A Study on Direction of Approach to Interaction

- In design fields -

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Abstract: In design fields, because of the changes of interaction, it is necessary that we have understanding of interaction in multiple complex environments. It connotates the necessity of wide view point of interaction value and approach to interaction. Based on that kind of background, this study gives the direction of approach to interaction, and then gives some directional features which are shown in actual interaction design methods.

Therefore, in this study shows the relationship between interactions, value, and needs. Also, for getting understanding of human needs, psychological approach to human needs and motive is proceed. And then, interaction value system is given through comprehension of relationship between needs and interaction which will be classified by abstraction level. Hence, it is found what the needs which are satisfied by interaction are. And it is shown how the interaction relates with value. Accordingly, it is found that there are two directions of approaches in interaction realization. Also, the features of two directions are can be seen. This feature helps the analysis of actual interaction design methods. Interaction design methods are classified into five processes. And these processes are analyzed. From the analysis of processes, some directional features are can be found.

1. Introduction

There are many attempts which are to see the relationship between human and tools in design and to get a better environment of use. But, these attempts missed the shift of interaction paradigm. Nevertheless, interaction changed. So, we have to understand of interaction in multiple complex environments. Also, it is needed that we know about the diverse approaches to interaction. Therefore, this study is for understanding direction of interaction approach. For this, interaction value system will be found. And then through the analysis of the approaches to interaction value system, we will be able to find the approach to interaction. For interaction value system, the relationship between interaction, value, and needs will be analyzed.

Procedure of study is mentioned follow. In chapter 2, change of interaction in design fields gives the necessity of this study. Through chapter 3, the relationship between interaction, value, and needs provides the basis of interaction value system. Also, for getting understanding of human needs, psychological approach to human needs and motive is proceed. In chapter 4, interaction value system is given through comprehension of relationship between needs and interaction which will be classified by abstraction level. In chapter 5, direction of approach to interaction is suggested. And, understanding of two directions is proceeds by finding features. Also, these two directions are used in analysis of interaction design methods as a measure. This study gives us insight of actual approach to interaction.

2. Change of Interaction in design fields

As the information industry has developed, the relationship between 'user and tool' in interaction design is considered as the relationship between 'user and computer'. People used to work with computer in the past; however, these days, people use computers not only for work but also for many purposes. Using digital media like a computer becomes a part of 'life' rather than a particular 'task'. Interaction paradigm, which used to be observed in a task in a particular time and place, could be seen in overall life. As a result, the scope of objects who participate in interaction and the scope of interaction become ambiguous. Therefore, we should understand interaction considering various viewpoint and approach of interaction.

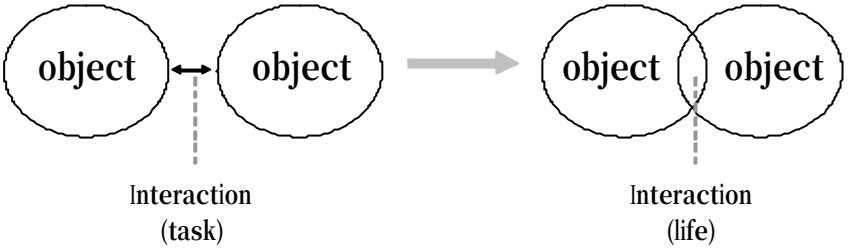

Fig.1 Change of interaction in design fields

3. Classification of needs in interaction

3.1 Relationship between Interaction, Value, and Needs

Value is defined as 'relative worth, utility, or importance' by dictionary. Especially, at the view point of economy, value is worth of goods arising from satisfying needs. In this viewpoint, it can be said that interaction value is worth or importance of tool arising from interaction between human and tool.

In economy, value is occurred if human needs are satisfied. Especially, in the case of using goods or service, human can have value to goods or service by satisfying human needs. In the same manners, interaction value can be occurred when human satisfy needs in interaction. Evaluation of value is according to human subjective satisfaction. Subjective satisfaction has relation with a degree of satisfaction. In interaction, it is possible that value is improved by satisfying needs.

