Co-creation Patterns between Designers and Users in the Design Process: A View of Reflexivity

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Abstract. In this paper, we empirically explore designer-user co-creation patterns in the design innovation process with a view of design reflexivity. This paper entails two propositions. First, co-creation between designers and users function as the core action in discovering and validating complex design information environments. Second, co-creation between designers and users can be identified by two reflexivity concepts: design reflexivity and role reflexivity. With these two propositions on designer-user co-creation, we ask the following research questions: (1) what do co-creation between designers and users characterize distinctive patterns in the design process? (2) How do designer-user co-creation patterns change a design routine in a design process? As an empirical approach, this study analyzed forty IT & design innovation project narratives and synthesized five designer-user co-creation patterns (two design reflexivity and three role reflexivity). The significance of this study is to open the importance of co-creation on the designer-user interaction, and it seeks to empirically explore the patterns of co-creation and suggests a theoretical / practical guideline for researchers and practitioners in the community of design process.

Keywords: Design & IT innovation Processes, Designer-User Co-creation, Reflexivity, Design Patterns.

1   Introduction

During the last forty years, the communities of design science, organization behaviors, and implementation have considered the importance of designer-user interactions in synthesizing better design outcomes in information systems (IS). In prior research, a few IS researchers have theoretically argued how IS designers could effectively understand IS users in user involvement (Ives & Olson, 1984; Kasper, 1996), information systems development (ISD) (Griffith, 1999; Levina & Vaast, 2005), and organizational learning for understanding the boundaries of users in ISD (Boland Jr, 1978; Carlile, 2002; Salaway, 1987). Based on their endeavors, IS systems design theories and methodologies have improved the theoretical knowledge and practices of

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designer-user interaction in IS. however, the established systems design methodologies do not consider how IS designers could co-create users more effectively. Also, the co-creation of designer-user has become a critical function for identifying the information boundaries of IS designers and IS users in the early stage of ISD. Moreover, these identified information boundaries between IS designers and users could lead successful IT artifacts and innovations in ISD. Therefore, this research deals with *how designers co-create with real users* in the design process. Based on the lack of co-creation between IS designers and uses in ISD, this research empirically explores the designer-user co-creation patterns and asks two research questions as follows:

(1)   *What do patterns of co-creation between designers and users encounter, occur in, and evolve in ISD?*
(2)   *What do roles between designers and users identify their co-creation patterns?*

To address these two research questions, this research posits a 'reflexivity' of designer-user interaction to demonstrate how designers co-create with real users in critical moments (Park, 2012; Park & Boland, 2012). Especially, this study takes a view of Bateson's reflexivity (Bateson, 1979, 2000) and Star and Griesmer's boundary objects (Star, 1989; Star & Griesemer, 1989) as theoretical foundations to support the issue of how IS designers could identify the information environments (boundaries) between designers and users in ISD. In this study, we 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 addressing the first research question; and (2) the other is *'role reflexivity'* by designer-user interaction as a micro view addressing the second research question. As macro view of co-creation, the design reflexivity adopts Bateson's reflexivity in order to represent the *invisible loops* by designer-user co-creation. As a micro view of co-creation, on the other hand, the role reflexivity uses boundary objects in order to present *designer-user intangible purposes, actions and outcomes on the loops of designer-user co-creation*.

To empirically validate these two questions, this paper collected forty reflexivity project stories (twenty design reflexivity and twenty designer-user role reflexivity) associated with designer-user co-creation and conducted a grounded theory approach to synthesize the designer-user co-creation patterns. As a result, it elucidates five co-creation patterns of designer-user interaction, and it includes two-design reflexivity and three-role reflexivity patterns in the design process. 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.

The contributions of this paper can be summarized: (1) it theoretically identifies five patterns of co-creation between designers and users in the design process; (2) it addresses the concept of reflexivity for arguing managerial dilemma between designers and users and their co-creation in the design process; and (3) it practically

represents the contexts of how current IS designers could interplay with IS users with a view of reflexivity in the design process.

This paper is separated into five sub-sections to present the five reflexivity patterns as follows: (1) literature review; (2) theoretical foundation; (3) methodology; (4) findings; and (5) conclusions and implications.

2   Literature Review

This study explores co-creation patterns between designers and users with a view of reflexivity in the design process. To understand previous works of designer-user co-creation, it reviews the studies of designer-user interaction in participatory design research, which deals with co-creation in ISD focusing on user-driven innovation, and user-centered design, and the other related topics of in the design process.

