PATTERNS OF INTERACTION BETWEEN DESIGNERS AND USERS

by

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*We also certify that written approval has been obtained for any proprietary material contained therein.
To My Father
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PATTERNS OF INTERACTION BETWEEN DESIGNERS AND USERS

Abstract

by

JAEHYUN PARK

This dissertation explores patterns of interaction between designers and users in the design process. Designer-user interaction has become an important concern in design for business innovation. Despite more than 40 years of design process research, design method researchers and practitioners continue to wrestle with the challenges of incorporating users in their design process vocabularies and practices: Where are users in the design process? How do designers communicate with them?

Established design vocabularies (methods and models) have ideally shaped designers’ practices; however, the vocabularies have encountered difficulties trying to explicitly bring users into their shifting design and business innovation paradigms. In this dissertation, I address the lack of research into designers’ practices of user interaction with a view toward generative actions in designer-user interaction. This research deals with three studies theorizing explicit learning processes with users: (1) two field studies describing how designers bring users into design; (2) analysis of design project stories representing interactions with users in the design innovation and refinement sequences; and (3) analysis of design project stories presenting co-creation with users in the design process.

This research addresses theoretical, methodological, and practical gaps. My three interrelated findings propose a theoretical foundation to understand users’ roles in existing design methods and to theorize an expanded design vocabulary, which identifies two latent learning loops, based on Bourdieu’s theory of practice. This integrated model demonstrates how designers could explicitly communicate with users with three learning levels: bringing users into design, interacting with users, and co-creating with users in the design process.
Chapter 1: Introduction

My core beliefs regarding designer-user interaction are premised on the facts that, first, emerging design processes are malleable and need to be modified, while most established products, systems, and services are expensive and hard to be reconfigured. Second, designer-user interaction is a critical issue in generating business innovation, especially in identifying design problems and suggesting solutions during a design process.

Motivations and Problems

A new business-design paradigm is emerging, replacing an industry-centered emphasis with a user-centered one. As a result, understanding user experience and user information environments are becoming central aspects in the process of design and business innovations. As Redstrom (2006, 2008) argues, the industry centered design paradigm has shaped an enormous variety of business friendly features, forms, and functions in design artifacts, but now the coming user-centered paradigm requires a deeper understanding of users and their values for identifying appropriate future products and services. This shifting business-design paradigm has required that more attention be paid to users throughout the design and innovation process, and it has expanded the meanings of business-design. For these inter-related reasons, the business-design paradigm is now highlighting the importance of human-centered approaches, which include the issues of human interactions, experiences, and services. Yet, in reality, over 95 % of recent business-design products and services failed, and less than 5 % of innovative product-service concepts and solutions have achieved success in a market.

Considering the failures of business-design solutions and applications in a market, I propose three causes. First, designers and practitioners are struggling to transform their approach to creating value from an industry-centered perspective to a user-centered one.
Second, they do not have clear sets of definitions, theories, models, or protocols to analyze or synthesize design actions in developing desirable design products and services. Third, they have limitations in their ability to synthesize dynamic methods and practices for incorporating users in the design process.

Churchman and Schainblatt (1965) persuasively argued the importance of mutual understanding for productive designer-user interaction to create successful application in management science. In spite of this importance, designer-user interaction has not been highlighted in business-design practice.

Previous studies on designer-user interactions have developed propositions and hypotheses to demonstrate how users can be more actively involved in information systems development (ISD); however, they have neglected the importance of interactions between designers and users, and they have not adequately studied the interactions between designers and users empirically. In addition, although only a few researchers have empirically investigated designer-user interactions, these studies have separately examined designers and users with particular regard to how designers can implement design artifacts, or how users can adopt the established designs as a passive stakeholder group.

This study reviews the literatures in product / service design and IT innovation, boundary objects in ISD, new product development (NPD), user-centered design (UCD), participatory design (PD), and design methods and processes, because these communities reveal the importance of designer-user interactions based on slightly different research disciplines.
With the importance of design studies, multiple inter-disciplinary research areas (e.g. industrial, engineering, and architectural design) have been paying more attention to design methods and models in the design process. Previous researchers have developed a variety of design vocabularies and they have sought to include users in their established methods and models; however, most existing vocabularies do not explicitly represent users in design.

Based on this literature review, I identify two research gaps and develop two viable questions on designer-user interactions.

**Summary of Dissertation**

In this dissertation, I focus on patterns of interaction between designers and users in the design process. In order to address this research gap, I conducted two empirical studies, and I ask the following two research questions:

**Research Question 1:** What patterns of designer-user interactions are associated with a design innovation versus a design refinement sequence during the design process?

**Research Question 2:** What relationships are observed between designer-user interactions (e.g. dialogues) and their temporal design outcomes (e.g. design prototypes) during a design process?

This dissertation is organized in the following manner:

In chapter 2, I review the existing literature of designer-user interaction in ISD, product design and service innovation, boundary objects, new product development (NPD), user-centered design (UCD), participatory design (PD), and design methods and process
development. From the literature review, I identify two viable research gaps concerning
designer-user interaction, and I explore the patterns between designers and users in the
design process.

In chapter 3, I adopt Bourdieu’s theory of practice and Star and Griesmer’s theory of
boundary objects as theoretical foundations to deal with these two research questions, and
I propose a model based on these two theories.

In chapter 4, I give an overview of my empirical data collection, including how I use two
approaches: first, conducting two extended field studies in design firms, totaling five months
duration; and second, conducting thirty-five interviews with designers from a broad range
of design settings. The two-field studies included observation and analysis of seven design
projects. The thirty-five designers’ interviews produced transcripts of ninety-nine
project narratives (32 designer led innovation projects, 27 designer led refinement projects,
20 designer led projects based on careful reflection about user needs, and 20 role reversal
projects in which users acted as designers) as well as transcripts of thirty-five interviews
summarizing their general design approaches and methods in a design process. I then
analyzed the ninety-nine design project narratives to identify the forms of designer-user
interaction that were evidenced and the steps of their methods, using a grounded theory
approach.
Figure 1 presents my three inter-related findings about designer-user interaction that I discuss in chapter 5, 7, and 8.

In chapter 5, I analyze the two field studies and describe how the seven "user-centered" projects that I observed did not actually involve users, and discuss how designers bring users into design without real user interactions in the design process. Based on field observations and interpretation, I identify three themes and present design innovation and
design refinement case studies of how designers brought "virtual" users into their design environments in the design process.

In chapter 6, I describe my rationale for conducting additional qualitative research using an interview method after conducting the two field studies (ethnographic research). Also, I explain the sampling issues considered in the qualitative designer interview, as well as the method of collecting data, the criteria applied in data analysis, and the visual vocabulary I developed to synthesize and portray the design patterns I observed.

In chapter 7, I report on interviews with designers who were chosen as subjects because they had experience with user interaction during design projects. Here, I analyze how designers interact with real users in the design process. The interviews yielded fifty-nine narratives of design projects with direct user interaction. I identified fifteen designer-user interaction patterns (nine innovation and six refinement patterns) based on those fifty-nine projects. These patterns constitute an initial taxonomy of interactions between designers and users, which explains (1) forms of designer-user interaction and (2) steps of methods in the design process.

In chapter 8, I present how designers could ideally co-create with real users in the design process. Based on the analysis of forty project narratives in which the users worked on the design with the designers, I identify five patterns. Two patterns involved design reflexivity by the designer, illustrating how designers’ and users’ problem solving (actions) could lead to different levels of prototypes (outcomes) in the design process. Three patterns involved role reflexivity (in which users acted as designers and designers acted as users) show how reversing the roles between a designer and a user could lead to successful designer-user interaction and outcomes in the design process.
In chapter 9, I discuss the theoretical and practical implications based on the results from chapter 5, 7, and 8. Also, I synthesize an integrated design method based on Bourdieu’s theory of practice. Finally, I propose a future research project, which would test the effectiveness of two different designer-user interaction protocols. This proposed study would identify a connection between designer-user interaction pattern research and testing effective protocols between designers and users in the design process.

In chapter 10, I conclude by discussing multiple future research directions and the contributions of my inter-related findings.

This dissertation explores and theorizes patterns between designers and users in the design process. It includes three degrees of designer-user interaction in the design process: (1) the alternative ways of bringing users into design; (2) the effective ways of interacting with users; and (3) the ideal ways of co-creating with users.

Overall, three positive directions are illuminated by this research. First, the dissertation addresses methodological challenges of established vocabularies and opens a variety of directions for the design process, method researchers, and practitioners to synthesize appropriate design vocabularies and create new products and services in a radically changing business-design environment. Second, this work overcomes theoretical limitations in understanding the generative actions of designer-user interactions and proposes an integrated theoretical model to understand users more explicitly in the design process. Third, the proposed connection between designer-user interaction pattern and protocol studies will pave the way for additional empirical study in designer-user
interaction for the research communities of ISD, management science, NPD, UCD, and PD, among others.
Chapter 2: Literature Review

This dissertation explores patterns of interaction between designers and users in the design process. Surprisingly, most prior information systems (IS) research has not highlighted designer-user interaction, although these interactions have been partly considered by the following research communities: information systems development (ISD); product / service design and IT innovation; boundary objects; new product development (NPD); user-centered design (UCD); participatory design (PD); and design methods and processes. In this study, the comprehensive scope of the literature review reveals previous scholars’ endeavors to explore the relationship between designer-user interactions and the effect on the design process. Through this literature review, I outline possible research opportunities concerning designer-user interactions and identify viable research questions that can be empirically explored.

2.1 Information Systems Development

In information systems development (ISD) research, some studies have investigated the following topics in designer-user interactions: (1) communication problems between IS designers and IT users; (2) ways of increasing user involvement; and (3) the patterns of designer-user interactions.

In ISD, few researchers have focused on communication problems between designers and users so that they might decrease emerging design problems and combine designer-user requirements during a design process. Kaiser & Bostrom (1982) regard IS research problems as communication gaps among a user, a manager, a system analyst, and their
different considerations in a MIS project team. Levina (2005) also argues for the importance of design collaboration among different stakeholders in a design project. In order to combine multiple stakeholders’ design actions and opinions, she discusses how two companies managed the organizational issues of collaboration associated with combining multiple stakeholders’ design actions and opinions. Robey (1994) proposes a modeling of interpersonal processes in order to overcome the conflicts by understanding the importance of interpersonal activities in ISD. Barki & Hartwick (2001) also test how IS designers and users can minimize interpersonal conflicts that occur in ISD. Although a few studies have highlighted the designer and user’s communication problems and gaps, they do not provide any constructs or models to conduct empirical testing.

Ways of involving users has been a research topic within the domain of designer-user interaction, and is concerned with how users can become a more active stakeholder group in ISD. Ives & Olson (1984) investigated the degree of user involvement in creating a final IS product. Schonberger (1980) suggests a contingency model including user involvement and decision making, and Tait & Vessey (1988) also argue the effect of user involvement in a contingency approach for system success. Hirschheim (1985) explores participative system design with the degree of users’ involvement between social content and technical content. Kasper (1996) seeks to enhance the design of decision support systems (DSS) through user calibration of their performance. Gurpal (2009) maintains that user-developer relationships and the degree of involvement are two major issues in conducting user involvement research in ISD. In his paper, he summarizes different typical methods among user-centered design, participatory design, ethnography, and contextual design (Kujala, 2003). These user involvement studies
have approached involvement with diverse perspectives; however, they do not identify what variables make a user a more active stakeholder in the process of ISD.

Interaction patterns between IS designers and IS users have also been considered in order to create successful IS products. Baskerville & Stage (1996) regard prototypes between systems developers and users as tools of risk analysis and IS control in ISD. Marakas & Elam (1998) investigate the semantic questioning patterns between analysts and users in software system development. In addition, McLean (1979) offers an alternative model in which end-users can be application developers in ISD. In an empirical approach highlighting the importance of designer-user interaction, Boland (1978) tests a more effective protocol of user interaction in ISD, and Salaway (1987) tests two different organizational learning models between users and analysts. In summary, only these two studies have empirically tested the mutual interactions between IT designers and IT users; however, current design process research recognizes the need for more attention to this area.

2. 2 Product / Service Design and IT Innovation

Van de Ven (1986) suggests a framework to define four basic factors of innovation -- new ideas, people, transaction & process, and strategy & institutional contexts, and he develops an integrative framework of how the four basic problems (idea, human, process, and structural problem) can be fit together in managing part-whole relationship. Based on his argument, this research considers innovation as a problem-solving encounter in the ongoing process of designing IT products and services.

Regarding the drivers of product / service design and IT innovation, many studies recognize the importance of multi-disciplinary collaboration as “innovation occurs at the
boundaries between mindsets” (Leonard-Barton, 1995). In design and IT innovation research, Dougherty (1992) explores the conditions of successful product innovation and investigates the way that key people in five companies tend to understand technology-market relations. She identifies differences in the thought world systems of meanings about product innovation as an explanation for their differences in performance. Hargadon & Sutton (1997) observe how IDEO employees play technology broker roles and exploit a broad range of technological solutions by making analogies between current design problems and past solutions. Hargadon & Bechky (2006) observe how the locus of creative problem solving shifts and demonstrated four moments (helping seeking, help giving, reflective framing, and reinforcing) in the ongoing contexts of creativity. Bechky (2003) argues the importance for knowledge sharing among multiple stakeholders and points out the spaces of misunderstandings among different stakeholders because of different language usage among them in the process of design. Carlile (2004) develops a framework of three processes (transfer, translation, and transformation) through which knowledge crosses syntactic, semantic, and pragmatic types of boundaries. Kellogg et al. (2006) investigate how different stakeholders perform boundary-spanning coordination work and how they can coordinate practices in order to synthesize visible representations for their works.

Different types of innovation have been classified with either a one-dimensional dichotomy (radical–incremental, continuous–discontinuous) or multi-dimensional categories. Borrowing from previous research, Slocum & Rubin (2008, p. 11) define radical innovation as ‘innovations that could not have evolved through improvements to, and modifications of, the existing technology’ that ‘[offers] unprecedented performance features […] for significant performance or cost improvements’, while incremental
innovations ‘improve upon and extend existing technology’. Cited in the same paper, Henderson and Clark’s (1990) framework adopts two dimensions (1.core concepts are reinforced–overturned, and 2. linkage between core concepts and components are unchanged–changed) to categorize innovation into four types: incremental, radical, architectural, and modular. Among the four, incremental innovation preserves the core concepts of existing product / service and the linkage between core concepts and components, while in radical innovation the core concepts are overturned and the linkage between core concepts and components are changed.

Therefore, I understand the importance of multiple stakeholders’ interactions and highlight the designer-user interaction as a core of the design and IT innovation process. This research especially focuses on the designers’ perspective as a boundary crossing action with the user, which is part of the design refinement and design innovation sequences in the IT development.

2. 3 Prototypes in Design & IT Innovation

I assume that most tangible artifacts between designers and users can be defined as different forms of prototypes, and this research seeks to also cast light on the role of intangible interactions in the process of design and IT innovation.

Design prototype as a tangible artifact of the designer’s intention and action has been studied in the context of design innovation because it enables both the representation and the transformation of project participants’ knowledge (Carlile, 2002). Prototypes are categorized as one of four types (conceptual, behavioral, procedural, and appearance) according to the design aspects they represent (P. Chayutsahakij, 2001). Kensing &
Munk-Madsen (1993) propose that horizontal prototypes, showing all intended functions, are used at the early stages of a PD process when user requirements are being defined, but vertical prototypes are used to show the selected functions and final forms in the later stages. Gero (1990) argues that prototypes—representing the structure of a product/service, how the structure and behaviors are related, and how the structure and functions are linked—facilitate the creative design process because participants can manipulate prototypes and can either add or substitute variables of the current problem and come up with innovative schemas for new design and IT products/services.

Intangible interactions between designers and users should be considered with the same weight as tangible ones, because intangible designer-user interactions are also a form of artifact that facilitates design innovation. Narratives and dialogues are useful intangible interactions. Tsoukas (2009) states the importance of dialogue by asking how new knowledge is created in organizations. Bartel & Garud (2009) propose that innovation narratives are a cultural mechanism that combines ideas to generate novelty, acts on real-time problem-solving, and links between present innovation efforts, past experiences, and future aspirations for the sustaining innovation. Vaara & Tienari (2011) argue the role of discourse in the cultural construction of organizations and highlight the use of narratives as central discursive resources in unfolding organizational change. Moreover, UCD and PD research areas have sought to discover alternative methods and techniques for the design and IT innovation process. Rust (2004) describes the value of enactment techniques—acting out behaviors of the future users of a product/service as part of qualitative user research—as the externalization of research participants’ tacit knowing. Drama techniques (Brandt & Grunnet, 2000) are widely used as a way of gaining concrete understanding of users and current design problems. Actions taken to show
function, structure, or behavior of a product/service are modeling or prototyping with gestures. Actions can be taken as analogies to help the understanding of problems and externalization of designers and users’ knowledge. This study argues that designer actions build mutual knowledge and function as boundary objects that shape design outcomes.

2.4 Boundary Objects Research

Boundary object research has considered the mutual interactions between designers and users associated with knowledge representations. Star and Griesemer (1989) define boundary objects as artifacts or categories that are meaningful in diverse ways to multiple stakeholders and different social groups. They observed boundary objects as mediating discourse and translation among the different experts involved in doing scientific research. In IS, boundary objects research has offered an alternative theory, methodological approach, or research protocol in innovation, knowledge management, and design science research. Indeed, I believe that boundary objects can be important protocols or mechanisms for describing interactions between designers and users during a design process. The ISD research community has adopted the boundary object in its core body of knowledge, and researchers have argued that boundary objects are temporal, procedural or final design outcomes, stemming from different stakeholders. However, prior research does not highlight the designer-user interactions during a design process, and only few studies have focused on how boundary objects can mediate designers and users’ mutual interactions. Based on these studies, I summarize three propositions on the theory of boundary objects and related research.

The first proposition concerns boundary objects as tools, and focuses on how designers and users’ mutual thoughts and actions, occurring over time, can produce better design
outcomes in a process of design (Bergman, Lyytinen, & Mark, 2007; Spee, 2009; Star & Griesemer, 1989; Yoo, Boland, & Lyytinen, 2006). This proposition expands on boundary objects as brokers between designers and users during a design project. As brokers, boundary objects support mutual interaction by functioning as communication mediators or moderators between designers and users. As brokering artifacts, boundary objects (Beth A. Bechky, 2003; Becky, 2006; Pawlowski & Robey, 2004) serve to create mutual interaction as a main coordinator between designers’ and users’ common values.

The second proposition demonstrates the intersections identified by the activities and interactions of designers and users in the design project (Albrechtsen, 1998; Bowker & Star, 1999; Star & Griesemer, 1989). The second proposition deals with how the roles and identities of designers and users, based on their social roles and cultural groups, establish a reliable category among them in their design actions (Fleischmann, 2006) and social identity (Gal, Lyytinen, & Yoo, 2008; Lee, 2007; N. Levina & Vaast, 2008; Luff & Heath, 1996; Lutters, 2007).

The third proposition deals with how boundary objects promote actions between designers and users during a design process with the following topics: (1) dynamic roles (Briers & Chua, 2001; N. Levina, 2005; N. Levina & Ross, 2003; Mambrey & Robinson, 1997); (2) communities of knowledge and of practice (B. A. Bechky, 2003; Richard J Boland & Tenkasi, 1995; Carlile, 2002, 2004; Henderson, 1991; Natalia Levina & Vaast, 2005); and (3) distributed cognition (Ackerman & Halverson, 1999; R. J. Boland, Tenkasi, & Teeni, 1994). This proposition accounts for how designers and users’ interactions can construct or reconstruct new types of boundary objects in a design process.
In summary, most studies have been examining designers or users separately in IS, and only a few studies have considered designer-user interactions in terms of communication gaps, user involvement, and designer-user interaction patterns in ISD. On the other hand, boundary objects research has argued the importance of designer-user interactions with three propositions: boundary objects as tools, social interfaces, and actions between designers and users during a design process.

2. 5 New Product Development

New product development (NPD) research has also investigated how users can be the core stakeholder of the design development process, and the research community has also expanded on why users should be involved during the design process. In NPD research, the interactions between designers and users have not been considered directly; however, this research community highlights users as designers in consumer-driven product development and lead-user innovation.

The consumer-driven product development takes the view of consumers (users) as designers, and includes customization by customers, interactive paths by customers, and generated design contents by customers as research topics. The topic, customization by customers, has highlighted the how consumers can customize and suggest their own design solutions, stemming from user life patterns, activities, and real users’ motivations in the design development process (Luo, Kannan, Besharati, & Azarm, 2005; Moreau & Dahl, 2005; Srinivasan, Pauwels, Silva-Risso, & Hanssens, 2009; Veryzer Jr, 1998). The interactive (Srinivasan, et al., 2009) paths of customers concern the interactive powers of certain organizational structures and the paths of value creations by customers in NPD. Jap (2007) argues for an interactive power between buyers and suppliers surrounding
internal and external organizational issues in order to create an online market solution. Some studies (Berkowitz, 1987; Carson, Devinney, Dowling, & John, 1999; Leenders, van Engelen, & Kratzer, 2007; Veryzer & Borja de Mozota, 2005) examine customer-centered system design processes and successful elements in order to create a new product solution. The topic, consumer-generated design contents, draws from consumer-communication environments, consumer-process components, and consumer-design elements, as well as features and functions in NPD (Dell'Era & Verganti, 2007; Kabadayi, Eyuboglu, & Thomas, 2007). There are diverse design variables such as cultural differences, geographical issues, user life styles and segmentations that can be used in order to appeal more to customers (Bruce, Daly, & Kahn, 2007; Dahl, Chattopadhyay, & Gorn, 1999).

The lead-user approach demonstrates that users are the most important stakeholder in order to produce marketable projects. Hippel (1994) identifies user-lead innovation with the concept of ‘sticky information’ which highlights users as the key problem solver. Sticky information explains how users are the core stakeholders to produce more marketable products by their tactic characteristics (Polanyi, 1966) in the process of innovation implementation. In order to address this, Hippel (1994) compares manufacturer-based design tasks to user-based design tasks, and then he suggests an iterative user-manufacturer-based design model between activities, users, and manufacturers. Prior lead-user innovation researchers (Franke, von Hippel, & Schreier, 2006; Hippel, 1988) have developed their theory of lead-user innovation with two components: expected benefit and market-trend position. These two components represent the importance of user involvement in the process of innovation in order to create expected benefits and to generate new market trends. For example, Shaw (1985)
argues for the important role of interaction between the user and the manufacturer in medical equipment innovation. Hippel (1976) defines the roles of users in the innovation of scientific instrument. Hippel & Tyre (1993) consider ‘learning by doing’ as an important user activity to increase users’ voices in the process of innovation. Moreover, Hippel & Katz (2002) suggest innovation toolkits for users, contrasting “need-related” and “solution-related” and identifying elements of user-friendly toolkits.

In NPD, customer-centered innovation and user-lead innovation propose a proposition -- users as designers in designer-user interactions.

2. 6 User-Centered Design

User-centered design (UCD) literatures have not focused directly on designer-user interactions themselves; however, UCD researchers have investigated temporal possibilities of designer-user interactions during a design process. UCD prior researchers have asked how designers can effectively understand users and their design environments by highlighting design analysis rather than design synthesis during the design process. Therefore, their endeavors have sought to identify alternative design methodologies in order to engage users in the design process by focusing on the following research topics: (1) design as dialogue, (2) design prototypes, and (3) UCD methodologies.

A few UCD design researchers have adopted language structures (design as dialogue) as an alternative design approach in the design process. Poggenpohl et al. (2004) argue that there is a lack of formal design structures and suggest language as an alternative way to understand how designers utilize design dialogues as procedural evidence in the process of design. Newton (2004) analyzes and suggests a designing narrative model in order to
understand users and their design environments. Here, design dialogues can be interpreted as forms of semantics and grammatical structures gleaned from the actions of designers in order to analyze users and design environment in the UCD process.

Design prototypes promote the relationship between designer-user interactions and the resulting design outcomes during a UCD process. Bucciarelli (2002) explores the importance of design sketches through a functional view. He believes that sketches are malleable design prototypes which connect designers’ ideas. Chayutsahakij (2001) demonstrates design prototypes with a taxonomy, which constitutes four sequential design prototypes during a design project: conceptual, behavior, procedural, and appearance. Suwa et al. (2000) study the co-evolution of unexpected design situations that arise between design problems and solution spaces in the conceptual design process. Dorst & Cross (2001b) suggest a co-evolution model to evaluate design problem and solution dimensions over time. Luck & McDonnell (2006) show an example of designer-user interaction in the area of design prototype research. In this study, they investigated collaborations between an architect and building users to create conceptual or behavior design prototypes in the early stages of the building design process. In order to do this, they ask how user-involved conversation can develop the required level of design information in the early stages of design process. In this way, design prototype research can be understood as a tool or a method that initiates interactions among designers in order to combine users and their life cycle in the UCD approach.

UCD researchers have improved a variety of UCD methods and frameworks (Vredenburg, Isensee, Righi, & Design, 2001) that reveal users’ unmet needs and address their information environments. Using diverse UCD methods, the UCD designers have
incorporated users more effectively in a design process. Owen (2001) synthesizes a system design methodology to analyze design environments and users. His structured planning method allows for systematic syntheses of design solutions based on the analysis of the user’s activities, functions, and environmental information. Gero’s Function, Behavior, and Structure (FBS) model (1990) captures only meaningful user behaviors and optimizes the design process around them. Howard et al. (2008) consider the creative process in the engineering design and suggest an integrated creative design process model based on Function, Behavior, and Structure (FBS) to generate dynamic design narratives. Crabtree (1998) and Lloyd (2000) highlight the importance of ethnographic research techniques and they regard them as a set of scientific methods that utilize observation and the mechanism of storytelling during a UCD process. Lai (2006) suggests a design mechanism that includes idea, agent, and role playing as design factors for a dynamic agent role interplay system. Kruger & Cross (2006) identify four types of designers’ cognitive strategies: solution driven, problem driven, information driven and knowledge driven strategies that increase solution quality and the creativity of design outcomes.

Previous UCD research has not directly studied designer-user interactions; however, the UCD research has identified different types of design methodologies that designers can use to communicate with users more effectively in the design process. Thus, their research efforts have revealed the topics of design as dialogue, design prototypes, and UCD methodologies.
2.7 Participatory Design and Related Works in Scandinavia

Bucciarelli’s (1994) concept of *object worlds* demonstrates that people with various backgrounds inhabiting different worlds would see a design object differently. Based on this concept, Lehoux & Hivon (2011) explain the benefits of user participation as a variety of knowledge they bring in because with the knowledge design problems can be reframed or solved from fresh perspectives. Also, Kensing and Munk-Madsen (1993) identify the six areas of user knowledge and relevant participatory design tools and techniques. Early PD research has focused on enhancing multi-stakeholders’ collaborations, and it has dealt with the complexity of emerging design requirements, stemming from different people, organizations, and technologies in a design process. The primary question of PD literature is how end-users can contribute to the process of design development as co-designers (Schuler & Namioka, 1993), and it deals with organizational techniques that participants can use to manage their conflicting interests in a design process (Mumford & Ward, 1968).

Based on the significance of participation design (PD), the participatory design literature consists of the collective resource to system design (CRA) (Bjerknes, Ehn, & Kyng, 1989), information systems development (Bansler, 1989; Dahlbom & Mathiassen, 1993; Hirschheim & Klein, 1989; Suchman, 1998), and computer supported cooperative work (CSCW) (Bansler, 1989; Greenbaum & Kyng, 1991). From this research, I can summarize participatory design (PD) and related works in Scandinavia that can help designer-user interactions.
Historical Development in PD

Based on the historical development of the participatory design since 1970’s in Scandinavia, Ehn (1988, 2008) contrasts participatory design and meta-design. To address these design approaches, he focused on the things modifying the space of interactions within a community of practice. He also focused on boundary objects in participatory design and infrastructures in meta-design.

In his later paper, he defined design methods towards user participation as ‘design-by-doing’ and ‘design-by-playing.’ Thus, PD has two characteristics: (1) PD as empowerment and (2) PD as entangled design-games. PD as empowerment identifies users as co-designers based on the roots in movements towards democratization at work in the Scandinavian countries. On the other hand, the PD as entangled design-games conceptualizes participatory design as a pragmatic design theory referring to Wittgenstein and the language-game philosophy, ‘communities-of-practice’ (Lave & Wenger, 1998).