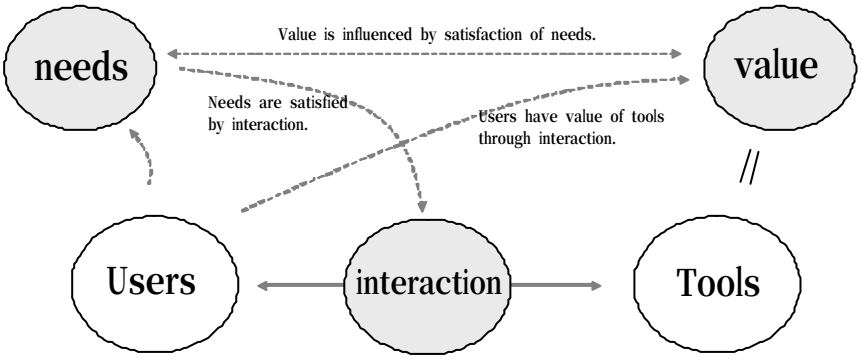

Fig.2 Relationship between interaction, value, and needs

3.2 Classification of needs in psychology

Interaction value has close relationship to needs. In this study, needs are defined by psychological aspect. Hierarchy of needs (Maslow) and motive theory are combined to view needs of human.

Table.1 Hierarchy of needs [Maslow]

Needs	Descriptions
Self-actualization needs	The desire to become everything that one is capable of becoming.
Esteem needs	ego self help, finding healthy pride, direction, empowerment in business
Social needs	Social self help, finding love, how to escape bad feelings
Security needs	safety planning, food supplies, shelter requirements, emergency supplies
Body needs	medical, emergency, rescue, coping

Table.2 Motive theory

Motive	Descriptions
Stimulus motive	Motive which satisfy curiosity by manipulation and search
Overcome motive	Motive which is satisfied by overcome of interference
Achievement motive	Merit motive, Motive which satisfied by fruitful work.
Work motive	Motive to work
Physiological motive	Motive which satisfied by reducing deficiency.

Hierarchy of needs is summarized by combination above two aspects. Human needs and motive are intermediate constant and these are defined only by deduction of human activity. So, it is impossible to exactly classify human needs and it not reasonable. Therfore, in this stduy. Needs are classifide into being needs and difficiency needs in broad point of view.

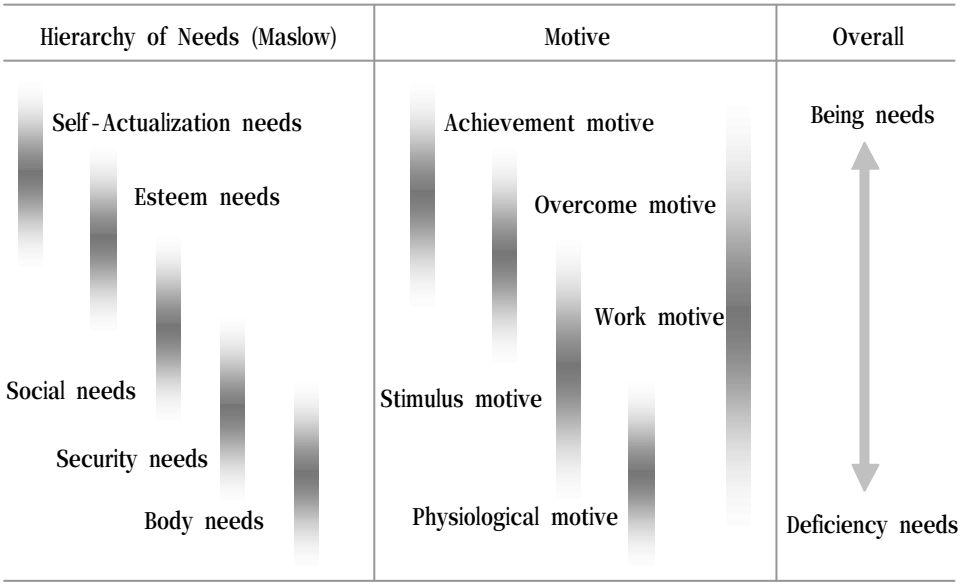

Fig.3 Hierarchy of needs and motive

4. Interaction value by interaction type

4.1 Classification of interaction by abstraction level

Rasmusen classify interface into 5 levels –from functional goal to physical shape-. Rasmusen presents the possibility of classifying interaction. In this study, interaction is divided into 3 levels. Criterion of this classification is the abstraction level of interaction. So, classified interactions call use, task perform, and

manipulation.

'Use' is the interaction which is satisfying human needs by the act or practice of employing something. 'Manipulation' means to treat or operate with the hands and to confirm feedback of tools, In between use and manipulation, 'Task perform' means to do assigned piece of work, which is similar to tasks in HCI. Task perform is divided more in detail. For example, Function, Sub task perform, and etc. But, this is not a main concern of this study. So, in this study, we can see only three pieces.

Table.3 Classification of interaction

Interaction	example
Use	"I use telephone."
Task perform	"I call to my friend by phone."
Manipulation	"I push the number key of phone."

