new way, about a
problem we have encountered. In the vignettes we see how I employed reflection-in-action to overcome a surprise I encountered in my exploration of the program. It is evident that the structures built into the framework of the application that support and guide how these reflection-in-action can occur. Reflection is an active process of examining one’s own experience in order to explore it in greater depth. By receiving ‘talk back’ from the application I learnt how to reframe my approach and rethink the scenario. This reframing is an essential component in the reflection-in-action process, therefore, it was necessary that the structures that are in place within the framework of the software are clear and provide both affordance and constraints to support these activities.

In this case study one of my curatorial objectives was to embody the methodological processes of hacking in the aesthetic, design and structures of the festival. I then took on the role of the hacker and actively participated within the workshop: this firsthand experience allowed me to observe and analyse whether the structures I put in place prior to the workshop facilitated interactions and dialogues between participants and hackers. As outlined in Section 6.3, another curatorial goal was to support the ways in which hackers carried out their practice. Furthermore I intended to provide a space, which supported how hackers explored and related different types of knowledge with one another. Thus, in my role as curator, I worked closely with hackers to support their needs.

In Section 6.3, I provided a clear trajectory of my thought process and how it was embedded within the aesthetic and structures of the festival. I articulated my working method and approach to the development of the festival and in my dialogue with hackers and participants who attended the festival. The methods and processes of hackers were a key influence for my approach to develop the experience of the workshop. In reinterpreting their approach within the structures of the festival, I established and constructed a space where cultural exchanges took place that related to their practice. I placed at the forefront of my agenda the experience of the participants, ensuring a suitable frame for them to experience the process of hacking in a unique way: by establishing participation as a key component in the experience of the festival, specifically the workshops, I enabled the acting out and performance of the practice of hacking.

Within this frame I sought to establish an open space in which the diversity of hacking could unfold. By focusing on engagement and providing a space in which
hacking could be performed, I aimed to contribute to the public perception of the practice whilst encouraging the public to look beyond how the practice is perceived. Allowing participants to participate within the workshop enabled them to formulate and evaluate their own understandings of hacking and foresee how they could incorporate it into their everyday lives.

In addition, I also received feedback from participants who attended the workshop: after the workshop finished, I spoke informally with some of the participants. When asked about their experience of the workshop, most spoke of it favorably. However, some participants, who were more familiar with programming, spoke of the slow pace of the workshop saying that they found it frustrating. As one participant put it: “it didn’t really get going for me until the second half of the workshop, too much time was spent explaining the basics to people that probably will never open the application again. It was fine when I worked on my own, and when we were given time to edit the openCV example. I got good help then from Steve and Andy and they gave me good tips and that. I was only interested in openCV, so for me there was too much time wasted with people that didn’t know programming. I wish it had been a little more advanced. But in saying that it wasn’t all too bad, as I said, there were some problems I had before with openCV and I got to speak and show them to Steve and he helped me with that. So for that alone it was worth it for me. But next time I will go to an advanced workshop, it’s pointless when there are too many beginners”.

After speaking with this participant, I found myself reflecting on my own experience and found myself in agreement with him: even though the workshop was still successful in terms of the overall feedback, I felt that I had failed to translate one aspect of hacking to the workshop – the ability to work at your own pace. In providing a workshop that was more structured to support a beginners’ introduction to the topic, I was unsuccessful in supporting the actions of those with more advanced skills.

Becoming more acquainted with hacking through the process of curating the festival and familiarising myself with hackers by actively engaging in the process of hacking, I also found myself appreciating the raw aesthetic of hacking. Prior to this workshop I had been more focused on finished forms and a polished aesthetic and this was especially evident in my selection process for the exhibition, given the aesthetic that was presented in the collection of artworks exhibited. However, as I deepened my understanding and appreciation of the practice, I found myself
appreciating the raw unfinished messy aesthetic of hacking. I felt that as curator and organiser of the festival that I had neglected this aesthetic in favor of my own agenda as curator and thus omitted a portion of the practice. Therefore, in the final edition of Tweak I aimed to acknowledge this aesthetic and bring it to the forefront of the festival.

6.6 Probing further: Open discussions with hackers
In this section, I discuss a series of informal interviews that were conducted following the workshop described in Section 6.4. After reflecting on the themes that emerged from the workshop, I wanted to investigate how these themes presented themselves in the practice of hackers. I conducted a series of informal interviews, which aimed to gather insights from the hackers themselves: the interviews took the format of an informal conversation and aimed to probe further the reflections derived from the workshop. They provide rich data from the point of view of the hacker, detailing insights into their process and experiences. The data is discussed here and further reflections are provided on the practice of hacking.

This interview session was conducted with François – an artist and hacker who previously studied graphic design. He holds a Masters in Fine Arts practice and during this Masters he studied theory, fine art history and media in addition to electronics and programming. He describes his interests in hacking as "discovering new strategies to recycle and look at technology in different angles through art practice". François describes himself as a mix between hacker and artist – "the best of both worlds" in his own words. From his perspective, he believes that hacking is a process and as an artist he uses hacking as a creative methodology to make art. He is an accomplished artist, having exhibited across the world and he also lectures University students in open source software and hardware.

6.6.1 Knowing your material
In Section 6.4, I discussed the immateriality of software, describing how understanding the constraints and affordances of the material allowed me to shape and bend the material to my own needs. I queried François about the importance of knowing his material, and about how he experiences this within his practice. My aim was to understand the nature of appropriation within materials, and how this
supported François in his practice. François frequently works with both hardware and software and in this excerpt François is describing a workshop he organises with a friend. He says:

“I am running workshops for the past five years. I have done about 7 or 8 in different countries in collaboration with a Dutch engineer. Basically we invite participants to act and recycle obsolete technology… The workshop is open to arts and graphic design students from different backgrounds. So far it is successful in finding new strategies, for example, there are things I know that work better than others in regards to devices that you can recycle, for example things that can be parts such as printers and scanners are really good, since they have motors, even if they are broken or they are being thrown away, there are still useful materials in there. So that has been one example, but people have been doing all sorts of things using toys and different pieces of old computers. One of the ideas is to recycle color flow labels and electronic parts such as resistors and transistors, extracting parts that are useful such as chips”.

In this excerpt, we see how François explains how, through his practice, he has become acquainted with the materials he works with: he knows how to recognise and identify components that are useful to him. He also understands the nature of these components and is able to integrate them into his practice building artworks. We see that he is able to demonstrate his tacit knowledge to others and regularly conducts workshops that show people how to actively recycle different components for re-use. Furthermore, it shows his capabilities to recognise how component can fit together, which is an integral part of hacking practice.

“Yes I am saying it is basically being evolved to make something relevant to what you are trying to say. Take a more analog example – paint, you can either buy your own paint or mix it. You can either buy hardware or make it yourself; it is just two different ways of doing things. It doesn’t mean one is better than the other. I am not always making everything; sometimes I buy or combine things. I see that also that is the true definition of hacking, just using the technology not in the way it was intended – it doesn’t need to be modified – it can just be used in a different context”.

In this next excerpt we see his perspective and the importance of understanding the tools that he uses. He states how for him hacking is more than modifying: it is about
understanding and viewing objects in a new light. Thus, it becomes essential that the hacker know his material inside and out, both technically and conceptually.

### 6.6.2 The necessity of dialogue and interactions

In Section 6.4, I described how interacting and participating in dialogue aided my learning approach and facilitated my actions. In my opinion, dialogue and interactions with other hackers are a crucial aspect of hacking practice. This collaborative aspect facilitates beginners to learn and those who are proficient to experts to enhance their practice. I queried François on the role of communities within his own practice and asked him how it affected his own process:

“Yes it is a big part of the whole thing, the fact that it is a community, and with processing, with Arduino, all those tools because they grow with their users and people using it, and creating new functions when people add onto the tool. So once you are outside of college you get a lot of support from the mailing list and the forums are good for posting problems. There are people all the time helping out, I wonder what they do with their life, but they are helping all the time. So whenever you have a de-bugging, problem solving problem it is good to use”.

Here we see how these online spaces of convergence are crucial for beginners and experts alike: they provide a starting point for many to engage with others and enlist their support and experience. We also see how for many it is key to their identity as François points out: “there are people helping out all the time” - and wonders how they manage to do this in their time.

While François points out the importance of the on-line community, attributing it as a major component of open source practices. François states that in his experience it is more beneficial to engage and interact with others in a physical setting; workshops are unique opportunities for beginners to become familiar with the material and develop their understanding of how it operates. He says:

“Yes well yes I had some workshops, as my experience with workshops and as a lecturer, I think one needs an introduction, I mean you can go and do everything online, but I think you need an introduction offline, someone physically to teach you the basics, and follow you and take the steps to teach. It’s very hard, I mean it’s okay once you have more experience, like now I have been using MAXMSP, so going to Pure Data is the same thing, so I don’t really need that, but for people who
François’s is trained as a graphic designer and does not have an engineering or technological background. Over the years he has developed his skills in software and hardware and his first introduction to the technologies that have become part of his everyday life was through workshops. From his perspective, he understands the importance of showing and explaining in clear language to others who, like him, may not have their beginnings in software and hardware. In my own experience as an engineer, I too understand how demonstrating and learning from others is key to developing your base knowledge for further explorations.