2.1   Co-creation in Information Systems Development

Based on Churchman and Schainblatt (1965), IS researchers have considered the importance of mutual understanding between designers and users in creating successful managerial application. On his conceptual idea, some IS researchers have discovered multiple stakeholders' collaborations and their interaction in ISD (Barki & Hartwick, 2001; Kaiser & Bostrom, 1982; Levina, 2005; Robey, 1994). In addition, the community of user involvement research has considered the roles of users and focused on how users could be a more active stakeholder group in ISD (Ives & Olson, 1984; Kasper, 1996; Schonberger, 1980; Tait & Vessey, 1988). Moreover, only a few IS scholars have empirically tested designer-user interaction in order to validate the effectiveness of their interactions in ISD (Baskerville & Stage, 1996; Boland Jr, 1978; Marakas & Elam, 1998; McLean, 1979; Salaway, 1987). Yet, these multiple stakeholders' collaboration, user involvement, and designer-user interaction studies have challenges for identifying the co-creation between designers and users in the process of ISD.

In IS research, Hirschheim (1985) firstly maintains the idea of participative system design based on Scandinavia research tradition, in which he highlights the degree of users' involvement between social and technical contents in ISD. Although a few studies have considered designer-user interactions in terms of multiple stakeholders' collaboration, user involvement, and designer-user interaction in ISD; these research do not provide any research theories, methodologies, and practical directions of co-creation of designer-user interaction in ISD. Therefore, this research considers co-creation in participatory design in Scandinavia.

2.2   Co-creation in Participatory Design

Since 1970's, some scholars has historically developed participatory design in Scandinavia (Ehn, 1993; Kyng, 1991). 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 (Ehn, 1988; Wittgenstein & Anscombe, 1997).

2.3   Users as Designers in PD

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 context-centered design approach investigates the effectiveness of cooperating tools and techniques among participants in PD.

Fischer & Scharff (2000) propose '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) argues 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) outline the diversity of designers and users stemming from passive customer to meta-designer in the designer development. With this categorization, they demonstrate 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, 2001; Suwa, Gero, & Purcell, 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.

2.4   User-Driven Innovation in PD

PD research has emphasized user-driven innovation in design methods and the concepts of collaboration. Buur et al. (2000) argue 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) argue '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) posit 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) overview 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.

2.5   Lessons from Literature Review

Co-creation of designer-user interaction has been theoretically and methodologically considered in ISD by most Scandinavian ISD researchers; however, it has become one of the most central issues in ISD, design science research, and information & organization research areas. Based on previous IS and PD researchers' endeavors, the issues and topics on co-creation by designer-user interaction can be summarized as the following 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, 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 focusing on co-creation with these three research orientations, IS researchers could consider the PD research as theoretical and practical propositions for identifing problems and solutions in-between IT and human-centered innovation. Yet, current problems of designer-user interactions in ISD and PD research do not provice any clear cut of theories, patterns, methods, protocols, and frameworks for the communities of researchers and practitioners of how they could understand the theoretical, methdological, or practical actions between IS designers and IS users in ISD. Thus, this research will highlight the patterns of co-creation that encouter, occur in, and evolve between designers and users in ISD.

3   Theoretical Consideration

To address the research questions, I adopt Bateson's reflexivity (Bateson, 1979, 2000) and Star and Griesmer's boundary objects (Star, 1989; Star & Griesemer, 1989) to elucidate the patterns of co-creation between designers and users in the design process. Using Bateson's reflexivity, this study supports the first research question focusing on design reflexivity--*What do patterns of co-creation between designers and users encounter, occur in, and evolve in ISD?* On the other hand, this argues the second research question on Star and Griesmer's boundary objects focusing on the roles of designer-user interaction --*What do roles between designers and users identify their co-creation patterns?*

