The previous chapter brought to a close the demonstration of the theory by way of analysis of the two interaction design inquires, ec(h)o and socio-ec(h)o. I now turn to discussing the implications and limitations of the proposed theory. I begin the discussion of implications by examining how interaction design can bridge with HCI in research practice. I follow with a discussion of the possible mobilization of the theory in interaction design research and education. I conclude the chapter with a contextualizing of the theory with the interaction design industry, interpretivist HCI discussions, and general approaches to design theories. Lastly I point out the limitations of the theory and study.

7.1 Implications

The discussion of implications includes the relationship between HCI and interaction design, followed by an exploration of interaction design research and education.

7.1.1 Bridging HCI

A clearer conceptualization of interaction design makes more transparent the shared techniques and shared objects of study with other disciplines. HCI and interaction design are distinct fields yet they are bound by complementary constraints, not unlike architecture and engineering where there is an interlocking of complementary opposites. In addition, if we look closely, there is overlap between the disciplines, especially with respect to
interpretive and post-cognitive formulations of HCI. If viewing things on a spectrum, on one end HCI formalizes aspects of interaction in terms of cognition like mental memory, motor-skills, and cognitive perception; on the other end interaction design articulates aspects of interaction with respect to experiential accounts and socio-cultural influences. In the middle of the spectrum, both fields integrate systematic observation related to the social sciences as a means to fully explore interaction. One can see how the composite of the different types of analysis is the fuller story. The approaches are therefore complementary rather than mutually exclusive. The commonalities and complementarities show the potential for bridging approaches that tie HCI and interaction design together. At this juncture, I focus on the shared concerns that bridge HCI and interaction design and techniques that concretely show the interrelationships between the fields. These include prototyping, evaluations, stakeholder views, and designer intentions.

7.1.1.1 Prototypes

Daniel Fallman (Fallman, 2003) makes the point that interaction design research is at the centre of HCI for no other reason than the research results from studying interactive systems and artifacts would have been unattainable if these objects of study were not designed. Fallman aptly observes within HCI the false notions that the design artifact either occurs by sheer chance or that a direct causality can be found between for example, fieldwork data and the design artifact (Fallman, 2003).

The knowledge manifest in making the prototype is of deep concern for any interaction design or design researcher. This knowledge in the making of artifacts extends into HCI studies since the space of explanatory causes is wider than requirements gathering or user analysis. The pragmatic theory describes the process of making in ways that can be integrated into efforts of evaluation and analysis. In addition, a focus on the prototype itself
as a source of knowing reveals factors of materiality, aesthetics, and the history. This ultimately, this increases discoveries and supports findings in interaction studies (see 1.4 Context for the study) whether from HCI research, interaction design research, or both.

Prototypes play roles in research other than the role of object of study. Paying attention to prototypes and their making when prototypes are research instruments used to either collect data (or motivate designers) or to create a phenomena for study is a critical undertaking. In the case of designing prototypes for data collection, issues arise in validating the instrument and the integrity of the design process behind the prototype. Both issues are methodological concerns. A good example of this is the cultural probes designed by Bill Gaver and his colleagues (Gaver et al., 1999). Firstly, the cultural probe, which is an autoethnographic toolkit for end-users and is designed to engage people in creating and collecting inspiring material for designers, is a good example of bridging between design and HCI. While some readers may consider probes as more methodological than prototypes of design ideas, the probes, similar to prototypes, rely on design and making. The approach of cultural probes has been modified and applied by numerous HCI and interaction design researchers in a variety of contexts (Crabtree and Rodden, 2004, Hassling et al., 2005, Hutchinson et al., 2003, Mattelmäki and Battarbee, 2002). Additionally, and more importantly in the context of this discussion, cultural probes have been the source of serious methodological and disciplinary reflection (Gaver et al., 2004, Boehner et al., 2007, Graham et al., 2007). In this example, it is constructive to view the methodological concerns of HCI in light of the concerns of design.

There are innumerable examples of a prototype designed to create phenomena of study. This is a traditional approach in HCI in which prototype systems recreate a problematic interaction situation or in which a theory is tested through its implementation
in a prototype. This same approach can also bridge HCI and interaction design issues when prototypes elicit situations as spaces for exploration and discovery. This was the case with socio-ec(h)o (Wakkary et al., 2005) in which the prototype environment was created to explore physical play and social interaction. Similar examples include the Home Health Horoscope (Gaver et al., 2007) in which Gaver and colleagues designed a prototype to explore interpretation in use, and investigations of public social interfaces and abstraction by Bilge Mutlu and colleagues (Mutlu et al., 2006).

7.1.1.2 Evaluations

Interaction design together with HCI can provide evaluations that assess a wider range of the experience of interactive systems and resulting phenomena. Interaction design incorporates multiple strategies to evaluation that include quantitative measures within a qualitative orientation. In Chapter 6, I described examples of mixed method approaches. Traditionally, the dictates of scientific realism behind HCI limit the evaluations to those phenomena or aspects that are quantitatively measurable. Evaluations typically assess the resulting phenomena of the system, such as user perceptions and user performance, or directly test the system or prototype through usability or system performance. While these approaches have a role in interaction design, the pragmatic theory offers two approaches to traditional HCI evaluation. Firstly, qualitative and mixed methods strategies provide rigor of interpretation that broadens the analysis of interaction phenomena. Secondly, the theory extends evaluation to its own design processes and discoveries in process. This increases the potential for discoveries and quality assessments of the making of prototypes and other outcomes.

There is a growing interpretive approach within HCI that I will discuss below (see 7.2 Interpretivist HCI and other design theories). Interpretive HCI together with the
dialogical and interpretive dynamic of interaction design can potentially allow a practice of criticism of interactive systems, practice and research to emerge. As discussed previously, criticism assesses the values of inquiries in HCI or interaction design in the context of everyday experience where such inquiries are potentially most relevant or have the most impact. Additionally, criticism acknowledges the temporal aspects of interpretation and contexts whereas current evaluation strategies do not.