6.6.3 The soul of hacking

For François hacking is not just something he does, it constitutes an important part of who he is. I ask him what attracted him to open source communities and how it pertains to his everyday life:

“I suppose for me at least, it’s an idea of community of people working toward the development of the tool and sitting around meeting, rather than just “using” a tool already there. I mean, for me comes from that being able to make your own tools, or your own piece of software, hardware or something you want to say or to do, and not just using somebody else’s idea. Somebody once said if she uses software it’s like living somebody else’s idea, it’s not your idea it’s somebody else’s. I kind of like that idea”.

This last sentence resonated with me – I found it to be quite poetic and I probed François to explicate further:

“The biggest artistic trap ever – it’s been done before. I have heard so much – it’s not a new interaction. My answer is “well I have never done it before.” I think it’s in how you make it, like if you think about digital art and we compare it to painting. The process and techniques of painting are the same for every artist but it’s how you interpret them that make a painting unique. It’s the same with digital art. I also believe this – in programming you are only piecing together a series of methods – the method of a brush or object the canvas object, etc… What you do with these is where you can make it your own. People get caught up with the ‘that object has been coded before’. I remember someone questioning me because I pieced together
François sees the roots of open source as being firmly embedded in working with others. He sees these communities as spaces for people to learn, collaborate and work with one another. Furthermore, he sees respect for others who have experimented and explored before as a key aspect of the communities. To François hacking is not about the tool: it’s about the understanding and the modification of the tool to support new ways of seeing and understanding.

6.7 Discussion
This informal interview discussed the importance of understanding the material that hackers work use within their practice. It offered unique insights into the pertinent aspects of the practice for François: to François it is essential to be able to make and learn and develop the skills that support these actions. These skills and knowledge are developed through practice and understanding how to connect components and develop new relationships and pairings. François’s motivation in these communities is his own art practice: he is concerned with the waste aspect of technology and by using recycled components within his artwork he turns provides his audience with a critical lens to examine technology within their lives. In addition, we see his approach to working and collaborating with others and there is an overall feeling of respect and pride in his stories or his own experiences.

After conducting the interview, I reexamined the vignettes and themes that emerged from the first and second case study. Moreover, I related the vignettes and themes to my own experience of attending the workshop. I began to critically analyse how these experiences and the reflective nature of the practice could inform a perspective of users as active participants within an open-ended design process. Thus, I went about developing a set of design sensitivities that allowed me to consciously position myself in relation to the design process, and the users involved
in it. These design sensitivities were also useful to reflect on, for thinking about how to establish the frame that users could participate in. Finally, they provided me with a means to examine what users would need for designing in an open-ended design process.

The dominant understanding that emerges from the vignettes and interviews discussed in this chapter and previously in Chapter 5, is the necessity of providing a space that accurately reflects the nature of the activities that will be conducted. Thus, the first design sensitivity that emerged pertains to the design of an “appropriate frame” for which users can participate in. In order for a designer to construct an “appropriate frame,” they need an in depth understanding of the nature of the activities that will occur. Furthermore, they should integrate different elements that will add to the feel of the space and consider how the presentation of the space affects the user.

However, an “appropriate frame” is not the only component that is required to encourage users to design, designers must also provide necessary “tools and ways of working.” By providing access to tools and illustrating how to manipulate the materials, it shows users how to expand their ways of designing. Furthermore, it is evident that by showing users how to learn by doing, it allows them to become proficient in a kind of reflection-in-action. To allow for users to engage in this process, it is essential that designers employ a practice of “I make, you do” in order to show and coach users and allow them to develop their own process of reflection-in-action. In addition to guiding users in their designing, it is also pertinent to “showing alternate contexts and applications” of the materials and tools that they are working with. These alternate contexts and applications provide inspiration for users and also show interesting ways of manipulating materials. They demonstrate the tacit knowledge and expertise of the designer, which positions the designer to the role of expert. To provide for users to develop their own sense of style and ownership over what they design, designers should implement a “raw aesthetic” that will allow users to build on and shape the aesthetic to their own preferences. The design spaces users encounter should be tailorable to their own needs, and be what I call a “flat surface”, upon which they can construct and carry out activities at their own pace. I use the term “Flat surfaces” as a way of referring to how accessible the space for designing is for users: if users perceive the design space as complicated and messy on their initial encounter, it can be off-putting and intimidating for them to engage in
design activities. Therefore, it is essential that these spaces are “flat surfaces”, free of clutter and of obstacles and allowing everyone to enter at their own starting point, and allow for users to enter the design space uninhibited.

Just as designers are proud of their work, so too are users. As an incentive and reward, if we place users design endeavors or elevate their outcomes by providing a space for an “exhibition of designs,” it allows users to take pride in their work and allows a “dialogue” to take place within the “community of practice.” Open “dialogue” is essential in an open-ended design process, and it is essential that as designers we provide structures for users to open conversations between one another, and also communicate openly to our users. This “dialogue” ensures that communication between users and designers is open and can be used to inform users about updates or provide new insights that have been uncovered by users. In an open-ended process, the designer is an expert from the perspective of the user, and look to them as leaders of the communities that they construct.

These design sensitivities allow designers to frame users as designers in our design process. They are informed by a deep understanding of the nature of hacking and reflections from my own experience of attending the workshop as a participant. These design sensitivities are not meant as implicit guidelines that designers need to embed each time they engage in an open-ended design approach, rather they are meant as suggestions for ways of thinking and doing for interaction designers to reflect on. Moreover, they allow us to perceive users as designers and understand the needs and requirements they might have in this role.

6.8 Summary
In this chapter, I presented the second case study documented during my research. I described the research objectives and the curatorial process that guided and shaped the development of the case. Furthermore, I elucidated how I put into place structures within the frame of the workshop that supported the practices of hackers. In addition, I took on the role of the hacker and actively participated in the workshop probing the practice of hacking from the perspective of participant.

I presented vignettes that were examined my experience within the workshop and I illustrated how the structures that are embedded with the practice support reflective practice. The vignettes were drawn from data, where as a
researcher I took on the role of hacker and participated in the workshop. I then provided reflections on the research and curatorial objectives I outlined at the beginning of the chapter. Finally, I probed the experiences of hackers in further depth by conducting an informal interview that explored the themes described in the vignettes.

From these vignettes and in depth examination of hacking, I developed a set of design sensitivities that facilitate an understanding of users as designers and allow interaction designers to frame users in this role by constructing a frame in which they participate. In the next chapter, I describe how I employed a curatorial approach to embed these design sensitivities in the third case study of this research.
CHAPTER 7: CURATING A FRAME FOR THE PRACTICE OF USERS: CASE 3 – E-WASTE WORKSHOP

7.1 Introduction

In Chapters 5 and 6, I have presented and discussed a selection of data, collected during Tweak, in order to show the reflective nature of hacking, and in Chapter 6 I have provided a series of reflections from my own experience of participating in a workshop, which led to the development of corresponding “design sensitivities” for informing how designers can frame users in the design process. These reflections reveal the rich and complex nature of hacking, and as discussed in chapter 6, it is evident that the practice cannot be simply translated into generic design requirements for employing within Interaction Design. Thus, the design sensitivities discussed in Chapter 6, and further elaborated upon here, are meant as suggestions or “ways of thinking and doing” for interaction designers to reflect on, when designing for “users as designers”.

In this chapter, I illustrate how I undertook a curatorial approach to shape and develop the third and final case study of this thesis. I describe in detail the elements of curatorial practice I drew on, and show how the design sensitivities provided me with a frame to engage with this practice. In the third case study, I take on the role of facilitator and curator, with the intention of supporting the interactions and design actions of participants in the workshop. This curatorial
stance is influenced by the reflections and understandings from the previous case studies. Within this frame, I aimed to provide an appropriate and supported environment in which to carry out the practicalities of the workshop. It was a way of collaborating and working with the hackers conducting the workshop and developing dialogue with participants who attended. It was also an informal social space where the social and cultural practices of hacking could unfold in a realistic environment.

As well as describing in detail the workshop, which serves as the third and final case study of this research, I present the curatorial perspective from which the workshop was constructed and describe the structure and content of the workshop. I present my findings as a series of vignettes that explore both my experience of facilitating the workshop and the participants practice within the frame. Additionally, I probe these reflections further by providing data from a series of interviews conducted with participants of the workshops that detail the participants’ experience and provide a means to critique and examine the curatorial frame I employed. The findings and reflections discussed in this chapter aim to evaluate the frame upon which the workshop was constructed: they provide a means to critically reflect on the curatorial approach I undertook and its outcomes in a real-life context. Finally, the findings discussed here aim to make visible an alternative approach of working as a curator to engage users in the practice of design.