    Considering the characteristics of co-creation of designer-user interaction, it consists of intangible interactions between designers and users. To represent these invisible actions, previous theorists have developed a few theoretical knowledge and practice for understanding multiple stakeholders' behaviors and their information environments (Argyris & Schön, 1999; Bourdieu & Wacquant, 2004; Giddens, 1984; Goffman, 1967). In macro view on multiple stakeholders' interaction, Giddens (1984, 1991) argues the modularity between social structure and individuals for incorporating social meanings by constructing the given social structures. Bourdieu (1986; 2004) more emphasizes subjective interpretation in order to theorize the generative actions among multiple stakeholders in our societies. In micro dynamics of multiple stakeholders' behaviors, Argyris & Schön (1999) argue how the involved participants could share their ideas and take actions by negotiating them in the cycle of organizational learning. Goffman (1967, 1970) argues the different self-images between front state and back stage using a dramaturgical perspective. Yet, these theoretical concepts do not give a clear guideline for understanding co-creation between designers and users in terms of the changing *cycle* and the information environments (boundaries) by their interaction and co-creation in the design process. Thus, in this research, I interpret Bateson's reflexivity as macro reflexivity for demonstrating design reflexivity, which identifies co-creations between designers and users. Also, as micro reflexivity, I use boundary objects for understanding role reflexivity on the co-creation of designer-user interaction that identifies the latent loops and knowledge boundaries as information environments between designers and users in the design process.

3.1   A Proposed Model

To analyze the co-creation patterns between designers and users, this paper proposes a research model.
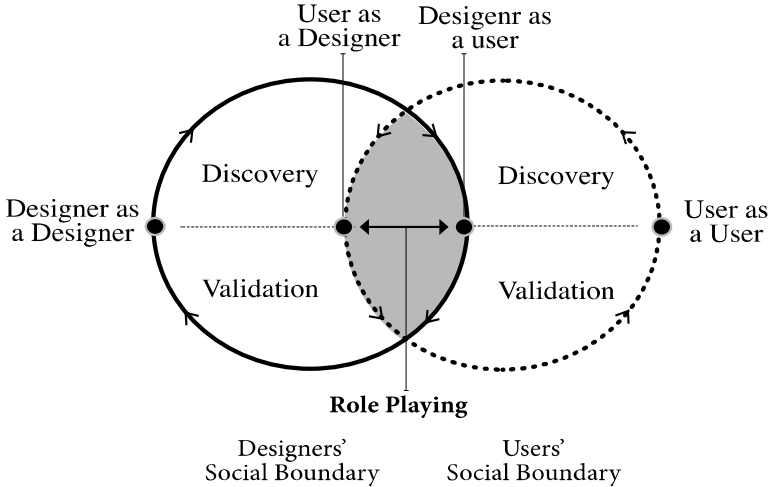

Fig. 1. Model of Co-creation of Designer-User Interaction

As Figure 1 presents, this model is made up of two different information boundaries. One is designer's boundary and the other is user's one. Looking at the boundaries (designer's and user's ones), there are two characteristics: (1) design action reflecting on design reflexivity, and (2) design roles by role reflexivity. Thus, each boundary consists of two design actions: discovery and validation. Also, the boundaries have two different roles (original and reversed roles). Based on these characteristics, each of the cycles of designers and users encounter, occur in, and evolve their information boundaries in the design process. Based on this proposed model, this study highlights the co-creation of designer-user interaction based on their design reflexivity and role reflexivity in the design process.

4   Methodology

During the interviews with designers, this study considers two questions associated with the co-creation of designer-user interaction by a view of reflexivity. The first question was about design reflexivity project experiences reflecting on the first research question. The other question was the project episodes about the designer-user role reversals in their design projects based on the second research question. 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.

4.1   Data Collection

As Table 1 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 well-balanced types of design artifacts among projects, software / systems, and service design projects.

Table 1. Descriptive Summary of Interview Data

Questions	Number of Data	Design Artifacts		
		Products	Software/Systems	Services
Reflexivity Projects	20	11	7	2
Role reversal Projects	20	7	8	5
Total	40	18	15	7

Table 2. Summary of Interview Data Characteristics

Collected Data		Designer-User Interactions in the Design Process		
Project Narratives (N)	Design Artifacts (N)	Research	Research & Synthesis	Research & Development
Reflexivity (20)	Products (11)	-	2	9
	Software/Systems (7)	-	1	6
	Services (2)	-	1	1
Role reversal (20)	Products (7)	-	3	4
	Software/Systems (8)	-	5	3
	Services (5)	-	3	2
Total: 40 Project Narratives		0	15	27

Table 2 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 & Development (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.

4.2   Data Analysis

To analyze the design reflexivity and designer-user role reflexivity on the collected *forty* reflexivity project stories with the co-creation of designer-user interaction, I performed a grounded theory approach (Strauss & Corbin, 1990) to identify relevant frameworks, directions, and guidelines on collected project stories (episodes) as analytic methods. During this analysis, I highlighted the forms of reflexivity by co-creation of designer user interaction, in which reflexivity could determine the forms of co-creation of designer-user interaction and applied design methods in the moments of design process. With this view, I identified *five* designer-user co-creation patterns by a view of reflexivity.