PD as empowerment among multiple stakeholders’ interactions entails the most important factors in a design process. Nygaard (1986) and Kyng (1996b) regard PD research as collaborative partnership or co-construction. The collaborative partnership encourages deep commitment of diverse stakeholders in order to cope with their design conflicts and contradictions in a design project. Cherkasky (2003) argues multidisciplinary design collaborations between designers and users. Kyng (1991) defines PD as an experimental inquiry or as a learning process that emphasizes mutual learning between designers and users in a design process. Gregory (2003) defines workplace democracy as a characteristic of PD, and suggests that workplace democracy combines multi-
stakeholders’ design actions such as work-oriented design, situated activity, and contextual inquiry in a system development.

PD as entangled design-games conceptualizes language-based communication as a necessary part of the designer-user interaction; however, it also imposes many limitations that have been discussed as the concepts of language-games (Ehn, 1988; Wittgenstein & Anscombe, 1997), the user’s tacit knowing (Polanyi, 1966), and the psychological, physical, and cultural distances between the user and the researcher (Gaver, Dunne, & Pacenti, 1999). In order to address these limitations, alternative research methods are being developed. One approach exploits the materiality of mediating artifacts to facilitate designer-user interaction and includes Participatory Design Games, Cultural Probes, Generative Techniques, and Behavioral Prototyping (Brandt, Messeter, & Binder, 2008; Praima Chayutsahakij & Poggenpohl, 2002; Ehn & Kyng, 1991; Gaver, et al., 1999; Sanders & Stappers, 2008).

Meta-Design for Users as Designers

The tradition of meta-design considers that PD research offers a context-centered design approach that outlines conflicting interests and suggests a solution from the design process (Kyng, 1996a; Suchman, 1998). The contexts for design proposition deals with the organizational context of design in order to discover the conditions for effectively organizing projects and for incorporating organizational techniques and tools. Also, the context-centered design approach investigates the effectiveness of cooperating tools and techniques among participants in PD.
Fischer & Scharff (2000) proposed ‘meta-design’ characterizing activities, processes, and objectives to create new media and environments that allow users to act as designers and be creative in the context of a particular system and participatory design processes. Fischer (2003) argued a fundamental objective of meta-design to create socio-technical environments that empower users to engage in informed participation. The suggested model explains how designers could incorporate users with the three conceptual stages: seeding, evolutionary growth, reseeding. This model demonstrates how designer-user interactions could support meta-design in the design process. Fischer & Giaccard (2006) outlined the diversity of designers and users stemming from passive customer to meta-designer in the designer development. With this categorization, they demonstrated how designers could provide the opportunities of users as designers addressing and overcoming the problems of closed systems. This meta-design approach involves seeing the designer-user interaction as a collaborative construction of mutual knowledge with which design problems are defined and solutions are created. It shifts the focus from how users’ current knowledge is revealed to designers to how the interaction expands designers’ and users’ knowledge. This approach works better for the actual design process where not only solutions but also problems evolve over time (Dorst & Cross, 2001a; Suwa, et al., 2000). Based on this approach, designers and users are encouraged to think beyond the knowledge within a person, department, or problem domain by reframing the current design problem and finding solutions from various domains.

**CSCW and HCI Development in PD**

In 1980-2000, Scandinavia design highlighted democratization in Scandinavia, and it has become a tradition of CSCW and HCI.
Ehn (1988) explored an inquiry (design as everyday practice) of the human activity in designing computer artifacts for everyday activity. He also highlighted alternative design practice among disciplinary boundaries with the techniques of prototypes, industrial democracy, and tools. MacLean et al. (1990) identified taxonomy of different types of users and their situations in the design systems. To present appropriate appropriateness between systems and users’ work practice, they suggest ‘tailoring systems’, in which users feel in control of the system and evolve each other within a system culture.

Winograd et al. (1996) argued design thinking and practice into software development with the view of participatory interaction in HCI. Bødker et al. (2000) summarized the identified Scandinavian IT Design Model and projects during the last 20 years. They conducted the Utopia project in 1981-1985 and maintained the importance of co-operative design and its methodology to provide a voice to end users in the design process. Also, they performed the KidStory project using role-playing techniques, in which children see themselves as inventors. The contribution of these project and co-operation method has transformed the measurement issues from laboratory testing (multiple stakeholders testing) to fieldwork to understand users’ vivid voices. Edwards et al (2003) focused on the indirectness of users’ experience with computer architectures and raise important questions and limitations. Büscher et al. (2009) argued the values of participatory design, which focused a holistic socio-technical connecting in-between new and existing technologies and practices. They considered the limitation of PD, because it was a successful methods or applications to validate direct user interaction. Yet, it was quite challenging to discover/validate users’ requirement for the software and its early process of design development. Therefore, they posited ‘palpable computing’ for identifying relationships between use and software architectural design.
User-Driven Innovation in PD

PD research has emphasized user-driven innovation in design methods and the concepts of collaboration.

Buur et al. (2000) argued a critical issue of utilizing video in the ethnographic data or fieldwork materials, because visual data and material are the core objects to reflect real interactions with users and participants in the design process. Especially, non-participated stakeholders (e.g. designers, managers, and IT developers) could reflect the real moments of interactions in the fields based on the raw data. Buur & Bødker (2000) argued ‘design collaboratorium’ as a design approach that creates an open physical and organizational space where designers, engineers, users and usability professionals meet and work alongside each other. It illustrates how it is possible to reframe usability work and it discusses the new usability competence such as event-driven ways of working known from participatory design. Burr et al. (2004) posited the limitation of tangible user interaction of how projects and service design processes could highlight a particular user’s tasks and contexts. To address this, they suggested two tangible user interactions techniques: (1) Hands-Only Scenario and (2) Video Action Wall. The Hands-Only Scenario is a ‘close-up version’ of the dramatised use scenario, while the Video Action Wall is a technique of ‘live post-its’ on a (projected) computer screen. Little snippets of action videos running simultaneously help designers understand user actions by the qualities they represent. Buur & Matthews (2008) overviewed three of the dominant approaches for engaging with users in co-innovation of products and services, in which they compared the three perspectives in terms of goals, methods and basic philosophy and discussed research directions of what they see as fundamental to the development of user-driven innovation.
In summary, the PD research community has developed four research concentrations. First, it has highlighted the importance of multi-stakeholders’ collaborations with two characteristics in PD research development: (1) PD as empowerment and (2) PD as entangled design-games. Second, it considers meta-design as a context-centered design approach to outline conflicting interests and suggests a solution between designers and users. Third, it has become a tradition of CSCW and HCI to synthesize socio-technical solutions by a human-centered approach. Fourth, PD research has supported to user-driven innovation in design methods and the ideas of design collaboration. Considering this research concentration into designer-user interactions with these four research orientations, the PD research have contributed theoretical and practical propositions to identify problems and solutions in-between IT and human-centered innovation.

2.8 Design Methods and Models

Design has become a central concept in multiple research areas, and current interdisciplinary studies call for more attention about a variety of design methods and process models. In prior research, most researchers related to the multi-scale complex design (e.g. interaction, systems, and service) have considered the effective design methods and models. Their efforts have developed a variety of vocabularies and practical manners of how designers could perform design actions in the design process. In addition, although established methods and models might imply diverse meanings about users in the design process; most current design vocabularies do not reveal users’ interactions within their methods and models.
In prior engineering, architectural, industrial, and UCD design research, design vocabularies (methods and models) were developed to identify steps of designers’ interactions in the design process (Dubberly, 2004; Jones, 1992).

Alexander (1964) points out design relationships between forms and contexts and defined design problems with different levels of information complexity. His design process dealt with an ongoing loop from identifying design particularities to figuring out design wholeness in-between design forms and contexts. Rittel & Webber (1973) describe the nature of “wicked” problems in a pluralistic society, and these problems require a variety of solving approaches with many different perspectives in order to solve the complex design phenomenon. Archer (1979) suggests the meanings of design methodologies and the related disciplines among design, humanities, and science.

Koberg & Bagnall (1974) consider design with a view of cybernetics and defined design process with two-steps: design analysis and synthesis. Based on their definitions, a few scholars tried to expand design process with more specific segmentations. Darke (1979) defines the limitations about the design process with two steps (analysis and synthesis) and provided an alternative model, which consists of generator-conjecture-analysis based on multiple case studies of architectural researchers. In this research, she highlighted the importance of how designers / architects could completely identify the domain of problems or complex information environment rather than a single statement. Doblin (1987) notes that design environments have become more complex and established approaches less effective. Based on this insight, he theorized two design dimensions. The one is design as process with direct and indirect design, which consists of analysis, genesis, and synthesis. The other is design as state, which identifies design performance.
and appearance ratios and three levels of complexity. With these two dimensions, he proposed six types of effective design methods in a design matrix.

Marcus & Maver (1969; 1970) suggest three different design levels (outline, scheme, and detail design) with the following actions: analysis-synthesis-approval-decision in industrial and architectural design methods. Pahl & Beitz (1984) provide a systemic approach of engineering design process, in which they highlighted a linear task-based problem solving approach: task-specification-concept-preliminary layouts-definitive layout-documentation-solution. Cross (1993) summarizes the history of design methodology and the movement showing how the design method community has moved toward scientific research on the issues of design. Also, he (2000) suggests engineering design methods and systemic design problem solving approaches in product design. Roozenburg & Cross (1991) criticize the consensus model of the engineering design process and developments in architectural and industrial design methodology, and they suggested a hybrid model, which defined a symmetric relationship between problem & solution and sub-problems & sub-solutions. This model suggested a heuristic understanding between macro and micro problem solving in the design process. Eppinger & Ulrich (1995) devise concept development actions and concept selection rationale in the engineering design and product development decision process. Krishnan & Ulrich (2001) review product development decisions in marketing, organization, engineering design, and operation management, and they identified product development decisions as follows: concept development, supply chain design, product design, and performance testing and validation / production and launch.
Previous design process researchers have suggested a variety of design vocabularies (methods and models) and sought to theorize existing methodologies and approaches in engineering, architectural, industrial, and UCD design. Thus, they introduce users into their vocabularies. Yet, most current design methods and models have limitations in bringing users into their vocabularies. In this dissertation, I seek to theorize the gap about how designers’ methods and models could bring, interact with, and co-create with users in the design process.

2. 9 Lessons from Literature Reviews

From this information systems development (ISD) research, I can summarize three research limitations of designer-user interactions as follows: (1) most prior IS research has separately investigated IS designers and users through two research orientations -- how IT designers can implement emerging system designs, and how IT users can adopt / adapt to existing system designs; (2) IS users have been regarded as passive stakeholders whose relationship to system design is not interactive; and (3) prior IS research has focused on existing IT system designs in order to measure IT users’ efficacy and efficiency based on the linear institutional view of IS designers.

In ISD, only a few researchers have considered the mutual interactions between designers and users as of primary significance in the design process (Boland Jr, 1978, 1994; Churchman, 1965; Orlikowski, 2002; E. Burton Swanson, 1994; E. B. Swanson & Ramiller, 1997). Also, only a few studies have sought to theorize a holistic relationship between designers’ development and users’ adoption (Griffith, 1999; Pentland, 2008; Wang & Ramiller, 2009). For instance, Griffith (1999) has theorized a framework on how
the interactions between IS designers and IS users could shape IT product forms and functions.

<table>
<thead>
<tr>
<th>Proposicións on Designer-User Interactions</th>
<th>Empirical Test</th>
<th>Authors</th>
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<tbody>
<tr>
<td><strong>ISD</strong></td>
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<tr>
<td>P1: Mutual understanding between designers and users is the most important factor in creating better design or organizational outcomes during a design process</td>
<td>Partly (Lab-Exp)</td>
<td>Churchman &amp; Schinblatt (1965) Boland (1978) Salaway (1987)</td>
</tr>
<tr>
<td>P2: Users can be developers (designers) in ISD</td>
<td>Partly (Case Study)</td>
<td>McLean (1979) Kozar &amp; Mahlum (1987)</td>
</tr>
<tr>
<td>P3: Users and designers co-create design episodes and patterns together as a social practice in ISD</td>
<td>Partly (Case Study)</td>
<td>Newman &amp; Robey (1992)</td>
</tr>
<tr>
<td>P4: No effective prototyping methods exist between designers and users in ISD</td>
<td>Partly (Interviews &amp; Lab-Exp)</td>
<td>Alavi (1984)</td>
</tr>
<tr>
<td>P5: Tailoring computing is a form of collaboration between designers and users in the software development process</td>
<td>Partly (Design Study)</td>
<td>Mørch &amp; Mehandjiev (2000)</td>
</tr>
<tr>
<td>P6: IT artifacts are the outcomes of social interactions between IT designers and users</td>
<td>No</td>
<td>Griffith (1999)</td>
</tr>
<tr>
<td>P7: Users take a broad organizational view, while designers take a local view such as technical concerns in solving problems.</td>
<td>Partly (Lab-Exp Grounded Approach)</td>
<td>Kaiser &amp; Bostrom (1982) Chakraborty et al. (2010)</td>
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<tr>
<td><strong>BOT in ISD</strong></td>
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<td>P8: Boundary objects are problem-solving tools between designer-user interactions</td>
<td>Case Studies</td>
<td>e.g. (Yakura, 2002)</td>
</tr>
<tr>
<td>P9: Boundary objects are social interfaces in designer-user interactions during a design process</td>
<td>Case Studies</td>
<td>e.g. (Star &amp; Griesmer 1989)</td>
</tr>
<tr>
<td>P10: Boundary objects are actions in designer-user interactions during a design process</td>
<td>Field study/Case Studies</td>
<td>e.g. Levina &amp; Vast (2005)</td>
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<tr>
<td><strong>NPD</strong></td>
<td></td>
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<tr>
<td>P11: Consumer-driven product development takes the view that consumers (users) can be designers</td>
<td>Case Studies</td>
<td>e.g. Srinivasan et al. (2009)</td>
</tr>
<tr>
<td>P12: The lead-user approach identifies users as core problem-solvers in NPD</td>
<td>Case Studies</td>
<td>e.g. Hippel (1994)</td>
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<tr>
<td><strong>UCD</strong></td>
<td></td>
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<tr>
<td>P13: The design as language structures, design as prototypes identify alternative UCD design methodologies in order to engage users in the design process</td>
<td>Partly (Case Study)</td>
<td>e.g. Poggenpohl et al. (2004)</td>
</tr>
<tr>
<td>P14: Designer-user interactions encounter role reversals (designers as users or users as designers) on temporal situations in UCD approach</td>
<td>Partly (Case Study)</td>
<td>e.g. Luck &amp; Mcdowell (2006)</td>
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<tr>
<td><strong>PD</strong></td>
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<td>P15: Co-creation (designers as users and users as designers) is an effective interaction technique in creating new design outcomes in PD</td>
<td>No</td>
<td>e.g. Nygaard (1986) and Kyng (1991)</td>
</tr>
</tbody>
</table>

The designer-user interaction has been considered by other disciplines, such as boundary objects research in ISD, NPD in marketing, UCD, and PD. From these studies, the community of ISD has made several propositions about designer-user interactions during
a design process. Based on this literature review, I summarize fifteen viable propositions on designer-user interactions in Table 1.

Considering from ISD research, propositions 1 to 7 reveal what aspects of designer-user interactions have been highlighted by the published ISD research. The aspects identified in those seven propositions as follows: (P1) mutual interactions between designers and users; (P2) users as developers (designers); (P3) designer-user co-creation in ISD; (P4) no effective prototyping tool between designers and users; (P5) tailoring computing as a form of collaboration between designers and users; (P6) IT artifacts as the outcomes of their mutual interpretations; and, (P7) different design attitudes and requirements between designers and users in ISD.

I believe these seven propositions are related to each other, and they have been partially tested. For example, P1, P2, and P3 seek to explore mutual understandings, which focus on the roles of designers and users in a design process. P4 and P5 have identified which tools are more effective for the interactions between designers and users. P6 and P7 assume that designers and users have different characteristics and requirements, so that they have considered how designers and users can produce a shared communication space in ISD.

Although few studies have been conducted on designer-user interactions in ISD, these studies have been inadequate, because they do not suggest any clear theories, models, frameworks or prototypes of designer-user interactions. Also, any detailed constructs or aspects of designer-user interactions have not been developed. Most of the studies have revealed certain propositions, and they have conducted preliminary studies or case studies
in order to provide validations for their propositions, rather than using relevant empirical approaches.

Considering research on boundary objects, new product development (NPD), user-centered design (UCD), and participatory design (PD), these remaining eight propositions (P8 to P15) have addressed slightly different aspects of the interactions between designers and users (See Table 1). Propositions 8 to 10 explore the relationships between designer-user interactions and their design outcomes on different forms of boundary objects. Propositions 11 and 12, resulting from NPD research, explore users as designers who are content developers rather than design evaluators and users as problem-solvers in the design process. Propositions 13 and 14 from UCD research have considered design languages and design prototypes. Proposition 13 explores alternative structures of designer-user interactions, and proposition 14 highlights the temporal outcomes from designer-user interaction as prototypes in the design process. Proposition 15 stemming from PD research has highlighted the co-creation by multiple stakeholders (designers as users and users as designers) as an effective interaction technique in a design project, and these studies also offer an active design space for designer-user interaction in a design project.

From these current limitations and propositions P1 to P15 on designer-user interactions, I identify two viable questions: the first question is what patterns of designer-user interactions can be identified during a design process; and the second question is what designer-user interaction protocol is more effective in creating better design outcomes in the process of design. Based on these two viable questions as research gaps, this dissertation focuses on the first question, which explores the patterns of designer-user
interactions, and then it will consider the second viable gap, which tests effective
designer-user interaction protocols during a design process will be discussed a the future
research direction.
Chapter 3: Theoretical Considerations

This chapter deals with theoretical considerations necessary to address the research questions: (1) what patterns of designer-user interactions are associated with a design innovation versus a design refinement sequence during the design process? (2) What relationships are observed between designer-user interactions (e.g. dialogues) and their temporal design outcomes (e.g. design prototypes) during a design process? These two research questions require designers’ and users’ to engage in single or multi-cycle generative actions, which result in the outcomes of the design process that again influences future cycles. Therefore, I view the social construction theories (Giddens, 1985, 1991) are suitable theoretical underpinnings to support these two research questions.

In this dissertation, I take up Bourdieu’s theory of practice (Bourdieu, 1973, 1986, 1998; Bourdieu & Nice, 1997; Bourdieu & Wacquant, 2004) and the theory of boundary objects (Star & Griesemer, 1989) as theoretical foundations to discover the two research questions. There are three reasons to select these two theories. First, this study includes two field studies with ethnographic research techniques; therefore, Bourdieu’s theory of practice is the most appropriate theory to understand generative actions of designers and users within the ethnographic research approach. Second, the theory of boundary objects indicates boundary objects as different types of artifacts, with the potential to be enhanced boundary objects as actions in a variety of social interaction contexts. Third, Bourdieu’s theory of practice and boundary objects have a theoretical intersection, which I define as the designers’ and users’ generative actions (Bourdieu’s theory of practice) and their resulting outcomes (boundary objects) in the design process.
With these theoretical understandings, a proposed model is suggested which consolidates Bourdieu’s theory of practice and boundary objects.

3.1 Bourdieu’s Theory of Practice

Bourdieu’s theory of practice (Bourdieu, 1973, 1986, 1998; Bourdieu & Nice, 1997; Bourdieu & Wacquant, 2004) deals with social interactions between individuals and the social structures in a society. In other words, his theory of practice explains how an individual who is cultured within a society of conventions and rules forms certain attitudes and perspectives that are revealed in his/her daily practices.

In his theory, he defines three components -- ‘field’, ‘habitus’, and ‘practice’ -- in order to explain the relationships between individuals and a society. In order to demonstrate them in a societal context, Bourdieu classifies these three components as follows: field is ‘a series of institutions, rules, rituals, conventions, categories, designations, and appointments […] which produce and authorize certain discourses and activities.’ (Webb, Schirato, & Danaher, 2002, p. 42); habitus is ‘the values and dispositions gained from our cultural history that […] allow us to respond to cultural rules and contexts in a variety of ways’ (Webb et al., 2002:36); practice is produced from habitus and habitus exists in moments of practice. I interpret his three components: (1) ‘field’ as a structural form of social, cultural, economic, and symbolic capitals; (2) ‘habitus’ as a mediation between subjective and objective understandings from the ‘field; and (3) ‘practice’ as individual actions in order to construct/reconstruct the given ‘field’ of a society. This theory explains how individuals interpret/negotiate the given socio-cultural structures or rules (field), and shape their own perspectives (habitus) in their daily practice in a society.
Therefore, each of the three components (field, habitus, and practice) characterizes a sequence of the relationships between individuals and social structures in a society.

I interpret Bourdieu’s theory of practice as a macro structure in order to explore how designers and users can produce interaction patterns during a design process (Jaehyun Park, 2013). When applied to the interactions between designers and users during a project, the theory of practice lets us see a design process as series of actions of participating stakeholders. It consists of field as rules of action, habitus as modes of action, and practice as situated actions. The field as rules of action is a collection of ideas; the rules include categorization, hierarchy, and definition of concepts, artifacts, and behaviors considered legitimate by stakeholders. The habitus as modes of action is the various perspectives and attitudes from which stakeholders see current design problems. While habitus is formed from the ideas stakeholders selectively draw from field, it only exists in the stakeholders’ situated actions (practice) of representing and co-creating design problems and solutions. Stakeholders become aware of field through the reflexive process of exploring tangible/intangible artifacts such as design problems and solutions, and underlying habitus.

Regarding the interactions between designers and users, I propose two different design sequences based on the theory of practice: (1) design refinement and (2) design innovation. Design refinement and design innovation. I see the process of design refinement as reinforcement of current field, habitus, and practice; whereas design innovation is the changes in the field and practice of involved designers and users as they change their habitus during a design process.
The sequence of *design refinement* highlights how existing design artifacts and system applications can be reconstructed by designers and users’ interactions. Design refinement follows a sequence from field to habitus, and on to practice. This design refinement sequence develops existing design problems, artifacts, and ideas through designer-user interactions in a design process. In previous studies, a few researchers have applied Bourdieu’s theory of practice with the refinement sequence. Levina (2005) argues Bourdieu’s theory of practice with the concept of boundary objects and boundary spanning. She utilizes boundary objects as design outcomes and boundary spanning as the central stakeholder who has a certain higher capability in social, cultural, and symbolic capital and communicates with others effectively. During this process, Levina follows the sequence of design refinement (field \(\rightarrow\) habitus \(\rightarrow\) practice) in a design project. Schultze & Boland (2000) also study how habitus can be internalized by a structure (field); how practice can be enacted from the habitus; and how this practice can construct or reconstruct the given social structure of Bourdieu’s theory of practice. Like these studies, the design refinement sequence of designer-user interaction develops from existing design products, ideas, and processes, and it might shape better design outcomes by designer-user interactions.

Yet, a *design innovation* sequence takes a different cycle from that of design refinement. In reality, interactions between designers and users (practice) are associated with design goals, orientations or requirements (habitus) in order to identify new design ideas, products, and design processes (field); therefore, I interpret that design innovation sequence follows from habitus to practice, and on to field in Bourdieu’s theory. In this sequence, I identify three components of Bourdieu’s theory of practice as the following: ‘field’ as a determined history of actions; ‘habitus’ as a mode of collected actions; and
‘practice’ as a situated action. Considering the interactions between designers and users in the contexts of design innovation sequence, interactions between designers and users as situated actions are associated with the mode of design actions as temporal outcomes by designer-user interactions.

In summary, Bourdieu’s theory of practice supports the first research question -- *what patterns of designer-user interactions are associated with a design innovation versus a design refinement sequence during the design process.* His theory can be understood with two design sequences in the design processes. In this dissertation, I explore the designer-user interactions using two design sequences (design refinement and design innovation). The two structural design sequences help one to observe what patterns of interactions between designers and users emerge, occur in sequence, and evolve during the design process.

### 3.2 Boundary Objects

Star and Griesmer’s “boundary objects” afford the discovery of meanings, definitions, and understandings between stakeholders in separate social worlds, different social groups, and multiple social actors. Star and Griesemer (1989) introduce the original concept of boundary objects, and Carlile (2002, 2004) further develops the boundary objects.

Star and Griesemer (1989) originally define boundary objects as a term of institutional ecology in order to distinguish amateurs and professionals in Berkeley’s Museum of Vertebrate Zoology, where they observe boundary objects as mediating translation among different perspectives across diverse groups. Carlile (2002, 2004) expands boundary objects as knowledge boundaries and observes three different knowledge boundaries in
new product development -- syntactic, semantic, and pragmatic boundaries by emphasizing the material structures of knowledge sharing in the process of a new product development in an engineering company. In his studies, Carlile (2004) enhances the definition of boundary objects and views intangible knowledge as a boundary object when it is shared as common knowledge among project stakeholders and let them see how one’s domain-specific knowledge is different but dependent on the others’. Meanwhile, Bergman et al. (2007) further define Star and Griesemer’s boundary objects based on four conditions: (1) they inhabit several social worlds; (2) they satisfy the institutional requirements of each social world, (3) they are weakly structured in common use, and (4) they are strongly structured in local use.

Boundary objects can be understood as a process or a protocol, which demonstrates the relationships between designer-user interactions and their outcomes in the design process. Prior researchers define three types of boundary objects (Star and Griesemer 1989; Carlile 2002; 2004; Bergman et al. 2007): (1) boundary objects as objects (e.g. repositories, database, and parts of libraries) (2) boundary objects as models (e.g. standardized forms and methods for problem solving across different functional settings), and (3) boundary objects as maps (e.g. representations such as prototypes, Gantt charts, process maps, and workflow matrices). Carlile highlights how a boundary object ‘establishes a shared syntax or language for individuals to represent their knowledge’, ‘provides a concrete means for individuals to specify and learn about their differences and dependencies across a given boundary’, and ‘facilitates a process where individuals can jointly transform their knowledge.’ (2002:451–452). Thus, these three types of boundary objects might be useful toward understanding what types of design outcomes can be created through the interactions between designers and users in a design project.
For designer-user interaction, tangible artifacts and intangible interactions can function as effective boundary objects, which afford the discovery of meanings, definitions, and understandings between stakeholders in separate social worlds, different social groups, and multiple social actors. In this paper, I focus on two relationships between boundary objects and designer-user interactions to explore the design patterns of designer-user interactions. The first relationship identifies a boundary object as a shared design object between designers and users during a design project. The designer-user interactions create temporal design outcomes as design prototypes in the design process. The second relationship defines a boundary object as an action in order to generate designer-user interactions (intangible interactions) in the design process. Regarding the second path, the interactions between designers and users (intangible interactions) can construct or reconstruct the different temporal design outcomes (tangible artifacts) as their boundary objects, and the temporal boundary objects (design prototypes) also construct or reconstruct the designer-user interactions during a design process.

In this way, the theory of boundary objects supports the second research question — what relationships are observed between designer-user interactions (intangible interactions) and their temporal design outcomes (tangible artifacts) during a design process. From the theory of boundary objects on designer-user interactions, two interaction relationships can be identified: (1) what aspects of the designer-user interaction can strengthen a design outcome (a boundary object); and (2) what aspects of boundary objects can strengthen design interactions between designers and users (intangible interactions). These two relationships construct or reconstruct situated tangible artifacts (e.g. temporal design
prototypes), and the design outcomes can produce new intangible interactions between designers and users (e.g. dialogues) in the process of design.

3.3 Proposed Model

Drawing from theoretical backgrounds on Bourdieu’s theory of practice and Star and Griesmer’s boundary objects, I propose a model of designer-user interaction in Figure 2. The model of designer-user interaction deals with (1) the patterns of design refinement or design innovation sequences and (2) characteristics relationships in designer-user interaction in the design process.

![Figure 2. Model of Designer-User Interaction](image)

In this model, a design process is viewed as a social interaction phenomenon wherein designers and users become aware of their field as rules of action and habitus as modes of action with which they participate in practice of shaping designed artifacts. Not only do
they become aware of relevant implicit rules, assumptions, and perspectives, but they also have the opportunities to evaluate, examine, and expand them for design innovation.

Regarding the first research question-- the *patterns* of design refinement or design innovation sequences, I suggest the following distinctions between design refinement and design innovation sequences.