7.2 Designerly ways of thinking about users who design
In this section, I describe in further depth the design sensitivities that were previously discussed in chapter 6. These design sensitivities draw on the episodes described in Sections 5.4 and 6.4 of this thesis. The episodes illustrate the reflective nature of hacking and highlight the nuances of the practice; furthermore, examination and reflection on these episodes reveal the rich and complex nature of the practice. It is evident that the practice and experiences of hackers cannot be simply translated into generic design requirements for employment within Interaction Design. Instead, these sensitivities aim to inspire or suggest ways in which we can frame “users as designers.” In addition they provide criteria for reflection and employing facilitation within our own Interaction Design practice:

- **Appropriate frames**: In order to encourage users to design for themselves, it is essential to provide an appropriate and realistic environment where they
improvise, experiment and play. Moreover, it should “feel” like a space where users can engage can feel free to work in. Designers should integrate different elements into the space to make users feel comfortable and to encourage them to participate and explore. In the workshop described in Sections 5.4, 6.4 and 7.4, I described how participants of differing backgrounds, from art to engineering, engaged and experimented within the frame of the workshops at Tweak. Creating Tweak was an integral part of the appropriateness of my frame as it ensured the research was conducted in the real world.

- **Tools and ways of working:** In order to encourage users to design, it is vital that they have access to tools and understand how to manipulate the materials – software and hardware – at their disposal. Furthermore, it is essential that, as designers, we not only provide access to necessary tools but also provide means of working with these tools. Illustrating to users clever workarounds, how to understand the material and how to shape materials provides them with means to explore and build their knowledge for themselves. This is necessary for users to grow and expand their ways of designing. These “tools and ways of working” are determined and intertwined with the properties of the material being used. The nature of software and hardware inform the “tools and way of working” and require different methods, techniques and equipment depending on the material being used. These materials (software or hardware) have their own constraints and affordances that underpin and determine the design activity that will take place. Thus, the material being used will impact directly on how the designer will establish their way of working and the tools that will be required for users.

- **Raw aesthetics:** Hacking as a practice has an aesthetic that is embedded within the raw materials that they use: often this aesthetic appears “raw” and unfinished, with wires and soldering exposed. Although this at times can look messy, it is actually representative of the practice in that it reflects the true nature of the raw materials used and the skills of the hacker who constructs a project with this type of aesthetic. In order for users to claim ownership over their design, it is useful to rely on an under designed aesthetic that reflects the fact that the material is open to appropriation and adoption. By
implementing a raw aesthetic, designers give their users free license to alter the look and feel to their own needs and requirements.

- I make, you do: showing users how to manipulate the material through examples provides them with an understanding of how they can use and manipulate the material in different ways. Designers can guide users through examples or tutorials and iterate through step-by-step instructions to show users how the material works. By imitating these instructions users can gain insights into how the material works, and gain a “feel” for the logical operations of the material. In this sensitivity, the objective is to introduce users to techniques that control and manipulate the material they are working with. Moreover, these examples provide users with practical means of understanding the capabilities of the material. When using this sensitivity it is essential that designers pay attention to how users progress through their instructions and facilitate the users understanding of the underlying logic of the material they are using. These examples provide users with their first insights and understanding of the material they are designing with. By following the instructions in the examples they develop their understanding of how the material works. This initial experimentation serves as the basis for the users self learning and exploration. This sensitivity provides a foundation of knowledge from which users can explore further.

- Flat surfaces: By providing structure or environments that are “flat”, it provides space for users to construct according to their own needs. A “flat surface” is what I term a space that the designer constructs where there are no obstacles to the user. By providing the basic understanding of how to participate in the space to the user, and by supplying tools and materials, this ensures that when entering the space for the first time, the user does not perceive any initial obstacles in their path. In the vignettes discussed in Section 5.4, I described how users constructed their knowledge in layers. In a “flat surface” a user establishes how they move and constructs these layers. Instead of providing step-by-step instructions for how to go about their activity, the creation of a “flat surface” for a user, allows them to construct and engage their activities in a flexible, open-ended way with the materials. “Flat surfaces” should facilitate for all skill levels of users. For example, the vignettes in Section 6.4 show how having participants with different skill
levels of programming meant that the hackers conducting the workshop spent the majority of time instructing participants with no programming experience. Thus, the other participants with intermediate and advanced programming skills felt restricted by the format of the workshop. “Flat surfaces” should cater for individuality and should not prescribe how users should carry out their activities. Instead it should provide the user with a space to experiment in, and instead is limited by the constraints and affordances of the material itself.

- **Communities of practice**: Online communities are vital for the development of open source technologies, they provide means for members to communicate, ask questions, post code and help one another. Users within these online communities are influential in providing methods and approaches through showcasing their work. Furthermore, they create a collective experience, which is negotiated through dialogue. When designers are creating a space where users will encounter one another, it is essential that the designers establish the tone and nature of this dialogue. By initiating a dialogue, or establishing upfront how to engage within the space, the user understands how to join and participate. In addition, this initial dialogue provides an understanding to all actors entering the space what activities will take place and how they will be conducted.

- **Showing alternative contexts and applications**: A hack is usually about making technology work the way one wants by directly manipulating the systems and operations of the device. These hacks usually emerge from the community of people who use the materials and show the diverse range of contexts where the material can be used. Instead of showing the techniques of how the material was manipulated, this sensitivity is aimed at showcasing finished examples that users have developed. These examples show how users have rethought the use of the material to fit the context of their everyday life. These alternate contexts and applications are clever or innovative examples of finished objects that illustrate visually how users have rethought different technologies to fit within the context of their lives. They also provide inspiration and allow users to link different aspects of the technologies they design with.
- **Exhibition of designs**: Hackers are proud of their work. Often they have their own website that displays documentation and thoughts behind their work. In addition they often share links on public forums to elicit feedback from others or acknowledgement and advertisement for what they have coded or built. It is not only important for hackers to receive recognition for their effort, but it is also essential for the development of the community. By acknowledging and placing a spotlight on the work produced by these hackers, it serves to validate their practice, and highlights them as an innovator of that community. Secondly, these exhibition spaces, whether offline or online, contribute to our knowledge and understanding of both hardware and software. By viewing and displaying these objects it shapes out understanding of how either hardware or software can be manipulated to create new objects, shapes and forms. Finally, these examples attract new members to open source communities and also provide inspiration for others.

- **Dialogue**: Dialogue is key factor in supporting the development and shaping of new ideas and forms. Thus, it is critical that it dialogue between users, designers and materials is actively supported through different structures. Dialogue can reveal the needs and requirements of users. In addition, through dialogue we can gain insight into the factors that influence the users experience of an environment or space.

These sensitivities provide an overview of the means in which we can frame contexts and environments for our users to design in. They provide inspiration for thinking about how we can guide users in their role of designer. As discussed in Chapter 6, hacking is a rich and complex practice, and how it is experienced varies widely from individual to individual. Therefore, these sensitivities are not explicit guidelines to be implemented each time an interaction designer chooses an open-ended design approach. Instead, they aim to encourage a conscious way of thinking about the nature of open-ended design and how we can support users in their role as designers.
7.3 Curating the frame

In this section, I discuss my curatorial aims for the third case study and outline the conceptual overview for the workshop, making transparent the curatorial process. I will also describe how this curatorial approach supported the design sensitivities into the structures of the workshop discussed here and show how this curatorial approach could be implemented within an Interaction Design context.

From my experience of curating and organising Tweak, my knowledge and appreciation of hacking has developed substantially. In addition, I have become conscious of the “raw” aesthetic of hacking. In order to illustrate the nature of this aesthetic, I will describe an artwork that I selected for the exhibition at Tweak 2010: ‘Juvenile Amplifier’, created by Joey Mariano (Figure 7.1). Mariano built this piece

![Figure 7.1: Juvenile Amplifier by Joey Mariano](image)
from Game Boy® parts, LSDJ sound loop, home made CMOY Amplifier Circuit and wires. The artist as a child was fascinated with the music from his GameBoy and felt that he often wanted it louder, therefore in his artwork he created a homemade amplifier that plays the sounds from a repurposed Gameboy without the use of headphones or a large PA. Visually the piece consists of a deconstructed Gameboy, mini speakers, a homemade amplifier circuit and wires. Instead of hiding the messy appearance of the circuitry within a case, the artist intentionally places it to the foreground of the piece, showing the inner workings of the electronics, laying it exposed for the viewer to witness. This raw form is authentic and representative of the materials used in its creation. As a curator, I viewed this piece as a ‘true’ representation of the process of hacking, and furthermore, held several of the aesthetical elements that are inherent in hardware. In Section 6.5, I described how as a curator I felt that often I overlooked this aesthetic, and when it came to selecting artworks I choose ones that had a more finished and glossy look to them. Consequently, in the third edition of Tweak I aimed to embody this raw aesthetic into the design and structures of the festival.

The final edition of Tweak was held in September 2010. The festival was similar in format to the previous two editions, and consisted of an exhibition, workshop, musical performances, a cinema and a listening post. The festival was again curated from an open call, and featured the work of nine artists in the exhibition, thirty-four in the cinema and four evenings of musical performance. Visual documentation of the festival, including a copy of the open call can be found in Appendix C of this thesis. The call asked for artworks and workshops that responded to:

“…Tweak 3 again highlights the idea of global communities working together, and aims to host some of the most respected/directed/neglected electronic stalwarts that continue to challenge how we think about mediums…”

This call received over 250 proposals in total, and each entry was selected for their relation to the overall curatorial theme.