To understand the co-creation patterns of designer-user interaction, 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 investigated forty 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 through 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 co-creation patterns between the designer-user interactions.
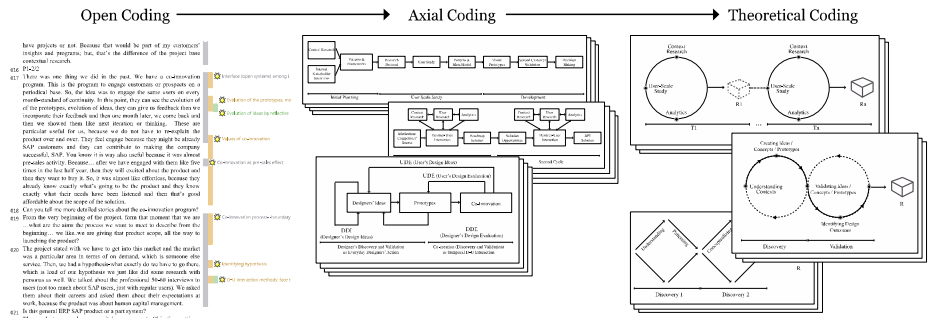

Fig. 2. Overview of Data Analysis Process

As Figure 2 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 the forty design project narratives to clarify codes, themes, and memos in the transcribed project stories using Atlas.ti, qualitative research software. Also, I analyzed the co-creation of 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 co-creation of designer-user interactions and applied design methods over time. Based on the open coding process, forty process diagrams were synthesized, which represent the co-creation of 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 forty project diagrams. After the axial coding process, I performed a theoretical coding process to incorporate the given process diagrams to synthesize co-creation patterns between designer-user interaction and their resulting outcomes in the sequence of design innovation and refinement.

During this grounded theory approach, I clarified eight designer-user interaction criteria to identify co-creation patterns on interaction between designers and users in the design process: (1) time (temporal versus longitudinal), (2) space (micro versus macro), (3) purpose (discovery versus validation), (4) history (with prior history versus without), (5) method (indirect versus indirect), (6) designer-user interaction leadership (designer-centered vs. user-centered vs. co-creation), (7) number of cycles (single versus multiple), and (8) problem-solving (problem-centered versus solution-centered). These eight criteria demonstrate the issues of scale / measurement how each pattern is identified through the data analysis process.

As an outcome, I elucidated five patterns (two design reflexivity and three designer-user role reflexivity) and created pattern diagrams and descriptions to theorize the relationships between the co-creation of designer-user interaction and design innovation in the design process. The next five co-creation patterns of designer-user interaction present how the co-creation of designer-user interactions can identify certain design outcomes (e.g. product, service, or IT system design) in the design process.

5   Finding: Five Co-creation Patterns of Designer-User Interaction

5.1   Two Co-creation Patterns in Design Reflexivity

Table 3 presents, I clarify two inter-related co-creation patterns in the design reflexivity based on twenty project stories: (1) problem solving reflexivity pattern (pattern 1) and (2) prototypes reflexivity pattern (pattern 2). 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 co-creation patterns in the design reflexivity are inter-related each other for encouraging mutual understanding and involvement between designers and users in the design process.

Table 3. Two Co-creation Patterns in Design Reflexivity

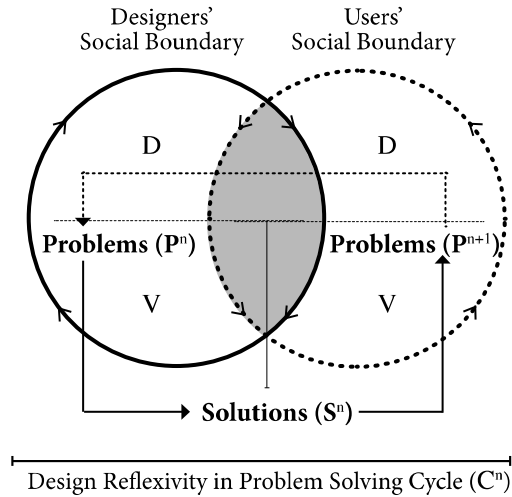| Patterns		Co-creation Patterns by Design Reflexivity	Data (N)
Design Reflexivity	Pattern 1	Design Reflexivity in Problem Solving	11
	Pattern 2	Design Reflexivity in Prototypes	9
Total		Two Design Reflexivity Patterns	20