First, the design refinement sequence follows from field to habitus, and to practice in a design process. Designers reinforce the current core concepts and components of the product/service. Design problems are framed within the conventional definitions of the product/service. Designer-user interaction maintains field, habitus, and practice. The field in which the design problems and all relevant social conventions reside is reflected upon their habitus, and the habitus manifests itself in the practice.

Second, the design innovation sequence follows from habitus to practice, and to field in a design process. This sequence is motivated by significant changes of designers’ perspectives (i.e. habitus as modes of action) on design problems and requirements. Although designers usually moderate the significant changes, the changes are the result of enlightening interactions between designers and users. The knowledge shared from one domain and adapted to another domain encourages designer-user interaction to re-examine what they have considered as unchallengeable or inevitable (i.e. field as rules of action). Design problems reframed from new perspectives often lead to structural changes in the core concepts and components of the product/service. Both the design problems and solutions evolve in practice as stakeholders’ field is expanded and habitus is reformed.

Regarding the design innovation sequence, I hypothesize that designers’ attempts are
made to (1) question what stakeholders have considered normalcy and commonality (i.e. field); (2) convey their knowledge to various domains that can be broaden among other stakeholders’ field; (3) moderate analytical thinking on how the knowledge interrelates among various domains, as well as pertains to current design problems; and (4) facilitate analogical thinking to adapt design problems and solution ideas from one domain to another based on newly acquired knowledge. Such designer actions enable changes in habitus that trigger subsequent changes in field and practice.

Considering the second research question -- characteristics relationships by designer-user interaction, I hypothesize that designer-user action (intangible interactions) can function as boundary objects (tangible artifacts) that lead to the design innovation or the design refinement. There are conditions between designer-user interaction and their outcomes: (1) share and represent their knowledge in communicable forms, (2) find commonalities, differences, and dependencies between each other’s knowledge, and (3) make analogies for each other’s knowledge to transform it from one domain to another.

Based on the micro designer-user interaction on the theory boundary objects, I apply this to Bourdieu’s theory of practice as a macro structure of designer-user interaction in the design process. These actions would encourage designers and users to think beyond the limit of each other’s individual knowledge. The world they experienced / understood will be expanded and their perspectives from which they view current design problems (habitus) will be changed. Expansion of field—individual participants’ conventional understanding on how the product / service should work—follows when designers and users start to see alternative ideas. Subsequent practice of developing product / service reflects the changes in habitus and field.
With this proposed model (Figure 2), I explore the *patterns* of designer-user interaction in a design refinement and a design innovation; and (2) the *characteristic relationships* of designer-user interactions in a design process.
Chapter 4: Research Methodology

This chapter explains the empirical process for exploring a variety of interaction patterns between designers and users. To do this, I utilized two empirical approaches (Patton, 1980): (1) two field studies and (2) thirty-five interviews with designers.

Conducting both field observations and designer interviews allows for both indirect and direct empirical approaches. Field observation is a direct methodology to understand real situations of designer-user interactions. The outcome of field observation produces different types of real episodes with a researcher’s perspective of users and designers. The designer interviews are an indirect approach to understand the designers’ experiences through their own perspectives.

For the field studies, I recruited field research sites and conducted two observational studies. One site is a user-centered product innovation company and the other is an online service and mobile application company. To collect the data, I followed an ethnographic research process to gather data regarding the designers’ everyday interactions and activities in their design projects (Agar, 1996; Fetterman, 2009; Hammersley, 1995). I adopted a grounded theory approach (Charmaz, 2003; Corbin, 1990; Eisenhardt, 1989; Glaser & Strauss, 1967a) to understand the data contexts stemming from designer’s and user’s interactions.

For the qualitative interviews with designers, I recruited designers who reported direct user interaction experiences in their design projects. Thirty-five in-depth interviews were conducted. To analyze the micro-dynamics between designers and users, I followed the
three grounded theory development processes to produce a systematic understanding of
design project narrative throughout the design process. This analytical process required
that I construct relevant frameworks which reflect a series of logical understandings to
theorize the collected data.

In this chapter, I briefly present the process for the field studies and qualitative interviews.
Detailed methodological approaches for each will be explained in subsequent chapter
(chapter 5 through 7): chapter 5 shows the process of ethnographic research with two
field studies; chapter 6 represents the patterns of a design innovation and a refinement
based on the designer interview data; and chapter 7 presents the reflexivity patterns of
design and designer-user role interaction during a design process based on the interview
data.

4. 1 Field Study

For a direct understanding about real situations of designer-user interactions, two field
observations were performed. In order to select suitable research sites, I listed user-
centered design consultancies, IT consumer products, web-applications, software
development, and product design firms in the United States, Europe, and South Korea.
After sending the request for field observations to fifty companies, I received six replies
with positive feedback, and they requested additional information to accommodate me to
conduct a field study in their firms. Because of the confidentiality related to their clients,
only two companies decided to assist my research project. The one was a product design
consultancy located in Cleveland, OH and the other was a mobile application company
located in Seoul, South Korea.
The purpose of these field observations was to discover how the patterns of designer-user activities and interactions occur in real situations and to generate interesting episodes stemming from interactions between designers and users. In order to address this objective on field observations, this study utilized a grounded theory approach (Strauss & Corbin, 1990) to explore the proposed model (Figure 2). Given this model, I explored rich description of the designer-user interaction in the process of design.

The data were analyzed as follows: data from the field observations were titled with the specific name of a project, and the data were categorized as note-taking, daily reports, photos, audio recording, and video recording. In order to analyze these data, open, axial, and theoretic coding process were applied to clarify the latent patterns of designer-user activities and interactions during a design project based on a grounded theory approach (Eisenhardt, 1989; Glaser & Strauss, 1967b; Strauss & Corbin, 1990). These two field observations generated a variety of episodes and dynamic patterns to interpret the proposed model. Chapter 5 describes the detailed ethnographic field observation processes and the ways of interpretation on direct field experiences.

4. 2 Designer Interviews

To understand fully defined designer-user interaction project stories, I also conducted in-depth designer interviews in order to better understand the designer’s experience of their activities and interactions with users based upon User-Centered Design approaches.

To foster external validity and to address threats to the internal validity of designer’s interviews, I sent emails to user-centered design-related companies in the United States, United Kingdom, Europe, and South Korea. In addition, I contacted user interaction,
experience, and service designers using my personal network. For interviews, I only selected designers who have experience with a user-centered design approach, because the interview questionnaires included the activities, interactions, experiences, and roles of designer-user interaction in the context of UCD product and service innovation. From their replies, I randomly selected approximately 35 designers with the considerations of their experience in the UCD approach in IT consumer products, communication & telecommunication, and design consulting companies.

These thirty-five interviews were semi-structured (open-ended) in order to elucidate interesting real episodes from designers. These individual, face-to-face interviews were between 45 minutes to 1.5 hours in duration. All interviews were transcribed in English to support formal analysis of data. The interview transcripts were coded by using Atlas.ti, qualitative analysis software.

The first round of the coding process, open coding, dealt with the preliminary coding structure for the data. The second round of the coding process, axial coding, identified specific themes based on the first structural coding through a grounded theory approach. By using these two coding processes, in the theoretical coding process, I iteratively revisited the coding structures, themes, and descriptions to theorize the characteristic relationships between the designer-user interaction and the types of design outcomes in the design process. Consequently, these designer interviews developed a variety of patterns between the designer-user interaction and their resulting outcomes during a design process. Chapter 6 and 7 present the detailed processes for identifying patterns of designer-user interaction during a design process.
4.3 Data Collection

My data collection consisted of two field observations of the everyday life of designers and users and thirty-five interviews with designers. For the field observations, ethnographic techniques (Geertz, 1977; Hammersley, 1995; Spradley & Baker, 1980; Wolcott, 2005) were used to collect the data and the qualitative interview skills (Kvale & Brinkmann, 2008; Ulrike Schultze & Avital, 2011; Spradley, 1979) are applied to prepare interview questions and collect the interview data.

<table>
<thead>
<tr>
<th>Table 2. Summary of Data Collection</th>
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</thead>
<tbody>
<tr>
<td><strong>Two Field Studies</strong></td>
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<tr>
<td><strong>Field Sites</strong></td>
</tr>
<tr>
<td>Smartshape (3moths)</td>
</tr>
<tr>
<td></td>
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<tr>
<td>INS Lab (2months)</td>
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<tr>
<td></td>
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<tr>
<td><strong>Interviews</strong></td>
</tr>
<tr>
<td>(35 Designers)</td>
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<tr>
<td>Design innovation project stories</td>
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<td>Design refinement project stories</td>
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<tr>
<td>Designer reflexivity project stories</td>
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<tr>
<td>Designer role reversal project stories</td>
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<tr>
<td>Total</td>
</tr>
</tbody>
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I summarize the collected data of two field studies and thirty-five designer interviews in Table 2.

The data from two field studies were collected during five months. The first Smartshape field study was conducted for three months from Jan to Mar. 2011 and the second INS Lab field study was performed for two months from Jun to Aug. 2011. In the Smartshape field study, I observed five design projects that involved new product development & prototypes, and I interviewed the team members involved. Using ethnographic research techniques, I observed direct designer-user interaction data and collected the following data: (1) daily diaries (field note), (2) photo observation, and (3) audio and video interviews. In the INS Lab field study, I observed two design projects and interviews the
involved staff. Like the first field study, I collected video / audio records, photos, and field notes. Based on the two field studies, I built a data collection which includes titles of the specific name of a project, the data, and related data resources categorized as note-taking, daily reports, photos, audio recording, and video recording.

The interview data consist of thirty-five general design approaches and strategies and ninety nine detailed design project stories, which demonstrate designer-user interaction and their design outcomes in the design process. As Table 2 shows, there are (1) thirty-two innovation; (2) twenty seven design refinement; (3) twenty reflexivity; and twenty role reversal of designer-user interaction project stores. I transcribed the all video / audio recorded interview data in English, and the transcripts were 250 pages (interview data).

Further more detailed data collection processes are explained in chapter 5 (field studies) and chapter 6 (designer interviews).

4.4 Data Analysis

To analysis the collected data, I generally used a grounded theory approach (Strauss & Corbin, 1990). In the process of data analysis, I followed three stages of coding processes (open, axial, and theoretical coding) to identify the patterns of interactions between designers and users.

In this dissertation, I used two slightly different grounded theory approaches, because, the characteristics of my field study and interview data were different. For my field study data, I followed a protocol coding process based on the video, audio, and text file data using Atlas.ti. The detailed field study analysis process will be discussed in chapter 5. For
my interview data, I followed an alternative grounded theory approach, which focuses on visualization of designer-user micro activities and interactions. In the stage of open coding process, I iteratively read the transcripts and broke down data, concerning the meaningful interactions and activities. From the open coding process, the basic categories of designer-user interaction were outlined in the design process. Based on the open coding, I tried to convert the ninety-nine text based project stories into visual project stories, which illustrate the micro interactions and activities between designers and users in a design project. In the axial coding stage, I further developed the coding categories and detailed meanings comparing differences and similarities based on the ninety-nine transformed visual diagrams (the result of open coding). In doing so, I refined the outcomes from the open coding. Following that, I conducted theoretical coding to outline core categories and relationships for identifying the meaningful patterns of designer-user interaction in the design process. Through these three stages of coding processes, I conducted the data analysis using a grounded theory approach. The detailed interview data analysis process will be discussed in chapter 6.
Chapter 5: Designer-User Interactions without “Real Users”

This chapter presents the two extended field studies conducted in design and innovation consultancies over a period of five months. These two field studies followed an ethnographic research approach, in which I observed designers’ interactions and participated as a researcher in their everyday design processes.

From these two field studies, I explore how designers bring the user into the design without actual user participation in the design process. This led to a recognition of the difficulties associated with the inclusion of real users in the design process. The discovery at this stage related to the ways in which designers compensated for the absence of real users in the design process. To show this finding, I explain characteristic designers’ interactions in their design projects and present a case study (Yin, 1994) as an example of how designers brought “virtual” users into their design environments in the design process.

Figure 3. Outline of Two Field Studies
As Figure 3 shows, this chapter is divided into four sections.

In the first section of this chapter, I describe the objectives of the two field studies and the rationale to support the ethnographic research approach (Geertz, 1977; Hammersley, 1995; Spradley & Baker, 1980; Wolcott, 2005). In the second section, I focus on the first field study, which ranges from subjective to objective understanding of the designers’ everyday interactions in their design projects. Specifically, I explain a distinctive design project, which delineates designers’ attempts to bring “users” into a design project. In the third section, I describe the second field study, which identified a communication tool for reflecting users’ requirements in the design project. In the fourth section, I summarize the lessons from these two field studies.

5.1 Ethnographic Research

As a qualitative study, this study comprises two field studies that I observed real designer-user interactions in the two user-centered design companies. These two field studies performed ethnographic research (Geertz, 1977; Hammersley, 1995; Spradley & Baker, 1980; Wolcott, 2005) as a direct methodology to understand real situations of designer-user interactions. Understanding about designer-user interaction calls for a close examination of the everyday designers’ interactions and activities with users in their working environments. To learn how designers and users interact with each other in the design process, I conducted two field studies: SmartShape and INS Lab. For these two field studies, I collected data over five months. In detail, I spent three months in Smartshape and two months in INS lab. During the field studies, I also conducted in-depth interviews (Kvale & Brinkmann, 2008; Ulrike Schultze & Avital, 2011; Spradley, 1979) with employees in order to comprehend more detail backgrounds of projects’
stories and involved participants’ interactions. Overall, the ethnographic research settings can be divided as follows: (1) observations and impressions in a field; (2) designers’ interactions in multiple design projects; and (3) a case study illustrating a series of interactions for bringing users’ voices and roles into a design project.

These ethnographic research settings enable me to understand designer-user interactions based on their ongoing or temporal actions in a design project, and these different observation settings provide me opportunities in creating a structural view for how I can understand the given actual daily life data by a variety of angles. Consequently, the desired outcome of this field observation is to observe different types of real interaction and project case episodes from a researcher’s perspective of users and designers. In each field study part, I explain the detailed of my data, which combine observations, understandings, and interpretations about these two field studies.

The goal of my study is to elucidate the noticeable and latent patterns of designer-user interaction in a design process. These two field studies play a role in presenting current ongoing situations of designer-user interaction patterns as the preliminary discovery in my dissertation. Therefore, I searched for the appropriate research sites. To select suitable research sites, I listed user-centered design consultancies, IT consumer products, web-applications, software development, and product design firms in the United States, Europe, and South Korea. After sending the request for field observations to over 50 companies, I only received six replies with positive feedback, and they requested additional information to accommodate me to conduct a field study in their firms. Because of the confidentiality related to their clients, only two companies decided to assist my research project. The one is a product design consultancy located in Cleveland,
OH and the other is a mobile application company located in Seoul, South Korea. Based on this overall research setting processes, I summarize the following rationales of the selected two field study companies as suitable research sites of my study:

1. These two firms deal with design / technology innovation, which highlight user & customer centered approaches. Therefore, they have their own design strategy and a variety of design & innovation methodologies and methods in creating design / IT innovations in the design process. Moreover, the companies’ identities, slogans, websites, and their brochures identify themselves as user-centered design consultancies or user-driven development companies.

2. Considering the suitability of this research topic, their project portfolios and mission statements demonstrate that designer-user interactions and understanding users are central issues for them. As a researcher, I assume that these selected research sites will show the situated meanings of designer-user interactions in their design activities.

3. Regarding the site category in design-business paradigm, the first research site can represent the designer-user interaction focusing on the product design concepts, prototypes, and manufacturing issues during the design process. While, the second research site can demonstrate the designer-user interaction in the area of online applications and content solutions emphasizing the design concepts and the development issues between IT developers and designers in their design projects.
Although these two research sites cannot illustrate the wholeness of the other design processes such as 2D, software, and systems, these are relevant selections as preliminary field studies in my research.

5. 2 Smartshape Field Study

In this section, I demonstrate observation processes and findings from the first field study with the following: (1) overview of Smartshape field study; (2) observations and impressions; (3) three themes of designers’ interactions in their design projects; and (4) a representative case study.

5.2.1 Overview of Smartshape Field Study

After looking at local design & IT innovation consultancies and companies, I sent an email to Smartshape with a research plan, which described my field study, and the CEO gladly accepted on my proposal. After this, the company invited me to present my study plan and what I will perform there in front of the staff of Smartshape. With this series of activities, the employees understood my field study plan and I joined as an observer. This field study continued on during three months from the beginning of Jan to the end of Mar. 2011.

During three months (Jan. 1st–March. 30th, 2011), I conducted photo-observation, employee interviews, design project observation and participation, and special events and workshops. Normally, I visited this field study site five days a week from Monday to Friday from 8:30 AM to 5PM. Most of the time, I conducted my role as a non-participant observer and if I did not understand their activities and interactions, I directly asked about the situations and contexts and conducted short interviews with designers.
To grasp designer-user interaction in designers’ everyday design projects, I performed photo-observation, video-observation, participant interviews, and field-notes. In addition, I developed confessional field-notes in order to maintain a consistent perspective as an observer. During the project observation, I recorded, summarized, and interpreted designers’ interactions in my field notes.

I developed the daily field-note template and it allowed me to report my experiences in a self-reflective narrative, which focused on specific design events and tasks, actors (participated designers and other collaborators), environments (time, space, and conditional factors), and their interaction relationships among them. It was a quite self-oriented confessional story telling as a grounded approach based on my subjective understanding and interpretation from the field. On the other hand, it also showed how I can understand different ways defining what the field tells me and what types of designers and users interactions exist in the field. This process was useful to concretize the details of the field’s contextual situation, and it was also a process to identify a structural perspective to mediate between my subjective understanding and the practice in the field. Based on my daily field notes, I incorporated a field observation format from daily interactions for illustrating the specific moments in a design project. Specifically, there are two inter-related learning directions; first, I accepted certain meanings and messages from the field; and second, I projected my understanding and interpretation to the field. Based on these series of actions enabled me to shape a view as an academic researcher. Also, this process was useful to collect a relevant set of data.
Because their design projects are new product development directly linked to their clients, I and Smartshape’s employees (president and project manager) had an agreement about the degree of confidentiality. With this reason, they wanted to clarify my observation method and the level of involvement in a design project. Therefore, we compromised and separated four different confidentialities as follows: no involvement (highest), observation with only note taking, photo observation, and video recording (lowest). Based on this definition, we decided the level of confidentiality on each project before attending any observation.

### 5.2.2 Observations and Impressions in Smartshape

Based on this field study approach and data, in this section, I describe the overall observations and impressions, which include background and field environment in Smartshape. Second, I explain two designers’ interaction episodes: weekly design meeting and co-op innovation workshops.

#### (1) Background and Field Environment in Smartshape

**Background of Smartshape**

Based on three CEO interviews and introductory session with a project manager) at Smartshape, I understood their history of organization, innovative products, the areas of business concentration, and related topics and issues over time.

| Main Event: | A presentation by a project manager |
| Topic: | History of Smartshape |
| Main Players: | Project manager and I |
| Visual Resource: | Video recording, Confidential Power Point |
Smartshape started in 1989, and it is a user-centered product design & IT innovation consultancy located in downtown Cleveland. This company has core strength of creative design and innovative thinking which supports their clients by generating consistently fresh ideas and patentable intellectual property. The company is a medium size of design consultancy, which consists of 20 members as full time and part time staff such as creative industrial designers, engineers, and business strategists. Recognizing multidisciplinary working trends and a global economy, they expanded their globe offices for developing their operations called Smartmerit, located in Shanghai/Suzhou and Shenzhen in China over 20 years ago. Over the past 10 years, Smartshape and Smartmerit LLC have worked together toward developing the most efficient and effective process possible for quickly bringing products from concept to production.

To effectively develop their business and design prototypes and manufacturing solutions, they divided their working operation and systems as two parts: (1) design & innovation and (2) prototyping and manufacturing. The Cleveland office deals with the innovative design concepts and strategy part. Smartmerit serves the tooling and manufacturing part. Thus, I can summarize Smartshape’s three core competencies as a product design innovation company: (1) design & innovation; (2) physical prototypes; and (3) manufacturing. Based on these three strengths, they highlight the growing biomedical and health-care and technology design-business, because there are a variety of opportunities from their local business and infrastructure such as new Cleveland Medical Mart and Convention Center. For example, their previous projects dealt with a variety of topics stemming from consumer projects, IT devices, ATM machines to medical products. Based on the characteristics of projects, they partly applied user-centered design approaches, ethnographic research, and usability test and ergonomic studies in the design
process. Particularly, IT-education project with India Product Company was very innovative children education solution for an undeveloped country. Their most successful innovations, such as developing electric vehicle charging stations and advanced technology LED bulbs, represent their future design categories.

From historical understanding about Smartshape, I understood the real goal of Smartshape, and it was a quite different direction. They are a product-centered design innovation agency rather a user-centered design one. In addition, although there were few user-centered design projects, their most product design innovation and refinement projects depend on clients’ needs and requirements.

Field Environments in Smartshape

SmartShape has a 10,000 square foot headquarters in downtown Cleveland consisting of the creative design and innovation studio, engineering test lab, prototype shop, and manufacturing sample showroom. In addition, they have a physical prototype development room in the basement of the building. Like their company design directions, they have a decent design ideation and prototype environment. They have different size design project rooms and a conference room for their presentation and communication with participating stakeholders (users, managers, clients, and so on). In addition, the company has entertainment and communication spaces for their employees and social events, and they usually invited musicians or rent this space for local artists as an exhibition or an entertainment space.

SmartShape design environment is well organized with enough design studio and working environments. At Smartshape, they assigned a working space for me to observe
their working behaviors and to understand the ongoing situations. Designers’ activities and interactions were diverse in terms of their design projects. Most designers and engineers spent their time in the design studio and prototype rooms. The participating designers and engineers determined their roles and leadership based on their time availability, ability of skill sets, and the area of concentration on each project. To deliver more professional outcomes, they have weekly meeting to discuss all their design projects, each designer’s activities, ownership, and other financial processes as well.

With these well-established environments, Smartshape was a very dynamic agency, and they have well-educated designers and engineers who deliberate over the following: (1) what they should conduct in their design projects; (2) how they can communicate with each other in the processes of design; and (3) what they should operate in order to maximize their product outcomes (prototypes and design solutions).

(2) Two Designers’ Interaction Episodes

Based on video-recording, photo-observation, note-taking, and participant observations, I summarized their everyday activities and interactions. Their working behaviors and interactions were determined by involved projects. Therefore, the first week I tried to understand what projects they were working on, what members were engaged in their specific projects and what different stakeholders collaborated with each other in a design project. After spending time there, I observed two interesting designers’ interaction episodes. The first interaction episode was the weekly design meeting and the second one was the co-op innovation workshop.
**Interaction 1: Weekly Design Meeting**

Date: Every Wednesday Lunch  
Main Event: Weekly lunch meeting  
Topic: Overview and discussion about current / future projects  
Main Players: All Smartshape staff  
Visual Resources: Note-Taking (Video and Photos are prohibited)

All Smartshape employees regularly met every Wednesday. In this weekly meeting, the participants shared their working processes on their involved design projects that they performed during a week. In order to create a visual representation of past, current, and future actions, they created a historical working table on Excel sheet, which included current, ongoing, and potential their design projects. Looking in more detail, the table combined start date, customers, job names, projects, ownership, assignments, updated schedule, current status, and next steps for each project. During this weekly meeting, all staff argued about each project’s ongoing design processes, challenges, and the relationships with clients or other stakeholders. In addition, they discussed the financial issues such as invoices from clients and reconstructed the leadership of each project by asking how they will take care of each design project development and financial requests. Then, they suggested their own opinions on how they can move forward most effectively.

To have a more effective weekly meeting, they created an Excel chart (a working table) as a boundary object, which incorporated their weekly multiple actions. It represented the whole company’s weekly interactions and activities and was utilized as a communication method among designers for evaluating the past weekly development, understanding ongoing processes, or forecasting future orientations and interactions. The Excel sheet acted as an evolving boundary object and stimulated communication among designers.
During the meeting, participants (Smartshape staff) shared the activities and interactions that they conducted during a week and changed the contents on the Excel sheet. Also, they created ideas for future interactions and project plans. This series of activities and interactions reflected two different concepts about boundary objects between boundary object as an object and boundary object as an action. In this respect, the Excel sheet was an evolutionally developing boundary object.

Analyzing the weekly lunch meeting draws on Bourdieu’s theory of practice and describes how designers emerged, occurred in a sequence, and evolved their design activities and interactions during a design process. Based on my model in Figure 2, the weekly meeting involves a field, because it happens at lunchtime on every Wednesday and the Smartshape employees understand this as a rule within their weekly schedule. This weekly meeting as a field provides a guideline or direction for what they should prepare before, during, and after the meeting. It is habitus, which deals with invisible direction or guideline between the company (Smartshape) and individuals (employees). Based on the invisible direction, the participants of this weekly meeting represent and construct / reconstruct visible activities and interactions (practice).

Considering the three definitions of practice (the situated action), habitus (mode of action), and field (history of action), they can understand company’s history action (field) and the history of actions will give a certain weekly working design orientation (habitus), and the designers can conduct / reconstruct their situated design actions in this weekly meeting (practice). Using an interpretation of Bourdieu’s theory of practice, I can summarize the meanings of boundary objects based on this interaction episode. Weekly meeting is a field, participants’ design cognition and design orientation of weekly
meeting are habitus, and the set of their visible activities and interactions is practice. Particularly, the Excel sheet is a new type of boundary object, *boundary objects as a form of evolutorial action*, which accumulates multiple stakeholders’ interactions in their working environments.

**Interaction 2: Co-op Innovation Workshop**

Smartshape has performed a series of co-op innovation workshops with local and global innovation companies and consultancies. This was one the other interesting episode that I observed during my field study. This workshop presented an example how the Smartshape can explore different disciplines and build connection opportunities with other industries. In addition, the result of co-op innovation workshop with Avery Dennison can be interpreted for identifying an action-centered boundary object among multiple different business approaches.

<table>
<thead>
<tr>
<th>Main Event:</th>
<th>Co-op innovation (Jan. 12th, 201)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topic:</td>
<td>Co-op innovation with Avery Dennison and Smartshape</td>
</tr>
<tr>
<td>Main Players:</td>
<td>All Smartshape staff and four Avery Dennison employees</td>
</tr>
<tr>
<td>Visual Resource:</td>
<td>Audio-recording and note-taking</td>
</tr>
</tbody>
</table>

During on this observation, I understood what activities and interactions they conducted in the co-op innovation workshop.

At the beginning of the co-op workshop, the president of Smartshape explained they process how they could build the co-op innovation workshop and mission statement, which identified ways of understanding, sharing, and creating business opportunities and innovation issues between two companies. In order to inspire their motivation on the co-
op workshop, they presented each company identity, concentrations, and their design processes and solutions. The Smartshape project manager (Anthony) depicted the overview of Smartshape, which included company history, organization, scope of business and design domain, and their developed projects. Then, Avery Dennison also explained what they are, how their design concentrations, and how they can develop in their design processes.

Based on their presentations, I comprehended that these two companies had quite different working boundaries. Smartshape focused on product innovation with prototypes and manufacturing issues, while Avery Dennison highlighted them as a brand packaging solution company with three key issues: trends, innovation, and sustainability. On the other hand, they have a similar design direction as co-op opportunities. The two companies focused on technology innovation on their final solutions and the design processes also required a variety of user studies. For example, Avery Dennison explored different types of materials, forms, and manufacturing in order to offer the optimized brand solutions. Smartshape have discovered the ways for developing new health and technology devices. Therefore, they have different knowledge boundaries; however, technology innovation and user studies are common areas of research in the two companies’ design process.

After sharing general introductions, the two companies sought to discover how they could build a shared knowledge based on each company’s projects. Smartshape raised design issues on the STERIS project in which they developed a medical light solution in a surgery room. Avery Dennison discussed design challenges concerning labeling and recycling of their specific shampoo brand solution processes. As different design
boundary experts (product prototypes and tooling versus brand and labeling and recycling), they transfer, translate, and transform their own knowledge in order to take different experts’ perspective on their innovative design solutions. Also, they discussed what types of works they could work together each other in the future.