### 7.1.1.3 Stakeholder views

Participatory design (PD) has influenced the practice of HCI for some time. It reframes the basic tenets of user-centred design that are central to HCI though the idea of participation. An additional benefit of PD is the illumination of the role of design in working with end-users. Participatory design, together with CSCW (computer supported cooperative work) extended focus to a broader analysis that was organizational if not more broadly social. The exact role of design processes emphasized organizational change and the facilitating role of the systems designer. Interaction design adds support by echoing the importance of PD and by incorporating in theoretical terms ideas of embodiment, interpretation, and knowledge exchange as being core to interaction design practice in ways that HCI does not. In addition, interaction design emphasizes the role of making or creating as a dimension to stakeholder influence. This adds to existing approaches in HCI and more fully rounds out collaborative techniques with stakeholders.

### 7.1.1.4 Conceptual models

Conceptual models and heuristics are formalizations that aid researchers and mobilize ideas in practice. Models arise in HCI from a traditional applied science route of implementing scientific ideas into practice like Card, Moran and Newell’s (Card et al.,
1983) Goals, Operators, Methods and Selection Rules (GOMS) model for analyzing human interaction based on cognitive science concepts of cognitive structures. HCI has diversified and made less formal its approaches to conceptual models yet psychology and social science theories or field research on users still drives most models. In our discussion it was shown how models like interaction models or audio display models can emerge from the practice of design. Additionally, such models can be substantiated within the interaction design process through a descriptive analysis, mixed methods or experimental studies. Interaction design adds another source and opportunity for conceptual models relevant to both fields.

7.1.1.5 Designer intentions

I devoted a lot of attention to the role of designer intentions in the analyses in Chapters 4 and 5. Designer intentions are pivotal in interaction design inquiries since they manifest the presence of the designer inquirer and initiate actions in the design process that typically engender interpretation and further actions of design judgment (see 5.2.2.2 The common pattern in interaction design). They are often framed or supported by design rationales. Designer intentions or as they are sometimes referred to, “design motivations” add an important qualitative dimension to the typically objective analysis of user needs that drives and shapes design process and outcomes in HCI.

7.1.2 The practice of research in interaction design

The dissertation has been devoted to a discussion of research and practice. Yet on a more practical level we can look at the implications of the theory with the intention of mobilizing it through the practice of research in interaction design. This topic merits a substantial and detailed discussion that is beyond the aims of this thesis. At this point, I will
limit my discussions to highlighting areas of the theory’s potential impact on research practice.

Denzin and Lincoln (Denzin and Lincoln, 2005) describe five phases to the research process that are helpful in understanding qualitative research practices. I’ve adapted their description to interaction design in Table 28. I maintained the headings of each phase and I was inclusive of the many terms Denzin and Lincoln used originally but excluded those that did not apply to interaction design like “policy analysis” and added some particular to interaction design like “making as interpretation.” Of the five phases, the main substance of three phases has already been discussed earlier in the dissertation: phases 1, 2, and 5. It is however worthwhile to briefly discuss each of these phases before focussing on the practical research matters in phases 3 and 4, which I will tackle in the remainder of the section.

Phase 1: The researcher as multicultural subject accounts for the socially situated researcher in qualitative research. The complexities of the setting, situation, and human interactions are part of the individual or individuals who conduct research in interaction design. This phase asserts a general reflexivity in the researcher who I describe as a designer inquirer. As discussed earlier, the designer inquirer’s prior history and experience with design and research is critical to acknowledge since this history guides and constrains the acts and interpretations of research. In design as in any other human activity, the broader issues of ethics, politics and ones self-reflexive awareness in relations to others are part of the conditions of research.

Phase 2: Theoretical paradigms and perspectives describe what has been the single focus of this dissertation to describe a theoretical foundation based on pragmatism. In particular, details of the philosophical and research perspectives are discussed in Chapters 3
and 6. The importance of the aims of this thesis and this phase especially is that all else in
the research practice (the remaining phases) flow from the philosophical and theoretical
orientations. The paradigms and perspectives can be viewed as pragmatism. It is the
foundational basis for research in interaction design and due to its multiplicity and inherent
experimentation an epistemological space opens to include the interpretive views of
constructivism and hermeneutics alongside postpositivism.

Phase 5: *The art, practices and politics of interpretation and evaluation* describe the
crafts and strategies of a situated researcher in interaction design. The ongoing negotiation
in interpretive approaches necessitates the range of awareness and skills from craft in
writing to developed criteria for judgment. This aspect of research in interaction design was
discussed in detail in Chapter 6.
Table 28 Five stages of the research process in interaction design based on Denzin and Lincoln (Denzin and Lincoln, 2005)

### 7.1.2.1 Research strategies

Research strategies are connected to the theoretical paradigms in phase 2. The strategies mobilize the paradigms by guiding the researcher with methods that in turn govern the data collection and analysis methods. Denzin and Lincoln summarize the role of
strategies in the research design as specifying: “how the investigator will address two critical issues of representation and legitimacy. A strategy of inquiry comprises a bundle of skills, assumptions, and practices that the researcher employs as he or she moves from the paradigm to the empirical world. Strategies of inquiry put paradigms of interpretation into motion (Denzin and Lincoln, 2005, p.25).”

The research strategies in Table 28 under *Phase 3: Research strategies* shows that there is no one method in interaction design research. In fact this list is not meant to be exhaustive. I can well imagine and would invite experimentation with other strategies. Additionally, each methodology has variants and hybrids and these would equally apply. For example, the analytical approach of diverse data collection, identifying explicit relations among the data, and creating a holistic description of the experience utilized in the analysis of inquiries in Chapters 4 and 5 borrow heavily from case study methods.

