A method for designing and analyzing interaction design at earlier phases of the design process - use of the scenario, performance, and description format

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Abstract

In this study, we explored a set of methodologies that can be used at earlier phases of the design process, for designing and analyzing interaction design. Our methodology features a prototyping method that adopts performance technique, an observation method using video from the view of a user and a view that includes the system as a whole, and a method for describing interaction scenarios. Our method aimed to use the scenario and performance as techniques for communicating new design concepts and sharing experiences between designers and users, and to promote interaction between the user community and the design team. We enacted two case studies regarding the adaptation of the methodology. In one case a designer role-played a user, and in another case real users enacted the performances. We evaluated and confirmed the effectiveness of the methodology through these practices.

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Introduction

The user's experiences are shaped via interaction among users, artifacts, information, and environments in the interaction sphere. In order to enhance the user's experiences, it is important to capture the user's needs in their appropriate context from the viewpoint of interaction design at earlier phases of design development. In current design processes, interactions are described using various methods. At the planning and designing phase, the interaction styles and scenarios are represented with using certain design methods such as idea sketches, storyboards, text stories, and flow charts. At the analysis phase, interaction sequences are observed and analyzed by means of usability evaluation methods, for example - video analysis and protocol analysis.

Two major problems are involved in these current processes:

1. We cannot directly compare the interaction designed in the design phase with the interaction captured in the analysis phase, because different methods are used for representing the interaction in each phase.

2. The target systems are analyzed in the context of their use, after functional prototypes are made. However, at this point it is too late to address the essential interaction design requirements and problems. Due to these problems, sufficient design in the context of use cannot be achieved with the participation of the user.

Research objectives

For performing user-centered interaction design, we think it is effective to create a description method that can be used for both design and analysis. If such a method is established, we can compare the interaction scenarios considered by the designer or planner, with interaction sequences the user actually acted. This also enables design teams to compare scenarios made by several persons, and to reuse whole or part of scenarios created in other projects.

On the other hand, it is also important to create a method that enables us to simulate artifacts-in-use (Bannon and Bodker 1996) in the real users' contexts at an earlier phase before functional prototypes can be made. We think the possibility of creating such a method exists in prior studies concerning performance such as "Informance" (Burns et al. 1994), "Experience Prototyping" (Buchenau and Fulton 2000), and the playful design approaches (Brandt et al. 2000a/b).

Based on such recognition, we explore and propose a method that uses an enhanced scenario-based design and prototyping method involving performance. Our methodology consists of:

1. A description formats for representing the interaction scenario, which can be used for design and analysis.

2. A method for prototyping the experiences of target artifacts at earlier phases of the design process, using the scenario and playing performance technique.

3. An observation method using video that captures the user's personal views and the system views.

4.   A method of analyzing interaction based on comparing designed interaction and observed interaction.

Procedure
Our methodology has four basic phases, preparation of scenario, activation of performance, observation of performance, and analysis of interaction.

Preparing scenario
The scenario is a sequence of users' activity in their context of use. Studies about target users, their work process and practices are used for designing scenarios.

Description format
In this research, a description format for representing the interaction scenario is introduced. Figure 1 shows a sample of the format. The format contains columns for scenes, situations, users' activities, interaction elements, and design points. This format is basically the same as that created in our prior study for the description of observed interaction (Hasuike et al. 2001).

Scene	Situation/ Event	User Activity	Sub-Acti vity	User	Target Artifact	Others/ Environ ments	Design Point
In a Train (Beside a door)	A little crowded. Cannot sit down.	He is standing beside a door.					
		He takes out the electronic pad from his bag.		Holds		A bag	How to hold?
		He turns the power on.	Push es the butt on.	Push	Provide Power Switch	A bag	How to turn on?
		He views electronic documents copied from his PC.			Display Docume nts	A Strap	How to scroll pages?
		He accesses to the database in the intranet, and downloads documents.		Touch	Display Informat ion		Key? Button? How to operate? How to download?
		He takes memos something picked up from a document.		Draw	Display Informat ion	Memo	With a pen? Where is the pen? How to draw?
	Receives e-mails			Hear View	Indicate e-mails exist		
		He browses the mails.		View	Display Mails		How to represent contents?
	Some seats become available.						
In a Train (On a seat)		He sits down.				Seat A bag	How to hold?
		He reads a newspaper (data).			Display Informat ion		How to represent? How to get the newspaper

Figure 1: Fragments of a scenario for case 1 described in the format

We consider it important to compare scenarios generated by designers with those generated by other designers or planners, and even to compare a prepared scenario and the observed sequence. This format enables us to do so. Besides, observed sequences can be used as base scenario for the

next design and the performance. We consider it is effective to create this scenario and performance cycles.