Considering the values of this co-op innovation workshop, the designers of Smartshape and Avery Dennison transferred, translated, and transformed their own knowledge boundaries, which dealt with their everyday design activities and interactions. Based on the collaboration workshop, the two different companies reinforced their knowledge boundaries and expanded new areas of their knowledge and practices by taking different perspectives. Moreover, the reinforced or expanded boundaries were inspired by the accumulated activities and interactions on each knowledge boundaries. There is a correlation between the concept of boundary objects and Bourdieu’s theory of practice in this episode. Using Bourdieu’s theory of practice, the co-op innovation raised two different companies’ interactions by sharing and arguing about their design project development. These series of interactions exemplified ongoing design reflexivity between the level of habitus and practice in order to reinforce or expand their everyday activities and interactions in their own boundaries. Through this series of interactions, each company incorporated their own boundaries as a different form compared to before this co-op workshop. This exemplified a new type of boundary object into their existing knowledge boundaries. Therefore, I conclude that a boundary object was created by two different companies’ interactions. I call this an action-centered boundary object emerging into the field of Bourdieu’s theory of practice.
In sum, these two designers’ interaction episodes in Smartshape inspired me to consider the relationships between the concept of boundary objects and Bourdieu’s theory of practice. These two episodes illustrate how multiple stakeholders or two different designer groups could interact with each other and create new boundary objects by transferring, translating, and transforming their knowledge boundaries.

### 5.2.3 Three Themes of Designers’ Interactions

During the Smartshape field study, I attended and observed five design innovation and refinement projects. These five observed projects are the sample of Smartshape design projects in which designer-user interactions create design outcomes in the design process.

<table>
<thead>
<tr>
<th>Projects</th>
<th>Design Category</th>
<th>Observed Events</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food Savor</td>
<td>New Product Design</td>
<td>New Product Concept &amp; Prototypes</td>
<td>Video Recording, Photo</td>
</tr>
<tr>
<td>Vaporizer</td>
<td>New Product Design</td>
<td>Concept Decision &amp; Development</td>
<td>Video Recording, Photo</td>
</tr>
<tr>
<td>Fish Tank</td>
<td>New Product Design</td>
<td>Product Ideation</td>
<td>Video Recording</td>
</tr>
<tr>
<td>Engineering and Medical Products</td>
<td>New Product Design</td>
<td>Product Prototypes &amp; Evaluation</td>
<td>Video Recording</td>
</tr>
<tr>
<td>Alpha</td>
<td>Product / Engineering</td>
<td>Problem-Solving</td>
<td>Video Recording, Photo, Note</td>
</tr>
</tbody>
</table>

As table 3 represents, Smartshape dealt with new product innovation and redesign by offering prototypes and manufacturing solutions for their clients. These samples revealed overall designer’s activities and interactions as a part of their whole project to generate new design and business impact. The food saver, vaporizer, and fish tank projects included new product ideations, concepts, and the development of prototypes. The engineering and medical product projects involve multiple designers, clients, and other outsourcing companies to evaluate current ongoing design ideas and prototypes.
The Alpha project dealt with existing product refinement project by focusing on problem solving in the design process. These project data identify companies’ identities, their own design knowledge and practices in the design process, and types of design outcomes as deliverable solutions. Based on the data, designers’ interactions and activities represent the process of discovering ideas and concepts and evaluating the temporal design concepts and prototypes in their design process.

**Three Themes of Designers’ Interactions**

All observed projects revealed the process between discovering designers’ interactions and resulted in design outcomes such as design ideas, concepts, and prototypes. From this project observation, I elucidated three themes: (1) transforming activities and interaction from individual to group ideas; (2) reflexivity with tangible and intangible activities and interaction; and (3) collaboration in everyday and infrequent interactions among designers.

**Theme 1: Transforming Interaction from Individual to Group Ideas**

The first theme, *transforming interaction from individual to group ideas*, shows how an individual designer can share original ideas and develop group knowledge. The Food Saver project is an example in discovering design ideas, concepts, and prototypes. In the Food Saver project, the designers’ interactions generated six conceptual design prototypes, which dealt with the issues of understanding design-business contexts, existing products, creating new value points among design, clients, and users. In this design session, designers discovered how they could identify new types of food savers.
As Figure 4 presents, the first theme includes three following actions: (1) understanding product / service contexts to create a shared common knowledge among designers, (2) generating individual ideas as design opportunities, and (3) sharing individual, collaborating each other, and integrating them as group ideas.

To understand product / service contexts for creating a shared common knowledge, the involved three designers examined the existing design products concerning their forms, functions, and styles. For example, they argued the existing food savers were black &
white color, steel materials, pretty simple and cleanly styled. Using Youtube videos representing food savers, they considered potential design improvements on current products. Also, they thought about the product mechanism linked to product & engineering design issues such as the position of handler, weight, and grip materials, process of sealing and sucking air, and so on. With this general group research process, they identified a major design challenge: what they can change a new design solution from a traditional huge and tall metal box style food saver?

Generating individual ideas as design opportunities, designers agreed to draw individual sketches for thirty minutes, and then discuss them. When they drew their own individual ideas, they kept talking about their ideas whether the other designers listened or not. When one designer drew his design idea as a conceptual prototype, he explained what he meant and gave reasons why it was useful as a new design idea. With this 30 minutes design ideation exercise, they generated different types design ideas as the first conceptual prototypes.

By sharing each of the individual design ideas, they actually developed all initial rough ideas together. They kept asking each other to develop more desirable functions, features, or forms in the design process. In this sharing and development process, they retouched the other designers’ ideas by adding or deleting design considerations. Based on that, they categorized and consolidated their design ideas. As a result, they generated six design ideas as conceptual design prototypes and the ideas stemmed from retro style food savers to internal and external bent over style ones. Finally, they discussed the next design actions from this ideation session.
Thorough this process, the theme, *transforming interaction from individual to group ideas*, reveals how the participants modify the design process from an individual to a group design action.

**Theme 2: Reflexivity with Tangible and Intangible Interaction**

Location: Smartshape Inc 3rd floor  
Date: Jan. 18th 2011  
Main Event: Design decision and concept development  
Topic: Vaporizer  
Main Players: Three Designers  
Visual Ads: Video-recording

As Figure 2 presents, the vaporizer project is a sample to present *reflexivity with tangible and intangible interaction* as the second theme. It synthesizes ongoing design ideas, prototypes, and concepts more desirable ways for identifying the next stage of design directions. In this project, the project manager and two designers developed the first prototypes (sketch or rough digital drawing). With these temporal outcomes (the first design prototypes), the designers discussed all design ideas to decide what ideas they should keep and take away for the future design development (the next versions of design prototypes).

When they criticized every design prototype, they worked together to develop each prototype and decided right directions or not. In this action, designers conducted design decision-making and design development at the same time. Like Food Saver project, they focused on how they can generate new prototypes compared to the existing projects. Therefore, their design direction was to create a combined idea called “vaporizer with
lighting.” With this evaluation and concept development action, they expanded the idea from the original functions of vaporizer to new design applications like a touch screen with smart phone, equalizer with temperature, led lighting, and so on. As a result of this design co-creation session among designers, they selected three existing prototypes to polish the first prototypes and also produced several alternative new ideas to be considered for the next round of prototypes.

In the process of these activities and interactions, designers continued the action, *reflexivity with tangible and intangible activities and interaction*, in order to identify a set of design directions and construct / reconstruct their design ideas, concepts, and prototypes in a design project.

**Theme 3: Collaboration in Everyday and Infrequent Interactions among Designers**

The third theme, *collaboration in everyday and infrequent interactions among designers*, shows two design actions: (1) discovering design ideas, prototypes, and concepts among designers in everyday interactions and (2) validating them in infrequent interactions.

The first design action, discovering design ideas, prototypes, and concepts among designers in everyday interactions, presents the previous two themes ((1) transforming interaction from individual to group ideas and (2) reflexivity with tangible and intangible activities and interaction) in designers’ everyday design interaction among designers, users or other stakeholders. While the second action, validating design ideas, prototypes, and concepts among designers or other stakeholders, represents *infrequent interactions* in the design project.
Date: Jan. 12th 2011  
Main Events: Engineering and Medical Product Project Meeting  
Topic: Engineering and Medical Project Evaluation and Development  
Main Players: CEO, an Engineer, a Designer, and a Project Manager in Smartshape office; Three different locations (client in Virginia, a working partner, and a manufacturing company)  
Visual Resource: Video recording

Engineering and Medical Product Project Meeting demonstrates the third theme, *collaboration in everyday and infrequent interactions among designers*. In this project collaboration, multiple companies located in different locations in U.S were involved and Smartshape also invited a professional project manager and an engineer to synthesize more desirable design-business solutions. Therefore, this project was made up of four members in Smartshape, a professional project manager, a client in Virginia, and an engineer working with Smartshape as an out-sourcing company. To set up this project meeting, they used gotomeeting.com for sharing their design documents to other involved designers from different locations.

The objective of this project meeting was to discover design directions by sharing different perspectives, ideas, and opinions. For the projects, they dealt with engineering and design projects and developed a variety of prototypes to identify design directions. In this project meeting, Smartshape designers shared their preliminary concepts (five different prototypes) about engineering and medical device projects and explained their design rationales to get feedback and recommendations from the participating designers and engineers.
In this meeting, they mostly argued about engineering issues focusing on project effective assembling or disassembling ways on current prototypes. For example, the project manager explained the detailed engineering and design issues from the other opinions and perspectives on participating clients, designers, and engineers. In this process, they encountered new engineering and design issues and clarified what prototypes they should select to develop as the next version or the final solution. In particular, they argued the suggested five prototypes (A, B, C, D, E, and F) to determine a mock up version prototype, which included grip and ergonomic studies. To do this, they argued A (simple and refinement) and F (risky and innovation) prototypes with different perspectives in-between simple vs. risky and refinement vs. innovation. This project meeting allowed me to understand a lesson—how everyday designers’ interactions can encounter different design perspectives by infrequent interaction. Thus, I can summarize this as collaboration in everyday and infrequent interactions among designers.

In sum, designers’ activities and interactions create design ideas, concepts, and prototypes in the design process. From these observed projects, the three themes can be summarized: (1) transforming activities and interaction from individual ideas to group ideas; (2) reflexivity with tangible and intangible activities and interaction; and (3) collaboration in everyday and infrequent interactions among designers. These three themes exist in everyday designers’ activities and interactions in the design project.
5.2.4 A Case Study: Designer’s Two Step Approaches

This section shows a case study of how designers bring users into design in their design process. In the Smartshape field study, Alpha project represents a case of product design refinement. In this project, I participated in designers’ project meetings and observed their design processes by asking the following questions: How can they improve the overall design process? Who are the major stakeholders in their project process? What types of designer-user interaction will they utilize in a whole project and a part of design process? How can they develop each step of the design process by strategic design actions and interactions? As a result of Smartshape field study, the Alpha’s network phone redesign process demonstrates how designers’ holistic design knowledge boundary can identify a strategic decision-making process to organize designers’ actions and lead to a successful design development regarding users’ requirements.

As Figure 5 shows, the new Alpha VSet12 phone is beautifully designed, with an attractive, friendly LCD color display that uses exclusive Status Symbols to let talent know what's going on in an instant. VSet12 can handle up to 12 phone lines, providing detailed line status, caller information and fader assignments at a glance. The info-rich
display shows caller ID for each line, along with time ringing-in or on-hold, and even screener comments from the VX Producer software application.

VSet12 gives talent unprecedented flexibility. It can map groups of lines to a single fader, making it simple to take a queue of calls to air sequentially — or use the Fader Assign function to map lines to individual console faders for precision control of multi-call interviews or conferences. One-touch controls let talent step through queued calls, busy incoming lines, lock calls on-air, even start an external recording device.

A built-in address book and call history log round out VSet12’s features; as with the rest of the VX system, each VSet12 has its own web server for easy remote configuration and software upgrades.

As Figure 6 shows, this project started because of users’ complaints. When users used the Alpha network phone, they felt electric shocks. Alpha understood that this was a serious product problem directly linked to users’ behaviors, product survival, and product sales as
well. Therefore, Alpha decided to work with Smartshape as an outsourcing design, product, and manufacturing division to identify the detailed problems and to discover design opportunities in order to synthesize a reliable solution. After Smartshape joined this project, they set up a communication route among Smartshape, Smartmerit, Alpha, and a manufacturing company working for Alpha. With this communication linkage, Smartshape and Alpha sought to define a project strategy and direction to identify problems. Also, Smartshape considered how they could create tangible prototypes as design solutions.

In this project, Smartshape designers tried to deal with the electric shocks as functionality and engineering issues. Based on this design orientation, they broke down this problem into two separate design issues: (1) finding an appropriate sink-mark position, and (2) changing the surface material and improving its quality. Therefore, in this product design refinement process, designers’ interactions can be summarized to conduct a rational approach as the following: (1) how to solve the electric shocks problem with a functional view; and (2) how to improve the product’s surface material and quality with a feature view. This approach used the designers’ habitus to overlap designers’ and users’ boundaries to meet users’ requirements (e.g. eliminating electric shocks) and improve the company’s decisions (e.g. product quality) through strategic problem-solving interactions in the product design refinement process.

**First Design Issue: Problem-Solving on Functionality**

Date: Jan. 11th 2011  
First Design Issue: Functionality of electric shock  
Main Event: Project meeting observation
Whenever they were working on a design project, I asked to observe the design event. Here, there were three actors (the CEO, an Engineer, and a Designer). Their major design challenge was to understand design problems and to find possible design solutions on VSet12, the Alpha’s digital conference phone. Their discourses began with the object of their current problem—the metal surface of VSet12, and they shared ideas about how they can change this material from metal to plastic.

As Figure 7 presents, when they changed the material, the critical issue was thickness of plastic and the position of sink-marker to connect the part of plastic body and metal body. The engineer explained the related issues between the sink-marker and thickness (tooling size). Then, he identified potential design issues that raised problems based on diverse ideas concerning different placement positions. When he described the technical design issues, the designer presented his opinions about the sink-marker positions and the thickness of surface. The CEO summarized potential design actions in order to clarify the given design issues and problems and to move toward a reasonable design solution.

To identify the most effective design solution, Smartshape collaborated with the three other stakeholders. As the figure 7 shows, the collaboration to solve this problem consisted of four different companies: (1) Smartshape (a design consultancy) and (2)
Smartmerit (a manufacturing company connected with Smartshape), (3) Alpha (client), and (4) a manufacturing company (engaged with Alpha). In this collaboration, the action of Smartshape was to share design issues with Smartmerit and to transfer technical issues to Alpha. This episode enabled me to understand the involved multiple-stakeholders’ interactions during a design project. From the series of design meetings on Alpha’s phone functionality issues, I interpret a picture to illustrate how designers can conduct design activities and interactions for innovative problem solving in a design project. Also, it is an example that demonstrates problem-solving activities and prototypes as boundary objects among multiple-stakeholders’ design collaborations.

**Second Design Issue: Problem-Solving on Surface Design**

Date: Jan. 17th 2011  
Main Event: Design Look & Feel and Decision-Making  
Topic: Alpha phone’s surface design prototypes  
Main Players: a Designer), a Project Manager  
Visual Resource: Video-recording

![Figure 8. Second Design Issue: Problem-Solving on Surface Design](image)

As the Figure 8 presents, as the sub-project group, two designers and one project manager made a surface design team in order to redesign Alpha’s phone surface design. Their design scope of redesigning product surface dealt with new logo design, phone interface design, and color variation on new suggested material prototypes. Therefore, they built different types of logos of Alpha and color variation studies on the phone surface. In addition, they developed different color variations of plastic prototypes and combined
logo and surface prototypes. As a result of this design process, a designer created 5 different graphic version prototypes of Alpha’s VSet12. The five design prototypes had different colors (15% degree difference) on the plastic surface. The designer and the project manager discussed which prototype was more attractive based on color variation, logo positions, and so on. Finally, they invited me to offer my opinions as a user voice to determine which prototypes were more desirable than the others.

![Figure 9. Interpretation of Alpha Design Refinement Project](image)

Looking at more detailed interactions between designers and users in this design project, as Figure 9 shows, it can be interpreted by designer-user interaction through Bourdieu’s theory of practice.

This project presents a case of product design refinement: in relation to the proposed model (Figure 2), the field (users’ complaints on the existing product) was expanded
through designers’ interactions about users’ complaints and pain points. The concept of field dealt with the established product (Alpha’s VSet12) and its forms and functions. Yet, users’ complaints on the VSet12 raised a design issue on existing rules and conventions about the VSet12. From the user’s voice, the company (Alpha) also determined this design issue as an important business issue, so that they created a design-business project in order to refine the existing product. This is a history of action in the field of Alpha product design refinement project.

The designers’ habitus is defined as action overlapping users’ and designers’ boundaries by identifying two design decisions. The first decision dealt with engineering and functional issues to discover the position of the sink-marker to solve the eclectic shocks. The second decision was to improve the surface design and material issue on the VSet12. These two design decisions as two modes of designers’ actions exemplified the habitus in this project.

The designers’ habitus reveals viable interactions at the level of practice; the designers have tested possible design opportunities, which combine engineering and design issues that address users’ requirements. As this figure 9 shows, the designers’ habitus allowed for designers to discover alternative actions regarding user requirements in the design project. With this regard, habitus represented visible designers’ activities and interactions (practice). The practice as situated actions (tangible designers’ interactions) was evaluated to reconstruct the other modes of habitus. Based on this reflexivity between habitus and practice, the design team suggested a final design outcome to the field, which changed the surface material from metal to plastic and changed the position of the sink marker in order to remove electric shocks.
5.2.5 Summary of SmartShape Field Study

Smartshape deals with a wide range of design innovations using dynamic brainstorming and develops a quick process to identify possible design opportunities and direction. To do this, they use a series of techniques (methods) such as brainstorming, concept ideation, and configuration development. Based on this design strategy, they also manufacture prototypes using 3D form development, aesthetic development, and human factors development.

As a user-centered design consultancy, Smartshape conducts strategically planned user research for their clients to expand their market segmentations. In order to address user desires and attributes, they perform the following series of interactions and activities: ethnographic user research, ergonomic evaluation, competitive product studies, trend research, technology research, user testing and validation, preference testing, and concept validation. Within this set of methods and techniques, and reflecting on the nature of each project, they determine the scope of their research activities. Based on a user-centered approach, they are able to point out unexpected values of innovative products for targeted users. To do this, they observe people and behaviors to identify user needs and discover opportunities for real innovation to support clients’ market positions.

The uniqueness of Smartshape, compared to other design agencies is that they are not a conceptual design consultancy but a prototyping and production company providing physical outcomes. Therefore, the most intriguing competency is their ability to generate a variety of cost effective prototypes by the collaboration with Smartmerit in China. The prototypes are powerful tools in the design and innovation process, and Smartshape
studies a prototype to learn and discover unforeseen opportunities for improvement in the process of their design / IT innovation. Therefore, they deal with prototypes from ‘looks-like’ to ‘looks-like + works-like’ prototypes and variations in between.

Smartshape defines itself as a user-centered design agency; however, in reality, I did not observe designers direct interactions with real users during my field observation. I assume the reasons regarding the lack of user interactions include: 1) they have lack of knowledge about theoretical or methodological approaches on designer-user interaction; and 2) they cannot conduct direct user interaction because of financial, time-consuming reasons, or the limited relationships with clients. Though there was a lack of designer-user interactions observed in my Smartshape field study, the designers identified the alternative interactions. Designers sought to consolidate user’s knowledge and practice boundary into their own. Resulting from the first field study, I present two design interactions, three themes of designers’ interactions, and a case study all demonstrating ways of bringing users into design. Therefore, designers accumulated the knowledge of users and applied it to their everyday interactions to understand users with indirect ways.
5.3 INS Lab Field Study

In the summer of 2011, using my social network, I contacted a colleague who works as a design director in a social media and mobile application agency called INS Lab. After reading the one page description about my field study plan, he discussed it with the CEO and called me to better understand the details. After two weeks, the INS Lab sent a letter to invite me for conducting a field study in their office. This second field study took place over two months from the beginning of June to the beginning of August, 2011.

In this section, I demonstrate (1) background and brief overview of INS Lab; (2) everyday designers’ interactions and observed communication issues between designers and IT developers; and (3) a full design project story as a case study.

5.3.1 Background and Brief Overview of INS Lab

INS Lab (http://www.inslab.co.kr) started their business in June 2010 with the knowledge and background about system development and user-centered design approach. As their mission statement defines, the company identities themselves as an intuitive software lab offering a holistic experience for users. This company discovers how software solutions can generate user values in the context of smart environments. With this vision statement, they define their three core service competencies in mobile and smart IT environments: (1) consulting strategy, (2) software solution, and (3) user values and experiences. To address the three service competencies, they summarize their business domains concerning corporate and customer issues to create intuitive experience for users.

Over the past three years, INS Lab successfully conducted projects with profit and non-profit organizations such as LG, KangwonLand, South Korean Assembly, City of Seoul,
and so on. Based on these major project experiences and their employees’ strengths, they have developed their strategies, processes, and solutions. Moreover, INS Lab staff has identified their leadership based on their previous working experiences at SAMSUNG Electronics, SDS, Microsoft, and Hyundai Motors and their knowledge in corporate, non-profit organization consulting and development, design awards, and professional writing.

As an IT consulting and development agency, INS Lab has characterized their project categories as follows: (1) development with five-innovation packages; (2) mobile ISP projects; and (3) development innovation projects. The first development with five-innovation packages combines five consulting areas and related solutions such as development organization, development process, software project visualization, continuous integration, and test strategy. The second mobile ISP project concerns how traditional PC-centric information systems can move toward mobile information systems. To do this, they perform information system solution case studies, service, mobile security, and strategic plans. The third development innovation project considers the development environments in order to reflect users’ needs and their life cycles during a design process.

As a user-centered software and experience solution company, they summarize their process with three steps: discovery, translation, and delivery. In the discovery stage, they conduct a series of actions such as understanding context, identifying problem statements, ideations, and project blueprint. In the second translation stage, they conduct multi-layered analysis, innovation worksheet, and multi-layered synthesis. Finally, in the delivery stage, they integrate execution.
5.3.2 Designers’ Interactions and Observed Communication Issues between Designers and IT Developers

My second field study was conducted at INS Lab, a social media and mobile application company, located in Seoul, South Korea. To create new mobile contents & solutions, this company utilizes their fast communication and decision-making as the principal capability to create a variety of versions of prototypes. As a medium sized design agency, this organization is made up of only seven creative designers, eight IT developers, and the president. Yet, they recognize how they can best manage their workflow effectively. This organization is divided into two departments—creative design and IT development.

During two months (June ~ August, 2011), I conducted photo-observation, employee interviews, and design project observations. Normally, I visited this field study site five days a week, from Monday to Friday, from 9:00 AM to 5PM. Most of the time there, I conducted my second field study as a non-participating observer. In addition, I performed
short interviews with creative designers and IT developers to understand better the working environment and their everyday design activities and interactions. Like the first field study, I performed photo-observation, video-observation, participant interviews, and field-notes. Based on the lesson from the first field study, I developed a confessional field-note to maintain a consistent perspective as an observer. During the project observation, I recorded, summarized, and interpreted designers’ interactions in my field notes.

The first impression of the second field study in INS Lab was the dynamic of working together between design and IT departments. Two directors (design and IT parts) and the creative designers and IT developers well understood what they were doing in a design project and how they could collaborate with each other designers or IT developers. In the project development, they developed information data for their current and future projects and used the existing company database. To use this, they protect company confidential materials and share their project experience among internal designers and their clients as well. During the design projects, the design team members showed more dynamic actions than IT developers, and the creative designers created their own design methods and histories that they used in their design projects. Although this design agency was very young, these accumulated data defined the knowledge and history of actions, which would be helpful to identify design directions in the planning stage and to save time in the design projects. Based on the interview data with the staff, I summarize two core issues of designers’ activities and interactions: the first issue was identity of the company and the second was communication between creative designers and IT developers.
Regarding the first issue, during interviews, most IT developers and creative designers were confused in response to my questions about company strategies, directions, and methodologies, and especially user interactions. Most IT developers did not understand what the company’s identity and core business directions are, and they did not think much about the strategic direction of the company as an IT developer. But this was a symptom from the culture of IT developers not to share the whole ideas that they were thinking about. This symptom was linked to director interviews as well. The two directors shared their own opinions on company identity, reporting that INS lab has discovered the business areas and identified their positions on changing markets. Yet, they have not defined the position as a design agency or a system development company. As an observer, I found that they needed to communicate with each other to incorporate the identity of company among CEO, creative designers, and IT developers.

Considering the second issue, communication between creative designers and IT developers, they showed two inter-related communication problems between creative designers and IT developers in the design process. First, this company utilized a different design development approach called “design first IT later” compared to traditional IT or system companies. It made IT developers confused, because they conducted IT developer-centered design, and then user interface (UI) and creative designers followed the technical directions in order to develop a ‘Look and Feel’ version of design outcomes in most IT / system companies. On the other hand, this company has sought to develop, first, design-centered concepts and, then, IT developers considered effective techniques or methods within the design directions in collaboration with creative designers. Based on this approach, they had communication challenges at the first stage; however, they came to understand the benefits of designer-centered approach, because it was a suitable
direction, producing more attractive user experience design and design outcomes. Second, sometimes, the creative design and IT development departments had conflicts because of knowledge and practice boundary issues. They always complained about the issues when they collaborated with the other department; who will take charge of a certain design action? How can they manage the collaboration issues to improve the quality of their current prototypes and outcomes of the design project?

In sum, this company had a dynamic culture and explored new types of design approach from the traditional IT / system direction to alternative creative-centered project approach. With this approach, they tried to solve their identity issue and communication problems between creative designers and IT developers. In addition, the following project case will demonstrate how they can elucidate their own problems, discover alternative opportunities, and solve the given problems.
5.3.3 A Case Study: Creating a Communication Protocol

As a mobile application agency, INS Lab conducted a mobile design solution project for the Korean assembly. This South Korean assembly project presents a case of new mobile application design. In this project, they developed a mobile solution with sub-contents (http://www.assembly.go.kr/mobile/sim/). This project began with the CEO’s individual social network and previous clients. This project objective was to create a new mobile assembly and they planned a series of different mobile solution applications under a mobile assembly solution. Thus, this project, called ‘Unquest,’ was a part of the whole mobile solution.

In this Uniquest project, I observed the activities and interactions between creative designers, IT developers, and the CEO (project leader). Here, I focused on how these three different stakeholders sought to understand users and their needs to characterize design features and functions into a design environment. During this project, I asked the following questions: (1) how do these different groups of people improve the design processes; (2) what types of designer-user interactions will they utilize in the project; and (3) how do stakeholders communicate with each other in order to elaborate users’ needs and requirements in the design process. As a result of the second INS Lab field study, the Uniquest project demonstrated how designers and IT developers can create a boundary object as a communication protocol for identifying a strategic decision-making process to understand users’ needs and everyday activities in the design project.

Figure 11 demonstrates how the designers (creative designers, IT developers, and CEO) and users (the congressmen and their assistants) communicated with each other and developed temporal design outcomes (different types and levels of prototypes) in the
design project. Also, it illustrates each stage of designer-user activities and interactions, reflecting changing decisions and behaviors in the design process over time.

First Stage: Designer-User Interaction with Prototypes

At the beginning of ‘Uniquest’ project, the CEO observed the daily life of the congressmen and their assistants. Every morning, the assistants compiled the days main headline news from most newspapers and they searched the important news of the previous night. This method was exactly the same for all of the congressmen’s assistants. The CEO considered the possibility of the company creating an IT compiling service as a solution to the mobile assembly project. The users (the assistants of congressmen) would be productive, gathering a variety of news and events from the previous night. Also, the service solutions would be fruitful for the congressmen in terms of quality and quantity. With this insight from the field (South Korean Assembly), the CEO of INS Lab discussed how they could create a service design solution, and creative designers and IT developers

Figure 11. Case of South Korean Congress Assembly Mobile Solution

First Stage: Designer-User Interaction with Prototypes

At the beginning of ‘Uniquest’ project, the CEO observed the daily life of the congressmen and their assistants. Every morning, the assistants compiled the days main headline news from most newspapers and they searched the important news of the previous night. This method was exactly the same for all of the congressmen’s assistants. The CEO considered the possibility of the company creating an IT compiling service as a solution to the mobile assembly project. The users (the assistants of congressmen) would be productive, gathering a variety of news and events from the previous night. Also, the service solutions would be fruitful for the congressmen in terms of quality and quantity. With this insight from the field (South Korean Assembly), the CEO of INS Lab discussed how they could create a service design solution, and creative designers and IT developers
built the Unigrant team under the mobile South Korean Assembly project.