4.2 Interaction value system by interaction type

As mentioned above, interaction value fulfill the human needs when human interact with tools, In this point of view, diverse interaction type –use, task perform, manipulation- meets the human needs. And, each interaction type has appropriate interaction values which satisfy the needs of human. These relationships can be presented by matrix as follow. It is called 'interaction value system'.

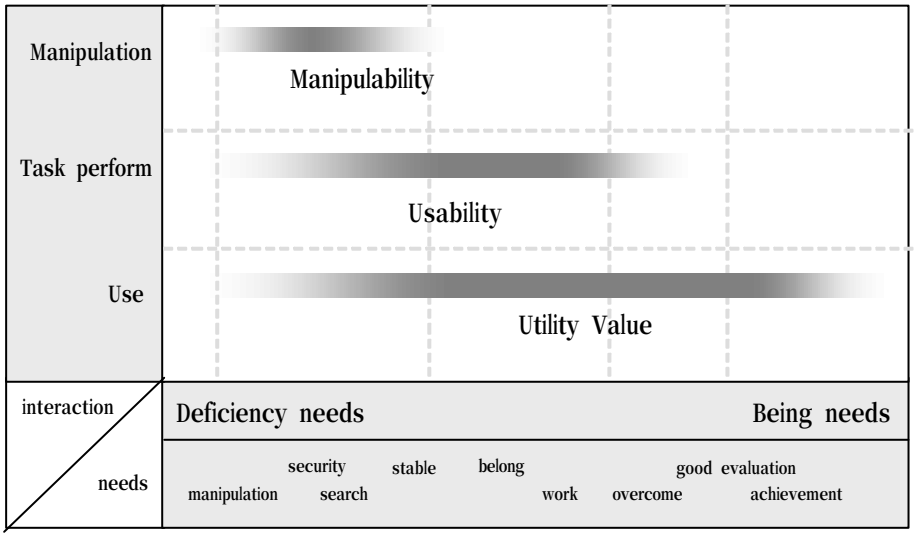

Fig.4 Interaction value system

Above matrix describes the relationship between interaction type and human needs. From this relationship, interaction value can be seen. Interaction value is divided into three levels. These are called Utility value, Usability, and Manipulability. Utility value is the value which is arisen when human uses tools, and it is broad concept which includes manipulability and usability. Usability means the value which is arisen when human perform tasks, and it includes manipulability. Manipulability is the value which is arisen when human manipulates tools. Below is the summarization of interaction value system.

Table.4 Summary of interaction value system

Value	Occurrence	Incensement	Needs
Utility value	Use	Satisfaction of use	self achievement, esteem, (include below)
Usability	Task perform	Satisfaction of task perform	Belong, work, overcome (include below)
Manipulability	Manipulation	Satisfaction of manipulation	physiological, security, stimulus

5. Direction of approach to interaction

5.1 Classification and Features of direction

In approach to interaction, it does not matter to which value you first approach, because all interaction value has a relationship with each other. Because of the possibility of approach to interaction, two direction of approach can be seen. It is called ‘Bottom-up approach’ and ‘Top-down approach’. It is as follow diagram. In realization of interaction –it can be called interaction design, but, it’s somewhat broad. It include HCI, ergonomics, and etc.-, if utility value is foreseen, it is called bottom-up approach. In contrast, if manipulability is foreseen, it is called top-down approach.