Acting performance

Roles
Three roles are involved in the execution of a performance: a performance director, actor(s), and observer(s). A performance director navigates the performance based on a scenario, suggests appropriate situations to the actor, and answers questions from actors. Actors neither see the scenario nor are cognizant of its details; they recognize the situation via dialogue with the director, and reorganize their activity along with the progress of the performance. Some dialogue takes place between the director and actors while executing the performance. These include an explanation of the situation, suggestions regarding the activity, and questions regarding the functionality of target artifacts, for example. The observer records these dialogues as well as the performance.

Environments and props
Performances should take place in real environments in which there may be some unexpected occurrences. These occurrences can be resources for grasping subconscious problems and requirements in the actual context of use.

There are two types of props for the performance: prototypes of target artifacts, and real artifacts existing in the use environment. We think it is important to observe how the actors act, which props they choose, and how they appropriately use the target artifacts and others in each situation. For this reason, it is basically better that the director doesn't designate to the actor which tool to use for each activity. However, in some situations, the director may have to suggest using the new artifact (prototype) rather than the existing real artifact.

Scenario and performance
Prepared scenarios are used as the bases for the performance. However, these scenarios are only a resource for the performance. They will be modified, detailed, and even re-created through the dialogues between the director and actors in the performance. We think it is important to modify and re-create scenarios interactively during the performance, based on the action and dialogue among the director, actor(s), and other design team members (product planners, designers, engineers and so on). This can make up forms of collaborative design work and user-participatory design (Kuhn 1996), for understanding work contexts, user requirements, and generating design ideas.

Observation of the performance
Observations of the performances are recorded in three ways as follows:

1.   Video and audio records from the personal view of a participant captured by CCD camera located on the head of the actor

2.   Video and audio records from the system view of the situation captured by observers via a hand-held video camera

3.   Observation notes taken by the observers (researchers and designers)
        The framework of this observation method is shown in Figure 2. This method is based on our prior study concerning an analysis of interaction design (Hasuike et al. 2001).
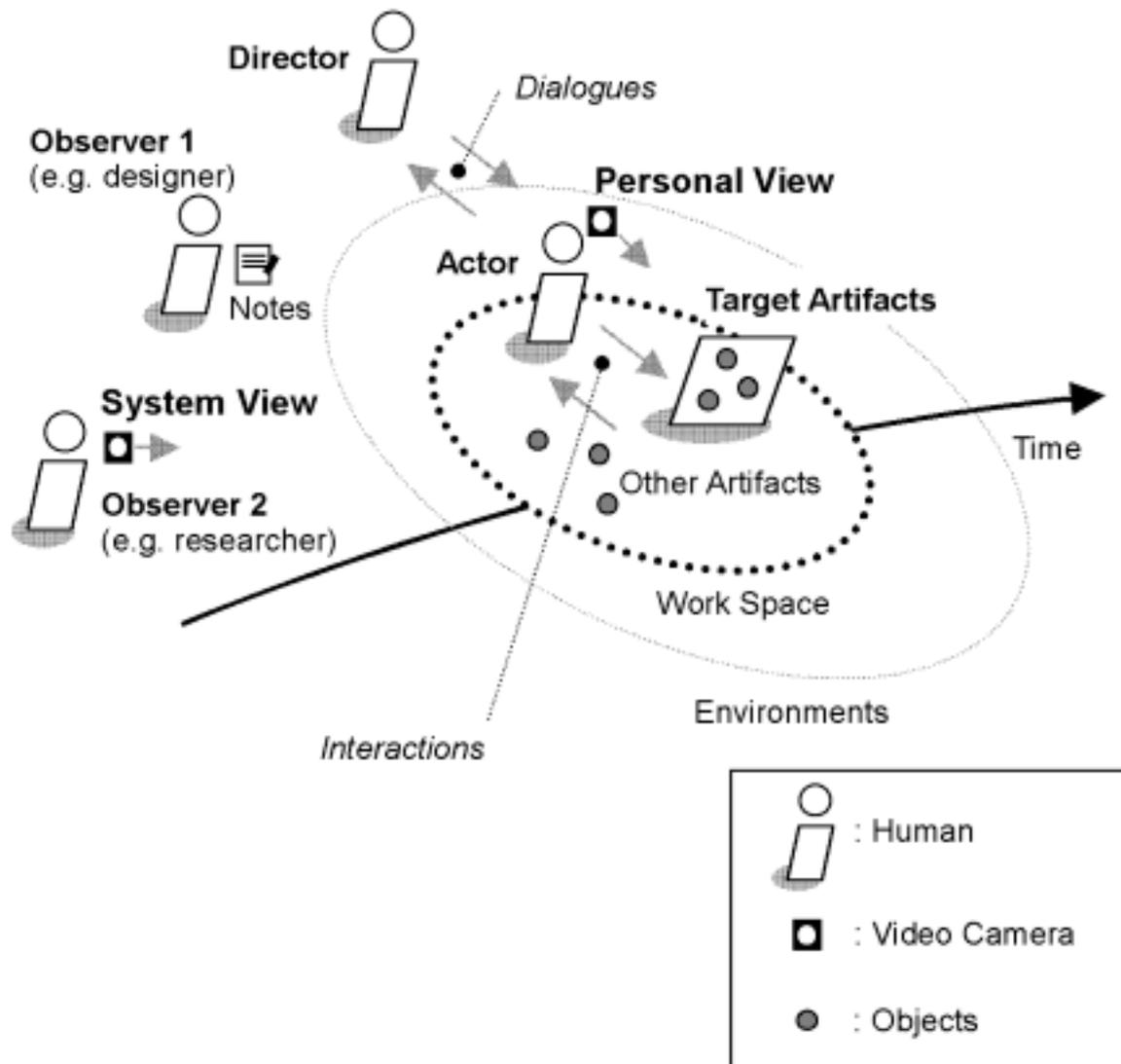
Figure 2: Framework for the performance and observation