Ethnography and participant observation are useful methods and were also relied upon in the earlier analyses. In particular, autoethnography on the part of the design inquirer or design team members ensures that the perspectives of the embodied inquirer(s) is acknowledged and incorporated. In a strict pragmatist sense, first-person inquiry is a default position given the dual effects of the inquirer to reflect and to shape the experience simultaneously. This also invites phenomenological strategies in which phenomenology would create insightful views of designers and stakeholders.

Research strategies in interaction design are largely dictated by the theoretical paradigms and perspectives that in the case of pragmatism look for strategies that acknowledge the dialogic inquiry and presence of the embodied inquirer, like ethnography and phenomenology. The qualitative orientation looks to strategies that provide thick description and reflexivity to guide and substantiate interpretations, like ethnography and
case study. Strategies that clearly and transparently describe the actions of design have analytical strengths to support dependability of findings. As such, strategies like ethnomethodology could be adapted to interaction design research. Experimental studies would form a targeted approach that is more technique than method since it is in support of qualitative or normative findings. Such studies though go beyond data collection since they incorporate unique analysis and validation strategies in comparison to qualitative approaches.

Criticism and critical theory together stand as a research strategy apart from the others, as this strategy is more humanities-oriented and does not necessarily follow the pragmatist dictates of an embodied inquirer. Criticism adds another dimension of interpretation and is therefore a promising avenue for interaction design research.

In the end an interaction design researcher would have a range of research strategies at his or her disposal that draw on existing research traditions. However, one would expect variants such as autoethnography in ethnography to gain some prominence and adapt to particularities of the interaction design inquiries. The advantage of cohering the discipline around an epistemological core is that the actual research strategies are open to their own level of experimentation and reflection in order to articulate new descriptions and discover new findings.

### 7.1.2.2 Methods of collection and analysis

It should come as no surprise that given the range of research methods in interaction design there is an even wider range of data collection and analysis methods. In the main, the many traditional qualitative techniques can be employed. These include many data collecting techniques and foci like interviewing, observations, artifacts, documents, and focus groups; as well as data analysis techniques like visual methods, computer assisted
analysis; and techniques that combine data analysis and collection like autoethnography and applied ethnography.

Some techniques are either particular to interaction design or could benefit from a design perspective. For example, data collection and analysis can emerge from participatory design workshops. Interaction designers utilize workshops to explore problems and examine particular design issues. These can quite easily have a research dimension. An added value of participatory workshops is that objects of study can include participant activities and artifacts produced by participants in workshops.

Similarly, affinity diagrams, information models, mapping, sketches and other visualization techniques common to interaction designers can augment visual methods of analysis. In ethnography, fieldwork and techniques from design ethnography have a particular design focus and applicability. Ethnographic techniques can be turned inward and conducted throughout the design work and can extend the focus more broadly for a design view of the setting and actors. As previously mentioned, field studies in design have a long history that is parallel to ethnography and can distinctly be considered as design ethnography (Randall et al., 2007).

Reflexivity is critical in qualitative studies however it takes on an added importance in interaction design research due to the emphasis on first-person research. I discussed reflexivity in respect to confirmability in interaction design earlier in Chapter 6 (see 6.1.1.3 Dependability and confirmability). Ethnography incorporates reflexivity through self-disclosures, first-person narratives, transparency in informant relationships, and thick descriptions. Techniques like research journals or diaries can be particularly helpful in first-person approaches.
The descriptive capacity of the theory supports reflexivity through auditing as discussed in Chapter 6 (see 6.1.1.3 Dependability and confirmability). Additionally, the detailed categorizations aid data analysis by providing a template for coding data. Creswell (Creswell, 2007) advocates coding for use with computer assisted analysis however it can be a much more generic analysis tool that aids thematic analysis or visual mapping (the approach used in the inquiries in Chapters 4 and 5). Keeping the more generic use in mind, Creswell writes that codes “help the researcher to conceptualize different levels of abstraction in qualitative analysis. The process of qualitative data analysis…starts with the researcher analyzing raw data (e.g. interviews), forming the raw data into codes, and then combining the codes into broader themes” (Creswell, 2007, p.169). In the case of the theory, the code is embedded providing researchers with an *a priori* code that has sufficient flexibility to be customized with researcher’s own code labels at a more granular level or orthogonally. See Figure 49 for a coding template based on the theory.

![Figure 49 A coding template for the theory](image)

In addition to coding, the theory offered structural descriptors for analysis (see Table 22) and a measure of the structural quality in the concept of integrity (see 5.2.2 The experience layer view). These include the common pattern that can be used to determine the basic structure of an inquiry (see 5.2.2.2 The common pattern in interaction design). At
a more granular level the theory describes relationship among entities that include formative findings, mirrors and feedback loops, and cascading (see 5.2.2.1 The relationships in an interaction design inquiry). The assessment of integrity or missing relationships becomes clear when applying the anatomical structures of inter-integrity, intra-integrity, and extra-integrity (see 5.2.2.3 The dynamic structure of an inquiry). The theory offers a unique framework for analysis of the quality of the inquiry.

### 7.1.3 Education in interaction design

Much like research, interaction design education is a substantial topic that deserves more attention than I can offer in this dissertation. My aim, not unlike the previous discussion on research, is to outline aspects of the theory that impinge on education as points for later investigations. It is important to note that interaction design programs are growing at a rapid rate. Less than five years ago employers were not hiring with job titles like interaction designers, this has changed dramatically in a short period of time. This points to the potential that there is a growing consensus on what an interaction design education should be that is at least consistent enough with a shared marker perception of the discipline. It also points to the potential that there is a strong need in the marketplace; that our educational approaches need to meet.