In order to further promote the raw aesthetic of hacking into the festival, I worked closely with a graphic designer to produce a printed poster, a logo and website that embodied this aesthetic. The concept was to produce a set of

47 The visual identity was developed in collaboration with JP Hartnett.
components that acknowledged the computing aesthetic, and reinterpret this aesthetic in a contemporary manner. While one of aims was to acknowledge and integrate the aesthetic of the materials, hackers used in their practice, it was also essential that I kept in mind the audience of the festival. The previous two editions of Tweak were dedicated to showing both the artistic and technological nature of hacking practice and attracted a broad audience ranging from engineers to artists.

Thus, it was essential that the identity portrayed did not exclude this audience. Therefore, considerable attention was given to the representation of the aesthetic: the logo, as seen in Figure 7.2, utilises a font that is characteristic of computing, and with the addition of color, it presents a modern contemporary aesthetic that is
approachable and inclusive of the festivals’ audience. This approach was carried through to the design of the website (Figure 7.3). Within the design of the site, there was a strong visual element and photos of artwork were heavily featured. The final component of the identity featured a poster, which was also a brochure with information about the festival. The design consisted of an image showing a spectrum analysis of a human voice spelling out the letters T, W, E, A and K. It was generated using the open-source application Audacity. The design aimed to embody and merge a playful approach to the aesthetic of computers.
My intention was to integrate the raw messy aesthetic of hacking. I clarified what this raw aesthetic comprised of and detailed how it could be presented in the design of a logo, a website and printed poster. Although one could argue that the discussion of the visual identity is not relevant, I believe that the aesthetics and design were an integral component of my approach. As an attendee of many events and festivals similar in nature to that of Tweak, I believe that the design and visual identity allow the curators and organisers of these events to communicate visual meanings to their audience. In addition it permits the organisers to promote their events in a particular light. As a curator, the careful design of the identity allowed me to reflect the curatorial concepts visually to an audience. Each year of the festival had a different curatorial focus (see Section 5.3 and Section 6.3) and as a result the identity changed from year to year. As a researcher, the visual identity allowed me to present the festival in a real world light and further authenticated the frame in which the research activities took place.

In the next section, I describe how I extended this curatorial approach to the workshop that forms the third case study of this thesis. I elucidate how I embedded the design sensitivities, described in Section 7.2, using a curatorial approach into the structures of this workshop.

7.4 Case 3: E-Waste workshop
In this section, I describe how I embedded the design sensitivities into the frame of the third case study and I explicate how I used a curatorial approach to create the frame of the workshop in collaboration with the hackers conducting it. During the development and planning phase of the festival, I contacted a hacker I had become familiar with during the first edition of Tweak. I discussed in detail with him my intentions for the direction of the festival and set about explaining my plans for curating a workshop. François describes himself as a practitioner whose artistic practice is infused with hacking ethos and methodologies. He regularly collaborates with another hacker – Jens, an engineer by profession – on a workshop that critiques electronic waste: through manipulation and appropriation of these discarded materials, they offer participants a critical perspective on technology. They encourage participants to recycle their old components into interactive artworks, while simultaneously equipping the participants with basic hardware and
software skills. In approaching François, my aim was to alter the format of their workshop and collaborate closely with both hackers to test the curatorial frame I proposed. The workshop was scheduled over two days and participants were asked to bring their own electronic devices for hacking. Allowing participants to bring their own devices provided them a “raw aesthetic” from which they could construct their projects. These devices belonged to the participants; consequently, they had an immediate sense of ownership over their device. This sense of ownership provided them with free license to do what they wanted with any of the devices they brought. Furthermore, they also felt they could arrange the devices to their own aesthetic preferences and requirements.

The workshop was open to participants of different backgrounds and no programming or electronic skills were required, all tools and materials necessary were provided, and were arranged on a table to one side of the room. Participants were asked to bring their own laptops and to install a series of software applications. Instead of being taken through a series of exercises, I asked François and Jens to alter the workshop to allow each participant to work individually or in groups on different projects of their own choosing. This provided the “tools and ways of working” and thus, allowed participants the space to develop their own ideas, while being supported and guided under the experience of François and Jens. In addition, this framing of the workshop allowed for the development of several unique interactive pieces and, at the end of the workshop, these pieces were exhibited in the main exhibition of the festival. By undertaking an approach that enabled participation in the exhibition from those who considered themselves as “outsiders to the hacking art world” it provided a means to support the “exhibition of designs.”

In order to incorporate an “appropriate frame” for the workshop, I sought a space that I thought was reflective of the nature of the activities. Due to the economic downturn, there were a number of properties in Limerick city centre that were unoccupied and left dormant. In order to counteract the image of a city being vacant, city council developed “Creative Limerick” – an initiative that gave recent creative graduates the loan of these vacant spaces to set up studios and exhibition spaces. These spaces were loaned free of charge and aimed to bring “life back to the
premises"^48. For the workshop setting I contacted “All Out Design"^49 – a graffiti studio occupying one such site – and asked them to host the workshop. The artists - in the same spirit of hacking - had transformed the space that had previously been a shoe shop, – shoe stands had been repurposed as tables, walls had been constructed to divide the space to their needs. The space felt undefined in nature and could easily be modified to support different activities: I felt that the space could provide an “appropriate frame” for the activities of hacking to unfold.

In total, 8 participants (7 students, 1 professional) attended the workshop. Each of the participants had varying degrees of skill and technical capabilities. Of the eight only 4 had previous experience with electronics and programming and the remaining 4 were beginners. Participants were arranged at square tables (Figure 7.5)

![Figure 7.5: The layout of the workshop](image)

that were placed in the middle and along two of the boundary walls of the room. At one side of the room, a long table was covered with tools, materials and electronic components and on the remaining wall a makeshift projection surface was

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^49 [http://alloutdesign.net/](http://alloutdesign.net/)
constructed. During the workshops participants worked individually on projects at their own pace: this was to ensure that the workshop was a “flat surface” which allowed participants to explore, construct and engage their activities on their own terms. Furthermore, it allowed each participant to proceed at a speed they were comfortable with, while the hackers who conducted the workshop went from one to other checking on their progress. Consequently, the “dialogue” between hackers and participants was critical to support the activities in the workshop.

François and Jens began the workshop by providing an overview of how the workshop would be conducted: they discussed their perspective of hacking, and spoke to the participants about recycling technology. François and Jens had developed the workshop as an artistic response to the large amounts of electronic waste being produced. The majority of electronics that are thrown away have little or zero economical value, however, they contain components that can be salvaged and reused in different contexts. For François and Jens, the workshop was a space where they could invite participants to act, and recycle obsolete technology, as a new way of creating systems and products. From their perspective, hacking is an art practice that can provide new ways to create systems and products. At the start of the workshop, François showed photos and videos and told stories about the types of activities and the objects participants had made in other editions of the workshop. These insights provided the participants with “alternative contexts and applications” and gave them inspiration to rethink the electronic components they had brought. François also showed a slideshow of his own artwork and gave tips on different components he had used.

In my role as facilitator, I interacted directly with participants and the hackers conducting the workshop. As part of this role, I ensured that everyone was comfortable and the overall tone of the workshop was relaxed and informal: I introduced myself to participants and encouraged them to interact with one another and share information and ideas. As participants worked on their projects, I would engage them in dialogue about their ideas and would share information from my own experiences that I thought would assist them, and in one instance, I was able to fix a programming problem a participant had trouble with. I also recorded the workshop with video and conducted participant observation throughout the two days of the workshop. In the next section, I will describe vignettes illustrating the activities that occurred during the workshop.
7.4.1 Experimenting with unexpected materials

In this vignette, I describe how participants used an experimental approach and employed knowing in action to examine materials, rethought their uses and created new contexts of use for them.

In Figure 7.6, vignette 12, Link, one of the participants in the workshop, has taken apart a small electronic keyboard. Using different materials provided by the workshop he has deconstructed the keyboard to access the sounds: he has connected an Arduino to his laptop and using wires has connected the keyboard to

![Figure 7.6: Vignette 12 – Link deconstructs an electronic keyboard and experiments with the sounds using an Arduino and a software patch in MAX](image)

the analogue pins on the Arduino. I ask him to describe what he is doing and take me through his thought process: “I’m going to build something in MAX, I’ll see if I can get stuff from these… data from the keys or signal from these keys, that goes into the Arduino and then it receives signal. I’ll see if I can transfer the signal onto the software side of it and just map it onto different parameters, I’ll just make something in Jitter. I want to make something visual. I’m just pulling it together at the moment”.

I probe him further and ask him what he thinks he’ll achieve from the workshop. He responds: “Well it’s more to do with the interactions, isn’t it? So I’m going to do something fun to interact with. Some kind of – just taking the keyboard from what
usually it is made for and trying something new – I’m not using anything from the sound.” I ask me to explain a little further and question: “What made you want to do that?” He pauses for a moment and explains: “I’m not into circuit bending, I didn’t want to take apart the keyboard for that reason. That’s not for me. I’m more interested in other things. I like the tactile buttons and things like that on these things – to use them, rather than to manipulate the sounds and stuff like that. I’m not into noise, so I didn’t want to go down that road, I’m just more interested in the signals and the buttons to do visual things”. This vignette clearly shows how Link was interested in both the digital and physical properties of the object. He has some proficiency with hardware and software hacking and understands how to manipulate digital material. Even his vocabulary shows that his tacit understandings of the material he works with. His aim is to recontextualise the keyboard, which is originally a sound based object, and manipulate it, to transform it, to a visual object. He labels the sounds as signals, illustrating that he understands how to change them according to his needs. He challenges himself and instead of manipulating the sounds, he aims to use the signals from the keyboard to create interesting visuals, thus, changing the nature and original function of the keyboard. This vignette shows that Link has a deep understanding of the material he uses and that he’s able to view the material in many different ways. He understands the functionality, affordances and constraints of the material and demonstrates that he can use his knowledge to think critically, and explore new ways of manipulating the materials.