As a fast prototyping mobile solution agency, the creative designers and IT developers (designers) worked together under the direction of two project managers (creative and IT directors). The two teams (creative designers and IT developers) considered what components and functions they could develop, and how they worked together. In this project, the design team first developed the design scope, standards & guidelines, and the basic blueprint. With this basic structure, IT developers collaborated with the design team in order to determine the functionality issues based on the design teams’ first version of ideations. With this design decision-making, the creative design team started to produce key frame sketches to identify the components of this mobile application and considered the issues of user interface and navigation concerning user journeys. The IT development team started to generate the domain of technical issues, which deal with the effective and efficient navigation of the first design idea. As a consolidated concept, the two design teams very quickly developed the first version of prototype.

Second Stage: Designers’ Decision—Generating Multiple Manuals

At the second stage, the CEO met the real users (the congressmen and their assistants) in order to simulate the first prototype with users and to acquire evaluation and feedback from them. With this interaction with users, the users’ reaction and result of this evaluation session brought the INS designers and IT developers (designers) to a design dilemma. There were a couple of reasons why designers and users did not have shared communication boundaries among them. The first reason was that the users did not have any previous experiences with assembly mobile application solutions, although they used web applications or other services. Second, they considered the service solution of digital compilation of newspapers a very new function compared to their previous behaviors.
Thus, they could not make a decision directly and needed more time to decide which one is better in creating comfortable performance. Moreover, they wanted to see and test the other prototypes as well. From this evaluation stage with real user interactions, the creative designers and IT developers (designers) identified a communication problem among users and designers (creative designers, and IT developers). In addition, the designer group had different development communication issues between creative designers and IT developers when they tried to understand users in the design process.

To address this communication problem, the CEO and project managers considered how the involved designers could solve this problem. Also, how the creative designers and IT developers (primary designers in this project) could discover alternative ways to combine the multiple complex issues, because they believed that no single person could fully understand the whole development process. With this consideration, the CEO suggested creating a variety of versions of manuals. This suggestion confused the creative designers and IT developers, because they did not have any definition and direction for creating a manual, nor did they have any experience for generating a manual before or during a design project. The creative design manager argued what a manual should be in this project, why they should create this manual, how they could create it, and so on. These issues inspired the other designers (IT developers, creative designers, and CEO) to think again what issues they were addressing in this project and how they could effectively understand users’ needs and requirements to move toward the next stage of the design project.

Based on these endeavors to identify concepts and versions of manuals, the designers decided on two different types of manuals. Creative designers and IT developers
developed their own versions concerning how users could understand multiple complex information and requirements within their current prototypes. The creative designer-centered manual revealed how they can generate design components and visualize functions and features based on users’ actions on the first prototype, while the IT developer-centered manual described how they can build technical, functional navigation concerning user interactions on the first prototype. These two manuals from the creative designers and the IT developers identified tangible knowledge boundary objects as internal mutual knowledge and practice between them. Also, the manuals worked as communication protocols for representing creative designers’ and IT developers’ common and different interpretation about users’ needs and requirements in the design development.

**Third Stage: Identifying an Integrated Manual**

From the second stage, designers (creative designers and IT developers) generated two versions of manuals, and they represented different understandings of users with their own perspectives: creative designer-centered and IT developer-centered on users. With these two manuals, the two groups (creative designers and IT developers) sought to incorporate a communication protocol in order to understand an effective guideline for the next prototype. During the process, creative designers and IT developers shared their own manuals and explained why they created these features and functions and how users can navigate the tasks represented in the manuals. Based on these two separate versions of development manuals, they integrated the final one as a communication boundary object, in which they posit users as the center of their development process. As a result, the designers and IT developers created a consolidated manual as a boundary-crossing object that included multiple views on users.
Consequently, users (the congressmen and their assistants) understood the whole development process, how designers and IT developers considered design aspects and components (e.g. forms and functions) in order to create an assembly mobile application solution. In addition, the users argued what behaviors and interactions were different or should be changed to reflect everyday life in the guidelines of the manual. Also, users determined what forms and functions were suitable for them or not and suggested how designers should change some features and functions based on the consolidated manual as the final solution.

In sum, designers have encountered an important challenge to capture users’ hidden needs and a series of information as users’ requirements in the project development process. In reality, congressmen and their assistants (users) were so busy that they cannot interact with users many times. Also, the field study was conducted in a very confidential location with limited direct user interactions. Therefore, creating a manual as a communication protocol was a novel approach as an alternative method to understand users indirectly.

My observation of the project reveals that the process was one of mutual communication processes incorporating (1) internal boundaries between two different designer groups and (2) external boundary with users. The objective of creating a manual is to create an image of users by asking how two different internal designer groups can interpret them. Here, the manuals represented indirect interactions with users based on the designers’ mutual understandings. Also, the consolidated manual from the two internally developed manuals created a communication protocol to facilitate direct to user communication. It means the actions followed from two internal boundaries to consolidate a mutual
boundary between two designer groups. Then, it externally linked to the issues between designers and users as the other mutual boundary in the design process.

In sum, it was a series of actions for creating a clear-cut mutual image between two different designers and among designers and users. Also, it was constructive to create a straightforward set of activities and interactions as an action plan. Moreover, it was a strategic approach as an optimized solution guideline to provide insights into how designers incorporate the users’ valuable evaluation and feedback in the design process.

Considering the all-inclusive interactions between designers and users through Bourdieu’s theory of practice, Figure 12 demonstrates a mobile application of the company’s organization design as a case of service design innovation. In relation to the proposed model (See Figure 2), field (a newly identified communication protocol as an outcome) is expanded with the designers’ endeavors to understand users by reflexivity between habitus and practice. As I mentioned earlier section on 5.4.3 (a case of Unquest project), designers sought to understand communication problems between designers and users. Based on the proposed model, field does not exist in terms of the history of actions and existing products & services in the Unquest project. Therefore, the company did not have any previous accumulated history of actions.
Based on these reasons, this project started with habitus as an expanded design orientation to identify communication problems between designers (creative designers and IT developers) and users (congressmen and their assistants). As a design orientation or proposition, the designer groups (CEO, creative designers, and IT developers) decided to identify different versions of manuals as a strategic design direction (habitus). With this design objective, direction, and proposition, they sought to synthesize two different versions of manuals (creative designer manual versus IT developer manual) in order to better understand users. From the designers’ orientation for understanding the importance of communication problems in habitus, designers created multiple manuals regarding users’ needs and requirements in practice.
To do this, creative designers and IT developers developed their own version of ideas and concepts of users and shared the common and different knowledge and interpretation on users’ needs and requirements (practice). Additionally, the internal designers (creative designers and IT developers) have changed their design ideas, actions, and outcomes based on their communications on two different versions of manuals in the design process. Through this reflexivity between changing designers’ invisible design propositions (habitus) and designers’ visible design activities and interactions (practice), they identified a consolidated manual as a history of action (boundary object in field) between two different designer groups.

5.3.4 Summary of INS Lab Field Study

As a user-centered design application and mobile solution company, INS Lab and its employees understood the methods and interactions of user-centered design processes fairly well; however, during my field study in INS Lab, I observed few real user interactions in their projects. In the second field study, creative designers and IT developers had slightly different cultural understandings of users’ roles and involvement in the design process. Also, the Congressman Mobile Apps project case study, presents how different designers (creative designers versus IT developers) develop their own methods (e.g. manuals) to understand each other and synthesize users’ requirements in the process of identifying an integrated manual. The designers’ interaction was an alternative method for bringing users into their design and IT development processes.

Similar to the first field study, there were no physical designer-user interactions in the field. Yet, designers have identified alternative design approaches to invite users into the design process.
5. 4 Lessons from Two Field Studies

Based on the two field studies, I conclude that there are huge gaps between ideal design methods and practices, and real designer-user interactions. In the published research, researchers have conceptually discussed the importance of user-driven innovation, user-centered design approaches and methods, co-creation between designers and users, and the values of participatory interaction. On the other hand, based on my two field studies, designers regarded designer-user interaction as knowledge and the interactions with real users were very limited and expensive.

Instead of this costly approach, the designers considered virtual users without necessitating real interactions in design. Although I did not observe real user interactions in their design projects, designers conducted user studies in limited design processes, insufficient design concept evaluation, and partial prototypes testing with users. In reality, the designers theoretically understood the ideas, concepts, and practical methods for bringing users into their design project; however, the alternative ways for inviting users to design were applied to inspire designers’ collaborations when real users to synthesizing ideas, concepts, and prototypes in the design process were unavailable. Therefore, the designers’ interactions reflect users’ ideas in order to encourage designers’ interactions in the design process.

Consequently, the outcome of these two field studies allowed me to develop a better understanding of where designer-users interactions occur. To understand effective ways of interacting with users in the actual design projects, I set up a qualitative study, which conducted interviews with thirty-five designers. From these interviews, I sought to
understand real designer-user interaction from their project narrative. This process is outlined in the two later chapters (chapter 7 and 8)
Chapter 6. Research Using Qualitative Designer Interviews

From the two field studies in chapter 5, this chapter demonstrates rationales to conduct the second qualitative research, which deals with thirty-five designer interviews. Based on the rationales, I summarize the research design and methodology, which includes the issues of data collection, data analysis, and developed criteria & identified visual elements in the second empirical research.

6. 1 Rationale from Field Studies to Designer Interview

As Figure 13 shows, I observed designer-user interactions do not exit from the two field studies and realized that the user participation and actual designer-user interactions are an ideal approach in the real design process. Thus, I decided to stop conducting field studies.
with ethnographic techniques and considered the other empirical approach to capture the actual designer-user interactions in the design process. As a result, I set up a qualitative study to perform thirty-five designer interviews to understand effective ways of interacting with real users in the design projects.

There are rationales to conduct a qualitative interview with thirty-five designers. First, I did not find any actual designer-user interactions from two field studies. The two field sites only virtually communicated with users without real interactions in their design projects. Therefore, field studies with ethnographic research techniques will not be a relevant research methodology to observe the actual designer-user interactions during a design process. Second, I hypothesize that designer-user interactions will be encountered in the parts of a design process rather than a whole design process. Thus, I decided to conduct a qualitative designer interview because there are a variety of designer-user interactions in their project episodes. Also, it would be a relevant research methodology to understand how designers could interact with actual users and how they could co-create each other in the design process.

6. 2 Collected Data

As a qualitative research, I sought to analyze actual designer-user interactions in their real project episodes. During the interviews, I asked six questions about how designers could interact with actual user and incorporate their design outcomes in the design process. The first question was to understand designers’ general designer-user interaction strategies and methodologies in their organizations and design processes. The second was to collect their design innovation project narratives, while the third question was to acquire designers’ refinement project narratives with actual designer-user interactions. The fourth
question was to understand designers’ fundamental definitions about designers’ and users’ roles and actions in the design process. The fifth question was to gather design reflexivity project narratives. The sixth question was to collect designers’ and users’ role reversal project experiences in their projects. Based on these six questions, in this research, I decided four research questions, which deal with designers’ project narratives (innovation, refinement, design reflexivity, and role reversal project narratives) as a collected research sample.

**General Description of the Collected Data**

In this study, I collected ninety-nine design project narratives from the thirty-five designer interviews. In the data collection, the thirty-five interviewees (participated designers) tried to share their project episodes on each question; however, the numbers of project narratives are slightly different based on the designers’ roles and companies’ directions. Some designers take responsibilities to work as design strategists or conceptual designers in design innovation companies, while the others’ roles are to work as usability designers in their design organizations.

<table>
<thead>
<tr>
<th>Questions</th>
<th>Number of Data</th>
<th>Design Artifacts</th>
<th>Products</th>
<th>Software/Systems</th>
<th>Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovation Project Narratives</td>
<td>32</td>
<td></td>
<td>12</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td>Refinement Project Narratives</td>
<td>27</td>
<td></td>
<td>11</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>Reflexivity Project Narratives</td>
<td>20</td>
<td></td>
<td>11</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Role reversal Project Narratives</td>
<td>20</td>
<td></td>
<td>7</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>99</strong></td>
<td></td>
<td><strong>41</strong></td>
<td><strong>38</strong></td>
<td><strong>20</strong></td>
</tr>
</tbody>
</table>

With this reason, as Table 4 shows, the collected interview data presents the different number of data on each question. It has thirty-two innovation, twenty-seven refinement,
twenty reflexivity, and twenty role reversal project narratives. Particularly, only 20 designers among 35 designers shared their project experience on reflexivity and role reversals, because they did not have reflexivity and role reversals in their design projects.

**Two Data Issues: Design Artifacts and Design Processes**

To show the content validity on my collected interview data, I analyzed this with two aspects: (1) design artifacts and (2) design process. The aspect of design artifacts shows what type of design projects involves actual designer-user interactions, while the design process aspect represents when the designer-user interactions encounter, occur in, and evolve in the design process.

**Design Artifacts**

Table 4 shows a summary of thirty-five designer interviews and their design project narratives with the issue of design artifacts. The collected data shows a well-balanced sample size among products, software/systems, and service design (41 products, 38 software/systems, and 20 services). Also, each question (design innovation, refinement, reflexivity, and role reversal) has a similar ratio in projects, software/systems, and services.

**Design Processes**

Theoretically, the designer-user interactions would be defined as the following four stages: design research, analysis, synthesis, and development. Yet, this interview data does not deal with the whole design stages, because the designer-user interactions do not encounter, occur in, and evolve in the every moment of the whole design process. I
consider the reasons of the difference between theoretical and actual designer-user interaction moments in the design process.

The reasons are associated with designers’ job characteristics and mission statements in their design projects. As a result, most actual designer-user interactions encounter in design research or development. In general, designers identify a project statement, which include a set of problem definitions by discovering users’ information and their design environments in the design research stage. Also, designers validate design ideas, problems, and solutions in the design development stage. On the other hand, design analysis stage remains only for designers to analyze user information and design environments with virtual interactions with users, while design synthesis stage has limited interactions with actual users in order to synthesize their design ideas, problems, and solutions in the design process.

<table>
<thead>
<tr>
<th>Table 5. Summary of Interview Data Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collected Data</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Project Narratives (N)</td>
</tr>
<tr>
<td><strong>Innovation (32)</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Refinement (27)</strong></td>
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<tr>
<td></td>
</tr>
<tr>
<td><strong>Sub Total</strong></td>
</tr>
<tr>
<td><strong>Reflexivity (20)</strong></td>
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<td></td>
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<tr>
<td></td>
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<tr>
<td><strong>Role reversal (20)</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Sub Total</strong></td>
</tr>
<tr>
<td><strong>Total: 99 Project Narratives</strong></td>
</tr>
</tbody>
</table>

Based on the argument about the design process of the collected data, Table 5 presents where designer-user interactions could encounter in their design projects, and I identify
three designer-user interaction spaces in the design process: (1) research (R); (2) research & synthesis (RS); and (3) research & development (RD). These three D-U interaction spaces represent where designers could interact with actual users in the design process.

From the collected ninety-nine project narratives, the data consists of thirty research (R), twenty research & synthesis (RS), and forty-nine research & development (RD) project narratives. Considering design innovation and refinement data (32 design innovation and 27 refinement project narratives), they have 30 R, 5RS, and 24 RD, while reflexivity and role reversal data (40 project narratives) have 15 RS and 25 RD. Considering thirty-two design innovation project narratives (12 product design, 11 software/systems, 9 services), they consist of 15 research, 3 research & synthesis, and 14 research & development projects. Specifically, 12 product innovation project narratives have 6R, 1RS, and 5RD. 11 software / systems innovation project narratives have 8 RD, 1RS, and 2R. 9 Service project narratives involve 7R, 1RS, and 1RD. Among twenty-seven design refinement project narratives (11 product, 12 software / systems, and 4 service project narratives), they comprise of 15 research, 2 research & synthesis, and 10 research & development. The 11 product design narratives have 7R, 1RS, and 3RD. 12 Software &Systems have 6R and 6RD. 4 Service projects have 2R, 1RS, and 1RD. For twenty design reflexivity projects (11 products, 7 software/systems, and 2 services), they deal with 4 RS and 16 RD project narratives. The 11 product projects have 9RD and 2RS. 7 software / systems projects have 6RD and 1RS and 2 services have 1RD and 1RS. Twenty role reflexivity project narratives (7 products, 8 software / systems, and 5 services) made up of 11 RS and 9 RD. The 7 product projects have 4RD and 3RS. Software / systems projects have 3RD and 5RS, and service projects deal with 2RD and 3RS. From Table 5, I might conclude
that design innovation and refinement projects mainly deal with R and RD, while design 
reflexivity and role reversal products more focus on RS and RD.

In sum, the objective of this study is to explore patterns of designer-user interactions in 
the design process. In this section, I demonstrate the potential issues on the collected data 
regarding design artifacts and processes. Yet, my research subject is to discover the 
patterns of designer-user interactions, which highlight the forms of designer-user 
interactions and their applied methods in the design process. Therefore, I hypothesize that 
designer-user interactions do not have quite a different propensity among design artifacts 
(products, software/systems, and services). Also, they would encounter mainly two 
design stages (design research and development) and some limited interactions on design 
synthesis stage. Therefore, I identify three designer-user interaction spaces: (1) research 
(R); (2) research & synthesis (RS); and (3) research & development (RD).

6.3 Data Analysis

Based on the data from the collected interviews, I performed two analytical approaches to 
elucidate the designer-user interaction patterns. As a preliminary data analysis, in the first, 
I conducted thematic analysis to demonstrate the characteristics of designer-user 
interactions and the different types of design innovation and refinement. As a result, I 
clarified 157 codes in the innovation data (thirty two design project stories), which 
represent the characteristics of designer-user interactions and the types of design 
outcomes from their interactions. Yet, the result did not support my research questions, as 
it was challenging to identify the forms and steps of generative interactions between 
designers and users in the design process. Therefore, I performed the second micro 
dynamic pattern analysis to represent a variety of generative patterns between designer-
user interaction and their resulting outcomes in the design projects. Consequently, I theorized 15 patterns (9 design innovation and 6 refinement), which demonstrate designer-user interaction identified by the types of design innovation and refinement during a design process.

During the design analysis on the collected data, I performed two grounded theory approaches to identify relevant frameworks, directions, and guidelines on collected project stories (episodes) as analytic methods.

### 6.3.1 Preliminary Data Analysis

As a thematic analysis, I elucidated the thematic relationships between characteristics of designer-user interaction and their resulting different types of innovation / refinement outcomes. To do this, I sought to understand a grounded theory approach, which includes open, to axial, and to theoretical coding processes on the data. In the open coding process, I clarified eight innovation and nineteen designer-user interaction themes (27 themes) based on 157 codes in the innovation data (thirty two design project stories), using Atlas.ti, qualitative research data analysis software. Based on the open coding, I outlined the characteristics of designer-user interactions and the types of design innovation / refinement as a result of the axial coding process. Following that, I tried to make a thematic relationship between designer-user interactions and the types of design innovation / refinement in the design process.

Throughout this analysis, I realized a limitation of the first data analysis approach. It did not present generative actions concerning how designer-user interaction can lead to different types of design innovation and refinement in the design process. In this regard, the first approach was not a suitable data analytic approach to measure / consider my data,
which included a micro dynamic behavior path between designer-user interaction and their resulting outcomes during a design process. Thus, I decided to conduct the second analysis with the micro-dynamic pattern analysis approach.

6.3.2 Micro Dynamic Pattern Analysis

To understand generative actions between designers and users, I investigated fifty nine project stories with a micro dynamic pattern analysis. In this data analysis process, I transformed all transcribed design project stories as visual process sequences to understand the micro dynamic patterns of how designer-user interaction went thorough a procedural path in creating design outcomes over time. In this analysis process, I used the sequence diagrams as an analytic tool for exploring the patterns between the designer-user interaction in the design innovation and refinement sequences.

<table>
<thead>
<tr>
<th>Open Coding</th>
<th>Axial Coding</th>
<th>Theoretical Coding</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Develop Codes, themes, and memos using Atlas. ti</td>
<td>- Draw 59 process diagrams to represent designer-user interactions and used methods</td>
<td>- Synthesize 15 patterns reflecting designer-user interactions and their methods in the design innovation and refinement sequences</td>
</tr>
<tr>
<td>- Summarize each design project stories</td>
<td>- Compare the similarities and differences based on 59 diagrams</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 14. Overview of Data Analysis Process**

As Figure 14 presents, this data analysis followed the three steps of the grounded theory approach: from open, to axial, and to theoretical coding processes. In the open coding step, I reviewed every single line of project stories to clarify codes, themes, and memos in the transcribed project stories. Also, I analyzed designer-user interactions and the applied methods in the design processes. As a result from the open coding, I outlined each project story with characteristics of designer-user interactions and applied design methods over time. Based on the open coding process, fifty nine project process diagrams were
synthesized, which represent designer-user interactions and the applied design methods in the process of design projects in the axial coding step. In this step, I compared the similarities and differences and sought to categorize the fifty nine project diagrams. After the axial coding process, I performed a theoretical coding process to incorporate the given process diagrams to synthesize patterns between designer-user interaction and their resulting outcomes in the sequence of design innovation and refinement. As an outcome, I elucidated fifteen patterns (nine innovation and six refinement) and created pattern diagrams and descriptions to theorize the relationships between the designer-user interaction and the types of design outcomes (innovation and refinement sequence) in the design process.

Figure 15 presents an example of how I conducted an open coding process on the transcribed data by codes, memos, and hierarchical codes. This line-by-line open coding result allowed me to understand each project story focusing on designer-user interactions and the applied design methods in the design process. With this baseline, I moved on the next coding stage, axial coding.
have projects or not. Because that would be part of my customers' insights and programs; but, that's the difference of the project base contextual research.

017 There was one thing we did in the past. We have a co-innovation program. This is the program to engage customers or prospects on a periodical base. So, the idea was to engage the same users on every month-standard of continuity. In this point, they can see the evolution of the prototypes, evolution of ideas, they can give us feedback then we incorporate their feedback and then one month later, we come back and then we showed them like next iteration or thinking. These are particular useful for us, because we do not have to re-explain the product over and over. They feel engage because they might be already SAP customers and they can contribute to making the company successful, SAP. You know it is way also useful because it was almost pre-sales activity. Because... after we have engaged with them like five times in the last half year, then they will excited about the product and then they want to buy it. So, it was almost like effortless, because they already know exactly what's going to be the product and they know exactly what their needs have been listened and then that's good affordable about the scope of the solution.

018 Can you tell me more detailed stories about the co-innovation program?
From the very beginning of the project, form that moment that we are...what are the aims the process we want to meet to describe from the beginning... we like, we are giving that product scope, all the way to launching the product?

020 The project started with we have to get into this market and the market was a particular area in terms of on demand, which is someone else service. Then, we had a hypothesis-what exactly do we have to go there, which is load of our hypothesis we just like did some research with personas as well. We talked about the professional 50-60 interviews to users (not too much about SAP users, just with regular users). We asked them about their careers and asked them about their expectations at work, because the product was about human capital management.

021 Is this general ERP SAP product or a part system?

022 The product was a human capital management. Objective settings, assessment, learning, personal development...all about the human resources.

023 Okay, this is a HR project, so that you interviewed 50-60 general users.

024 Yeah, we interviewed professionals and then we asked them how do you about the planning of your careers? How do you set your objectives? How do you do in your work? Where are your expectations from your company? It was like...it was more about understanding of high level like what exactly people expect. From their interviews, we created a bunch of personas. This is the guy we are going to design
Figure 16. Data Analysis Process 2: Axial Coding

Figure 16 presents the examples of ninety nine coded design project stories translated as visual diagrams in the axial coding stage. In this stage, I highlighted the generative actions between designers and users in the design project and drew diverse versions of diagrams to illustrate the original project stories. After drawing each diagram, I revisited the original coded data to compare with the developed visual diagram. With these ninety nine visual diagrams, I analyzed the similarities and differences on the diagrams to move on the next theoretical coding stage.
Figure 17 illustrates a couple of examples of a theoretical coding process. In the theoretical coding stage, I sought to match the given ninety-nine project stories to generate relevant patterns, concerning the similarities and differences of designer-user interactions and their applied design methods. As a result, I incorporated fifteen designer-user interaction patterns and drew the patterns to define the supportive descriptions of designer-user interaction in design innovation and refinement sequences.

Based on the micro dynamic pattern analysis using visual diagrams, I recognized that this analytic method was appropriate to reveal the generative actions or procedural paths
between designer-user interaction and their design outcomes (e.g. levels of prototypes, design opportunities, and final solutions) over time. This analytic approach especially can identify the micro dynamics of how human interactions have discovered the information environments in whole systems. Also, it overcame the limitation of the first thematic understanding identifying the themes of latent characteristics of human interactions and their outcomes. I believe that it is an appropriate analytic method to reveal the processes and paths of how micro human interactions cause different types of design outcomes in the design process.

With this notion, I might suggest an alternative analytic method to explore how micro-dynamic human interactions (e.g. designer-user interaction or IT developer-manager) can be measured in the process of design and implementation. This analytic method can be enhanced as a tool to understand multiple stakeholders’ interaction paths and orientations in creating better design outcomes (e.g. products or services) in the design process.
6. 4 Developed Criteria by a Grounded Theory Approach

During a grounded theory approach, I clarified eight designer-user interaction criteria to identify patterns on interaction between designers and users in the design process in Table 6.

<table>
<thead>
<tr>
<th>Design Criteria</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose (D-V)</td>
<td>Discovery vs. Validation</td>
</tr>
<tr>
<td>Orientation (P-S)</td>
<td>Problem-centered vs. Solution-centered</td>
</tr>
<tr>
<td>Time</td>
<td>Temporal vs. Longitudinal</td>
</tr>
<tr>
<td>Space</td>
<td>Micro vs. Macro</td>
</tr>
<tr>
<td>Number of cycles</td>
<td>Single vs. Multiple</td>
</tr>
<tr>
<td>History</td>
<td>With prior D-U interaction vs. Without one</td>
</tr>
<tr>
<td>Method</td>
<td>Direct vs. Indirect</td>
</tr>
<tr>
<td>Leadership</td>
<td>Designer-centered vs. User-centered vs. Co-creation</td>
</tr>
</tbody>
</table>

The eight criteria consist of the following issues of designer-user interaction: (1) purpose (discovery versus validation); (2) orientation (problem-centered versus solution-centered); (3) time (temporal versus longitudinal); (4) space (micro versus macro); (5) number of cycles (single versus multiple); (6) history (with prior history versus without); (7) method (indirect versus indirect); and (8) designer-user interaction leadership (designer-centered vs. user-centered vs. co-creation). These eight criteria demonstrate the issues of scale / measurement how each pattern is identified through the data analysis process.

Based on the eight criteria, I developed the components of nine-design innovation and six design refinement patterns to demonstrate how designers and users could generate the forms of interactions and what design methods are applied to interact with actual users in the design process.
Chapter 7: Design Innovation and Refinement Patterns

This chapter integrated actual patterns of how designers could interact with users in innovation and refinement sequences. To present the variety of designer-user interaction patterns in design innovation and refinement sequences, this chapter is divided into four sections: 1) collected data; 2) innovation patterns; 3) refinement patterns; and 4) lessons from the designer-user interaction pattern study.

7.1 Collected Data

I collected ninety-nine design project stories related to designer-user interaction and their design outcomes from the thirty-five designer interviews.

<table>
<thead>
<tr>
<th>Table 7. Summary of Interview Data Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Narratives (N)</td>
</tr>
<tr>
<td>------------------------</td>
</tr>
<tr>
<td>Innovation (32)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Refinement (27)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

Based on the data, as Table 7 presents, I defined the meanings of the project stories based on my research questions. Thus, I separated my data into the following categories: design innovation, refinement, reflexivity, role-reversal, and designer-user roles and interactions in the design process (see Table 2). This chapter considers in detail fifty-nine project stories (thirty-two design innovation and twenty-seven refinement projects).
7. 2 Design Innovation Patterns

In this section, I demonstrate nine-design innovation patterns as a result of the data analysis.