Analyzing interaction

Observation records are to be resources for understanding problems in the context of use, and generating design ideas. It is useful to simply review and share the recorded video/audio and notes. However, we propose more advanced use of the records. In our method, information gathered from the video, audio, and the observation notes are integrated in the format shown in Figure 2. This format was created for analyzing interaction design (Hasuike et al. 2001), in order to describe the observed information. Figure 3 shows a sample of the format. The format contains scenes, places, situations, and users' activities. Users' views and system view captured from video are placed next to these descriptions. The dialogue protocols of the director and actors, and analysis notes are then added in the last field. This format is basically the same as the format for scenario description described above. Thus, we can compare the scenario with the records described in this format.

Index	Scene	...	Situation/Event	User Activity	System View	Personal View	...	Director	Actor
2.5	Waiting for a train at Platform		A train comes in.	He Gets on the Train					
	In a Train (Beside a door)			He stands beside a door.					
				He takes out the electronic pad from his bag by his right hand.					"Hard to open." "Too difficult to operate while hanging on to a strap."
				He holds and operates the e-pad by his right hand.					"Too difficult to push a button while hanging on to a strap."
									"Can operate if I can hold it on upper side." "Something such as jog-dial is suitable than the button"
				He hangs on to a strap by his left hand.				"Can hold only the body?"	"Heavy for holding by one hand." "OK. Easy to hold if without the cover."
									"The center button is easy to push, but others are difficult to do, because I lose balances."
								"Do you needs something such as a strap to hold?"	"Yes. I want such strap as that of a video camera."

Figure 3: Fragments of the analysis sheet for case 1 described in the format

Case studies

We conducted two case studies as adoption of our methodology. Table 1 shows the summary of these studies.

Table 1: Summary of two case studies

	Case Study 1	Case Study 2
Type of Task	Sales Work	Housework
Environment	Office, Street, Station, Train, Customer's Office	Living Room and Kitchen at Home
Target User	Sales Person	Family, Homemaker
Actor	A Designer	Three Homemakers
Prototype	Non-functional Mockup for Office Use	Non-functional Mockup for Home Use
Source for the Base Scenario	Results of Former Ethnographic Study	1. Results of Preliminary Web-based Questionnaire 2. Outcome of Group Interview and Brainstorming with the Actors

Table 1: Summary of two case studies

Sample artifact

We assume a new sample artifact, which is a kind of PDA (personal digital assistant) that adopts the technology of electronic reusable paper. This future artifact is expected to replace some of the current paper/electronic documents and the tools used to handle these documents. The artifact's basic specifications and features had been already defined by the product planners and the designers. There were two types of non-functional design mock-ups, and the performances were enacted using these prototypes.

Types of participation

We established two types of participation as cases in the process.