Fig. 3. Design Reflexivity in Problem Solving

Co-creation Pattern 1: Design Reflexivity in Problem Solving

As Figure 3 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 the other 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, some samples of the collected data (e.g. Taiwan package design, gymnastic equipment, and Korean Gas Safety Corp projects demonstrate 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 (see Figure 4) and Beta's China automobile Service design (see Figure 5) illustrate 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.
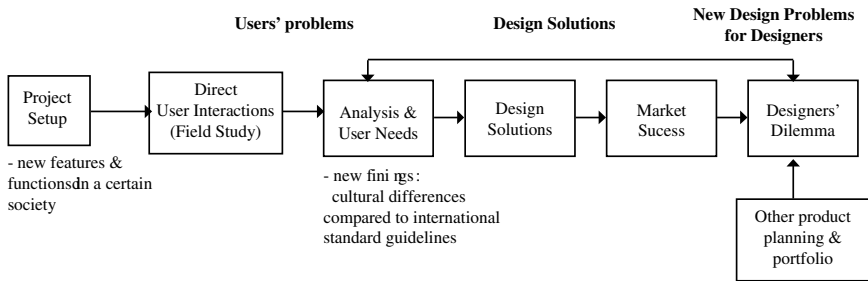
Fig. 4. A Case of Co-creation Pattern 1
(Design Reflexivity in Problem Solving)

Story of Arab TV Project

As Figure 4 shows, 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?

Co-creation Pattern 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.

As Figure 6 represents, 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. 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.
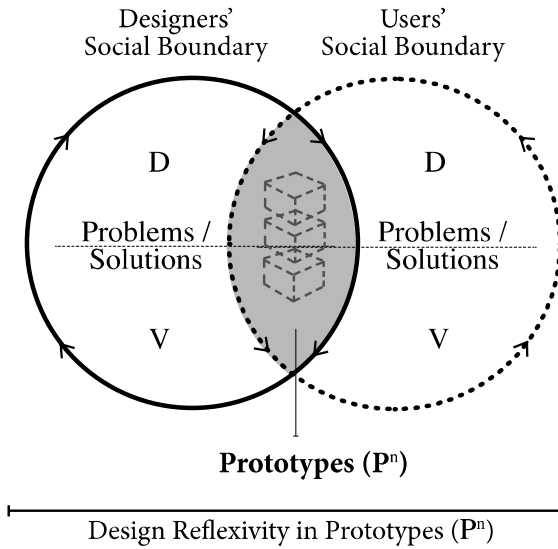
Fig. 5. Co-Creation Pattern 2: Design Reflexivity in Prototypes

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 "pretypes" 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 co-creation patterns of reflexivity by designer-user role reversal in the design process.

5.2   Three Co-creation Patterns in Designer-User Role Reflexivity

Table 4 presents, based on twenty project stories about role reflexivity of designer-user interaction, this section represents three co-creation 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.

Table 4. Three Co-creation Patterns in D-U Role Reflexivity

Patterns		Co-creation by Designer-User Role Reversals	Data (N)
Role Reflexivity	Pattern 3	One way reflexivity	8
	Pattern 4	Two way reflexivity	10
	Pattern 5	One way double looped reflexivity pattern	2
Total		Three Role Reflexivity Patterns	20

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.

Co-creation Pattern 3: One Way Reflexivity
As Figure 7 presents, the first role reversal co-creation pattern (pattern 3) 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.
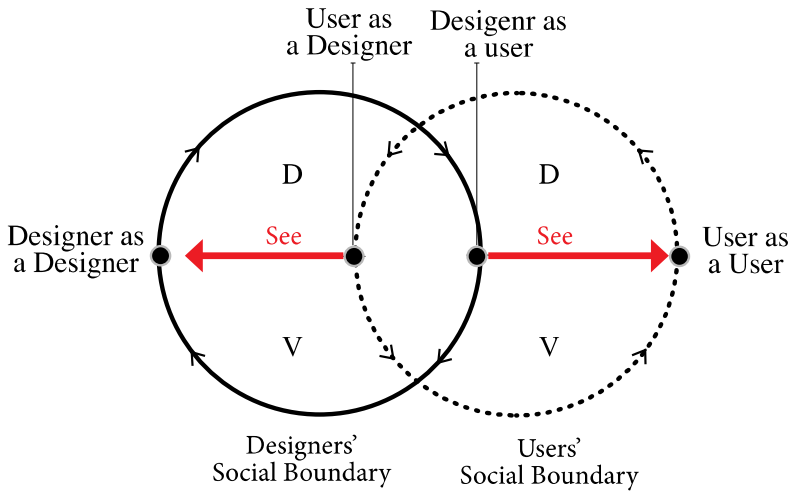

Fig. 6. One Way Reflexivity

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
Gamma'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

Delta's 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 (pattern 3), I interpret this pattern about the co-creation of designer-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."