Pragmatism offers foundational thinking for interaction design. In education this helps to tie understandings together but also offers the chance to separate the curriculum into distinct learning aims like the study of the field, its context including history and cognate disciplines, and issues of practice like methods and skills that are both disciplinary and inter-disciplinary.
7.1.3.1 The study of interaction design

The theory articulates an understanding of interaction design for those who practice it and those who don’t. For practitioners or future practitioners, this level of understanding conceptualizes the field. It describes a holistic view that will help guide and aid students in making more sense of the methods and skills later learned. To those who will not practice interaction design, it offers a broad understanding of the principles, actors and concepts that constitute the field in a language and form that is comprehensible without the practice. The importance of this approach is that it helps to establish interdisciplinarity by making the field accessible to those whose main study lies elsewhere. It also increases the intellectual accessibility of the field to a wider audience of non-designers.

This approach to studying interaction design would focus on the outcomes at the experience layer of the theory including theoretical reflections and descriptive accounts of interaction design. A descriptive account of the interaction design experience would include the overall dynamics such as the common pattern (see 5.2.2.2 The common pattern in interaction design), relationships (see 5.2.2.1 The relationships in an interaction design inquiry), and the idea of integrity among actions, intentions, and rationales (see 5.2.2.1 The relationships in an interaction design inquiry). At this level of learning, gaining an insight into the theoretical questions for the field is important in order to see interaction design in the same light as other fields. Questions concerning the main issues such as how we design, how and why we create interactive systems and artifacts, and how we define an interaction designer would be discussed and debated here.

Understanding the definitions and terms behind the main concepts of interaction design as experience and interaction designer as inquirer is equally important. The terms and definitions include concreteness, multiplicity, entities-in-interaction, embodied
inquirer, and the designer as a proactive inquirer (see Chapter 3). Experimentalism in interaction design would be another critical concept that would provide an introduction to the ideas of design actions. At a level of practice, the structure of interaction design inquiries (see 5.2.2.3 The dynamic structure of an inquiry) would be a basis for further understanding of practice without having to be a practitioner. The learning of these concepts could be aided by thorough descriptions and accounts of interaction design inquiries established as case studies or exemplars.

7.1.3.2 The historical and interdisciplinary context of interaction design

The study of the field of interaction design for non-practitioners is fundamental in developing a practice of criticism that may also open the field to eventual historical investigations typical in art and design history studies. In this regard, a contextual study of interaction design could be focused on emerging history and cognate disciplines. This approach would serve both future practitioners and scholars of interaction design, as well as students from other disciplines like computing science and other design traditions.

The theory’s conception of interaction design incorporates intellectual viewpoints, skills and methods from cognate disciplines. Figure 50 shows interaction design situated in relation to cognate disciplines. This is at best a provisional representation yet it shows how a contextual study of interaction design would establish historical and current linkages with other disciplines. The linkages could be defined in a myriad number of ways from shared methods to common intellectual ground to complementary dependencies like with HCI.

Historical investigations of interaction design would serve a scholarly and educational need. Such investigations would provide scholars with the intellectual and historical basis for investigating the field. For practitioners, they would help provide a rationale for techniques like participatory workshops and physical prototyping. Any history
would overlap substantially with a number of other histories and this would help broadly situate interaction design as part of an overall set of historical movements framed by design, technology, and culture. Such investigations would additionally buttress scholarly and educational outcomes in interaction design criticism.

![Diagram of Interaction Design situated in relation to cognate disciplines]

**Figure 50 Interaction design situated in relation to cognate disciplines**

### 7.1.3.3 Methods

Some readers, particularly those with an interest in design may feel that I have neglected design methods in my discussions. As I discussed in Chapter 2 (see 2.2 Strategies in interaction design), design theory and interaction design theory has focused considerable effort on methods resulting in more strategic directions, e.g. *Goal Directed Design* (Cooper et al., 2007) at the expense of theoretical directions. The intervention of the theory is at the level of theoretical paradigms and perspectives (see 7.1.2 The practice of research in
interaction design). Additionally, I proposed that a theory would not be prescriptive with respect to methods but would guide methods into experimentation and innovation with different ways of practicing design, not unlike HCI and its approach to methods (see 1.2 Role of theory in interaction design).

Having said the above, methods are the area that is the most stable in interaction design education. There is no shortage of texts that describe and detail different methods for design (Löwgren, 2008, Cooper et al., 2007, Bødker et al., 2004, Krippendorf, 2006, Kolko, 2007, Preece et al., 2002). Almost all of these methods can be applied to interaction design including fieldwork, participant observation, focus groups, participatory workshops, personas, scenarios, role-playing, storyboarding, dead-sea scrolls, affinity diagrams and so on. This would also include the long list of evaluation methods and experimental study methods.

However, methods of reflexivity could be a critical new area for the development and teaching of interaction methods. These methods would aid interaction designers in documenting and reflecting on the actions of the design inquiry. The methods would cover formative reflection: accounts of reflections on action during the course of the design inquiry; summative reflection: reflective accounts after the inquiry, and long term reflection: accounts of reflection over the course of several inquiries that help in the accrual of experience over the course of a career in interaction design. The methods would support the auditing capacity of the theory discussed in Chapter 6 (see 6.1.1.3 Dependability and confirmability) that provides research dependability and confirmability, as well as diagnostic abilities for practice.

Reflexive methods would mostly be new but they could extend to traditional design practices like keeping a sketchbook and a notebook. More formal methods would be an
improvement. The qualitative techniques of research diaries and journals typically used by ethnographers would serve as a good starting point. I can imagine that codes, languages and taxonomies would also develop in line with new methods. It is also important that reflexivity as a practice is considered in terms of education separate from any given methods. Questions such as: what are the principles of reflexivity, what exercises and practices can be used to develop and hone the sensibilities, and how does one cultivate a practice of reflexivity would all be considered in the learning of interaction design students.