1. The designer(s) act as a real user(s).
2. Real users act as themselves.

In the former case, the designer "actors" role-play as users. This is similar to the attempt of "Informance" (Burns et al. 1994). This case is considered collaborative design work performed by

the design team. In the latter case, the user "actors" role-play as themselves. This case is considered a user-participatory design in its early design phase.

Case study 1
Task and scenario
In this case, we establish sales work as a sample of business scene, and conduct a performance. We used the results of an ethnographic study regarding mobile sales work done by people in our company (Tamaru et al. 2002) for creating a scenario. This ethnographic study uses the self-photo method. The results are represented in several analysis sheets and the interaction map (see Figure 4). We described a scenario of sales work by thinking about what types of activities the electronic paper system can support. Figure 1 shows fragments of the scenario written in our interaction scenario format.
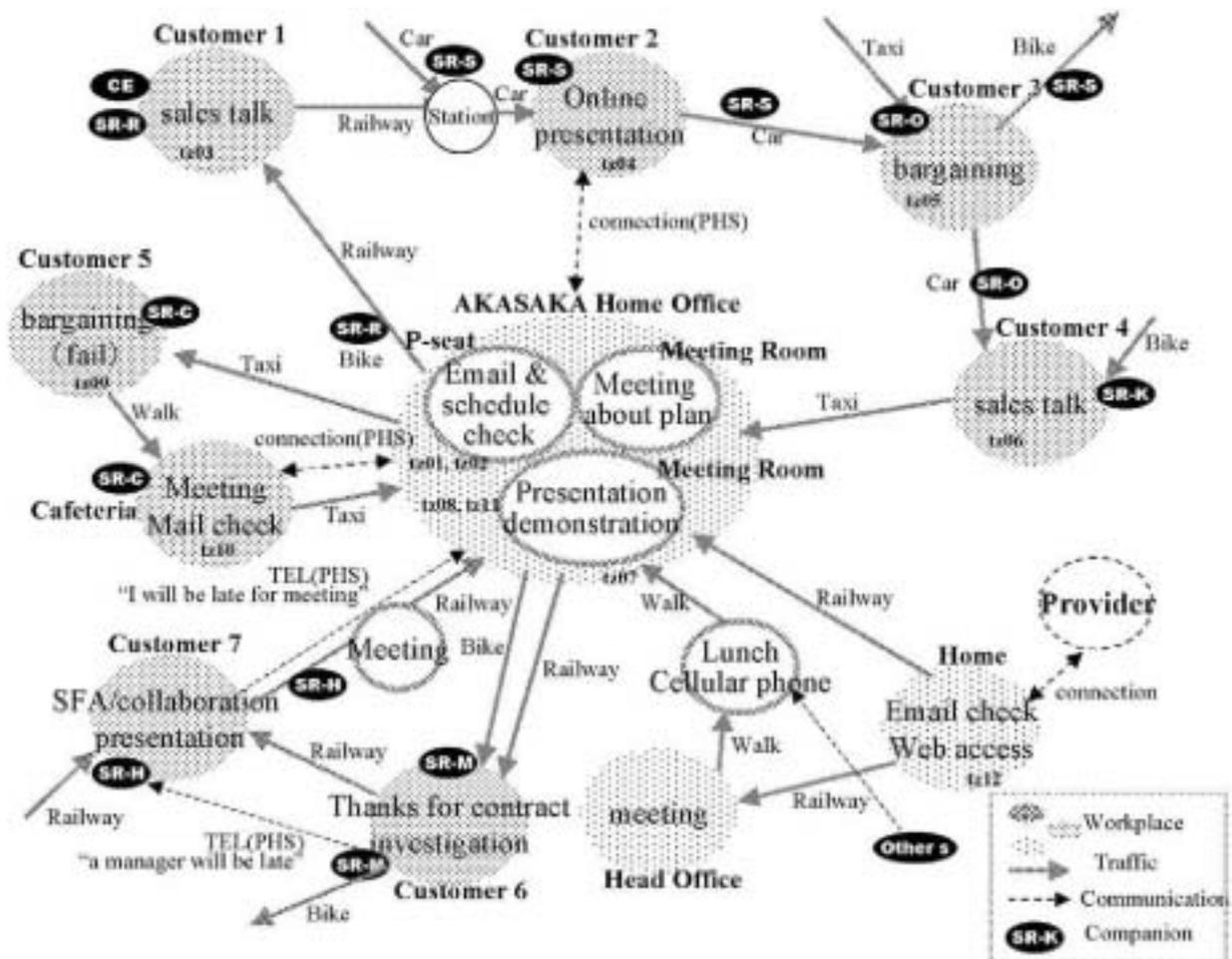
Figure 4: The interaction map created in the ethnographic study