Figure 7.7 shows the next vignette, where another participant, Alison, is playing with her Arduino and is experimenting with different electronic components. I notice that she has cut open a Coke can, and connected a crocodile clip between the Coke can, a small circuit and the Arduino. I am intrigued by her setup and ask her for more information: “Basically I put a proposal into the Science Gallery, I think I called it Zen Pool or something and what I want to do is build a mini prototype of it here. I’m just trying to get the technology of it together and the sensors going. So if you drop something on it” - She drops her hand onto the makeshift sensor, constructed from the Coke can, and points her finger to her computer screen, where a Processing sketch is open on her screen - “you get a read of it here. So we’re getting all the capacitors and that kind of stuff together. So that’s an idea of how it will work and then what I suppose we will do it, eventually take the data from that.” She points again to the computer screen: “and put it into… eh… pd, and hopefully at some stage get visuals and
sound from it. So that’s the idea taking an input from the sensor and using it to generate visuals and sounds”. I respond: “Hmmm, interesting, what will you use to generate the interaction with the sensor?” She points to the sensor and says: “oh it has to be metal, so this is functioning like a capacitor, so this has to be like a surface. It’s basically finding a location for where something is and this will do how hard it’s dropped as well. So I’m doing that and from that then, getting the data and…” She pauses for a moment and I prompt

Figure 7.7: Vignette 13 – Alison’s makeshift sensor constructed from a coke can

her “to create visuals and sounds?” – She replies: “No, well what the idea is, say if you had a table like this, say if it was Perspex or something and you were going to drop a stone onto that surface, there will be an audio sound, which will be more like a musical instrument sound and there will be a plop or something like that and I can see it in my mind that there will be a visual rippling out. So you’ll have all these things being dropped in and all these visuals going out from them, and then they would interact with each other so that you’d get harmonics or a build up of chords and different sounds. I saw in the Science Gallery, during the exhibition BioRhythm, the reactable50, so I was thinking of that, and being able to move things around to create new sounds and things like that. So that was the

50 http://www.reactable.com/
idea of it. It’s been 15 years since I’ve done electronics, so what I’m doing at the moment, is putting in resistors to this circuit to see what happens in the software. It’s all part of the fun isn’t it?”

This episode depicts the resourcefulness of hackers and shows how they use everyday materials to create new objects and interactions: Alison has cut up a Coke can and used it as part of her circuit. This demonstrates Alison’s understanding of electronic components and materials. Her objective is to create a surface that functions like a capacitor. She shows that she understands the properties of a capacitor and turns this tacit knowledge into an experimental action. Knowing that she needs a surface as part of her prototype, she cuts up an aluminium can and integrates it as part of her circuit. This vignette shows how hackers are able to think, and apply their process and knowledge to materials that are not considered design materials. This innovative way of thinking allows them to work and explore with everyday objects that constitute their everyday lives.

7.4.2 Working at different paces
Schön describes an educational environment as a practicum – a setting designed for learning through practice and carrying out tasks (Schön, 1987). He describes the practicum as reflective and supportive of reflection in two ways: it aims at helping students learn reflection-in-action and it involves learning by doing, with the help of coaching, specifically through a dialogue of reciprocal reflection-in-action between coach and student (Schön, 1987). In the following vignettes, we see how the workshop and its structures supported different participants in their actions and the ways in which they uncovered knowledge during the workshop.

In Figure 7.8, Link has encountered a “surprise” and he has paused the building of his circuit. He concentrates on his screen and he is analysing the code in his program. He looks to the circuit he has built with the keyboard and replaces one of the connections in the circuit, he then pushes a key that generates a sound and he returns his attention to the screen. He has a perplexed look on his face and pauses for a moment. He opens up the Internet browser and begins searching for solutions to his problem; his search returns with some options and he analyses and examines an online forum. A user of the forum has posted a question online and the problem it describes is similar to Link’s. Link reads through the replies and then opens
another tab in his browser window: this time he searches for a schematic diagram of the chip he is using. He returns to the other tab and compares the responses on the forum with the schematic of the chip. From this comparison he derives at a solution, he returns to his circuit and makes changes. He runs his software again and receives the outcome he was looking for. He returns his attention to the circuit and begins

to probe it again, testing and checking it for further vulnerabilitie{s}. At this point Jens joins him and queries him on his progress. Link shows him the circuit he has built and explains his project, pointing out the issue that he has just overcome. Jens sits down beside him and looks at the circuit, he nods his head and looks impressed and they discuss the circuit for some time. After some discussion on how Link should proceed, Jens stands up and wishes him luck and returns to help another participant.

In this vignette, we see that Link is resourceful and is well adept at problem solving: to him, the workshop is a space for exploration and for conversing with his peers. It is essential for him to be able to problem solve and he has accumulated a large body of tacit knowledge from his experiences of hacking and problem solving. He is familiar with materials and resources and he knows how to negotiate his way through forums and tutorials to uncover solutions for surprises he encounters.
In Figure 7.9, we see a contrasting picture: Karol is a student and, in comparison to Link, has only some experience with working with electronics. Karol has built a pd patch with assistance from Jens. He is unfamiliar with the software and has only used it once before attending the workshop. Under the supervision of Jens, he has built a small circuit that is connected to an Arduino and his laptop. The circuit is also connected to an old games controller that he has hacked for the purpose of the workshop. When he moves the controller in different directions, the pd patch generates different sounds. When Jens is talking with another participant, Karol is examining his pd patch: the controller and the patch have stopped working, and Karol is attempting to devise a solution of his own accord. He talks to his friend Ben sitting beside him, and asks him for his opinion. Ben is not adept with pd and is unable to assist him. He says to Karol: “Why don’t you just ask your man?” Karol nods and says: “Yeah. I’m just waiting for him to finish up over there, and then I’ll ask him”. While he is waiting, he looks at the software and brings up the help file to see if he can find a solution. Jens walks over and sits down beside Karol to help him with his
problem, he examines the software and shows Karol that one of the connections in
the patch got deleted and shows him how to reconnect and edit the patch to make
different sounds.

These contrasting vignettes show how different participants with varying
degrees of knowledge and experience utilised the resources within the workshop in
different ways. Link is highly adept in electronics and programming, and, instead of
receiving coaching from the hackers conducting the workshop, he receives guidance
and advice and is free to work at his own pace without having to pause or wait for
others who are less proficient in coding and electronics to catch up. In contrast,
Karol makes the most of Jens and receives one on one instruction from Jens to assist
him in developing his knowledge and understanding.

7.4.3 Exhibiting the Results
In this vignette, I describe how the option of participation in the main exhibition of
Tweak impacts and influences the participants’ way of thinking and doing.

Towards the end of the workshop, the activities of the participants gain pace.
In Figure 7.10, James is packing a box full of equipment, including the prototype that
he has been making in the workshop. The workshop has not ended and there are
still participants finishing the projects they are working on, however I assume that
James has finished with the workshop and is packing up to go home. I walk over to
him and ask him about his experience of the workshop. He responds:

“Oh yes, I learnt a lot. It was good fun. I’m just packing up now and heading over
to the exhibition space so I can finish off my piece. Is it okay to pack up and head
over there now?”

I assure him that it is and give him directions to the space. I also remind him that he
doesn’t have to participate in the exhibition and that it is optional. He laughs and
replies:

“Oh no! I really want to. It’s a good opportunity. I mean, I know I’ve only done
something really small and basic, but a lot of my friends are coming to the
exhibition so it’d be kind of cool to be involved. I mean like, not to sound ridiculous
or anything, and I know I’m not on the same level as any of the other people
exhibiting but it’s just a bit of fun and I’m not taking it too seriously. I just really like
being involved and part of something. I really like the festival and there is nothing
else around like it. So, to be a part of it, even in only a small way is cool. So I’m just going to head over there and finish up my piece. I want to make sure it looks ok in the gallery, and fix it the way I want”.

Figure 7.10: Participants tidy up their work area and prepare their prototypes for the exhibition

This episode illustrates James’ attitude towards the exhibition as a space and as an activity concluding the workshop: to him, the space is fun and offers an opportunity to be part of a community. Although, he does not perceive himself seriously as an artist or a hacker, he appreciates how the exhibition allows him to be part of a community he respects.