<table>
<thead>
<tr>
<th>Patterns</th>
<th>Pattern Name</th>
<th>Data (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pattern 1</td>
<td>Multiple Discovery-Validation (Design Evolution)</td>
<td>3</td>
</tr>
<tr>
<td>Pattern 2</td>
<td>Single Discovery-Validation</td>
<td>2</td>
</tr>
<tr>
<td>Pattern 3</td>
<td>From Business Insights to Design Opportunities</td>
<td>1</td>
</tr>
<tr>
<td>Pattern 4</td>
<td>Analysis &amp; Synthesis Discovery Cycles in UCD</td>
<td>7</td>
</tr>
<tr>
<td>Pattern 5</td>
<td>From Design Insights to Business Opportunities</td>
<td>4</td>
</tr>
<tr>
<td>Pattern 6</td>
<td>Impact of UCD: From Designer-Centered Design to UCD</td>
<td>4</td>
</tr>
<tr>
<td>Pattern 7</td>
<td>Discovery-Validation with Direct User Interaction</td>
<td>6</td>
</tr>
<tr>
<td>Pattern 8</td>
<td>Co-creation</td>
<td>4</td>
</tr>
<tr>
<td>Pattern 9</td>
<td>Combined Direct and Indirect User Interaction</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>Nine Design Innovation Patterns</td>
<td>32</td>
</tr>
</tbody>
</table>

As Table 8 shows, the nine-design innovation patterns are summarized. These nine patterns highlight how designer-user interaction can identify a variety of patterns to create innovations during a design project. Therefore, the next nine designer-user interaction patterns (7. 2. 1 ~ 7. 2. 9) present the different micro dynamics to lead a certain product, service, or IT system design innovation in the design process.
7.2.1 Multiple Discovery Validation (Design Evolution Pattern)

The first pattern (design evolution) represents a design evolution over time. This pattern cycles three design actions to discover reliable design outcomes with a longitudinal perspective: context research; user-scale study; and analytics. These three design actions can produce a design outcome ($R^1$) as a result of the first design cycle ($T^1$), and then these three design actions construct or reconstruct the previous design outcome ($R^n$) in a different discovery / validation cycle ($T^n$) (Figure 18).

The characteristics of the first pattern should include at least two design innovation cycles to synthesize a design innovation over time. Here, the three designer-user interactions reflect directly or indirectly how designers can understand users and their information environments in the process of design. As a longitudinal pattern, this pattern combines the actions of discovering and validating temporal design outcomes to improve a design solution. In addition, this pattern might explain the transformation of IT / design outcomes how designer-user interactions can develop different types of design / IT solutions or outcomes.
A Project Story of Pattern 1

Alpha company project is an example of pattern 1. The Alpha is one of the biggest agriculture companies, which produce agricultural manufacturing, equipment, and products for farmers in the world. Yet, the company had a dilemma how they can provide the quality of products and services for their customers (users) by radically changing IT technologies. Therefore, the Alpha Company requested an IT innovation and design project to Beta Company, an IT innovation and design consultancy.

As Figure 19 presents, this project has two cycles for generating a new IT & Internet service solutions for the Alpha Company. The first cycle identified where problems are. The second cycle discovered a tangible solution from the result on the first cycle.

In this project story, the first cycle started with the Alpha Company’s realization about the importance of IT and Internet usage in their business. Also, they observed their competitors’ success in using the Internet. The Alpha assumed a new IT service and platform solution would generate the positive experiences and new values for their customers (users). Thus, the Alpha contacted the Beta Design consultancy to create a new platform service solution using IT and the Internet.
Based on this project motivation and basic direction, the Beta designers asked the following questions: what aspects of IT and the Internet will be useful for the Alpha? How can a new innovation solution reinforce the established Alpha’s products as a service solution? What aspects of IT and the Internet service innovation will change the quality of use for current Alpha users? With these questions, the Beta company designers’ planned a design direction with three inter-related design actions: (1) context research, (2) user-scale study, and (3) design analytics.

In the context research, designers firstly considered the Alpha Company’s contexts and current users’ (customers’) usage on the Alpha products and services. In addition, they tried to identify a domain of knowledge about the projects and a problem statement for creating potential design innovation opportunities. Based on understanding the Alpha, Beta designers set up the user-scale study to understand users’ requirements, needs, and their pain points with direct user interactions. With the second direct designer-user interaction on the user-scale study, designers conducted an analytic measurement to validate design opportunities stemming from the processes of context research and user-scale study.

Through these three actions in the first design cycle (process), designers identified design problems and suggested a design solution. The solution was an information-centered roadmap solution, which focused on a scenario-based approach on Alpha Company’s existing products, resources, and their customers. Particularly, this solution highlighted the relationships concerning how the Alpha can provide a service platform that included a series of dynamic interactions with Alpha’s products and their related service agents for their users (customers) in a cultural society.
Given the described design opportunities from the first cycle, the Alpha Company requested the other related project to synthesize a tangible solution for their customers (users) based on the information-centered roadmap solution. Thus, the second cycle is activated. In this cycle, the Beta Company recursively conducted the three design actions (context research, user-scale study, and design analytics) to synthesize a tangible design solution. During these designer-user interactions, every design action was more sophisticated than the first cycle. Especially, they focused on the user-scale study and design analytics to characterize detailed solutions. As a result, the Beta Company suggested the API as a protocol (a module solution) to create new relationships among the Alpha Company’s products, related service partners, users (customers), and their usage behaviors under service platform. Based on the API solution, the Alpha Company developed a variety of Internet and IT solutions for their customers across diverse societies.

7.2.2 Single Discovery Validation

![Figure 20. Single Discovery Validation](image-url)
The second pattern (*discovery and validation*) discovers design ideas, concepts, and guidelines (D) and validates them (V) to identify design outcomes (R) in a design process. Generally, the pattern consists of four actions reflecting designer-user interaction: 1) understanding contexts, 2) creating ideas, concepts, or prototypes, 3) validating them, and 4) identifying design outcomes in a design process. The second pattern demonstrates a basic design innovation cycle to consider discovery and validation actions in the design process (Figure 20).

**A Project Story of Pattern 2**

The design project episode done by Gamma Company illustrates an example of pattern 2. Gamma Company is one of the biggest ERP companies, and this project was a new product innovation episode of Gamma.

As Figure 21 presents, this project story combines a discovery and a validation cycle. The motivation of this project was to create a single source management system. To do this, the Gamma Company performed mergers and acquisitions (M&A) with V Company, a
single source management company. After M&A, Gamma Company set up a project to create a new product development using V Company’s knowledge and resources.

In this project, the Gamma Company firstly followed a discovery cycle for understanding contexts about single source and its supply risk. With this context research, designers considered two assumptions: (1) availability and locations of materials and manufacturer; and (2) risk situations and how these risk situations can be overcome. Based on these two assumptions, designers identified their design orientations, which deal with task-based concepts and general scenarios. In the step of contextual understanding, designers identified this project with detailed action plans such as a design orientation.

With this contextual understanding, designers effectively developed design concepts by the direct interactions with users. To create viable concepts and scenarios, they conducted a pilot study. In this pilot study, designers interviewed procure managers to create real task-based scenarios, concerning what the procure managers will consider and create tasks and relationships within a system. In this concept generation action, designers considered how the users (procure managers) could effectively navigate a system. Based on these design orientations, ideas, and developed detailed stories in the discovery cycle, designers prepared to validate their current design ideas and prototypes with the real users in the next validation cycle.

In the validation cycle, designers set up a concept validation with prospective users in this potential system product. To do this evaluation, designers generated reliable questions and tasks for the concept validation session. The concept validation iteratively conducted with the following actions. The Gamma Company hired a professional recruiting company to invite potential user groups and conducted concept validation sessions. After
completing the sessions, the Gamma Company repeatedly changed the questions and tasks to test ongoing concepts and scenarios to synthesize an optimized design solution (a final design solution) with direct user interactions.

This project as an example of the pattern 2 demonstrates two different designer-user interactions. The one is the discovery cycle of interaction, and the other is the validation cycle. Based on these two inter-related cycles, designers utilized the designer-user interaction as the core action for discovering and validating a new product definition (a set of system requirements in this case). Particularly, this project story considers the scenario-based concept discovery and validation as a detailed design technique of designer-user interaction dealt with in the design process.

7.2.3 From Business Insights to Design Opportunities

![Figure 22. From Business Insights to Design Opportunities](image)

The third pattern is made up of two cycles (C1 and C2) of discovery (D1) and validation (V1) in a design process. The first cycle (C1) conducts a discovery (D1) and a validation (V1) to identify business opportunities (prototypes in business) (R1), and the second cycle
(C\(^2\)) performs a discovery (D\(^2\)) and a validation (V\(^2\)) to develop design opportunities (prototypes in design) (R\(^2\)) in a design process (Figure 22).

**A Project Story of Pattern 3**

AD Company’s design project story represents two cycles of discovery and validation as an example of pattern 3. The AD Company is one of the biggest software companies for professional designers, and this project story dealt with a new service innovation story of how they consolidated their current and future business and design portfolio in the design process.

This project story presented the everyday designers’ routine in-between the strategic innovation and design departments. AD designers usually considered how they could create a product / service solution to integrate the business and design impact of their current design & business portfolios. Therefore, their works mainly highlighted the design planning stage as the front of design innovation. This general design episode also represents a story about how they have sought to create a strategic service solution or a platform to produce new values for their customers (users).
As Figure 23 presents, this project firstly followed two discovery and validation cycles. In the first cycle, designers searched for a discovery and validation cycle for identifying a business value for users. To do this, designers discovered certain patterns and frameworks in the initial planning stage. In this stage, they conducted context research and interviews with internal stakeholders to create a business direction, concerning the multiple stakeholders’ ideas and opinions. Following that, the designers validated whether or not the conceptual understandings of their business strategy were successful. To validate their conceptual business directions, they performed a user-scale study with the direct user interaction. In the process of user-scale validation, designers created a research protocol and tested the ways in which users can understand their conceptual business concepts. Based on the test, the designers elucidated new patterns based on users' voices. Then, designers outlined a meta-model detailing how they can move toward business opportunities in a detailed way. As a result of the first cycle, designers discovered a set of business values and validated the business direction with concern for internal stakeholders’ and users’ feedback.

In the second discovery and validation cycle, designers considered how they could synthesize design service solutions, considering the business strategies and directions. In the second cycle, designers sought to discover the design concepts and visual prototypes to create tangible design opportunities and solutions. With these visual prototypes, designers conducted design validation with direct customers (users) to collect design feedback. Based on this iterative process between creating prototypes and validating them with real users, designers determined a design-service solution as the result.

This project story presents two discovery and validation cycles as an example of pattern 3. The first cycle is “pretotypes” and the latter is “prototypes” in the business-design
process. The first cycle of “pretotypes” discovers the business discovery and its validation, while the second cycle of “prototypes” explores design discovery and its validation. Therefore, pattern 3 shows how business and design perspectives and concepts can be consolidated to synthesize optimized service/product solutions in the process of design innovation.

7.2.4 Analysis & Synthesis Discovery Cycles in UCD

The fourth pattern consists of two discoveries (design analysis and design synthesis) with four actions reflecting on designer-user interaction as follows: 1) understanding contexts, 2) generating patterns and design opportunities, 3) developing design ideas (concepts), and 4) identifying design outcomes in a design process. The first discovery (D¹) cycle understands contexts (exhale) and generates patterns (inhale). The second discovery (D²) cycle develops design ideas (concepts) (exhale) and identifies design outcomes (inhale) in a design process (Figure 24).
A Project Story of Pattern 4

Pattern 4 is the most popular design innovation pattern, which most companies have explored in the design process. S Company implemented a new grocery shopping service for K Company department's supermarket, and it demonstrates pattern 4.

In the stage of understanding contexts, the S Company system designers tried to understand that the service was targeted to residents in the X district (a suburban residential area): most of them are in their 20-30's, newlyweds or working couples, work downtown, and have very little time for grocery shopping as a result of their long commuting distances. Therefore, the S Company designers briefly outlined a new service concept of receiving the users’ shopping orders over the Internet on K Company’s online store and delivering groceries to their homes within two hours.

In the stage of generating patterns and design opportunities for developing ideas, the S Company designers felt they needed a completely new approach. Typically a grocery shopper went through the sequence of researching, browsing, collecting, paying, and
transporting food items. While S Company’s previously built e-commerce solutions were designed as separate subsystems of each step packaged as one. In the end, the new service idea required an integrated solution of online and offline components. Therefore, they identified the following two things: (1) the online catalog/order/payment system should be designed as the seamless flow of transaction data among subsystems; and (2) The offline components of retail space layout, human shopping agents, and delivery arrangement after the payment should be optimized as the fast collection and delivery of groceries.

In the stage of conceptualizing design ideas for inspiration, S Company designers conducted a qualitative study using a variety of ethnographic techniques. From the data gathered designers observed several issues to address, including the discrepancy between online product categories and offline store product layout that may cause significant delay during the item collection.

In the stage of detailing design ideas through research activities, designers conceived the initial design ideas and identified three key components. First, “pickers” were human shopping agents who pick up internet-ordered items on behalf of their customers. Second, K Company’s offline supermarket product categorization was made congruent to Delta’s online product categories. In addition, K Company’s offline supermarket layout was optimized for efficient item collection. They also improved grocery-bagging procedure to minimize delivery damage. Third, the online system was designed to seamlessly pipe the customer’s order, payment, and collection information for all involved parties, providers, seller (i.e. K Company), pickers, and carriers. As a result, K Company’s new service successfully delivered groceries to X district residents within two hours.
7.2.5 From User Discovery to Designer Validation Pattern

The fifth pattern represents first user-discovery and then designer-validation cycles. Given the problems, the first user-discovery cycle performs the action of users being designers, and it suggests potential design solutions as users' design ideas. The first user-driven discovery cycle creates a set of problems stemming from users’ everyday contexts and their information environments. The second designer-validation cycle conducts how designers can develop the design solutions from users’ design suggestions. Also, designers seek to connect a reasonable direction between creative design ideas from users and the corporate values in creating projects and services for market success (Figure 26).

**A Project Story of Pattern 5**

The design project episode completed by Beta Company demonstrates an example of pattern 5, which deals with user-driven innovation (discovery) and designer-driven development (validation) to synthesize a new innovative product / service. The Beta Company is a Telecommunication and Service Company, which provides a variety of
mobile and wireless computing products and services. This project is a smart-learning project collaborating with C Institute, a leading educational institute.

![Diagram](image)

**Figure 27. Beta Company’s Project Story**

As Figure 27 demonstrates, Beta Company and C Institute set up a task force team (TF) as a collaboration project, and Beta Company designers interacted with C Institute to identify the domain of knowledge about the project. In this project, designers did not have any specific knowledge or practice in relation to education fields. Therefore, the participating designers tried to learn the contexts of education to create a smart learning platform, which included devices, systems, and services.

To identify sophisticated concepts about smart-learning innovation, designers conducted in-depth interviews with real users (students, teachers, education special lists, and parents). To do this, designers separated two groups of users: the first was the primary user group (students and teachers); and the second was the peripheral user group (parents and others). Through the interviews, designers sought to understand the specific contexts...
of education fields as well as the interrelated areas. Moreover, they tried to identify users’ needs and challenges with the current learning systems, products, and services.

Based on the context research and learning process, designers set up multiple participatory design workshops with multiple stakeholders (types of users or potential users). In this project, designers conducted three steps of participatory design (PD) workshops with real users.

The first PD workshop dealt with a learning session among participants (parents, students, educational engineers, and teachers) to share their experience and knowledge. After completing the first PD workshop, designers provided an assignment to participants for the second PD workshop. The assignment was to write a diary on the participants’ everyday activities and interactions about learning, teaching, relationships, schools or institutions, and among the others in their information environments. At the second PD workshop, designers conducted an open discussion session among participants in which designers took the role of facilitator for stimulating the participants’ sharing episodes and encouraged their collaboration in more dynamic ways amongst themselves. In the second PD workshop, all participants took design ideation session as designers (users as designers), and they further developed the design opportunities. In the third PD workshop, designers and users interacted with each other to create more desirable design ideas and concepts. Also, they evaluated their identified design concepts in determining which ones would have more a marketable impact as smart-learning services, devices, and solutions.
With these three stages of PD workshops, designers and participants (different types of users) collaborate with each other to explore design concepts with the focus of user-driven discovery.

Based on this user-driven discovery, designers performed a designer-driven validation cycle. In this cycle, designers evaluated users’ design ideas and created the relationships between users’ design ideas and design-business connections with a designer's view. In this stage, designers considered how the smart learning systems and service solutions could provide effective relationships in the complex interactions between teachers, parents and students. As a result, designers developed users’ design ideas and created marketable design innovations as the successful design-business solutions.

As this project story shows, the fifth pattern performs first user-driven innovation (discovery), and then designer-driven innovation (design validation for the marketable solutions) cycles. The first cycle explores how users can take the role of designers in a certain moment, and how they can emphasize the nature of user-centered design by expressing extreme user-voices and representing potential design outcomes. The second designer-driven validation cycle navigates how designers can create connections from ideal user-driven innovation to real user-centered design innovation solutions using their design abilities. Through this second cycle, designers can suggest how user-driven innovative concepts can be transformed as user-centered design solutions by the designers’ validation in the design process.
The sixth pattern consists of two cycles of discovery: designer-driven discovery and user-driven discovery. The first designer-driven discovery cycle produces designers’ ideas and prototypes and then meets user problems with direct user interactions (DD). Based on the first cycle, the second user-driven discovery reveals users’ requirements, creates designers’ prototypes, and tests them on a user’ perspective (UD) (Figure 28).

**A Project Story of Pattern 6**

The design project episode of SD Company presents an example of pattern 6. This design episode firstly explored designer-driven discovery and then user-driven discovery to generate a new innovative product / service. The SD Company deals with system management and integration and engineering convergence service. In this project, the SD Company created an online ticketing system for an E-entertainment theme park.
As Figure 29 presents, this project episode explored a designer-driven discovery in regard to how designers could build the most effective online ticketing system. To do this, designers reviewed the established system designs and figured out what system factors would be useful to apply to this project. Also, they created new factors for this ticketing system. With this series of activities and interactions as a designer-driven discovery, designers constructed and reconstructed a beta version system solution.

Based on the first cycle from designers’ ideas for creating their design outcomes (prototypes and potential solutions), they tested these outcomes with real users in the entrance of the E-entertainment theme park. With the real user interactions, designers encountered a series of real problems on the beta version. Designers observed users waited in line for a long time at the entrance, and they realized the beta version of online ticketing system only considered the system effectiveness and efficiency in terms of computing standpoints. The beta system had a limitation that the system designers did not fully consider the real users’ social behaviors to support their real interactions in the field. Therefore, designers admitted their beta system was too ideal.

Given the encountered real problems with the user interactions in a field, designers decided to follow user-driven discovery as the second cycle for creating an optimized solution within a real field. To do this, designers conducted a field study with
ethnographic research on direct user interactions in the field. Through this ethnographic research, they elucidated a set of requirements from real users and developed multiple prototypes. With these prototypes, designers iteratively tested how they could integrate the issues from real user interaction issues to designer-driven systems as well. As a result of this process, designers suggested a tangible sub-system as the outcome of the user-driven discovery cycle to support the main online ticketing system. The sub-system included the following for effective communication with users in the field: (1) alternative mobile devices; (2) guidelines and protocols for effective ticketing communications with users; and (3) employee education.

As this project episode presents, the pattern 6 illustrates two innovation cycles: designer-driven discovery and user-driven discovery. This pattern reflects real problems by the interaction with real users after the first cycle (designer-driven discovery). Based on the first cycle, this pattern seeks to find out a problem-solving process as a user-driven innovation cycle. This pattern shows an extreme case why IT and design innovation should consider a user-driven innovation approach and what aspects would be limitations when the designers would only apply the designer-centered approach in the process of design innovation. As this example reveals, we do not know what are the most effective systems and this pattern six might create a variety of outcomes when we use the user-driven discovery cycle or the combination with designer-driven cycles in the innovation design process.
7.2.7 Discovery Validation with Direct User Interaction

The seventh pattern illustrates two direct user interactions in the design discovery and validation: The first cycle is to discover temporal design outcomes (e.g. design ideas, concepts and prototypes) with direct user interaction (e.g. field study); and the second cycle is to validate them with direct user interaction to synthesize a final design outcome in the design process. In other words, designers discover design ideas and user requirements from field study and create design concepts in the first cycle. Following that, users validate the suggested design concepts and provide their design ideas to finalize the detailed design outcomes in the second cycle (Figure 30).

A Project Story of Pattern 7

CK Company’s design project episode presents an example of pattern 7. This project performed direct user interaction in a design-discovery and a design-validation cycle to generate a new product / service definition. As a knowledge management outsourcing system company, the CK Company created a new innovative system for L insurance company.
CK Company and L insurance realized the limitations about current knowledge management systems, and they felt a need for a new knowledge system to increase the quality of working processes, the workability of systems, and employees’ performances. With this project motivation, they decided to synthesize a system design called ‘a smart working system’ for L insurance company.

As Figure 31 shows, the first cycle conducted a design discovery with a direct user interaction. In the first cycle, CK designers set up a smart-work TF in the real field (L insurance company) to interact with real users. The first cycle consisted of an internal and an external cycle to create design concepts (e.g. ideas and temporal design prototypes). The external cycle was to discover how designers’ ideas could be identified as the resulting design outcomes, while the internal cycle supported how designers could elucidate invisible user patterns, needs, and current pain points to identify a set of new design requirements from them. Particularly, through the field study and interviews with users, designers sought to identify what aspects of the smart-work could be characterized as the outline of the smart-work knowledge system for the L insurance company. Throughout the first cycle, designers developed design ideas and a development process.
Based on the design concepts from the first cycle, designers conducted design validation with direct user interactions. In this process, designers iteratively evaluated the defined their concepts and constructed / reconstructed them by the interaction with users. As a result, designers finalized an outcome (solution) as the result of this new product development.

As this project episode presents, pattern 7 demonstrates two cycles of design discovery and validation with the direct user interactions. This pattern shows a well-established user-centered design approach, and it depicts rational moments when designers should interact with real users in their design processes. For instance, it suggests a guideline for how designers could conduct a field study for idealizing design opportunities and how they could validate them in the design process.

7.2.8 Co-Creation

![Figure 32. Co-Creation](image-url)
The eighth pattern involves co-creation between designers and users, and it includes two routines of co-creation: 1) ideas and concepts discovery among designers in their everyday activities and interactions; and 2) designers’ activities and interactions with users in a certain time. In the first routine, designers’ ideas create temporal design outcomes (e.g. ideas, prototypes, or design opportunities). At the same time, other designers validate their own temporally identified design outcomes over time. On the other hand, in the second cycle, designers interact with their real users to validate / discover their temporal design outcomes (e.g. design prototypes) in a certain time in the design process (Figure 32).

This pattern illustrates how designers’ ideas reflected on users in their everyday interactions can be validated by the interaction with real users in a certain time.

**A Project Story of Pattern 8**

The design project episode of Zeta Company presents an example of pattern 8. This Project story demonstrates two different cycles. First cycle deals with designers’ interactions in their everyday activities, while the other involves the designer-user interactions in a temporality in the design process. This Zeta Company project episode presents how everyday designers’ discovery and validation can be incorporated by the temporal designer-user interaction (e.g. once a month in this case) in the process of product-service design development in Zeta.

As Figure 33 presents, the Zeta Company’s project story demonstrated a routine which identified designers’ discovery and validation among designers in their everyday activities and interactions. With these design ideations and concept development,
designers created fast prototypes as the temporal outcomes from their actions. To create fast prototypes, the Zeta designers utilized two prototype tools (Axura and Invision), and they validated their prototypes with their internal designers and product managers. This discovery and validation cycle supported how designers could develop their design ideas and create potential business-design opportunities.

Based on the discovered and validated prototypes, in the second cycle, the Zeta Company designers performed a co-creation session with real users of the Zeta systems. To conduct this co-innovation session, a general manager of Zeta invited real users every month to validate Zeta’s new design ideas and prototypes. This co-op innovation acted as a collaboration session to share how Zeta designers deeply considered their users to create new products, services, or concepts for generating user values in their everyday design activities and interactions. By this monthly session, designers’ everyday routine was transformed by the cycle of users’ validation and discovery. In this moment, users acted as designers. This co-creation and co-evaluation as parts of the second cycle reinforced or expanded the designer’s ideas, concepts, and prototypes in the design process.
As this project episode presents, the pattern 8 demonstrates two inter-related cycles: designers’ ideas, feedback about their resulting outcomes (e.g. prototypes) in the first cycle; and users’ feedback and their suggesting ideas for designers’ ideas in the second cycle. In this pattern, the different types of prototypes act as boundary objects, which connect everyday’s designers’ interactions reflecting on users and their temporal interactions. As the Zeta Company episode presents, this pattern highlights how designers can effectively communicate with both designers and users. Here, design prototypes perform as boundary objects to reinforce and expand different knowledge boundaries between designers and users in the design process.

7.2.9 Combined Direct and Indirect User Interaction

The ninth pattern includes direct and indirect user interaction to identify design requirements in the first cycle. Then, the second cycle discovers detailed design concepts and prototypes to synthesize design outcomes. Especially, in this pattern, designers
conduct direct (e.g. field study) and indirect user interactions (e.g. existing data) to identify design requirements, which include design concepts, prototypes, and design outcomes in the design process (Figure 34).

**A Project Story of Pattern 9**

The E-university administration system project episode accomplished by S Company presents an example of pattern 9. This project story illustrates the process of how designers could identify a combined user-centered design approach that considers direct and indirect user interactions during a design project.

![Figure 35. S Company’s Project Story](image)

As Figure 35 shows, S Company designers set up a TF in the real field (E university) to interact with real users. The first cycle was made up of two-sub internal cycles to understand user contexts: the first sub-cycle dealt with a direct user interaction, and the other one was indirect-user interaction. The first inner cycle was the way to elucidate users’ latent needs and voices. On the other hand, the other inner cycle was used to confirm users’ needs based on existing knowledge, categories, and data about users. With these two designer-user interactions, S Company designers incorporated new features and functions from direct user interactions and reused existing effective functions and features.
from the existing system designs. This cycle identified a set of combined requirements through the two inner designer-user interaction cycles in the design process.

Based on the combined requirements from the first cycle, designers considered the school and system size, and they sought to synthesize an optimized administration system solution. To do this, they analyzed how the new system solutions can be matched to the different stakeholders’ perspectives regarding the different user’s life styles. With this consideration, the designers generated a variety of concepts and prototypes. In this cycle, designers developed their temporal outcomes (different types of design prototypes) to synthesize a system design solution in the design process.

Like this project episode, the pattern 9 presents direct and indirect user interactions to conduct economic performance in the system development. As a complementary user-centered design approach, this pattern demonstrates how designers could determine effective design decision-making in the process of new product development. In addition, the results of this design pattern might be diverse in terms of designers’ capabilities for consolidating direct user (e.g. field studies) and indirect user interaction (e.g. data).

In this section, I demonstrate nine design innovation patterns and six refinement patterns are described in the next section.
7.3 Design Refinement Patterns

In this section, I will demonstrate six design refinement patterns as a result.

<table>
<thead>
<tr>
<th>Patterns</th>
<th>Pattern Name</th>
<th>Data (N)</th>
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<tbody>
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<tr>
<td>Pattern 2</td>
<td>Identifying Solutions from the Given Problems</td>
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<tr>
<td>Pattern 3</td>
<td>Method - Product Change</td>
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<tr>
<td>Pattern 4</td>
<td>Method - Process Change</td>
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<tr>
<td>Pattern 5</td>
<td>User Testing with Multiple Prototypes</td>
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<tr>
<td>Pattern 6</td>
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<td>Total</td>
<td>Six Design Refinement Patterns</td>
<td>27</td>
</tr>
</tbody>
</table>

Table 9 shows an overview of six designer-user interaction patterns in the design refinement sequence. The next six designer-user interaction patterns (7.3.1 ~ 7.3.6) demonstrate the six identified patterns from twenty seven as design refinement project stories.

7.3.1 Identifying Problems and Solutions

As Figure 36 represents, the first refinement pattern deals with designer-centered discovery cycle, and it describes how designer-user interaction can discover how to improve upon existing design products and services. A more detailed look at this pattern reveals that it cycles a linear interaction path of how designers can discover users and their information environment with more effective ways in the design planning stage.
Then, they conducted designer-user interaction as mediation for understanding users’ hidden factors to identify design ideas and opportunities to synthesize a design-business impact in the design process.