Co-creation Pattern 4: Two Way Reflexivity

As Figure 8 shows, the second co-creation pattern (pattern 4) by designer-user role reversal is *two-way reflexivity*, demonstrating a designer or a user with their original roles sees role-playing (role reversals) in the design process. This co-creation 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.
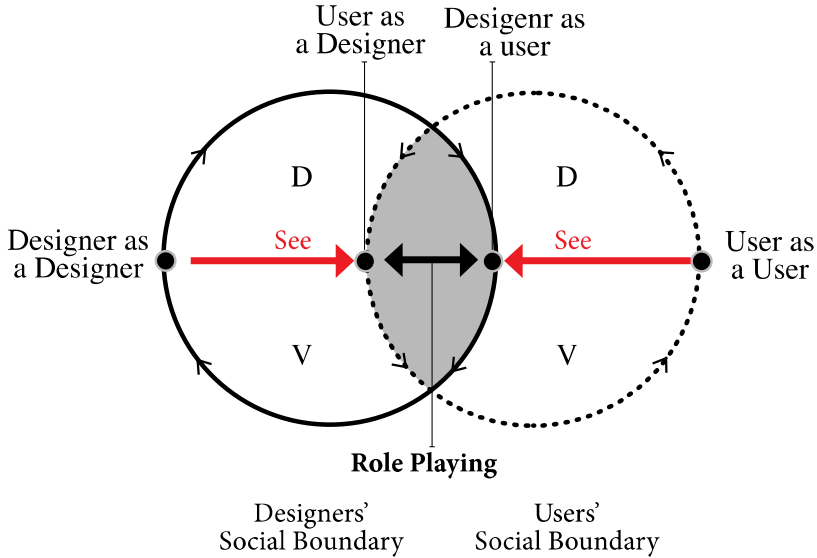
Fig. 7. Two Way Reflexivity

Project Case of Two-Way Reflexivity

Epsilon'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 to users' voices and observe their real interactions in the design development.

Co-creation Pattern 5: One Way Double Looped Reflexivity

As Figure 8 represents, the third co-creation pattern (pattern 5) by designer-user role reversal reflexivity 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.
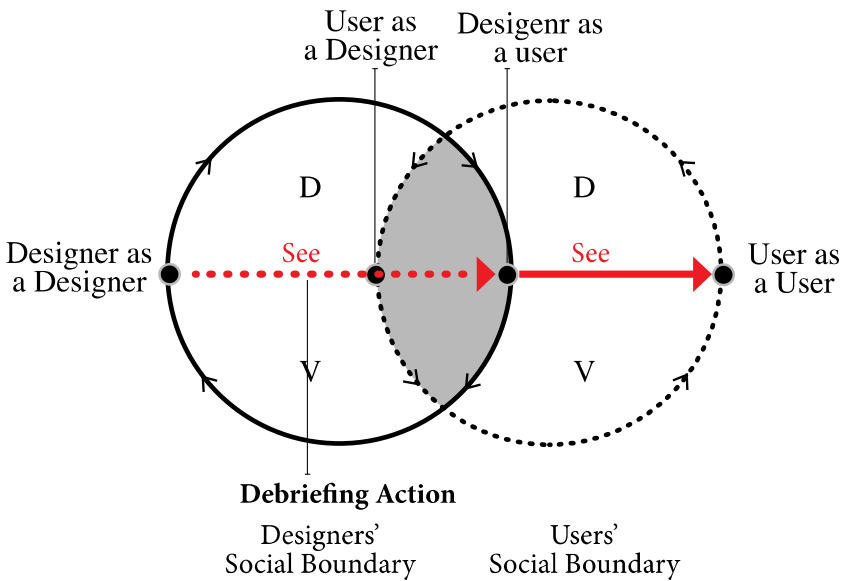

Fig. 8. One Way Double Looped Reflexivity

Project Case of One-Way Double Looped Reflexivity

Zeta'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 fifth co-creation 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.