After the workshop has concluded, the participants walk over to the exhibition space, which is a ten-minute walk from the workshop venue. On the walk over I chat to some of the participants about the exhibition and the workshop. The participants are in good form and all are excited about having their projects exhibited. I talk to Ben and Jack and they discuss the projects they have made and how they will exhibit them: I ask them how the exhibition makes them feel. Ben responds:

“Pretty excited actually. It was kinda one of the reasons I joined. I mean I mostly wanted to get help for my project for college. I’m going to use this again in college and put in more functionality for my FYP. But I also thought it was cool to do this
part too. I’d really like to do more of this type of stuff. I know this is only a basic thing and probably real easy to make for other people. But I’m not great at it, so it was cool to learn how to build it. I think I’d like to end up doing more stuff like this when I finish college. I’m a good bit away from that level where I could actually be in a big festival like this, but doing something like this is a good buzz and makes me want to learn more. It’s cool like. It definitely made me work harder to get something made for it. I was determined to get it all done in time. It’s totally deadly though, it’s good to be highlighted!"

Figure 7.11: One of the finished prototypes in the exhibition

I turn to Jack and ask him what he thought about participating in the workshop. He shrugs his shoulder and replies:

“Ah yeah. It’s pretty cool. I actually didn’t find out about it until the start of the workshop. At the start of the workshop, I didn’t even think about it. But then today, when we were finishing up, I got excited that we had finished something for it, and that we were able to be in it. It didn’t really bother me whether or not I had been in it, [referring to the workshop] but now that I am, I’m happy. It’s cool because everyone [from the workshop] got to be in the exhibition. So that’s cool because we’re like a little “special” group – the crap artists in the exhibition!” He laughs
and continues “Sorry, I don’t mean to call everyone crap, but we’re no where near the exhibition level, but I guess with a bit of hard work and a good idea, you can see how easy it is to make things that could be shown somewhere else. That would be the dream now, to get paid and hang out with other artists and go to stuff like this all the time”.

This episode shows two differing point of views of participants. The first participant described how the exhibition was a motivating factor in attending the workshop and that it was a key part of the experience. The second participant highlights how participation in the workshop was not important to him, but instead made him feel part of a group. He identifies himself and the other participants in the workshop as a “special group – the crap artists in the exhibition.” He distinguishes the work made in the workshop and reflects that although his par may not be “at the same level” he assures himself that it is achievable and within his reach by applying himself to learn more about the practice.

7.5 Reflections on third workshop
Schön states, that when confronted with a design situation, participants use their tacit knowledge to engage in a process of unconscious knowing in action that allows them to perform a set of actions until a surprise is encountered (Schön, 1987; Schön, 1983): they then engage in a series of frame experiments and employ reflection-in-action until the design situation is solved and designer is satisfied with the outcomes (Schön, 1983; Schön, 1987). The prototypes shown in Figure 7.12 are outcomes of this reflective practice, and during the workshop the participants used resources, materials and dialogue to support their actions and guide the development of their process. Each of the participants who partook in the workshop was confronted with a design problem that they set for themselves. In joining the workshop, they brought their own materials that were implicit in shaping the nature of their outcome. The structure of the workshop allowed participants to explore and experiment at their own pace and provided them access to tools, materials and peers. By engaging in a series of frame experiments and through dialogue all the participants produced an interactive prototype with some degree of functionality.
Interestingly, François pointed out that in his ten years of conducting this workshop this have never happened before.

Figure 7.12: Working prototypes from the workshop on display in the Tweak 2010 exhibition
The episodes illustrate reflective behaviour employed by the participants during the workshop. Moreover, the curatorial approach I employed allowed for multiple interpretations and resulted in the development of different prototypes. Participants developed these prototypes, and although they have varying motivations for attending and outlooks on what they should design, the process by which they were constructed was similar for each participant.

7.6 Conversations with participants
In this case study, my objective was to demonstrate how a curatorial approach could be used to develop an open-ended research setting. I showed how the design sensitivities, described at the beginning of this chapter, guided the development and structure of this setting. Upon reflection of the data collected, I decided to probe further and conduct a series of informal unstructured interviews with participants who attended the workshops over the past three years. This allowed me to collect the experiences of the participants and uncover their perspective of the workshops and the festival itself. The interviews in this section are conducted with three participants – Link, Orla and Sheldon. Link and Sheldon have attended workshops every year of the festival, and although they did not attend every workshop, they did attend all three workshops discussed in each of the case studies in this thesis. Orla attended the e-waste workshop discussed earlier in this chapter. The objective of these interviews was to reveal the participants experience of the workshop and to critique the curatorial methodology applied. The data collected, is discussed in terms of the design sensitivities described at the beginning of this chapter in Section 7.2.

When developing the festival, there was considerable thought given to the selection of a venue, that seemed a suitable location to conduct hacking in. When participants were questioned on how they related their experience of attending Tweak workshops in comparison to others they had attended Orla responded:

“I suppose it was better in a lot of ways – it was much better materials wise. There were a lot more materials for setup then what we had in the Science gallery, and the actual location, where it was more suited, I suppose to the nature of the workshop. It was nicer in that way, and the way that we all sat quiet close together, around in a group was cool, because you got chatting to the other people across
For Orla, the space and the environment seemed suitable for hacking. In contrast, Sheldon drew attention to the layout and the diverse range of people that attended:

“There was really a good positive vibe around it, and everyone was like, very curious, because a lot of people hadn’t done that, even though they had been working in related areas. But it resonated like it was very new, and everyone was like ‘oh right! Ok cool!’ There was a very broad spectrum of people there. There were art college type people, there were more science types from UL, and then a couple of randomers who just liked noise and stuff, so I thought it was really cool. There was a good buzz and I liked the fact that it was in the art college as well because it just felt right, it seemed like the natural thing to do was just throw it in the back room there, a big square of tables, a space in the middle, everyone sitting around it, seemed very open, and not like, sitting down getting told what to do kinda thing. I thought that was really cool”.

Although Orla and Sheldon draw attention to different aspects of the environment of the workshop, this shows how careful consideration of layout and choice of space can affect the participants who attend. Furthermore, Orla draws attention to the tools and materials provided for the workshop and states that the workshops conducted during Tweak were well stocked with necessary equipment. When this point was discussed with both Sheldon and Link, they glossed over the point made and instead Link stated that there was nothing that came up during the course of the workshop that was not available.

When questioned about how they arrived at their particular design and aesthetic choices, it transpired that the materials participants used guided their decision-making process. For example, during the workshop on openFrameworks, the look and feel of the outcomes could be edited into any style of the participants choosing. Consequently, the systems and objects that were constructed within the openFrameworks workshop had a strong graphical aesthetic attributed to them. In the two workshops discussed in Chapter 5 and Chapter 7, the materials used were
electronic components, and thus, the results exhibited an aesthetic that was representative of the components that were used.

Within each workshop, participants were taken through examples and shown how to manipulate materials. Orla stated that not only did the workshop help her develop her knowledge but also provided motivation:

“The workshops motivate you to go and to start doing that stuff. So I always want to do it, but I just don’t make the time to do it, but if you actually pay to go and do it then you’ve got these designated hours that you are going to achieve something in. So it’s a good way of learning and getting something made”.

Furthermore, the flat surface of the workshop, provided for a wide range of motivations and activities that took place. Participants were motivated to attend for a wide variety of reasons. For example, Sheldon was primarily interested in noise music and said:

“I was like, oh great, build your own noise making device – that’s going to be fantastic! So that was the initial motivation. When I actually got there and did it, it turned out to be even better than I thought, but yeah, I just like making lots of noise”.

In contrast, Orla describes how she is motivated to learn and build her knowledge and understanding of the practice:

“I’ve been thinking, since doing workshops like that, it makes me want to go to more workshops, and I’ve been thinking, it would be really cool, to someday, if I had enough knowledge to actually run workshops like that. I suppose being down there, and at Tweak, and everything like that, it definitely makes me more interested to be involved in more of that stuff, not just workshops, but exhibitions, talks, things like that. It definitely gets you more into every, all sorts of digital technology, art stuff like that. So just generally, I walked away feeling inspired and encouraged to get more involved in open source technology, and in things going on around the place like talks and workshops and things like that”.

The open nature of these workshops provided different functions and responded to different needs depending on the needs and requirements of the participant.
Link adds:

“All I need is to be shown the basics. I figure out most of it in my own time. I am an intuitive learner. I know how to find the answers. We are on the interwebs. Also, I read instructions. I used to beat all my mates at games, just because I read how to do special moves. They used to call it cheating. RTFM. That’s me. The workshop was more practical. It stayed away from art for arts sake. Say for example, I am teaching you the guitar. What is the first thing I need to do? One of the important things for me is asking a student “what music do you like.” No point in week in week out playing metal when the student likes Funk. It turns them off. It’s about them”.

Demonstrating to users and showing them alternate contexts that are interesting and engaging provides us with a means to captivate their interest. Sheldon described his main motivation for joining the workshop was to learn as much about noise music as he could. In 2008, Sheldon attended the workshop discussed in Chapter 5, and attributes the knowledge he learnt in those workshops as the basis for:

“…About 3 years musical work. Getting my mind blown, and also, just that reusing digital stuff for things that it wasn’t really meant for, that’s class like. It really opened up my mind to a lot of stuff that I hadn’t considered. Just even using chaos in music, and it not being like - my apologies, but wanky academic nonsense, you can use really bizarre kind of stuff for making music that people will actually listen to. I did a lot of my stuff with it, (referring to a controller he built in the workshop) but I use it all the time with my techno stuff as well”.