7.1.3.5 Skills

Skill acquisition in interaction design is not challenged by lack of knowing the possible skills required. Rather in education, the challenge is in making choices among the wide variety of known skills. From the perspective of organizing and designing a discipline, there is limited number of courses, teaching staff, and expertise available. From the student’s perspective, there is limited time and ability to learn all the possible skills that can be used in interaction design. For example in prototyping alone, there is a vast range of skills whether the prototype is physical, software or both. The range of general skills and knowledge would include physical modelling and rapid prototyping skills drawn from industrial design, electronics circuitry and programming based in electrical engineering, as well as user interface, networking and programming skills for software prototypes. All too often students and faculty feel that most, if not all of these types of skills are needed, and try to take or offer whatever one can with the limited resources available. This typically results in a scattershot approach with several critical gaps in skills and abilities.

The pragmatic theory proposed offers guidance that supports students and curriculum design. The theory’s descriptions of the actions of interaction design ensure that a student can secure broad and manageable sets of skills that are targeted to each outcome
of the inquiry. Table 29 show the outcomes of interaction design interpretations and Table 30 shows the outcomes of interaction design judgments. In each case, competencies and skills are mapped to inquiry outcomes. The tables are not definitive in terms of skills enumerated and mapping rather they both provide a provisional starting point that illustrates the educational value of the theory in relation to skills acquisition. The strength in this approach is that the structure of the inquiry offers guiding principles for the choice and priority of skills learning in interaction design. The principles are as follows: it is necessary for an interaction designer to have the potential to contribute in every judgment and interpretation outcome. This builds experience and ensures that each designer is sufficiently informed of the nature of the outcomes and possibilities in order to assume the responsibility of the inquiry and create actions. The priority then is to learn and to master at least one but as many competencies as possible across all of the outcomes, e.g. the ability to analyze information would serve as a basic competency for a number of outcomes. Skills are then seen in light of competencies. The skills needed are those that support a given competency and often a competency can be supported by numerous skills but not all are needed. For example, in meeting the outcome of representation (e.g. creating scenarios) with the competency of narrative abilities, a student may choose to focus on illustrations and sketching as his or her main skills. When faced with a choice of new skills to learn, the emphasis is on another competency rather than choosing in addition to illustration and sketching, video, photography etc. Students can later expand on their skill sets if all the competencies and a supporting skill have been learned. Additionally, in practice, designers tend to “specialize” given particular skills in which they excel at. The organizing principle mitigates this focus from being skill-based but ensures the focus is wider in terms of competencies and mastery of the interaction design inquiry as a whole.
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<th>Outcomes</th>
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<td>Accounts</td>
<td>Ability to collect information</td>
<td>Sketching/Illustration</td>
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<td>Ability to analyse information</td>
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<td>Stakeholder views</td>
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<td>Findings</td>
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<td>Knowledge of interaction design and related theories</td>
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Table 29 Competencies and skills mapped to interpretation outcomes
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<th>Outcomes</th>
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Table 30 Competencies and skills mapped to judgment outcomes

7.2 Interpretivist HCI and other design theories

The discussions on the implications for education and research highlight new opportunities that arise from the proposed theory of interaction design. As I mentioned
earlier, the marketplace perception is that the field of interaction design is strong and growing without a crisis of theory. Design in the HCI community is also growing. At times it seems that there is a theoretical crisis looming, yet there are also clear and positive signs that a debate on the role of design in HCI is resonating within the community. This of course leads to the question of whether we really need a revised theory of interaction design. My answer of course is a resounding “yes” and I have devoted all of the preceding chapters to constructing the argument for and to present a revised theory of interaction design. However, I would be remiss if I did not consider the alternatives. The discussion in this section is not a resolution of the need for a theory or not; rather I aim to show the parallel investigations of design and interactive technologies. I aim to show the everyday experience in which a new theory of interaction design would live and be tested.

As a measure of the strength of the interaction design industry, the IxDA (Interaction Design Association) has over 10,000 members and over 70 local chapters worldwide. The IxDA began in 2005 with the aim to support interaction designers with the challenges they face in their professional lives. In 2008, the association began hosting annual conferences (see www.ixda.org). The strength of the IxDA community after such a short period shows that the field has quickly emerged as an industry and practice. According to the IxDA’s definition of interaction design, it views user-centredness at the heart of its practice:

Interaction designers strive to create useful and usable products and services. Following the fundamental tenets of user-centered design, the practice of interaction design is grounded in an understanding of real users—their goals, tasks, experiences, needs, and wants. Approaching design from a user-centered perspective, while endeavoring to balance users' needs with business goals and technological capabilities, interaction designers provide solutions to complex design challenges, and define new and evolving interactive products and services (Interaction Design Association, 2009).
In addition to user-centredness, interaction design is seen to draw on a range of design disciplines with a distinct focus on interactivity:

While interaction designers often work closely with specialists in visual design, information architecture, industrial design, user research, or usability, and may even provide some of these services themselves, their primary focus is on defining interactivity (Interaction Design Association, 2009).

The definitions of the field read as sensible and grounded. As an industry the requirements of “theory” are that it sufficiently guides practitioners in practice and business and that its language and concepts can be used to market services to clients. Suffice to say that an intellectually viable foundation that borrows from existing traditions in design and user-centred theories of interaction has been achieved to quickly mobilize a burgeoning practice and industry.