**A Project Story of Refinement Pattern 1**

H Company's design project involves an example of refinement pattern 1. The H Company is one of the biggest IT companies, which produces products, technologies, software, solutions and services to consumers. This is a project episode about their digital camera new product development.

The objective of this project was to create a new marketable user experience on H Company’s existing digital camera business area. As a project motivation, designers set up a project statement, which discovered new service factors for their digital camera solutions. Then, they built a design hypothesis for generating a design solution — the experience of scrap booking between children and parents (especially mothers) will provide unique product service experiences for users, and it would be marketable to expand current users' experience as a new product definition.

With this notion, designers planned to conduct ethnographic research in a local community. During this ethnographic research, as the core of designer-user interaction,
designers observed that mothers and children used a digital camera within a scrap booking community. Also, the designers focused on current problems and the aspects of potential design ideas and opportunities. To understand more detailed contexts about user behaviors and their needs, they conducted focus group interviews to identify new service solutions for current digital cameras and their users.

Based on this ethnographic research, designers found that children’s behaviors and interactions were very different from that of the designers. First, children used most functions without requiring their parents’ helps. Second, they really wanted to share their photos and scrap books to various social media sites and communities. Therefore, designers created multiple functions and features for scrap-booking solutions and suggested a dynamic platform that users can share their digital scrapbooks as an expanded design service solution of current H Company’s digital camera.

As this project episode presents, the refinement pattern 1 demonstrates a usual cycle of how designers could discover new product factors with user interaction. As a well-defined user-centered design refinement cycle, this pattern shows how designers could use designer-user interaction to incorporate new user values to existing products and services in the design process.

7.3.2 Identifying Solutions from the Given Problems
As Figure 38 presents, the second refinement pattern illustrates two cycles of how designers could discover the given problems on existing projects and services. In this pattern, designers highlight the user interaction as the core to identify a system of problems and latent factors. These designers' problem solving actions discover and validate problems with users. Through this process, designers can identify areas for improvement in design opportunities, solutions, and business impact in the design refinement process.

A Project Story of Refinement Pattern 2

Alpha company's project is an example of refinement pattern 2, which demonstrates the designer's problem solving. As a user-centered design consultancy, Beta agency dealt with the Alpha’s service design project. This project started with initial problems with their current products and services. The problem was the Alpha Company encountered challenges in providing a new relationship amongst Alpha Company, products, and users (customers).
With this motivation, the Beta agency conducted a design research project for Alpha and asked what factors and new services could enhance current Alpha Cosmetic products and services. For better understanding about current products and service problems, the Beta design agency conducted ethnography research in real cosmetic stores to analyze user interactions and behaviors. Through this ethnographic research, designers identified a systemic problem among Alpha Company products, sellers in retail stores, and customers (users). Here, sellers in retail stores acted as knowledge center to connect between the Alpha Company products and customers; however, they did not provide high quality and efficient information to users in the retail stores.

Based on this specific problem discovered through the user interaction, the Beta designers conceptually developed a variety of design opportunities to create new user experiences as a product-service solution for Alpha. From the real field observations and user interviews in cosmetic stores, designers clarified users’ latent pain points and needs for generating design opportunities. First, users complained that the cosmetic colors were different before and after purchasing. Second, users felt limitations about the whole retail store's interactions because there were not direct, interactive, tangible relationships with Alpha’s products and the retail store's staffs were not helpful in obtaining sufficient information.

With these two latent problems, the Beta designers suggested a service solution to expand user experiences as follows: (1) providing a user experience zone with a variety of tangible interactions for users and (2) establishing a service zone with high quality information managing users’ needs and desires in a retail store. With this service solution, as a result, the Alpha cosmetic company had a radical market success.
As this project episode presents, the refinement pattern 2 describes how designers can discover and validate the given problems and create new values on the current existing products and services with user interactions. As a well-defined user-centered design refinement cycle, this pattern shows how designers could discover / validate a system of problems and suggest solutions using designer-user interaction in the design refinement process.

7.3.3 Method - Product Change

![Figure 40. Method - Product Change]

As Figure 40 presents, the third refinement pattern illustrates how designer-centered design can develop user’s scenarios, which focus on user’s behaviors and interactions using designer’s indirect interactions with users. Based on designer’s understanding and imagination about users, designers identify design opportunities and then test, simulate, and experiment with them through direct user interactions to synthesize design suggestions and final solutions in a design refinement process.
A Project Story of Refinement Pattern 3

L advertising company's project story shows an example of refinement pattern 3: user-centered approach through measurement and an experiment design.

The user experience department of L advertising company conducted an airplane ticket search engine project. In this project, they reviewed the established search engines and set up a research project to synthesis an effective search engine that could search for a travel ticket within 30 days for the users. To do this, designers identified a layout of information with two hypotheses: (1) users know when they will travel, but they do not know where; and (2) users know where they will go, but they do not know when. Based on these two hypotheses, designers generated multiple user-scenarios focusing on users’ behaviors and interactions.

With this layer of information for synthesizing an effective ticket search engine data and its solution, designers invited two samples of users, suitable to their two hypotheses to validate their scenarios with direct user interactions. As a result of this user test and
simulation, designers validated their design hypotheses and user-scenarios and then, they developed the scenarios. Throughout this process, designers suggested a new type of ticket search engine as a design refinement solution. This project can be interpreted as a design refinement or a design innovation project. I believe that this is a refinement project, because it does not change the core concept of the search engine itself and it reinforces or creates improvement of current existing products or services.

The refinement pattern 3 demonstrates a methodological approach to how designers could conduct an experiment design with a user-centered approach. Here, designers created user-scenarios (design discovery) and tested them with direct user interactions (design-validation) in the design refinement process.

7.3.4 Method - Process Change

![Figure 42. Method - Process Change](image)

As Figure 42 presents, the fourth refinement pattern illustrates how designer-user interaction can complement the current design dilemmas with existing products or services. The existing design information and the patterns on products / services could encounter design dilemmas, and designer-user interactions would then be able to discover and validate the design issues while suggesting alternative suggestions and patterns in the design refinement process.
A Project Story of Refinement Pattern 4

Beta Inc.’s project story demonstrates an example of refinement pattern 4.

It deals with how the designer-user interaction could manage and amend a design dilemma in the new product development process. Beta Inc is a multinational corporation that produces footwear, apparel, equipment, and services focusing on the design, development and worldwide marketing. As a massively successful company, Beta Inc. already identified their design directions with nine different stereotypes of users, which defines their user behaviors and interactions. Yet, the Beta product developers and designers were curious whether the nine established segmentations would be useful in the process of their design process. Therefore, the Beta Inc. requested a design research project to Alpha design agency, a user experience design consulting firm.

The Alpha design agency conducted a design research project to evaluate the existing nine user segmentations and suggest new directions based on users’ life styles and patterns. First of all, the Alpha designers identified hypotheses about the existing user segmentations. To discover their hypotheses, designers invited thirty users as their qualitative research sample from three different countries and suggested for users to write...
a journey diary about their everyday activities and interactions. With the outcomes of users’ journey diaries, designers sought to validate their hypotheses and revealed reliable findings on Beta’s existing nine user segmentations.

Yet, the result of designer-user interaction (qualitative discovery) revealed that Beta's existing user-segmentation was not practical, because it did not reflect on current users’ behaviors and interactions. Therefore, the Alpha designers polished their existing nine segmentations and suggested new patterns of user-lifestyles for the Beta designers and new project developers.

Refinement pattern 4 demonstrates how designer-user interaction could construct and reconstruct the existing design problems, dilemmas, or design ironies. Through this process of redefinition, designers might create alternative design methods or integrated patterns or frameworks.

7.3.5 User Testing with Multiple Prototypes

![User Testing with Multiple Prototypes Diagram]

As Figure 44 shows, the fifth refinement pattern demonstrates how designers can validate their different types of design concepts or prototypes with multiple direct user interactions as the core of designer-user interaction to synthesize a final, official version.
during a design process. This pattern includes two modes of designer-user interactions: (1) types of users’ design evaluations (UDE) and (2) users’ design ideas / suggestions (UDI) in the design validation process.

A Project Story of Refinement Pattern 5
Gamma Company's project story demonstrates design refinement pattern 5 and how designers can validate and develop their design ideas and prototypes within the design refinement process. Gamma Company is an American multinational mid-range department store. The Gamma Company project was a refinement project for the shopping cart on their current online shopping site.

In this project, designers monitored users’ behavior data of Gamma’s online shopping site. Also, they conducted ethnography research to observe users’ real behaviors and interactions in a store. Based on these two pieces of user interaction data, Gamma designers generated the shopping cart prototypes and created a beta version to test real users in online. Through this first online beta test version, designers understood users’ behaviors and interactions, and they further developed the beta version for the next validation with the direct user interaction.
To conduct the second user test on their ongoing prototypes in the development process, designers invited a sample of a user group to their user-experience center, which had real user-test facilities and environments. Designers observed users’ interactions on their improved prototypes and asked some questions to see their design effectiveness and interactions with real users. Also, designers requested how users could change the current versions of design based on users’ perspectives. Through these data and two design tests with users, designers consolidated the design ideas and prototypes to suggest final design solutions to the engineers. With this series of actions, designers developed an online shopping cart for their online store, and it succeeded in a market.

Refinement pattern 5 demonstrates how designers can develop their design prototypes with multiple user interactions in the design refinement process. This pattern shows how designers can design the types of user testing, and how the designer-user interaction can validate them to synthesize their design concepts and prototypes in the design refinement process.

7.3.6 User Testing with Multiple People

![Figure 46. User Testing with Multiple People]
The sixth refinement pattern describes how designers’ concepts and prototypes can be validated by the multiple designer-user interactions to determine the current design-business opportunities and solutions. Especially, this pattern includes at least two times of designer-user interactions with different interaction methods. As Figure 45 shows, the first validation is performed by internal designers, in which designers act as users called ‘pre-skim test. The second validation is conducted by the direct interaction with real users.

A Project Story of Refinement Pattern 6

S mobile credit card project story shows an example of design refinement pattern 6 about how design ideas can be validated by multiple designer-user interaction methods.

The S Company is a provider of mobile service in South Korea, with 50% of the market share. The S Company mobile project was to create a new payment mobile method by developing the current existing mobile cards. I define this project is a suitable example of the pattern 6 because of the multiple validation processes rather than the whole design development.

![Diagram of D-U interaction patterns and evaluations](image)

**Figure 47. S Company’s Project Story**
In this project, designers developed design concepts and prototypes validate them with two different interaction methods to create an alternative mobile card. In the first validation, designers conducted the preskin test among designers. During the preskin test, designers acted as users to validate the different design ideas and prototypes by a view of users. As a result of this, designers created tasks and users’ journey processes on the current developed design prototypes or ideas.

Based on the first preskin test, designers conceptually validated users’ behaviors and interaction on the design ideas and prototypes. With this result, designer set up a qualitative simulation test to validate their qualified design concepts with real users. In this experiment, designers asked what types of alternative payment methods would be acceptable users concerning users’ mental models and life styles. To do this, designers utilized the card sorting and the live-building methods to clarify users’ preferences in the moments of payment. As a result, users’ behaviors and mental models made designers surprised, because users emotionally considered the other users and sellers. Therefore, they did not select the efficient payment methods. For example, in the simulation of movie theater payment situation, users did not select a special (optional) card to take additional discount because the other users were waiting because of me. Also, users did not select any credit cards as their payment tool in the traditional grocery markets, because they considered the sellers would prefer cash than credit cards. This qualitative simulation to validate design ideas and prototypes brought very different results and feedback that of designers’ preskin test. Consequently, designers decided to reconsider this project again at the end.
The refinement pattern 6 demonstrates how design ideas and prototypes can be validated by multiple designer-user interaction methods in the process of design refinement. This pattern shows the values of different interaction methods and how designers can create effective decision making to create a marketable design-business solution concerning user values in the design process.

7.4 Lessons from Designer-User Interaction Patterns

In this chapter, I demonstrated effective methods of designers’ interaction with users with nine-design innovation and six design refinement patterns. Table 10 summarizes innovation (P1~P9) and refinement patterns (RP1~RP6).

7.4.1 Summary of Designer-User Interaction Patterns

<table>
<thead>
<tr>
<th>Table 10. Summary of Designer-User Interaction Patterns</th>
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<tbody>
<tr>
<td>Patterns</td>
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<td>------------</td>
</tr>
<tr>
<td>Innovation</td>
</tr>
<tr>
<td>P1</td>
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<td>P2</td>
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<td>P3</td>
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<td>RP5</td>
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<td>RP6</td>
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</tbody>
</table>

Based on the summary of designer-user interaction patterns in design innovation / refinement sequences, in general, I conclude the following:
1) The patterns of designer-user interaction in design innovation sequence explore a variety of discovery-validation cycles, while patterns of refinement sequence have a tendency toward problem solving within given products and services.

2) Designer-user interactions in innovation patterns require multiple and dynamic designer-user interaction and learning than refinement patterns

3) Designer-user interaction in innovation patterns provides better-balanced leadership than refinement patterns.

With respect to the patterns of interactions between designers and users in the innovation sequence:

1) Patterns 1 and 2 demonstrate a macro view of how designers and users can discover and validate designer-user interaction. The first pattern deals with multiple cycles, while pattern 2 accounts for a single discovery-validation cycle.

2) Patterns 4 and 6 deal with a general user-centered design approach of how designer-user interaction could operate in the innovation process. Pattern 4 explains designer-user interaction in the process of design analysis and synthesis, while pattern 6 illustrates the values of the UCD approach compared to traditional designer-driven design process.

3) Patterns 3 and 5 represent designer-user interaction characterized by design-business relationships. Pattern 3 deals with how designer-user interaction can lead with a business context, and then the qualified ideas can be developed in the design contexts. On the other hand, pattern 5 argues that designer-user interactions
discover the potential of design ideas first, and then the qualified design ideas can be polished in the business contexts.

4) Patterns 7, 8, and 9 deal with method issues related to designer-user interaction (direct and indirect) developing methodological movement in the design innovation sequence. Pattern 7 describes a direct designer-user interaction (field study), pattern 8 presents how designers and users can co-create with each other, and pattern 9 shows the ways of combining direct (field study) and indirect (existing qualitative, quantitative data) methods.

With respect to the patterns of interactions between designers and users in the design refinement sequence:

1) Refinement patterns 1 and 2 deal with how designer-user interaction can be essential in problem solving. Refinement pattern 1 explores problems and solutions on the existing products or services, while refinement pattern 2 considers certain solutions within fixed problems in the refinement sequence.

2) Refinement patterns 3 and 4 explore betterment of the existing projects and services. Refinement pattern 3 deals with measurement of users’ behaviors to identify design betterment, while refinement pattern 4 considers methodological betterment from the existing user history and user segmentation.
3) Refinement patterns 5 and 6 demonstrate user testing in order to refine design concepts, products, and services. Refinement pattern 5 tests different prototypes, while pattern 6 explains how different people are used to test prototypes, concepts, or ideas in the design refinement sequence.

Nine designer-user interaction patterns of a design innovation sequence reveal how designer-user interactions could operate in the traditional designer-centered, user-centered, and participatory design process. Here, the nine patterns highlight macro design structure (P1, P2) and user-centered approaches (P4, P6), design-business relationships (P3, P5), and methods (P7, P8, and P9). The six designer-user interaction patterns of a design innovation sequence represent problem solving (RP1, PR2), betterment (RP3, PR4), and user testing (RP5, PR6).

| Table 11. Summary of Fifteen Design Patterns (Design Artifacts) |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                  | Patterns        | 9 Innovation Patterns | 6 Refinement Patterns |
| Artifacts        | P1 | P2 | P3 | P4 | P5 | P6 | P7 | P8 | P9 | R  | R  | R  | R  | R  |
| Products (41)    | 2  | -  | -  | 1  | 2  | 3  | 1  | 3  | -  | 3  | 2  | -  | 1  | 1  |
| Software/Systems (38) | 1  | 2  | -  | 1  | 1  | 1  | 3  | 1  | 1  | 2  | 3  | 1  | 2  | 2  |
| Services (2)     | -  | -  | 1  | 5  | 1  | -  | 2  | -  | -  | 1  | 3  | -  | -  | -  |

Table 11 shows a summary of fifteen design patterns with the respect to the design artifacts. This result describes relationships between the fifteen design patterns (from P1~RP6) and design artifacts (products, software/systems, and services). For example, P4, P5, and P7 deal with diverse design artifacts, while P2, P3, and P9 account for specific design artifacts. Although there would be latent patterns between fifteen design patterns and three types of design artifacts, the data set (59 design project narratives) has a limitation to generalize the relationships because of sample size. Yet, it might be a summary of what patterns could take a certain type of design artifacts with their concentrations. Also, it can be further developed by a relevant data size.
Table 12. Summary of Fifteen Design Patterns (Design Process)

<table>
<thead>
<tr>
<th>Process</th>
<th>Patterns</th>
<th>9 Innovation Patterns</th>
<th>6 Refinement Patterns</th>
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<tbody>
<tr>
<td></td>
<td>P1</td>
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</tr>
</tbody>
</table>

Table 12 shows a summary of fifteen design patterns with the respect to the design process. This result deals with relationships between each design pattern (from P1~RP6) and design processes (research, research & synthesis, and research & development), which highlight where actual designer-user interactions encounter in the design process. For example, P4, P6, and RP5 have a clear relationship with a certain design process, while the other patterns are blended or associated with diverse design states. Like the design artifact result in Table 11, it might not generalize the relationships because of lack of data; however, it might be a guideline or a framework how the future studies could move toward to theorize the issues of actual designer-user interactions in the design process.

7.4.2 Taxonomy of Designer-User Interaction Patterns

Based on the identified patterns, I synthesized a taxonomy of patterns, which identifies forms of designer-user interactions and their applied methods in the design innovation and refinement sequences.

To synthesize the taxonomy of designer-user interaction patterns, I analyzed the fifteen patterns in two states: (1) problem state (open-semi-close) and (2) solution state (open-semi-close) in Table 13.
Among the nine innovation patterns, only six (P2, 3, 4, 5, 7, and 8) characterize an open problem and an open solution state in the design process, while three (P1, P6, and P9) include different aspects of the innovation sequence. For example, P1 deals with a pure innovation cycle (P2), and then seeks to identify a semi-open solution. P6 and P9 also consider a semi-open problem state based on an existing design approach and a method for identifying an open solution state.

Six refinement patterns represent a variety of problem and solution states. RP 5 and 6 present a semi-open and a semi-solution state. RP 1 and 4 show a semi-open problem and a closed solution state. RP3 deals with a closed problem and an open solution state. RP2 describes a closed problem and a closed solution state.
As Figure 48 presents, I identified a taxonomy of designer-user interaction, which includes six pure innovation (P2, 3, 4, 5, 7, and 8), one pure refinement (RP2), and eight blended patterns (P1, P6, P9, RP1, RP3, RP4, RP5, and RP6). The six pure innovation patterns (P2, 3, 4, 5, 7, and 8) and three blended innovation patterns (P1, P6, and P9) characterize nine patterns in the innovation sequences, while the pure refinement pattern (RP2) and the blended refinement patterns (RP1, RP3, RP4, RP5, and RP6) identify six patterns in the refinement sequence.

Prior research did not establish design methods and models for interactions with users in the design process. The value of this taxonomy is to highlight the designer-user interaction as the critical processes for identifying the forms of designer-user interactions and the steps of applied design methods to promote effective interaction with designers in the design innovation and refinement sequences.
Chapter 8: Reflexivity Patterns in Designer-User Interaction

This Chapter deals with *how designers co-create with real users* in the design process. To address this, I posit a ‘reflexivity’ of designer-user interaction to demonstrate how designers co-create with real users in critical moments (Jaehyun Park & Boland, 2011). Therefore, I explore ways in which reflexivity could identify effective interactions in the design process. Here, I highlight two reflexivity interactions: (1) one is ‘design reflexivity’ by the designer-user interaction as a macro view; and (2) the other is ‘role reflexivity’ by designer-user interaction as a micro view.

Based on this, I analyzed forty reflexivity project stories (twenty design reflexivity and twenty designer-user role reflexivity) and clarified two design reflexivity and three role reflexivity patterns. The two design reflexivity patterns demonstrate how designer-user co-creation can identify different levels of problem solving and how designer-user problem solving interaction could identify different types of prototypes in the design process. The three-role reflexivity patterns portray how different types of designer-user co-creation by role reflexivity can develop the forms of designer-user interactions and the steps of design methods in the design process.

This Chapter is separated into four sub-sections to present the six reflexivity patterns as follows: (1) data analysis; (2) two-design reflexivity patterns; (3) three-role reflexivity patterns; and (4) lessons from reflexivity study.
8. 1 Data Collection and Analysis

During the interviews with designers, I asked two reflexivity questions. The first question was about design reflexivity project experiences, and the other question was the project episodes about the designer-user role reversals in their design projects. Based on these two questions, only twenty designers answered and shared their project experiences among thirty five designers, because the other fifteen designers did not have any experience about design reflexivity and role reversed designer-user interactions in their design projects.

Data Collection

<table>
<thead>
<tr>
<th>Questions</th>
<th>Number of Data</th>
<th>Design Artifacts</th>
<th>Products</th>
<th>Software/Systems</th>
<th>Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reflexivity Project Narratives</td>
<td>20</td>
<td></td>
<td>11</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Role reversal Project Narratives</td>
<td>20</td>
<td></td>
<td>7</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>40</strong></td>
<td></td>
<td><strong>18</strong></td>
<td><strong>15</strong></td>
<td><strong>7</strong></td>
</tr>
</tbody>
</table>

As Table 14 shows, the forty collected data deal with only twenty designers’ experiences and their project stories. The collected forty design project stories are twenty project stories related to design reflexivity and twenty project stories are associated with designer-user role reversals in the design projects. This data include a well-balanced types of design artifacts among projects, software / systems, and service design projects.
Table 15. Summary of Interview Data Characteristics

<table>
<thead>
<tr>
<th>Project Narratives (N)</th>
<th>Design Artifacts (N)</th>
<th>Research</th>
<th>Research &amp; Synthesis</th>
<th>Research &amp; Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reflexivity (20)</td>
<td>Products (11)</td>
<td>-</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Software/Systems (7)</td>
<td>-</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Services (2)</td>
<td>-</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Role reversal (20)</td>
<td>Products (7)</td>
<td>-</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Software/Systems (8)</td>
<td>-</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Services (5)</td>
<td>-</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Total: 40 Project Narratives</td>
<td>0</td>
<td>15</td>
<td>27</td>
<td></td>
</tr>
</tbody>
</table>

Table 15 shows the characteristics of the forty collected data in terms of design artifacts and processes. The data deal with well-balanced types of design artifacts; however, they only highlight Research & Synthesis (RS) and Research & Synthesis (RD) in the design process, because ‘reflexivity’ requires the actual forms of co-creation between designers and users in the design process. Thus, the data show higher number of data in RS and RD.

Data Analysis

To analyze the design reflexivity and designer-user role reflexivity on the collected data, I applied the micro dynamic pattern analysis to reveal designer-user interaction forms and methods for the collected forty project stories. In this data analysis process, I highlighted the forms of reflexivity by designer user interaction, in which reflexivity could determine the forms of designer-user interaction and applied design methods in the moments of design process. With this view, I identified five reflexivity patterns.
8. 2 Design Reflexivity Patterns

Table 16. Summary of Design Reflexivity Patterns

<table>
<thead>
<tr>
<th>Patterns</th>
<th>Reflexivity</th>
<th>Data (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Reflexivity</td>
<td>DR1  Design Reflexivity in Problem Solving</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>DR2  Design Reflexivity in Prototypes</td>
<td>9</td>
</tr>
<tr>
<td>Total</td>
<td>Two Design Reflexivity Patterns</td>
<td>20</td>
</tr>
</tbody>
</table>

Table 16 presents, I clarify two inter-related design reflexivity patterns based on twenty project stories: (1) problem solving reflexivity pattern (DR1) and (2) prototypes reflexivity pattern (DR2). The problem-solving reflexivity pattern focuses on designer-user problem solving actions, while the reflexivity in prototypes emphasizes the outcomes of how designer-user interaction could identify different levels of design outcomes in the design process. These two design reflexivity patterns are inter-related each other for encouraging mutual understanding and involvement between designers and users in the design process.

Figure 49. Design Reflexivity in Problem Solving
8.2.1 Design Reflexivity in Problem Solving

As Figure 49 presents, the first design reflexivity pattern demonstrates reflexivity of problem solving. In this pattern, designer-user interaction identifies problems of a design project and discovers solutions. After the problem-solving cycles, designers suggest / release the design solutions to users. Yet, users feel design problems on the suggested / released products or services, and they request another design reflexivity. At this moment, designers’ solutions encounter design problems and create other designer-user interaction cycle to identify the latent design problems and their solutions in a design process.

Designer-user interactions identify the problem solving reflexive pattern, and the cycles of designer-user interaction reveal the iterative problem solving. For example, the Taiwan package design, gymnastic equipment, and Korean Gas Safety Corp projects demonstrated how designer’s problem solving interaction could identify new and refined design ideas, prototypes, and design solutions as the communication boundaries between designers and users. However, their efforts failed when they met user’s boundary. Therefore, designer’s outcomes stemmed from problem-solving actions understood as problems to users and it caused designers to discover the products or processes for new design solutions. In addition, Alpha’s Arab TV and Beta’s China automobile Service design projects illustrated how designers’ problem solving met design dilemmas because of users’ cultural differences. Users recognized designers’ solutions as problems in their cultural boundary. Consequently, designers sought to understand different domains of knowledge and practice of identifying new problem statement in order to fit users’ boundary in the design sequence.
# Story of Arab TV Project

This project was completed by Alpha’s TV company, the largest worldwide digital TV Company. The Alpha designers recognized the importance of users and their cultural environment in the early stage of design planning. Thus, the designers conducted a field study and observed cultural differences in the order of writing and reading compared to international standards and guidelines. The Arab culture followed left to right rather than right to left. Based on that, they used their ethnographic research results, and then they successfully released a new product into the market. However, designers encountered a new design dilemma, because they noticed an interesting phenomenon that Arab people used the other consumer electronic projects such as mobile phones and office hardware with the international standard—from left to right order. It made a new design dilemma for designers—should we follow the international guideline or cultural practices for their future design planning?
Figure 51. A Case of Design Reflexivity in Problem Solving

# Story of Automobile Service Design Project

Beta’s automobile service design project showed the different knowledge and culture between designers and users. The Beta had a service and communication infrastructure in China, and they realized that the demand for automobiles in China had radically increased; however, the service infrastructures and maintenance were not developed. With this assumption, the Beta designers performed ethnographic studies in ten Chinese major cities to find the service relationships in real fields. Based on the field observations during three months, the designers discovered users’ hidden needs and requirements—users did not have sufficient information about cars and protocols for maintenance. Thus, the Beta designers suggested information-centered service using their existing agencies and equipment stores in China. To validate this service solution, users agreed that this design solution would be very useful; however, we will not use this, because we do not trust other service organizations or agencies. Designers recognized a unique cultural belief in China and it brought up a design dilemma—how should we contribute to this society?

Like this, the designer-user interaction identifies a problem solving reflexivity. It explains designers identified problems from the existing/established products and services, and they suggested developed design ideas and solutions to users. However, users did not
understand why the designers’ solutions and their ideas were useful or effective in their information environments. As a result, designers encountered how cultural beliefs and attitudes affect design outcomes.

8.2.2 Design Reflexivity in Prototypes

The second reflexivity pattern involves design reflexivity in prototypes as the outcomes by designer-user interaction in the design process. This pattern shows how designer-user interaction reflexivity can generate different types of prototypes by enhancing the designer-centered discovery cycle and how they can expand their knowledge boundary by connecting with users.

![Design Reflexivity in Prototypes](Figure 52. Design Reflexivity in Prototypes)

Different types of design prototypes can be explained about how this cycle can be reinforced by user validation. In this prototype reflexivity pattern, I summarize three prototypes issues: 1) prototypes for project setting and goal definition, 2) prototypes for
the new product and service development, and 3) prototypes for communication with clients and users.