Furthermore, creating a space for the participants to exhibit in created an experience where they felt part of something bigger. Orla describes her experience of participating in the main exhibition in 2010 as:

“It was fun. It was cool. I suppose well, you weren’t at it thinking you were one of the artists or whatever, but it was quite fun that day, even setting up with the other people who were in the workshop. It was really nice, there was an end to it and you could showcase your work, and then other people you knew came, even though you knew that something you had made was really small and crappy. It was really nice. It was a cool part of it”.

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The data discussed here show the many views that participants held about the nature of their participation within the workshop. It highlights how the open nature of the workshop provided a diverse set of experiences for the participants who attended.

7.7 Reflections on design sensitivities
Through the case study presented in this chapter, I sought to demonstrate a curatorial approach to open-ended design by embodying the design sensitivities discussed in Section 7.2. These sensitivities are aimed specifically at interaction designers and participative strategies that encourage users to act as designers. The case study presented in this chapter aimed to realise the curatorial position that the design sensitivities provide. Developing from the previous case studies, this curatorial approach combined the in-depth knowledge of hacking practice with a concern for supporting users in the role of designers. While these sensitivities outline the foundation for this curatorial perspective. While the case study and vignettes discussed in this chapter demonstrate the success of this curatorial approach, I believe there is room for further research and refinement of the design sensitivities presented in the start of this chapter.

For example the concept of “flat surfaces” caters towards creating spaces that facilitate for users working at different skill levels. However, during the workshop some of the participants who were not proficient with programming and electronics would come across design problems they could not resolve by themselves. They would then pause their activities and wait on the hackers instructing the workshop to aid them in solving their problem, and when I questioned them about what they were doing, they would respond that they were “stuck and waiting on help”. This highlights that further concern should be given to “flat surfaces” and how the design sensitivity “I make you do” can be used to support the structures that are required for the creation of “flat surfaces.”

As seen in the vignettes discussed in this chapter, the participants who attended the workshop worked toward their own individual goals. The curatorial approach employed in this case study provided a means by which participants could engage in their own practice of design, and successfully carry out a set of actions that resulted
in finished objects for exhibition. However, the design sensitivities could be further extended to support collaborative making activities between participants. Collaboration is a key aspect of open source culture and many hackers within these communities work together to produce new solutions to design problems, or new objects that represent their work and viewpoint as open source users. Throughout the 3 workshops, there were instances of collaborative activity between participants – participants would help one another with design problems, or actively explore solutions to design problems by working with one another by combining skills. While this is a significant aspect of design practice, I instead chose to focus on design practice for individual users, and I regard that collaborative design practice raises new concerns for a curatorial role that falls outside the research in this thesis.

The informal atmosphere of the workshops allowed users to feel comfortable and relaxed. Participants would often engage and converse with one another on topics unrelated to the workshop activities. I believe that this aspect of social engagement is not fully addressed in the design sensitivities, and could be integrated following further research. While the social exchanges between users and designers are acknowledged in the design sensitivity “dialogue”, further attention should be given to how the social interactions between users affect and shape their design practices. Within this research, one of my objectives is to understand the blurring boundary between users and designers. Hence, within the design sensitivity “dialogue” I focused on the dialogue that occurred between users and hackers as I considered it significant for understanding how we interact with users in their role of designers.

Finally cooperation and exchange are a fundamental part of open source practice and aid in the development of these communities. These aspects of the communities relate to the development of technology, knowledge, practices and expansion of the community itself. Within the context of this research I focused on how users perceived and understood the information and knowledge that the hackers conducting the workshop shared. My interests were concerned with the strategies and activities that participants responded to in order to engage with the practice of hacking. Thus, how users reciprocated to these communities, exchanged ideas and knowledge with one another fall outside the scope of the design sensitivities.
While the concerns discussed in this section outline some of the limitations of the design sensitivities, they also suggest some of the directions that can be explored in future research. These design sensitivities draw from a curatorial understanding of hacking, and further refinement can be achieved through further exploration and framing of the curatorial framework from alternate perspectives.

7.8 Summary
In this chapter, I presented the third case study, I illustrated my curatorial approach and described how the design sensitivities discussed in Section 7.2 guided my ways of thinking and doing in the construction of the workshop. I presented a series of vignettes that explored the activities that occurred with the workshop: reflections were provided on these vignettes and on the curatorial approach I undertook. I illustrated this by providing data from a series of interviews conducted with participants their experience of the workshop. I have also highlighted some points of critique about the curatorial approach that have arisen from the data.

Through the last three chapters, I have shown how Schön’s theory of Reflective Practice was applied in my research and also led to the reflections and analysis made in each chapter. In the following concluding chapter, I will summarise the results achieved through this works and discuss to what extent the research questions outlined in the introduction to this thesis were addressed.
K/NOT 2.1
Transmitting Object Behaviours
8

CHAPTER 8:
CONCLUSIONS & REFLECTIONS

8.1: Introduction
In this thesis I have explored how the view of hackers as reflective practitioners could inform a novel perspective of users as designers in an open-ended design process. I have also shown how curation could be employed as a methodological tool within Interaction Design.

In the introduction to this thesis, I outlined my area of interest in Interaction Design, the awareness and understanding of the design practices of users within open-ended design practices, and I proposed a set of research questions that I explored within subsequent chapters:

- Can interaction designers employ curation as a methodological tool, and how can it be implemented within an Interaction Design context?
- Can a curatorial methodology reveal new understandings about the experiences and practices of hackers?
- How can these understandings inform new ways of working with open-ended design practices and users within an Interaction Design context?

In Chapter 2, I have reviewed existing literature concerning open-ended design approaches within Interaction Design. In addition, I examined literature concerning the perspective of the user and their role within design processes. From this review,
I have shown a need for sensitivity towards a model of users who design. In addition I highlighted how approaches within Interaction Design are limited when it comes to allowing for users participation in a design process: while these design approaches create new possibilities for users to participate, the perspective where users are designers is still largely unconsidered. It is also evident that design practices do not facilitate for users to take on design responsibilities while simultaneously creating their own interpretation of systems. Within Interaction Design there is either a focus on the experiential meaning making where users are provided space to create their own interpretation, or on how the frame allows them to change the functionality of systems. In addition the reflections made that relate to these issue are made towards designers and do not take seriously the role of the user as a creative participant within the design process.

These design approaches are framed around generating design insights for designers and frame the user in a yet somewhat passive role.

In Chapter 3, I have explored literature pertaining to the perspective of the hacker, highlighting some of the dominant perspectives related to the practice: I have shown how empirical studies conducted on hacking are focused on understanding and classifying the practice in terms of the values and motivations of hackers. In this chapter, I introduced a novel perspective of the hacker as a reflective practitioner for employment in Interaction Design, and presented an analysis of their practice in terms of Schön’s theory of the Reflective Practitioner.

In Chapter 4, I outlined my methodological approach within this thesis, and I have shown how Schön’s theory of Reflective Practice provided a framework for the practice-led approach in this thesis. Furthermore, I introduced the empirical context of this thesis work and described the curatorial process in detail. I also explained how this curatorial perspective informed both my choice of methods and ways of thinking and doing, and the construction of the contextual setting of this research.

In Chapter 5, I introduced the first case study of this research. This case study was discussed and analysed from the perspective of designer-researcher. I outlined the research and curatorial objectives for the case. I outlined the workshop – build and bend with electronic circuits, and discussed in detail the nature of the activities that took place. Using the language of Schön’s theory of Reflective Practice, I presented episodes that illustrated the reflective nature of the practice of hacking. Finally, I presented excerpts from informal interviews with hackers that probed the
reflections from the workshop in further depth. From these excerpts, I highlighted how hacking can be understood in terms of Schön’s theory of Reflective Practice, and how it offers designers a way of contextualising their practice within Interaction Design.

In Chapter 6, I presented the second case study of this research. I described how the frame of this case study was constructed from my perspective of participant in the workshop, whereon I took on the practice of hacking in order to gain a deeper nuanced understanding and appreciation of the practice. I outlined the curatorial frame upon which the workshop was constructed and gave details of the structure and content of the workshop and I presented my experiences from my participation within the workshop in a series of vignettes. I again probed the practice of hacking in further depth and described another set of excerpts from informal interviews conducted with hackers. I introduced a series of design sensitivities that are meant as ways of thinking and doing, for framing users as designers.

In Chapter 7, I introduced the third and final case study, and described how the frame constructed in this chapter was from the perspective of designer as curator and facilitator. I examined these design sensitivities in further depth, and illustrated how I undertook a curatorial approach to embed these sensitivities within the structures of the workshop. I described in detail the curatorial approach and provided vignettes exemplifying the activities that took place within the workshop. Following the workshop, I conducted a series of interviews with participants who attended the workshops throughout the duration of Tweak.

8.2: Results and Reflections
I feel that the research questions I have set out to explore with this thesis have been answered: the research presented here shows how curation can be employed as a methodological tool within an Interaction Design context. The case studies presented in this research demonstrate how this curatorial methodology can be applied to the design of an open-ended design space – a workshop – and how this method was used to examine the experiences of the relevant actors within this space. The curatorial approach undertaken for this research supported the multiple activities, wide range of experiences and unique interpretations of the participants. Furthermore, conscious attention to and detailed planning of aesthetics, layout and
presentation of spaces were relevant to how participants experienced the space and shaped their activities.