Reflections on the practice of interaction design that also reflect the viability of practice and industry can be found in several recent and excellent texts (Kolko, 2007, Buxton, 2006, Moggridge, 2007). Kolko’s account synthesizes HCI-oriented theories of usability, contextual design, and user research and grounds them firmly in design practices of scenarios, workflows, and prototyping streamlined to function in a business context. The text makes accessible design ideas of desirability and aesthetics and also makes these ideas compatible with usability and business in a deft manner. Buxton and Moggridge construct a view of designing for interactive technologies through highlighting practitioners and exemplar designs.

If theory as a practical matter is currently resolved in industry and practice (the question of course is for how long?), how is it playing out in research fields like HCI? In Chapters 1 and 2, I provided HCI views focused explicitly on interaction design. Yet a wider view of HCI shows emerging attention to issues related to the discussions of this
dissertation. These include design research and theory in HCI (Fallman, 2003, Zimmerman et al., 2007, Stolterman, 2008, Fallman, 2008) and interpretive and reflective practices (Gaver et al., 2003, Sengers et al., 2005, Dourish, 2006, Sengers and Gaver, 2006).

7.2.1 Interaction design research frameworks

In Chapter 1, I discussed how Harrison and his colleagues argued for a third paradigm in HCI that is oriented around design and phenomenology (Harrison et al., 2007). The authors aim to evolve HCI through an extension of human concerns that centre on phenomenology, and important to this discussion, methodological advancement of HCI through an inclusion of design thinking and practice. The issues that an interaction design theory is lacking and that HCI theories need improvements upon have more or less been joined together. What follows in this discussion is that to understand interaction design research is to understand a missing facet of HCI theory.

Fallman’s approach to interaction design theory is to disambiguate the role of design in HCI. In 2003, he argued that a design-oriented HCI begins with differentiating between the practices of knowledge generating design-oriented research and artifact generating research-oriented design (Fallman, 2003). In design-oriented research, the object of study is design itself, whereas in research-oriented design, design is in the service of producing artifacts and may or may not be related to research since the main objective is to produce new design artifacts. In 2008, Fallman adds to his view of interaction design theory by establishing a framework that differentiates three types of research activities: 1) Design practice: aims that are synthetic and context driven, e.g. design industry; 2) Design studies: aims that are descriptive and philosophically oriented; and 3) Design exploration: aims that are idealistic, socially oriented and subversive (Fallman, 2008). The framework animates the concepts of loops, trajectories, and progressions that describe the development
Fallman’s contributions are in articulating models that condition and frame interaction design research. In many respects, Fallman aims to synthesize current and recent design research practices.

Jodi Forlizzi, John Zimmerman, and Shelley Evenson’s writings on interaction design theory draw upon Christopher Frayling’s idea of “research through design” (Frayling, 1993-1994). The authors propose and describe a model of interaction design research in HCI based on four lenses for distinguishing and evaluating interaction design research within HCI: process, invention, relevance, and extensibility (Zimmerman et al., 2007, Forlizzi et al., 2008). The authors argue based on Frayling that interaction design researchers focus on making the right thing by making transformative artifacts that move the world from the current state to a preferred state.

The models of Forlizzi et al (Forlizzi et al., 2008) and Fallman (Fallman, 2003, Fallman, 2008), focus their attention on descriptions on the process of design. Though these contributions are important, it is unclear how far a theory of interaction design can proceed through descriptive models alone. The risk is that the theory arising from descriptions is reactive and does not forge new insights and practices. What is lacking are theoretical principles or the start of theorizing through an investigation of principles.

Erik Stolterman argues that a theory of interaction design and HCI rests on understanding design practice and in particular, design complexity in practice (Stolterman, 2008). The complexity of interaction design practice is not reducible and therefore not amenable to the science-oriented design methods commonly found in HCI. Rather, Stolterman argues for a “designerly approach” to HCI education and practice. Such an approach can leverage existing design theory and design philosophy from the rich intellectual design history. Stolterman’s contribution is to describe the uniqueness of
interaction design practice and point to the problem of leveraging past design thinking into a theory of interaction design. He sets the goals for such a theory to be both practice-based and philosophically sound.

7.2.2 Reflection and interpretation in HCI

At the conclusion of the discussion on criticism in Chapter 6, I referred to the reflective and interpretive strategies emerging in HCI (see 6.1.3 Criticism). For example, Dourish is critical of current ethnographic practice in HCI (Dourish, 2006). He argues that ethnography in HCI is utility driven at the expense of theoretical and interpretive discoveries that true ethnography leads toward. HCI reduces ethnography to the status of techniques aimed at uncovering “design implications” for system improvements. Ethnography, Dourish argues couples analytic and methodological concerns (Dourish, 2006) that operate at a level of reflection beyond current HCI thinking. The implication for HCI theory is that it lacks the analytical and methodological (rather than methods) formulations to create the reflective and interpretive space required for understanding interactions.

Bill Gaver, Jacob Beaver, and Steve Benford argued for ambiguity as a resource in design (Gaver et al., 2003). They claim that ambiguity encourages a personal relationship with systems through interpretation. Ambiguity creates a level of reflection on the part of users that creates personal value through understanding an interaction artifact or system. The authors describe three types of ambiguity: “Ambiguity of information finds its source in the artefact itself, ambiguity of context in the sociocultural discourses that are used to interpret it, and ambiguity of relationship in the interpretative and evaluative stance of the individual” (Gaver et al., 2003, p.233). Gaver and his colleagues describe strategies to emphasize ambiguity for designers to incorporate into their own practice. Naturally, the
idea of ambiguity is antithetical to traditional HCI aims. HCI’s inability to address ambiguity is perceived as a gap in HCI theories.