In sum, this research synthesizes five co-creation patterns, which consider a view of reflexivity—design reflexivity and designer-user role reflexivity. The first two co-creation patterns (pattern 1 and 2) highlight how designer-user co-creation could lead designer reflexivity in problem-solving process (pattern 1) and prototypes (pattern 2) based on designer-user interaction in the design process. On the other hand, the latter three co-creation patterns (pattern 3, 4, and 5) emphasize how designer-user role reversals could identify three reflexivity as the patterns of co-creation on designer-user interaction as follows: 1) one way reflexivity; 2) two way reflexivity; and 3) one way double looped reflexivity.

6   Implication and Conclusions

This study 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. 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 (pattern 1 and 2) and three role reflexivity patterns (pattern 3, 4, and 5) present the time temporality when the forms of the co-creation on designer-user interaction and the applied design methods are utilized in the design innovation.

Through this research, intangible five co-creation patterns between designers and users are elucidated. This conclusion makes the following contributions for the community of participatory design, information systems development, and information and organization studies in IS. First, it theorizes the patterns of co-creation on designer-user interaction in the design process. Second, it provides a methodology of how IS designers could understand effectively IS users in the design process. Especially, it highlights intangible micro dynamics between designers and users and their co-creation moments in the design process. Third, it suggests a practical guideline of co-creation about how IS designers could apply co-creation methods in order to interact with actual and virtual IS users in the design process.

References

Argyris, C., Schön, D.A.: On organizational learning (1999)

Barki, H., Hartwick, J.: Interpersonal conflict and its management in information system development. Mis Quarterly 25(2), 195–228 (2001)

Baskerville, R.L., Stage, J.: Controlling prototype development through risk analysis. Mis Quarterly, 481–504 (1996)

Bateson, G.: Mind and nature: A necessary unity. Dutton, New York (1979)

Bateson, G.: Steps to an ecology of mind: Collected essays in anthropology, psychiatry, evolution, and epistemology. University of Chicago Press (2000)

Boland Jr., R.J.: The process and product of system design. Management Science 24(9), 887 (1978)

Bourdieu, P.: The forms of capital. [S.l.] (1986)

Bourdieu, P., Wacquant, L.J.D.: An invitation to reflexive sociology. Univ. of Chicago Press, Chicago (2004)

Buur, J., Bødker, S.: From usability lab to "design collaboratorium": reframing usability practice. Paper Presented at the Proceedings of the 3rd Conference on Designing Interactive Systems: Processes, Practices, Methods, and Techniques (2000)

Buur, J., Binder, T., Brandt, E.: Taking video beyond 'hard data' in user centred design. Paper Presented at the Participatory Design Conference (2000)

Buur, J., Jensen, M.V., Djajadiningrat, T.: Hands-only scenarios and video action walls: novel methods for tangible user interaction design. Paper Presented at the Proceedings of the 5th Conference on Designing Interactive Systems: Processes, Practices, Methods, and Techniques (2004)

Buur, J., Matthews, B.: Participatory innovation. International Journal of Innovation Management 12(03), 255–273 (2008)

Carlile, P.R.: A pragmatic view of knowledge and boundaries: Boundary objects in new product development. Organization Science 13(4), 442–455 (2002)

Cherkasky, T.: Designing Experience. International Journal of Engineering Education 19(1), 9 (2003)

Churchman, C.W., Schainblatt, A.H.: Commentary on "The Researcher and the Manager: A Dialectic of Implementation". Management Science 12(2), 2 (1965)

Dorst, K., Cross, N.: Creativity in the design process: co-evolution of problem–solution. Design Studies 22(5), 425–437 (2001)

Ehn, P.: Work-oriented design of computer artifacts. Umeå University (1988)

Ehn, P.: Scandinavian design: On participation and skill. In: Participatory Design: Principles and Practices, pp. 41–77 (1993)

Ehn, P.: Participation in design things. Paper Presented at the Proceedings of the Tenth Anniversary Conference on Participatory Design (2008)

Fischer, G.: Meta-design: Beyond user-centered and participatory design. Paper Presented at the Proceedings of HCI International (2003)

Fischer, G., Giaccardi, E.: Meta-design: A framework for the future of end-user development. In: End User Development, pp. 427–457. Springer (2006)

Fischer, G., Scharff, E.: Meta-design: design for designers. Paper Presented at the Proceedings of the 3rd Conference on Designing Interactive Systems: Processes, Practices, Methods, and Techniques (2000)