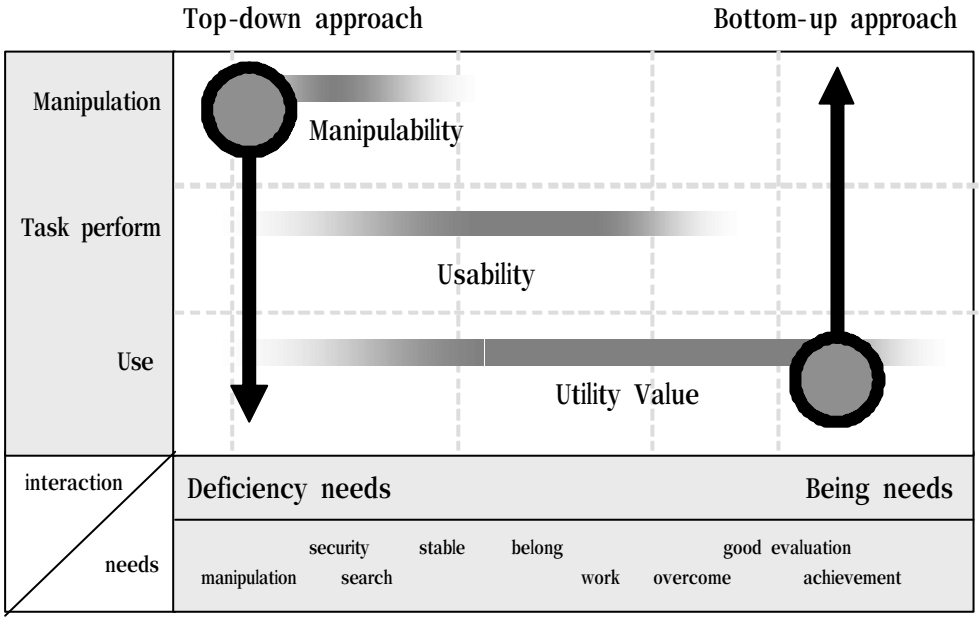

Fig.5 Direction of approach to interaction

Bottom-up approach starts from utility value and ends at manipulability. Utility value is total and general, but manipulability is more detail and specific than utility value. So, bottom-up approach to interaction is total and empirical. But, top-down approach is partial and deductive. Also, bottom-up approach is more fit to diverse problem definition. Top-down approach is more suitable to exact problem understanding and problem solving.

Table.5 Features of interaction value 1

	Boundary	Object
Utility Value	Total	General
Manipulability	Partial	Specific

Table.6 Features of interaction value 2

	Viewpoint	Approach to problem	Method
Bottom-up	synthesis	diverse problem definition	empirical
Top-down	analysis	exact problem understand	deductive

5.2 Analysis of Direction of Interaction Design Methods (understanding user, system and task domain)

Basis on the features of two directions which is addressed above, actual interaction design methods can be analysis. The technique used in analysis is the literate survey -The procedure, special features of each interaction design processes is surveyed-. The target process of this study is classified into process, methods and technique as follow. (In this study, the target processes are regarded as the processes for understanding user, system, and task domain.)

Table.7 Methods for approach to interaction

Process	Method
Object-Oriented Design (OMT)	Object Modeling Dynamic Modeling
Usability engineering lifecycle	User Profile Task Analysis Platform Capabilities /Constraints General Design Principle Usability Goal Setting
Contextual design	Contextual Inquiry Work Models Consolidation
Scenario-based design	User Interaction Scenario
Participatory design	CARD

5.2.1 Object-Oriented Design (OMT)

OMT has two steps. These are object modeling and dynamic modeling. At first, object modeling shows the object itself and shows the static relationship of these objects. And then, dynamic modeling shows the changes of these objects. Dynamic modeling deals with the interaction within objects and the sequence of action. In object modeling, the understanding of user, task and system is performed by separated objects. And then, by dynamic modeling, these separated objects are combined. This sequence can be called analytic sequence. So, OMT can be the top-down approach.

5.2.2 Usability Engineering Lifecycle

Usability engineering lifecycle is not a method for evaluating, but a process for designing. Usability Engineering Lifecycle has 5 steps in requirements analysis stage. These steps -which are addressed by Deborah J. Mayhew- are User profile, Contextual Task Analysis, Platform capabilities and constraints, General design principle and Usability goal setting. At first, User profile shows the features of users. The techniques for user profile are interview or questionnaire and so on. Because diverse technique is used in this stage, user profile itself can't be known the direction of approach. At second, Contextual task analysis is done. Contextual task analysis is an empirical task analysis method. Therefore, it is the bottom-up approach. And then, Platform capabilities and constraints / General design principle are the method for gathering information which is used in design stage. These are also used diverse techniques and these techniques affect the direction of approach in this stage. So, these two methods can't be known the direction of approach. At last, there is Usability goal setting. It is the

method for deciding goal by gathering and analyzing information of formal stage –from user profile to general design principle-. From that it can be known that usability goal setting is a deductive convergent method. Therefore, Usability goal setting is a top-down approach.

5.2.3 Contextual Design

Contextual design is consisted of Contextual Inquiry, Work modeling and Consolidation. Contextual inquiry is the method based on ethnography. But, it takes shorter time than ethnography. Contextual inquiry is based on the information in realistic field. It is empirical research. So, contextual inquiry is bottom-up approach. Based on the experience or insight, work modeling is performed. Its techniques are work flow model, sequence model, artifact model, cultural model and physical model. These models are basically based on drawing diagram. This activity can be called analytic activity. So, work modeling is called top-down method. In contextual design, work modeling can skip many creative ideas and holistic viewpoint for analytic activity. So, consolidation stage is needed. Consolidation can give a holistic understanding of task and critical issues. It uses the affinity diagram. It is a method for induction ideas by using small notes –ex. Post-It. Consolidation is a synthetic method for divergent ideas. So consolidation is a bottom-up approach.