Phoebe Sengers and her colleagues investigate the idea that reflection on unconscious values embedded in computing is a critical concern for design. The authors put forward their analysis and the strategies that result in what they call reflective design (Sengers et al., 2005). The essential argument is that “reflection itself should be a core technology design outcome in HCI” and reflection is “bringing unconscious aspects of experience to conscious awareness, thereby making them available for conscious choice” (Sengers et al., 2005, p.50). The problem is that there are wider experiences of interactive artifacts and systems than can be accounted for with HCI theory. The authors build the idea of reflective design on design traditions of value design, participatory design, reflective practice and ludic design. They contribute a set of strategies, which among other aims creates space and encouragement for reflection and interpretation.

Sengers and Gaver collaborated to write on the role of interpretation in evaluation (Sengers and Gaver, 2006). They adopt a humanist view of HCI that positions interpretation and multiplicity at the centre of evaluation interactive systems. This turns upside down the scientific realism principles of HCI. In there view, there are no definitive accounts and no privileged roles of evaluation. The truth values of the systems are negotiable. In addition, not unlike ambiguity, designers need to encourage the heterogeneous readings and uses of the artifacts they design. Sengers and Gaver argue that designers need to downplay system authority and play up the interpretive space the designs create (Sengers and Gaver, 2006).

Rather than provide descriptive models of practice, the ideas and arguments of Stolterman (see 7.2.1 Interaction design research), Dourish, Gaver and Sengers discussed
here focus on principles to investigate. What emerge are investigations of reflection and interpretation that tend to invert classical HCI notions.

7.2.3 Reflective and interpretive practice

Not all of the authors from the previous section would consider themselves to be practitioners or designers yet many would fit in the loose category of “practitioner researcher.” As Stolterman argued, the credible road to interaction design theory is through theoretical investigations grounded in practice. A good example of this is Gaver whom I have cited above for his investigations of ambiguity, multiplicity, and interpretation (Gaver et al., 2003, Gaver et al., 2004, Sengers and Gaver, 2006). These are issues central to a pragmatist view of experience and related to the pragmatist framing of interaction design in this dissertation. These investigations carry over into Gaver’s research practice, an interesting example is the Video Window (Gaver, 2006, Gaver et al., 2008).

The Video Window is what Gaver refers to as a “threshold device” (Gaver et al., 2008):

Threshold devices look out from the home, gathering information from its surroundings to suggest how here is connected to and situated within a there. In supporting appreciation of the home’s setting in a wider physical and social environment, the devices provide resources for inhabitants to think about where they are, what and who is around them, and may occasion their attitudes towards these facts. Such an appreciation may be rich and complex, potentially involving utilitarian, aesthetic and emotional elements, and thus the devices are best seen as resources rather than tools (Gaver et al., 2008, p.1429)

The Video Window is a flat screen monitor that is hung on the wall of Gaver’s bedroom next to an actual window. The monitor is connected to a camera perched atop a telescopic fishing pole creating a skyline view to be seen in the bedroom. Gaver describes the Video Window as using technology not to emulate the physical world but to conceptually and
aesthetically reframe for new forms of appreciation. For example, it integrates utilitarian concerns like knowing the weather with aesthetic concerns like viewing a sunrise, and thirdly it also creates a personal view of world (Gaver et al., 2008). The Video Window generates a reflective space on issues of technology, the home, and one’s surroundings.

The design artifact is compelling in itself but what makes it most interesting in the context of this dissertation is a particular account of the work Gaver published in an article in the academic journal, *Personal and Ubiquitous Computing* in 2006 (Gaver, 2006). What is remarkable (and rare in HCI and interaction design) in this account is the quality of reflexivity and interpretation in the making and use of the design. This particular design account is a good example of how reflections of a designer inquirer create research value from a description of the making of a design artifact. The article is a first-person account in which Gaver discusses the making of the Video Window and how its experienced by his family:

About 6 months ago, I mounted a small video camera on a mast outside our bedroom window, oriented to pick up a view of the skyline down the hill from our house. The camera output is wired directly to a small flat-screen display hung on our bedroom wall, across from our bed, and is always left on (Gaver, 2006, p.60).

The author continues with an acknowledgment of the presence and personal history of himself as designer inquirer. The reader can gather that the inquirer lives with his wife and 3-year-old child in a house in London with a limited view from the bedroom. The designer inquirer, Gaver, has past interest and research in mediascapes and telematics.

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4 The 2006 account (Gaver, 2006) is different from a later account in 2008 (Gaver et al., 2008), in which Gaver speaks of the Video Window in a combined field and case study approach from a third-person perspective. This hybrid approach of a field study analysis and data collection of case study designs has been a productive approach in design research, particularly in an HCI context. It utilizes many of the attributes of qualitative strategies discussed in Chapter 6 yet lacks the truly reflective descriptions of thick descriptions and first-person research exemplified in the 2006 article.
Additionally, he is an educator with regular encounters with colleague researchers and graduate students in a shared studio.

Gaver describes how the first Video Window was a temporary result of simple play that in hindsight held significant value and enjoyment for himself and his wife. Years later he was inspired to create a more serious and permanent version by a student’s project of a camera attached to a weather balloon and a colleague’s purchase of a telescopic fishing pole. The experimentation with designing Video Window was felt to be enjoyable tinkering. In the making, there was great experimentation with different types of cameras (four in all) and the particularities of the right view:

The video window is a very simple arrangement of technology, but it took a surprising amount of work to ‘‘get it right’’. In retrospect, ‘‘getting it right’’ involved both practical and aesthetic issues. But at that time I did not differentiate the two. Instead, they were intertwined in creating an experience we wanted to live with (Gaver, 2006, p.62).