Giddens, A.: The constitution of society: introduction of the theory of structuration. Univ. of California Press (1984)

Giddens, A.: Modernity and self-identity: self and society in the late modern age. Polity press, Cambridge (1991)

Goffman, E.: Interaction ritual; essays in face-to-face behavior. Aldine Pub. Co., Chicago (1967)

Goffman, E.: Strategic interaction. Blackwell, Oxford (1970)

Gregory, J.: Scandinavian approaches to participatory design. International Journal of Engineering Education 19(1), 62 (2003)

Griffith, T.L.: Technology features as triggers for sensemaking. Academy of Management Review 24(3), 472–488 (1999)

Hirschheim, R.A.: User experience with and assessment of participative systems design. Mis Quarterly, 295–304 (1985)

Ives, B., Olson, M.H.: User involvement and MIS success: a review of research. Management Science 30(5), 586–603 (1984)

Kaiser, K.M., Bostrom, R.P.: Personality Characteristics of MIS Project Teams: An Empirical Study and Action-Research Design. MIS Quarterly 6(4), 43–60 (1982)

Kasper, G.M.: A theory of decision support system design for user calibration. Information Systems Research 7(2), 215–232 (1996)

Kyng, M.: Designing for cooperation: cooperating in design. Communications of the ACM 34(12), 73 (1991)

Kyng, M.: Designing for cooperation: cooperating in design. Communications of the ACM 34(12), 65 (1991)

Kyng, M.: Users and Computers-A Contextual Approach to Design of Computer Artifacts. DAIMI Report Series 25(507) (1996a)

Kyng, M.: Users and Computers: A Contextual Approach to Design of Computer Artifacts = Brugere og datamater: En kontekstuel tilgang til design af edb-systemer. Aarhus Universitet, Datalogisk Afdeling, Aarhus (1996b)

Lave, J., Wenger, E.: Communities of practice (1998) (retrieved June 9, 2008)

Levina, N.: Collaborating on multiparty information systems development projects: A collective reflection-in-action view. Information Systems Research 16(2), 109–130 (2005)

Levina, N., Vaast, E.: The emergence of boundary spanning competence in practice. Implications for implementation and use of information systems. MIS Quarterly 29(2), 335–363 (2005)

Marakas, G.M., Elam, J.J.: Semantic structuring in analyst acquisition and representation of facts in requirements analysis. Information Systems Research 9(1), 37–63 (1998)

McLean, E.R.: End Users as Application Developers. M&O Quarterly 3(4), 4 (1979)

Nygaard, K.: Program Development as a Social Activity. Paper Presented at the Information Processing 1986 (1986)

Park, J.: Designer-User Interaction as the Core of the Design & IT Innovation Process: A Socio-Cultural Perspective. In: ICIS 2012 Proceedings (2012)

Park, J., Boland, R.: Boundary Objects as Action in Information Systems Development (ISD): a Dramaturgical Perspective Using Sociodrama. AMCIS 2012 Proceedings. Paper 6 (2012)

Robey, D.: Modeling Interpersonal Processes During System Development: Further Thoughts and Suggestions. Information Systems Research 5(4), 439–445 (1994)

Salaway, G.: An organizational learning approach to information systems development. M&O Quarterly 11(2), 245 (1987)

Schonberger, R.J.: MIS design: a contingency approach. Mis Quarterly 4(1), 13–20 (1980)

Star, S.L.: The structure of ill-structured solutions: boundary objects and heterogeneous distributed problem solving. Distributed Artificial Intelligence, vol. 2, pp. 37–54. Morgan Kaufmann Publishers Inc. (1989)

Star, S.L., Griesemer, J.R.: Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39. Social Studies of Science 19(3), 387–420 (1989)

Strauss, A.L., Corbin, J.M.: Basics of qualitative research: grounded theory procedures and techniques. Sage Publ., Newbury Park (1990)

Suchman, L.: Human/machine reconsidered. Cognitive Studies 5(1), 1 (1998)

Suwa, M., Gero, J., Purcell, T.: Unexpected discoveries and S-invention of design requirements: important vehicles for a design process. Design Studies 21(6), 539–567 (2000)

Tait, P., Vessey, I.: The effect of user involvement on system success: a contingency approach. Mis Quarterly, 91–108 (1988)

Wittgenstein, L., Anscombe, G.E.M.: Philosophical investigations. Blackwell publ., Oxford, GB (1997)