This scenario includes a series of tasks involved in the presentation of a product to a customer, at the customer's office. This scenario begins with the preparation of materials, for a sales presentation at the salesperson's desk in his office. After that, he reconfirms a appointment with his customer, puts the paper/electronic documents into his tools and a business briefcase, adds his schedule to his team's bulletin board, leaves the office, walks toward the railway station, gets a newspaper (data) from a vending machine in the station, reads the electronic documents while standing in a train, gets

off the train and walks to his customer's office, confirms the route to the building, attends the meeting with a customer, makes the presentation in the conference room, goes back to his office, and sorts out the documents at his desk. During these sequences, the salesperson performs certain communications; he receives and sends some e-mail, he accesses the intranet of his company, and he talks with a colleague on the telephone.

Participant and props

The actor was a designer who had not participated in designing the system. He had a mockup of the target artifact, a cellular phone with e-mail capability, notes, pens, a bag, paper documents, and some electronic documents stored in the target artifact. In addition, certain artifacts were present in the environment. For example, there was a desktop PC in his office, paper documents were on his desk and in paper files, electronic documents were in the PC, there was a bulletin board in his office, there was a vending machine at the station, there were straps in the train, there were a projector and a whiteboard in the conference room, and there were other pieces of furniture or other facilities in each environment.

Procedure

After the director explained the outline of the target work, the actor began to enact the performance. The director suggested situations like these: " Now, you just got an e-mail from your colleague in the office, how would you become aware of that here?", "If your system's battery became low, how would you know the situation?", "How would you present the document in the system to your customer? How would you scroll pages?". The actor then responded these questions in his performance and explanations. The actor sometimes put questions to the director. These included questions regarding the supposed situation, regarding the features of the artifacts, and regarding the functions and operational methods of the artifacts. In view of this dialogue, the scenario was modified and re-created interactively.

The performance and dialogue with the director were recorded using two video cameras from personal view and system view, and using the notes taken by observers.

Results and analysis

Observed data were described into the format. Figure 3 shows the fragments of the interaction analysis sheet of the performed sequence. They are compared to the original scenario, and the differences point out problems in the context. Many problems became tangible through the analysis, and many ideas were generated through the performance and the dialogue. The following are fragments:

- Sales persons want to sort the documents and add memos by the system before the presentation.

- Operations by touch are easy and suitable than that by scrolling keys, for selecting and sorting the electronic documents, especially in case user can hold it by a hand, and operate it by another hand.

- User has to hold and operate the artifact by one hand, while hanging on to a strap in a train. However, current design is not suitable both in weight balance and in the layout of the keys for one-handed holding and operation. In this scene, operations only by keys should be prepared.

- Current cover design is not comfortable for taking the artifact in and out of a business briefcase.

- The system should prepare a mode for face-to-face presentation, and prepare a one-touch button for rotating screen.

- The system should have additional control methods for presentation, which must not interfere with the audiences viewing the contents in the screen. One method is to have a remote control device for presentation mode.

- It is key point how the artifact works together with other artifacts in users' contexts, PCs, information vending machines, cellular phones, electronic white boards, video projectors, and so on. There are some overlapping features, and may be possibility for smart collaborative work.

Case study 2
Task and scenario
In this case, we established housework as a sample of domestic scene, and conducted a performance. We submitted preliminary questionnaires regarding the home use of the target system to unspecified persons on the Intranet via a web-based system, and used the results to create a scenario. This scenario contains scenes such as this: a homemaker gets a recipe while watching a cooking program on TV, she takes an order for foods, she receives a circular notice of the neighborhood association.

Participants
Three participants acted in the performance. They were all homemakers.

Procedure
In this case, the sessions were conducted in the living room of the house of one of three participants. First, the designer explained the outline of the artifact using the mockup to the three participants gathered in the room. After that, the director conducted a group interview and discussion session. In this session, they discussed the everyday life and work of the participants. Then they discussed about how the target artifacts can support these tasks.