This experimentation is like the design actions of judgment motivated by intentions and rationales that were intrinsic and influenced by his wife, colleagues and students. The account included many interpretive actions as well. The author’s wife, Anne Schlottmann provided insights and a stakeholder view. She was not as “adamant” about the particular view as Gaver. She felt the Video Window was like having “a room with an ocean view, in which the sheer scope of the scene seems to extend one’s feeling of living space to include the landscape and its subtle changes”(Gaver, 2006, p.62). An everyday aesthetic value was interpreted in the nuances of the augmented view through the camera. Gaver noted the view of a breaking sunrise not viewable through the window but plainly visible on the monitor when waking very early in the morning, or the lights of an airplane or distant fireworks.

The qualities of the cameras were measured by the interpreted value of the clarity and breadth of view. The effects of snow, rain, and wind were noticed for the abstract patterns
created by refracted light through raindrops caught on the lens or “the giddy effect of seeing the landscape heaving onscreen like a ship on a stormy sea” (Gaver, 2006, p.64).

I have described at length Gaver’s account in order to provide a sense of how the experience was communicated through description and reflexivity. In the process, Gaver (knowingly or not) illustrates two dimensions of pragmatic experience. Firstly, the author describes the nuances and effects of everyday experience in explaining “my life with a ludic system,” the subtitle of the journal article. He articulates the simple aesthetic and usefulness of the artifact felt over time on a lived in basis. Interestingly, the system was not originally considered to be part of his research:

The video window is a simple system. Considered merely as a concept, it seems hardly worth discussing as a design at all. Its value, and the variety of experiences it offered, has only become clear because my wife, child and I have lived with it continuously over a period of time (Gaver, 2006, p.64).

It was this living with the design and experience, the everyday concrete nature that led to another order of reflection and interpretation that can best be described as a design inquiry of the experience. The second dimension is that of the designer inquirer’s pragmatic experience. Here Gaver renders the values or contributions of Video Window in the context of interaction design:

- Technology can offer ludic pleasure during all our waking hours (even early in the morning!).
- New views on the existing environment can be fascinating.
- Slight distortion can augment experience without distracting from the “natural” view.
- One’s own, non-arbitrary view may engender strong feelings of engagement.
- Physical causation can convey information (e.g. about the weather) in unconstrained and aesthetically pleasing ways.
• (Some) technological artefacts and constraints can be aesthetically pleasing.
• Systems can seamlessly mix resources for task-based pursuits, ludic engagement and aesthetic pleasure.
• Tinkering is enjoyable, but maintenance is a chore (Gaver, 2006, pp.64-65).

I argue that these values would only be evident and realizable by the particulars of this design inquiry and designer inquirer yet are transferable and credible in relation to similar designs of ludic and threshold devices.

In this discussion of reflective and interpretive HCI and practice it is evident that concerns are shared between the theory articulated in this dissertation and the authors above. Whether a new interaction design theory is required to advance the investigations further is not a matter of conclusive evaluation at this stage. It is however evident that the issues and goals that can lead to a theoretical understanding of interaction design are more broadly shared and articulated in practice.

7.3 Limitations

There are several limitations to the study and theory in this dissertation. These include the theoretical nature of the contribution, the relationship of the theory to the interaction design inquiries, and the scope of the theory in respect to design and other professional practices.

The central limitation is that the contribution of this study is theoretical. As a theory its trustworthiness is firstly a matter of interpretation. The extent and value of the theory can only be assessed over time through criticism and discussion among other researchers, practitioners and theorists. The degree to which a theory merits discussion is also a measure of its contribution or lack of contribution. Interpretation would also include ongoing
refinements and changes to the theory. For example, Schön’s reflective practice stands as the most trustworthy of design theories given its influence on subsequent theories (this one included) and discussions on design and its adaptation. Another contribution of the theory is its eventual normative impact on research and practice. This will be measured by the degree to which other researchers and practitioners use the theory to support research cases, diagnose practice or substantiate formative findings. The measures of interpretation and normative effect can only happen over time. Thirdly, the contribution of the theory could be measured by its transferability in the qualitative sense to other interaction design projects. In this measure transferability would need to occur through another researcher. In all instances the measures are beyond the scope of the dissertation.

Another limitation is that the inquiries (ec(h)o and socio-ec(h)o) in the dissertation were conducted parallel to the development of the theory. In this sense they were good but imperfect examples of the theory since they were neither informed by the complete theory nor did theory emerge wholly from the practice in the inquiries. From the perspective of establishing the theory, if the inquiries were informed by the complete theory they could illustrate all the points more clearly, e.g. reflexivity methods and criticism. In this case, generalizing the theory through logic would be stronger since the full dimensionality of the theory would be more evident. If the theory wholly emerged from practice of the inquiries, the inquiries would be less illustrative and more substantial in relation to the development of the theory, like in the case of grounded theory, where the inquiries would be theoretical data and not illustrations. A good example of this in HCI is Beyer and Holtzblatt’s Contextual Design (Beyer and Holtzblatt, 1998). The theory was built over a period of time through cases that substantiated the theory. Additionally, the developed theory was applied to several cases that served as clear illustrations.
The dissertation focused on interaction design. While I discussed other design theories I did not investigate the disciplinary boundaries of the theory. The theory is aimed at interaction design yet does it extend to other design disciplines? The theory argues that interaction design is distinct from HCI yet is it distinct from other design disciplines? This is a compelling question for a fuller definition of interaction design. Additionally, the approach of the dissertation, limiting the study to interaction design, foregoes the opportunity for a broader theory of design or even professional practices as a whole (e.g. nursing, education, etc.) as with reflective practice. The significance of investigating the scope of the theory is that the theory is an important test for the epistemological strength and quality of pragmatism. As an example, does pragmatism apply to industrial design and if not, is there value in determining the difference and comparing it against the philosophical foundations of industrial design? As it stands, the epistemological assumptions of pragmatism could bear further investigation at the boundaries of interaction design.