Using this experimental approach I have analysed the concept of hackers as reflective practitioners, and demonstrated the reflective nature of their practice through a series of vignettes, thick descriptions and data excerpts. These episodes highlighted how hackers employed reflection-in-action, experimentation and a framing approach in their practice. Specifically they presented concrete examples of how hackers overcome surprises and are continually engaged in a process of adaption and appropriation of systems and objects to their own needs. Moreover, they illustrated the rich experiential nature of the practice, where hackers describe their coding as “poetry” or try to generate “magic moments” in everyday life. The curatorial methodology I employed in these case studies, allowed me to establish a way of working that responded to the findings through a process of framing and reflection. Furthermore, the real life context that the research was embedded in, allowed me to test my strategies, furthering my understanding of hacking practice and how the curatorial perspective employed in this research could inform new ways of working in Interaction Design.

The results from this data showed hacking as a reflective practice and to what extent the practice relates to the Schön’s concept of Reflective Practice. These episodes illustrated the participants engaging in activities that demonstrated reflection-in-action, experimentation and a framing approach that is inherent of Schön’s concept of Reflective Practice. For the participants, the practice of hacking came naturally to them and was guided by their instincts and feelings. In addition, these episodes highlighted the multiplicity of perspectives and approaches that the perspective of hacking as a reflective practice can sustain. Thus, these insights into hacking were employed to develop design sensitivities that encourage a conscious way of thinking about users who design.

The rich, elaborate account of this process aims to inspire reflection on the methodological tools and processes that designers use and develop within Interaction Design. The design sensitivities offered in this thesis are presented as criteria for reflection and for advice when employing facilitation within our own design practice: they provide a way of consciously thinking and doing when framing users as designers within a design process. Moreover, they provide a means to allow designers to take on board the concerns and the perspective of the user.
Fundamentally the design sensitivities are aimed at facilitating ways for users to create meaningful designed experiences on their own terms. Previous research has made contributions in a similar fashion, however these reflections have favored the designers’ perspective and are aimed at expanding their design practice instead of understanding that of users. Users are at the centre of Interaction Design practice, and if designers want truly to design for users, they must take into consideration how the users and their role have evolved: they are constantly changing and, as designers, we have a responsibility to change with them, engage with their practice and facilitate it (Löwgren and Stolterman, 2004).

In this research, I presented a detailed description and reflection on the process of curation and on how I have employed it: specifically, I describe how a curatorial approach was used in implementing and designing a set of workshops that formed the case studies described here. This approach allowed me to deliberately engage and consciously work and build alternatives to the challenges presented by many other design approaches. Furthermore, this approach was a responsive and dynamic way of working that offers a new critical lens from which to examine Interaction Design practice. Stolterman argues that designers are more likely to take up design methods that they recognise as being related to design practice, and that design methods relevant to practitioners should be grounded in design practice (Stolterman, 2008). As part of their practice, interaction designers often organise events, workshops and conferences, and by employing curation as a methodological tool, interaction designers can engage their natural creative and explorative abilities whilst also providing opportunities for users to participate. By employing curation as a tool, it offers designers a conscious way of thinking and working about ways of organising and designing.

The design sensitivities presented in this thesis offer designers an open-ended approach to engaging users in a multiplicity of ways. While some may argue that the sensitivities presented in this thesis may only pertain to unique settings such as festivals or one-off events, in my opinion they can be employed in different contexts that designers practice in. This set of sensitivities is useful in that they provide designers with a conceptual way of thinking about users. In addition, there is not one prescribed way of interpreting or employing them within a design approach, and their open-ended nature means that designers are free to interpret them according to the context and the users they are working with. Through the case studies
discussed in this research, I have shown how the design sensitivities embody the concerns addressed in the beginning of this thesis, and work towards an understanding of the user as an active practitioner in an open-ended design practice. Each case study contributes new understandings of hacking and details a way of working that draws on a curatorial perspective. This curatorial perspective allows us to reconsider the designer’s role in a design process and has the capability to engage users in an experiential manner. An open-ended design approach requires open-ended ways of thinking, and the sensitivities I propose offer a designer inspiration or a starting point from which they can frame users and design processes that are open to appropriation and adaption.

While I have shown how the approach undertaken in this thesis was successful in the context of a workshop, there is room for further reflection and an investigation into whether this approach can be employed in different interactive spaces, for example, domestic and other leisure settings. It remains to be seen whether a curatorial process can be applied to the development of technological objects in general. These issues fall outside the scope of this thesis; however, I do aim to address them in future work, in addition to exploring further the concept of user as designer.

In future work, I aim to investigate further the concept of active users in design processes and to analyse further a curatorial methodology for Interaction Design. This work aims to focus on:

- Exploring the model of users as designers, and to examine whether the model of users as reflective practitioners is valid for other design settings (public, domestic, etc)
- Examine other implications for Interaction Design that the perspective of hacking as a reflective practice brings to our design setting.
- Explore the role of curation in further depth and examine whether it is of further use within the Interaction Design community.
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2008 Tweak Open Call for Works

Tweak 2008 is a new interactive art and live electronic music festival taking place in Limerick City between the 23rd and 27th of September 2008. Its aim is to promote understanding of the use of technology within our culture and to explore contemporary issues (social, economic, psychological, aesthetic and functional). The festival will consist of a 5-day exhibition, (interactive artworks, robots and installations) comprising of artworks from international and local artists.

Tweak examines the growing impact of digital technologies in the creation of art and aesthetic experience. Providing a space for digital artists to redefine the nature of technology within our lives, the festival intends to create public awareness of the complex nature of technology and explore the relationship technology has to our lives.

**Tweak is calling for submissions:**

**Exhibition submissions:**
Tweak invites architects, artists, designers, technologists, engineers, urbanists, or teams thereof, to submit artistic contributions for an exhibition that will critically
explore new roles, contexts and approaches for design in relation to the social, cultural and ethical impact of existing and emerging technologies.

For submissions please include a 1-page description of the contribution, include photos or videos and a short bio.

Workshop submissions:
Tweak aims to educate and showcase alternatives methods of programming and hacking to produce creatively. Current topics include:
- Arduino fun with microcontroller electronics
- Visual Programming for your inner VJ
- Circuit Bending and Music Making
- Making plants talk - "I'm thirsty, feed me!"

These workshops aim to alter the public perception of technology from being functional to something that is aesthetic and engaging and illustrate how programming and electronics can be used creatively to create music and art.

Workshop proposals should include a 1-page description of the theme of the workshop, short CV of organisers, duration and schedule of workshop.

**Deadline for all submissions is July 11th**

For more information:
Visit: http://www.tweak.ie
Email: bonjour.tweak@gmail.com
2009 Tweak Open Call for Works
Tweak is two! Currently in its second edition, Tweak is an interactive art and live electronic music festival taking place in Limerick City between the 21st and 26th of September 2009. Its aim is to promote understanding of the use of technology within our culture and to explore contemporary issues (social, economic, psychological, aesthetic and functional).

The festival will consist of a 5-day exhibition, (interactive artworks, robots and installations) comprising of artworks from international and local artists, 3 days of workshops and many evenings of live electronic performance.

Digital technology has become a medium that has redefined the arts broadening horizons and changing practices. New works that explore interactivity and the possibilities opened up by multimedia and electronic technologies to create immersive experiences bring physicality and play to the digital medium.

We call for submissions from artists and designers whose work has been labeled as ‘new media’, ‘physical computing’, ‘tangible interfaces’, ‘digital media’, ‘techno craft’, amongst other titles, which attempt to define the field.
We are currently accepting proposals for the following categories:

Exhibition
Workshops
Live Electronic Performance
Cinematic Works
Listening Post

The call for submissions is open from April 15th to July 20th, 2009. All submissions should have the participant's name, work title and technical specifications as well as a work abstract in English (maximum of 200) and a brief biography (max of 200 words) about the author. Group works should have all members listed on the entry form. Please include links to video and photo documentation.

Submissions are open to professionals, researchers and design groups of the digital medium.

To find out more visit:

www.tweak.ie
2010 Tweak Open Call for Works

tweak
t.r.v. tweaked, tweaking, tweaks
1. To adjust; fine-tune.
2. To pinch, pluck, or twist sharply.
To adjust; fine-tune.

Year three. The picture is clear. Transmission crystal. The concept and vision of using interactive design and digital art as a means of expanding our ideas on how we engage with technology in society remains the central theme running through the third annual Tweak festival, taking place this September 13th to 24th all around Limerick City. Tweak is a festival that operates under a multi-faceted, multi-dimensional design that aims to inspire, educate, inquire and celebrate contemporary art mediums such computer coding, creative recycling, rewired sound sculptures and electronic art installations.

To pinch, pluck, or twist sharply.
Tweak 3 again highlights the idea of global communities working together, and aims to host some of the most respected/directed/neglected electronic stalwarts that continue to challenge how we think about mediums. This year’s tweak consists of an exhibition, cinema, talks, music performances and a weeklong workshop and lots more in-between. Submissions are open in the following categories:

- Exhibition
- Workshop
- Cinema
- Music Performance
- Listening Post
- Symposium

More information can be found at http://www.tweak.ie