5.2.4 Scenario-Based Design

Scenario based design are also popularly used in interaction design. So, it is the important stream in design methods. The core of scenario based design is the 'using scenario' in design. But scenario based design allows diverse technique for creating scenarios. In actual cases, scenarios are created by using object-oriented methods or by using ethnographical methods. So, the direction of approach is can't be said.

5.2.5 Participatory Design

Participatory design is a process for user participating. It starts from Scandinavian trend. In participatory design, user participates in early stage of development. So, user-centered is available. A methods used in participatory design is diverse. In these methods, CARD is popular. CARD –Collaborative Analysis of Requirements and Design- is used in task analysis stage. CARD is a participatory method for macroscopic task understanding. This method is somewhat like card sorting method. But it has the importance in participating users to process From CARD, many ideas arise and empirical information is gathered. So, CARD is the bottom-up approach.

5.2.6 Summary of Analysis

From analysis of interaction design process, some special features are known.

At first, participatory design is a totally bottom-up approach. In contrast, object-oriented design is a totally top-down approach. At seconds, interpreting methods –methods play the role of interpreting data- are top-down approach rather than bottom-up approach. And, gathering methods –methods play the role of gathering data- are difficult to knowing their direction of approach.

Because diverse experiences can be gathered by user participation, participatory design is bottom-up approach. But, object-oriented design is top-down approach for that process analyze out phenomena by using systematic diagram. In the role of methods, interpreting methods are top-down approach because these methods play the convergent role to define requirements. On the other hand, gathering methods are difficult to knowing their direction of approach because most of methods use various methods to gather information.

Table.8 Analysis of Methods

Process	Method	Role	Approach
OOD	OOD	Interpreting	Top-down
Usability Engineering Lifecycle	User Profile	Gathering	Unknown
	Task Analysis	Gathering	Bottom-up
	Platform Capabilities and Constraints	Gathering	Unknown
	General Design Principle	Gathering	Unknown
	Usability Goal Setting	Interpreting	Top-down
Contextual Design	Contextual Inquiry	Gathering	Bottom-up
	Work Modeling	Interpreting	Top-down
	Consolidation	Interpreting	Bottom-up
Scenario Based Design	Clarifying Concerns and Objectives of Use	Gathering	Unknown
	Envisioning Alternative Situations	Interpreting	Unknown
Participatory Design	CARD	Interpreting	Bottom-up

6. Conclusions

Interaction is varied because of social changes. At past, interaction (of interaction design) was generated in task using computer. But, nowadays interaction is generated in every common life because computing is used not only in work but also in entertainment, communication and so on. Because of the change of interaction paradigm, it is needed that we consider approach to interaction. The goal of this study is finding the direction of approach to interaction.

So, in this study, it is assumed that the direction of approach to interaction is exists. And also, it is assumed that the approach to interaction is the approach to interaction value system. In there, interaction value system is the relationship among interaction, needs and value.

In interaction of user, interaction is arisen because of human needs deficiency. So, interaction satisfies human needs. This satisfaction of needs makes interaction valuable. From this, the value of interaction is decided. Each interaction satisfies each need. This makes each value. In this study, above relationship are summarized in interaction value system. In interaction value system, interaction classified into 3 levels –manipulation, task perform, use-. These three interactions satisfy different range of human needs. For example, use satisfies more human needs than manipulation. These relationships make 3 values –manipulability, usability, usability value. Above relationship are called interaction value system.

As mentioned, approach to interaction is approach to interaction value system. As the direction of approach to interaction, bottom-up approach and top-down approach were proposed. Bottom-up approach starts from utility value and ends at manipulability. Top-down approach starts from manipulability and ends at utility value. These two approaches have some features. Bottom-up approach to interaction is total and empirical. But, top-down approach is partial and deductive. Also, bottom-up approach is more fit to diverse problem definition. Top-down approach is more suitable to exact problem understanding and problem solving.

Actual interaction design methods are analyzed by these two approaches. It is found that each interaction design methods had some special features. At first, participatory design is a totally bottom-up approach. In contrast, object-oriented design is a totally top-down approach. At seconds, interpreting methods are top-down approach rather than bottom-up approach. And, gathering methods are difficult to knowing their direction of approach.

Interaction satisfies human needs. From this, interaction value arises. Through the study of these relationships, it is can be seen that the direction of approach to interaction can be specified. These directions of approach to interaction can be diverse. And, these approaches are shown in actual interaction design fields.

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