The prepared scenario was used as a reference for these discussions. As a result of the discussion, four new scenarios were generated. The first was a sequence for checking mails, faxes, messages of answering machine, and adding memos to the schedules. The second was a sequence for taking an order for foods, for dinner. The third was a sequence for cooking in the kitchen while viewing recipes and other documents. The fourth was a sequence for writing and contributing an article to a magazine. Performances were conducted using these new generated scenarios. After the director confirmed the outline of the target work, the actor began to act each performance. The director suggests situations like these: " Now, you just came home. You are at the entrance, what do you do at first?"

The performance and dialogue were recorded using two video cameras from personal view and system view, and with notes taken by observers. Each actor had a small CCD camera attached to her head when she acted the performance.

Results and analysis
Observed data were described into the format. Figure 5 shows the fragments of the interaction analysis sheet of the performed sequence. They are compared to the original scenario, and the differences point out problems in the context. Many problems became tangible through the analysis,

and many ideas were generated through the performance and the dialogue. The following are fragments:

-   The management of a family's schedule is an important and complex task, and the system should support them.

-   The system should handle memos and messages via mail, fax, and answering machine from the children's schools, from the father's company, from the local community, and so on.

-   The system could be touched by wet hands or by hands covered with powders from kitchen work.

-   The system should be resistant to splashes of water and oil from the kitchen.

-   The system should easily vary the direction of the monitor at the kitchen counter, allowing it to be seen from the kitchen side and from the dining room side.

-   The system should easily be carried from room to room without concerns regarding the power plug.

Inde x	Scene	...	Situat ion/ Event	User Activity	System View	Personal View	...	Direct or	Actor
3.5	In the living room			She carries the e-pad to the kitchen counter.				"Wher e would you set the such comm unicat ors?"	
	In the living room			She places the e-pad on the kitchen counter.					A: "Here. Changes the direction to the Living room or the kitchen according to the situation." B: "May be same in my home." B: "I will changes the direction to the kitchen while cooking."
				She views the lamp of the e-pad, which see suppose s as to be at the top of it.				"OK. Please chang es the directi on."	B: " If the lamp is on, I will see the display."
	In the kitche n								A: "Oh, it will be useful. "

Figure 5: Fragments of the analysis sheet for case 2 described in the format

Analyzing difference

In the two case studies, we could successfully observe many differences between the designed interaction scenario and acted performances, using the method. We consider that these differences can be divided into three levels:

1. Differences in scenario level
2. Differences in function and modality level
3. Differences in representation level

The first, there are some differences between the prepared scenario and sequence of acted performance. Prepared scenario has some activities that is not suitable for real contexts. These parts are re-created through the dialogue between actors and the director. This can be a resource for re-thinking about concepts of the artifact, target scenes, works, basic features, and users. The second, there are some modification or requests in some part of prepared scenario. This can be resource for re-thinking about basic interaction style, and about applied technologies for the features and functions. The third, there are some modifications or requests for quality of each design details. This can be a resource for re-thinking about details of design details and qualities. These three levels of differences can be useful resources for the next design steps.

Discussion

We carried out two types of case studies regarding the adaptation of this methodology. Through these two case studies, we try two types of participation for the process. In one case a designer role-played a user, and in another case real users enacted the performances.

In the first case, a designer simulated a user and acted a performance. The designer actor said in the reflection interview after the performance, "In a scene, I couldn't enough perform the role, because I could not image actual user's objectives and its background on the situation." This shows that the experience of the performance gave the participants an awareness of what he does not know about target users. This awareness will promote the design team to study more about target users and their work practices.

In the other case, actual user acted performances. Through this, the design team could share the context of use with actual users. The user actors performed the prototype of the experience, and participated in generating ideas as well as in finding problems. In the dialogue with the director, participants made many ideas and suggestion for the design. We consider we could develop a form of positive user participation in the design generation.

Conclusion

In this paper, we have proposed a methodology for early phases of the design process. This featured a prototyping method that adopts performance technique, an observation method using video from the view of a user and a view that includes the system as a whole, and a method for describing interaction scenarios. Through two case studies, we confirmed our methodology is effective for understanding user requirements and generating ideas of interaction design. From these experiences, we think we could develop a form of collaborative design, and that of user-participatory design, for the interaction design. By using this method, designers and users can take into account the user's unconscious characteristics and requirements, forming a basis of cooperation toward better design.

Though we have applied our method to only two cases, we have to study more cases and improve the methodology. For making the scenario and performance cycles, it is necessary to study more formal description of the scenario on the format. It is also important to study how to incorporate

this methodology into the whole design process for user-oriented design approach, and how to use it in combination with other design methods such as ethnographic field work, questionnaires, the usability evaluation methods.

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