1) Prototypes for Project Setting and Goal Definition

With respect to prototypes for the project settings and goal definitions, the Han River, Gamma’s game, and mobile product-business planning projects are examples. The Han River and mobile product-business planning projects offered a broad view about how designer-user interaction sought to define a new design innovation direction and project setting. These projects discovered and validated design ideas, concepts, and solutions based on direct interactions (e.g. field observations and interviews), because designers also should identify the project motivations, statements, and problems with a user-centered approach.

# Story of Gamma’s Game Solution Project

The Gamma’s game solution project showed the process identifying two different design-business prototypes using designer-user interaction. These two prototypes demonstrate how designer-user interaction can set up a project statement and orientation in the design-business project.

Gamma is one the biggest software, office, and game solution companies. To release new version of game solutions, they conducted preplanning, planning, and execution processes to identify and validate business and design impact. In this design planning and development process, designers conducted two steps of interactions: 1) business opportunities as “pretotypes” and 2) design opportunities as prototypes. In these design processes, designer-user interaction sought to understand and create values for users in
every stage of business-design development. The business prototypes deal with how the company can build a business direction, while the design prototypes consider design development based on the business goals. In this way, designer-user interaction encourages how the designers could understand effective ways of communications with real users in a certain design movement, and they synthesize different types of prototypes to communicate with users in the design project.

2) Prototypes for The New Product and Service Development

With respect to prototypes for new product and service development techniques, the insurance tool development and user testing projects demonstrate the processes about how designers sought to understand users’ interactions and information environments, and then developed design prototypes as the outcomes of multiple design actions in the development process.

3) Prototypes for Communication with Clients and Users

With respect to prototypes for social interactive tools to communicate with clients and users, the S Company’s design process and paper prototype stories represent how designers developed a series of prototypes to communicate with their users and clients to move their design process forward in negotiation and by persuasion with them. The S Company’s design process story focused on why they should invite clients and users and how their participation workshops were effective for identifying clients’ or users’ hidden needs and requirements based on the multiple and different levels of prototypes. In addition, these design actions with prototypes provided a rationale about a design process to clients and users; therefore, they easily comprehended the designers’ actions and challenges in the design process.
In this way, the design reflexivity in problem solving and prototypes should be mutually interplayed to develop the effective designer-user interactions in the design process. Most design projects consist of the recursive reflectivity between *problem solving* and *prototypes*. In the next section, I will explain the patterns of reflexivity by designer-user role reversal in the design process.
8.3. Reflexivity in Designer-User Role Reversals

<table>
<thead>
<tr>
<th>Patterns</th>
<th>Reflexivity</th>
<th>Data (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RR1</td>
<td>One way reflexivity</td>
<td>8</td>
</tr>
<tr>
<td>RR2</td>
<td>Two way reflexivity</td>
<td>10</td>
</tr>
<tr>
<td>RR3</td>
<td>One way double looped reflexivity pattern</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>Three Role Reflexivity Patterns</td>
<td>20</td>
</tr>
</tbody>
</table>

Table 17 presents, based on twenty project stories about role reflexivity of designer-user interaction, this section represents three reflexivity patterns focusing on role reversals by designer-user interaction in the design process: (1) one way reflexivity; (2) two way reflexivity; and (3) one way double looped reflexivity pattern.

To address reflexivity, I define four roles of designer-user interaction in the design process: a designer as a designer, a designer as a user, a user as a user, and a user as a designer. Also, I define three interactions between the roles of a designer and a user: (1) communication; (2) role-playing; and (3) reflexivity. The communication deals with a designer and a user interact with their original roles. The role-playing entails how a designer and a user interact with the reversed roles. The reflexivity demonstrates how a designer and a user reflect on original or reversed roles. With this justification, I illustrate the following three role reflexivity patterns by designer-user interaction in the design process.
8.3.1 One Way Reflexivity

This first role reversal reflexivity pattern is one-way reflexivity, which includes two paths. The one path demonstrates a designer as a user sees a user as a user, while the other describes a user as a designer sees a designer as a designer in the design process.

The one-way path of designers observing users is commonly encountered in an ethnographic research or a field observation, in which a designer seeks to understand real users’ interactions and activities within a users’ boundary. On the other hand, the one-directional path of users seeing designers occurred during usability testing in the design validation process. Here, a user as a designer tried to provide feedback and suggestions to designers.

**Project Story of One Way Reflexivity Pattern**

SKT’s China hotel project shows an example of this reflexivity pattern—the case of a designer as a user sees a user as a user. The objective of this project was to create a new
hotel service design for international businessmen in China. In this project, designers conducted ethnographic research to understand businessmen’s behaviors and to clarify requirements. In the ethnographic research process, the designers performed a mission -- ‘Being the customer’ (a designer as a user), and the designers separated different two different tasks: 1) a businessman with ample budget and 2) a businessman with a limited budget. Each designer conducted a series of tasks during their experience traveling as a rich or a moderately budgeted businessman from the Chinese international airport to the hotel. With this action, the designers identified design opportunities for synthesizing new hotel information service concepts as their future business-design models.

**Project Story of One Way Reflexivity Pattern**

The usability testing projects present this path of designer-user reflexivity, which describes a user as a designer sees a designer as a designer. User-centric usability S mobile device usability project demonstrated an example of this path. The S-mobile designers considered alternative alarm features and functions and they developed prototypes using multiple functional LED and vibrating. Therefore, the user-centric usability specialists validated the design prototypes what functions and features between the LED and vibrating combinations are effective as alternative signals. To do this, the usability specialists invited users and tested the prototypes. At the time, users evaluate them with the mode of a user as a user and they suggest some feedback and design ideas about on the prototypes. The result of usability test was users prefer the LED functions and features, but they were concerned about the vibrations. Also, they suggested light vibration with special alarm functions.
Based on the first one way reflexivity pattern, I interpret this pattern about designer-user interaction as follows: current effective designer-user interaction methods imply theoretical understanding about the first role reflexivity with two major paths: 1) ethnographic research by designers and 2) usability testing by users. These two designer-user interaction methods assume that “designers believe that users cannot be designers, and users only can contribute their design ideas and suggestions under the control of designers in the user-centered design process.”

8.3.2 Two Way Reflexivity

This second role reversal reflexivity pattern is two-way reflexivity, demonstrating a designer or a user with their original roles sees role-playing (role reversals) in the design process. This reflexivity pattern has two paths: 1) a designer as a designer sees their role-playing process and 2) a user as a user sees the process of reversed role-playing. This
pattern is mainly raised in participatory workshop and co-creation (co-innovation) in the design process. Especially, the participatory workshop and co-creation (co-innovation) have been considered effective approaches to understand user interactions and their environments and they have been applied with diverse versions of design methods or methodologies in the design process.

**Project Case of Two-Way Reflexivity**

Alpha’s longitudinal participatory workshops for identifying new mobile interactions present an example of this pattern. The objective of this PD workshop was to discover new interactions and validate them with users in the process of early design stage. The PD workshop was separated with three steps. In the first workshop, designers and users understand the issues of projects and generated a shared knowledge boundary as a project setting. From the first PD workshop, designers suggested for users to write a diary about their device interactions reflecting their everyday interactions with other users, products, and services. In the second PD workshop, users presented their diaries in front of other designers and users. Here, designers and users indirectly understood users’ interactions. In the second PD workshop, users shared their knowledge and practices to generate multiple versions of experiences. At the same time, designers and users transformed a general user experiences and unique experiences. In the third stage of PD workshop, designers and users pick several interesting, unique stores that they can develop as design opportunities. Here, designers and users role reversals were conducted to generate more valuable design opportunities and concepts, which reveal real user stories. Therefore, in the third PD workshop, users acted as designers and designers changed their role as users. Also, the designers and users see their interaction with their original roles. Based on this
series of PD workshops, they conducted multiple design patent and developed specific design ideas to release real design-business solutions.

For the second reflexivity pattern on designer-user interaction role, this pattern partly admits users can be designers in a certain time in the design process. Also, the user-centered designers have tried to build alternative methodological approaches to listen users’ voices and observe their real interactions in the design development.

### 8.3.3 One Way Double Looped Reflexivity

![Diagram of One Way Double Looped Reflexivity](image)

This third role reversal reflexivity pattern deals with one-way double looped reflexivity, and it explains a designer as a designer sees how a designer as a designer sees a user as a user. This pattern usually meets in the time for design analysis. Especially, we call this design analysis process as ‘design debriefing’ with other designers. At this design analysis process, designers see the participated designer how the designer as a user sees a
user as a user to identify design problems and opportunities by user interactions. In reality, this pattern is usually met in the sequence of design process because of time, financial, and resource limitations.

**Project Case of One-Way Double Looped Reflexivity**

Beta’s design debriefing process shows an example of this pattern. It refers to two-way interactions between designers and users. A designer conducted field or ethnographic studies to understand users (a user as a user) with the role of a designer as a user. After the field or ethnographic research, the designer come to his or her office and should share the direct experience and collected data to other designers that they did not have direct interactions with users. To share the observed and collected data, the designer should represent his or her experience (a designer as a user sees a user as a user) with the most objective way as possible. At this time, the designer tries to illustrate the real situations of fields without any subjective understanding, because the other designers should understand user’s objective interactions and activities like the designer. In this design debriefing, the other designers see the designer’s experience how the designer as a user understood a user as a user for identifying the facts of users and their environments. Throughout the design debriefing process, the designers doubly see the user’s information environment by the interaction of a participated designer’s experience in the design process.

For the third reflexivity pattern on designer-user interaction role, this pattern accounts for the process of how designers could create and share their design knowledge. Also, the debriefing process shows how designers could discover the effective process to
understand users, concerning the given resources (e.g. members of designers, project budgets, and so on) in the design process.

8. 4 Lessons from the Reflexivity Patterns

This chapter demonstrates how designers co-create with real users in the design process. Based on the analysis of forty reflectivity project stories, I identify five reflexivity patterns. The five reflexivity patterns describe ways in which designer-user reflexivity could support their effective designer-user interactions in critical movements. These five reflexivity patterns demonstrate how designers conduct problem-solving, prototypes, and role reversals with users for co-creating design interactions. Because most designers assume that users cannot be designers, they attempt to create the moments for co-creating users (users as designers). Therefore, design reflexivity patterns represent the designers’ endeavors to synthesize moments for co-creating with users in the process of design projects.

Table 18. Summary of Pattern Relationship

<table>
<thead>
<tr>
<th>Reflexivity</th>
<th>Design Innovation Patterns</th>
<th>Design Refinement Patterns</th>
</tr>
</thead>
<tbody>
<tr>
<td>DP1</td>
<td>P1</td>
<td>P2</td>
</tr>
<tr>
<td>DR1</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>DR2</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>RR1</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>RR2</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>RR3</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

As Table 18 presents, the reflexivity patterns deal with a micro-dynamics of designer-user interaction and these patterns demonstrate co-creation between designers and users. Also, the two design reflexivity (DR1 and DR2) and three role reflexivity patterns (RR1, RR2, and RR3) present the time temporality when the forms of the designer-user interaction and the applied design methods are utilized in the design innovation and refinement sequences.
A detailed look at the relationships between designer-user interaction patterns and reflexivity ones demonstrates that the DR1 (problem-solving design reflexivity) pattern, supports P6, P8, RP5, and RP6. Those designer-user interaction patterns in design innovation (P6 and P8) and refinement (RP5 and RP6) sequences include the forms of designer-user interactions and methods to describe how the designers’ boundary could have the problem solving inquiry between designers’ and users’. The DR1 (prototypes) pattern explains how designers could use and develop their design movement using the concepts of prototypes (P1, P3, P5, P7, P8, and RP5). Considering the relationships between roles reflexivity by designer-user interaction and the designer-user interaction patterns in the design innovation and refinement sequences, The RR1 (one way reflexivity) pattern deals with two paths: one involves designers as a users, sees the users as a user, using ethnographic / direct user interaction (e.g. field studies) techniques; the other path considers users as a designers, sees designers as a designer using usability testing techniques in the design process. Therefore, the first path of RR1 serves P1, P6, P7, and P9 patterns, which include ethnographic / direct user interaction in the design innovation sequence, while the latter path reinforces the RP5, and RP6 patterns, which conduct usability testing in the design refinement sequence. As two-way reflexivity pattern, the RR2 reflects the participatory interaction of designer-user interaction, which utilizing the techniques of role reversals (original roles see the reversed roles). Thus, it supports P3 and P8 patterns. Lastly, the RR3 (one way double looped reflexivity) is encountered all design innovation and refinement patterns, because most user-centered design firms and agencies use these techniques as a form of resource management (e.g. financial reasons and theoretical, practical experiences).
In sum, I explored the reflexivity patterns of designer-user interaction in the chapter 7 and the five reflexivity patterns have relationships to support designer-user interactions in the design innovation and design refinement sequences. Therefore, the reflexivity patterns suggest the ways for understanding how the forms of designer-user interactions and the applied methods can be applied in the moments of design processes.
Chapter 9: Implications and Future Study

This dissertation explores the patterns of interaction between designers and users in the design process. As a result, this study reveals three key findings from chapters 5, 7, and 8. In Chapter 5, I describe how designers could bring users into design without real user interactions based on two field studies. In chapter 7, I explore how designers could interact with real users. As a result, I identified fifteen designer-user interaction patterns (nine innovation and six refinement patterns) in the design innovation and refinement sequences based on the fifty-nine project stories and their analysis. In chapter 8, I present how designers could ideally co-create with real users. Based on the forty project stories and their analysis, five reflexivity patterns were clarified.

With these three inter-related findings, I define the theoretical and practical meanings from two empirical studies. Based on the three inter-related findings, I synthesize an integrated design method based on Bourdieu’s theory of practice. Finally, I propose a future research project, which would test the effectiveness of two different designer-user interaction protocols.

To address this, this chapter is divided into two sections: implications and a future study.
9.1 Implications

Based on Churchman and Schainblatt’s notion (1965), many researchers have argued the importance of designer-user interaction as a critical action in creating successful applications in management science, ISD, UCD, PD, and NPD. Indeed, management science and information system development researchers have agreed on user-designer interaction as a core of the design innovation actions for identifying design innovation. Most studies and prior research have identified the theories, models, and frameworks of how technology-driven innovation could lead to types of innovations in a society. On the other hand, interdisciplinary design researchers have identified a variety of design vocabularies (design methods and models) to explain designers’ manners and movement in the areas of engineering design, user-centered design, participatory design, and so forth. Yet, they did not suggest appropriate theories, models, frameworks, and protocols to theorize the design vocabularies, which deal with where users are and how designers could communicate with them.

This study tries to bridge this gap; that is, how human interactions could drive the different types of innovation in the design process. Particularly, I posit the designer-user interaction as the core of human interactions among multiple stakeholders and seek to theorize the relationships between designer-user interaction and their design outcomes. With this research proposition, I explore and theorize patterns between designers and users in the design process. This includes three ways of designer-user interaction in the design process: (1) the alternative methods of bringing users into design; (2) the effective methods of interacting with users; and (3) the ideal methods of co-creating with users.
Figure 56 summarizes three findings of designer-user interaction to theorize patterns between designers and users in the design process. In chapter 5, I realized that there are not actual user interactions in the design process. Designers only conduct alternative interactions for virtually bringing users into design. In chapter 7, I identified fifteen designer-user interaction patterns (nine innovation and six refinement patterns) by exploring how designers interact with real users in the design process based on fifty-nine project narratives. In chapter 8, I identified five patterns (two design reflexivity and three role reversal patterns) by discovering how designers could ideally co-create with real users in the design process based on the analysis of forty project narratives.

Theoretically, these three inter-related designer-user interaction findings elucidate a generative inquiry of designer-user interaction on Bourdieu’s theory of practice in design research.
Toward a Model of Designer-User Interaction Based on Bourdieu’s Theory of Practice

After Schultze & Boland (2000) explained Bourdieu’s theory or practice in ISD, few scholars have applied his theory as a theoretical foundation in organizational technology and ISD. Their major augment was how multiple stakeholder-capital (field) could influence subjective interpretations, and the individuals’ understandings could represent actual practice in their working places in the context of information processing, community of knowing, and community of practice. Here, they highlighted the concept of ‘boundary spanners’ to expand different boundaries within their practices (boundary in practice) in ISD or new product development. Yet, this concept presents a limited understanding of his theory with a determined condition, rather than generative actions.

In this dissertation, I suggest a model of designer-user interaction, which identifies two designer-user interaction loops on Bourdieu’s theory of practice. This model describes a generative inquiry between designer’s decision (reflected on habitus) and designer-user representative actions (reflected on practice) in the design process.

As Figure 57 presents, every design project could follow Bourdieu’s triangular loop based on his theory of practice (field-habitus-practice), in which the designer’s decisions (habitus) can enact designer-user interactions (practice). With the direction from habitus to practice, there are two paths: moving toward field, or not. In most design projects, the represented design practices might not suggest successful design outcomes into the field by a single cycle, because the designers have challenges in bringing users into design in the design process. Therefore, most design practices, representing designer-user interaction require the other two loops, which represent the cycles of (1) the effective methods of interacting with users and (2) the methods of co-creating with users.
The first designer-user interaction loop identifies *effective* ways of *interacting with users*, and consists of the following three actions: 1) the outcomes of design practice (e.g. lack of information, ill-defined problems, and ill-developed solutions) could encounter X (change of practice); 2) the conditions of X (change of practice) could enhance Y (designer’s cognition); and 3) the conditions of Y support Habitus (designer’s decision).

This latent designer-user interaction cycle could reinforce existing design decisions or synthesize new design orientations to enact new designer-user interaction. As an outcome of chapter 6, I elucidated fifteen designer-user interaction patterns (nine innovation and six refinement patterns) as communication structures, stemming from the first designer-user interaction loop.
This first latent loop, the effective methods of interacting with users, supports designer-user interaction to construct/reconstruct the interactions between designers’ habitus and designer-user interaction in practice. Yet, this loop does not explain the communication methods of enactment or leadership between a designer and a user. Most existing interactions of designers and users are rooted in the belief that a user cannot be a designer, except at certain times. Although the communities of ISD, UCD, and PD have developed alternatively effective methods of designer-user interaction, the original Churchman and Schainblatt assumption was to synthesize a balance of leadership between designers and users in management science. Therefore, a second designer-user interaction loop is required to understand the dynamics of leadership of designer-user interaction.

The second designer-user interaction loop illustrates the methods of co-creating with users. Specifically, this loop presents the moments when a designer acts as a user and a user as a designer (role reversals). This view with role enactment and role-reversed communication represents pure communication.

This second loop follows three actions: 1) the problems of X (e.g. ill-presented enactment of designer-user interaction, ill-balanced roles/leadership between designers and users) could encounter X’ (change of X); 2) the conditions of X’ could enhance Y’ (e.g. better enactment and leadership between a designer and a user); and 3) the conditions of Y’ positively support Y. Ultimately, this loop describes an equilibrium status, well-balanced designer-user interactions. Ideally, there are three equilibrant moments in the design process: (1) when the roles of a designer and a user are same; (2) when the spaces of problem and solution are same; and (3) when the conditions between design and business are same. To show reflective communication, this loop explains how the roles of
designer-user interaction can be balanced and/or their leadership can be shared in the
design process. Chapter 7 elucidates five patterns about design reflexivity (two patterns)
and designer-user roles (three patterns), stemming from the second designer-user
interaction loop.

Based on the theorized the patterns of designer-user interaction with three levels, I
proposed an integrated model (Figure 57) that enhances Bourdieu’s original theory of
practice. Specifically, I highlight how designer-user micro dynamics could synthesize
effective interactions to reinforce the first loop of the design-user cycle. Also, this model
represents how designer-user reflexive design boundaries and roles could reinforce the
ideas about forms of designer-user interaction and steps of design methods in the second
loop. These expanded meanings identify a generative design inquiry between designers
and users to develop a model of designer-user interaction for design researchers in
management science, ISD, UCD, PD, and design methods and processes areas.

In radically changing design-business environments, this dissertation provides a guideline
of how designers can identify users and can communicate them. Since user-centered
design (UCD) approach and participatory design (PD) have spread out in research and
practice areas, they have addressed weaknesses and improved the traditional client-
centered design methods and managerial decisions by ethnographic research, user
interviews, usability testing, or ergonomic studies. Broadly, this research has effectively
brought / invited users into design place; however the established design methods and
models have limitations. They must overcome the requirements of current IT and
systems, user experience, innovation, and service design practitioners. Complex business
environments call for multiple aspects, methods, and relationships with users in creating
successful management and innovation applications. Yet, in reality, there were no directions and guidelines to identify users and communicate with them. Therefore, this dissertation suggests positive directions for practitioners to develop a set of practical manners and new design vocabularies with users in the design process.
9. 2 Future Study

This dissertation explored the *patterns* of designer-user interaction in the design process. This finding allows me to set up the designer-user interaction *protocol* testing study a future study. Figure 55 presents the ideal interaction between a designer and a user, which takes the same leadership (equilibrant power), and a dramaturgical perspective demonstrates the moments of how a designer’s and a user’s the roles are ideally equilibrant in the design process (Jae Park & Boland, 2012). Therefore, my designer-user interaction pattern study requires a protocol testing research. The objective of this protocol study is to test which designer-user interaction protocol is more effective in creating better design outcomes during a design process. To conduct a laboratory simulation study, I ask the following two questions:

(1) Which designer-user interaction protocol can effectively represent their taken roles in the design process over time?

(2) Which designer-user interaction protocol is more effective in creating better design outcomes in the design process over time?

**Proposed Two Protocols**

As a laboratory simulation study, this research synthesizes two designer-user interaction protocols (a user-centered design protocol and a sociodrama protocol) and determines the effectiveness of these two designer-user protocols during a design process. Figure 58 presents two designer-user interaction protocols: (1) User-Centered Design protocol and (2) Sociodrama protocol.
Protocol 1: User-Centered Design Protocol

The first user-centered design protocol demonstrates how designers can identify design problems and solutions based on users’ requirements. In the first user-centered design approach protocol, designer-user interaction consists of four interaction stages during a design project over time: (1) understand users, (2) propose design ideas and situated design outcomes, (3) evaluate design ideas and situated design outcomes, and (4) finalize design ideas and situated design outcomes.

A general outline of the first user-centered design protocol is as follows: in the first stage, a designer seeks to understand a user and his or her design requirements. That stage identifies design problems and a certain design environment, concerning users and their design requirements. The second stage defines the user’s requirement in a design project, the role of a designer is to suggest design ideas and situated design outcomes to the user,
while a user’s role is to understand these temporal design ideas and design outcomes from the designer. In the third stage, a user, an active actor, will adopt the given temporal design ideas and design outcomes, and evaluate them in order to provide feedback to the designer. In the fourth stage, the designer will develop the temporal design ideas or design outcomes through the user’s evaluations and feedback. This stage will identify final design ideas or design outcomes in a design project.

This User-Centered Design protocol suggests a methodological technique in order to express how a designer actively interacts with a user during a design process. In the first protocol, a designer is a more active stakeholder, and he or she has more power than a user during a design process.

**Protocol 2: Sociodrama Protocol**

The second sociodrama protocol (Moreno, 1943, 1953; Sternberg & Garcia, 2000) demonstrates how designers and users can co-create design problems and design outcomes. The sociodrama protocol comprises four interaction stages between a designer and a user during a design project: (1) *interplay* with general design ideas, (2) *identify* propositions in creating design ideas and situated design outcomes, (3) *co-create* design ideas and situated design outcomes through their dynamic role-reversals, and (4) *share* integrated design ideas and situated design outcomes as a designer and a user in a design group.

The second sociodrama protocol illustrates a strategic outline as follows: during the first stage, a designer and a user interplay in order to generate design ideas such as what aspects create a design problem and how to define design goals, motivations, and related
design knowledge. To understand what the designer’s and the user’ cognition and actions are, a designer and a user should express their authentic thoughts, feelings, and emotions through their interactions. In the second stage, a designer and a user can identify a unique design proposition in creating design ideas and situated design outcomes. In this stage, a designer and a user can elucidate a boundary and a mutual interface through their interactions based on sociodrama practice. In the third stage, a designer and a user co-create design ideas and situated design outcomes through dynamic role-reversals. To co-create design ideas and situated design outcomes, a designer and a user transfer design ideas and translate / transform different design ideas and situated design outcomes through four modes of design roles: (1) a designer as a designer; (2) a designer as a user; (3) a user as a user; and (4) a user as a designer. In the fourth stage, a designer and a user share the integrated design ideas and situated design outcomes by developing emerging design ideas and outcomes. To integrate design ideas and situated design outcomes, they cooperate as a design group. Through the approach of sociodrama, they determine what types of design ideas and design outcomes are applicable.

In this second protocol, the strategic outline of sociodrama seeks to find out how a designer and a user can interact with each other with an equivalent level of interaction during a design project.

Compared to protocol 2, protocol 1 assumes that a designer has more power than a user, and most intentions of activities and interactions depend on a designer. On the other hand, protocol 2 assumes a democracy of involvement between a designer and a user during a design process. Therefore, protocol 2 focuses on how a designer and a user can interplay,
co-create, and share with each other in order to create design ideas and situated design outcomes during a design project.
Chapter 10: Conclusions

A new business-design paradigm requires better understanding of user experience and user information environments in order to identify successful value propositions in a market. Therefore, “users” are becoming critical in the analysis and synthesis of innovative ideas in the design process.

Despite previous endeavors of design researchers and practitioners to incorporate users in design theories and practices, there are gaps between theories and actual designer-user interactions in the design process. In an effort to bridge this gap, I explored patterns of interaction between designers and users in the design process with two research questions regarding patterns of designer-user interaction and relationships that emerge from these interactions. Bourdieu’s theory of practice and boundary objects formed the theoretical foundation of my analysis.

The dissertation comprises two qualitative studies. Firstly, the two extended field studies in design firms, conducted over a period of five months described how designers bring the user into the design without actual user participation in the design process. This led to recognition of the difficulties associated with the inclusion of real users in the design process. The discovery at this stage was the ways in which designers compensated for the absence of real users in the design process. The second qualitative study consisted of thirty-five interviews covering a broad range of user-centered design settings. In the data analysis phase, the ninety-nine project narratives were transcribed and analyzed using the grounded theory approach. From this analysis, I was able to codify fifteen designer-user
interaction patterns in the design innovation and refinement sequences and five reflexivity patterns in the design process.

I consolidated the three inter-related findings – substitution for actual users by designers, designer-user interaction patterns and reflexivity patterns in the design process - to propose an integrated designer-user interaction inquiry system in the design process. The proposed designer-user interaction inquiry system demonstrates two latent interaction loops between designers and users for bringing users into design, effectively interacting with users, and co-creating with users in the design process. Finally, this study will provide a connection between discovering designer-user interaction patterns (a qualitative research) and testing effective protocols (a lab experiment research).

The dissertation makes three contributions. First, it addresses methodological gaps of established design methods and models (vocabularies), which have found it challenging to incorporate users in the design process. My pattern studies will open a variety of methodological directions for the communities of design process and method researchers and practitioners. Second, this study focuses on theoretical limitations in understanding generative actions of designer-user interactions. To address this, it adopts and consolidates two theories (Bourdieu’s theory of practice and boundary objects) to elucidate the patterns of designer-user interaction during a design process. As a result, it suggests fifteen designer-user interaction and five reflexivity patterns and proposes an integrated theoretical model to understand users more explicitly in the design process. In addition, the proposed connection between designer-user interaction pattern and protocol studies will pave the way for more rigorous empirical study in designer-user interaction for the research communities in ISD, management science, NPD, UCD, PD, among
others. Lastly, this dissertation points out the failures of business-design solutions and applications in a market resulting from the differences between ideal approaches and real situations of designers’ interactions with users. Therefore, it will suggest a practical guideline for practitioners to synthesize appropriate design vocabularies to create new products and services in a radically changing business-design environment.
## Appendix

### Two Field Study Data

<table>
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<tr>
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<th>Observed Projects</th>
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**Total: Nine Patterns / Thirty Two Innovation Project Narratives**
### Six Refinement Patterns (RP1–6)

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**Total: Six Patterns / Twenty Seven Refinement Project Narratives**
Design Reflexivity Pattern (DR1~2)

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Total: Two Patterns / Twenty Project Narratives
## Role Reflexivity Pattern (RR1–3)

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**Total: Three Patterns / Twenty Project Narratives**
References


of the European Academy of Management 2nd Annual Conference on Innovative Research in Management (EURAM), Stockholm, Sweden.


