A BASIC CONSIDERATION OF EVALUATION METHOD AND CONSTRUCTION MODEL OF MENTAL MODEL

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ABSTRACT

This article aims to create a mental model according to the basic idea by using two questionnaires as well as a framework that details the construction of the mental model using two separate approaches of a top down approach and a bottom up approach. Finally, the evaluation table is constructed in order to evaluate the mental model from the viewpoint of the significant difference between pre-evaluation and ex-post evaluation.

Keywords: *Mental model, evaluation of mental model, pre-evaluation, ex-post evaluation*

1. INTRODUCTION

WHY IS THE KANSEI INFLUENCED BY MENTAL MODEL?

Whenever machines and systems are used, a mental model of these machines is constructed. The mental model is defined as a system image. The Kansei design items are related closely to "functionality and convenience" influenced by mental models with the other eight items such as colour, shape and so on (yamaoka,2001). So, the mental model which influences functionality and convenience is studied.

Kansei was examined for constructing good Kansei design regarding the basic consideration of the evaluation method and the construction method of the mental model. As the mental model is changing gradually, it was examined from a time base viewpoint. The designers and engineers should design products and systems based on the mental model. Since the process of creating the structure of the mental model is currently unclear, the study aims to clarify the process while proposing an evaluation method for the mental model.

2. BASIC IDEA OF MENTAL MODEL CREATION PROCESS

Usually, the system is restricted based on the purpose. If the purpose of product is unclear, the decision is taken without fully understanding the purpose. The system is realised based on the means under the purpose (Fig1). The means is included by the condition of the constraint.

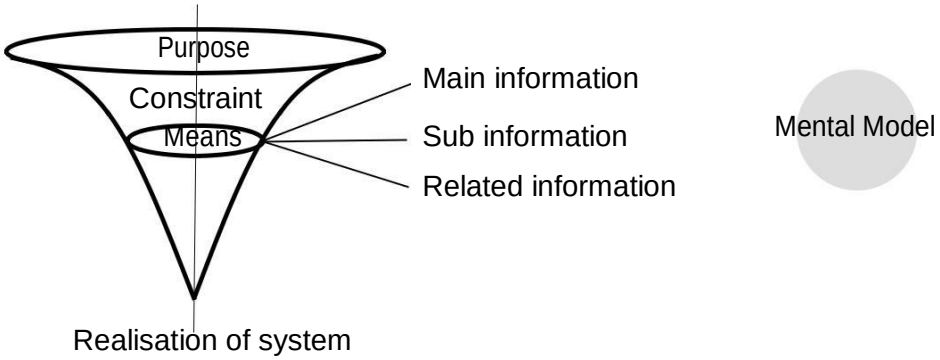

Figure 1: The realisation of system based on purpose and means(constraint)

3. TWO QUESTIONNAIRES

3.1. Questionnaire 1

The SCT (Sentence Completion Test) was done in order to let information of time base of users.

3.1.1. Method

The following SCT were done for 81 students of Kyoto Women's University. They were freshman and sophomore.

[A]takes time and makes me cheerful. [B]takes time and makes me trying.

3.1.2. Results and discussion

At that time, participant's feelings had changed since it is based on their motivation. Whenever they understood the task actively, they received a good impression. Meanwhile whenever they understood the task negatively, they received a negative impression. The results shown signifies its importance for users.

3.2. Questionnaire 2

3.2.1. Method

The participants were asked to show some examples to be able to operate when participants did not know how to use products. The participants were 98 freshmen of Kyoto Women's University.

3.2.2. Results and discussion

It is reported that participants are able to operate products based on visual clues of products and their experience of using the product by trial and error. However, they could operate without understanding how to use product. As the information revealed that a functional model was constructed but a structural model was not constructed, the participants seem to understand the structural model gradually by familiarising with products. Thus, the mental model consists of both functional and structural models.

4. FRAMEWORK OF CONSTRUCTING MENTAL MODEL

The main information, sub information and related information were created based on the results of the two questionnaires. These information is needed when the means for the purpose are examined. These information is consolidated where the mental model is derived (Fig1). A system is realised based on the purpose and the means of constraint condition. The system's construction process should be examined based on the two approaches of mental models used which are top down and bottom up approach (Fig2).

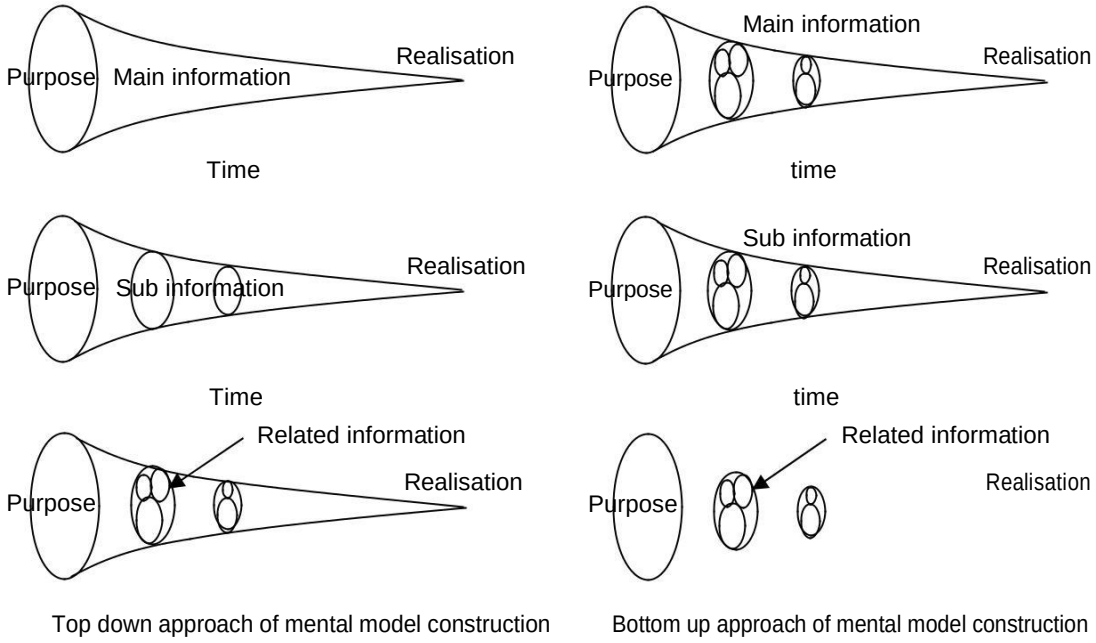

Figure 2: Top down and bottom up approach of mental model

4.1. Top down approach of mental model construction

Usually, users are able to operate products according to the purpose, information and the realisation of the system. At first, they grasp the whole and ambiguous image of the system using the purpose, main information and realisation of the system roughly. Next, they attain the sub information to identify the framework of the system and then they get the related information in order to know the detained information of system. Finally, they can construct the mental model through three steps.

4.2. Bottom up approach of mental model construction

Users are able to understand the function of displays as well as controls while experiencing them by trial and error. The displays and controls and so on are the related information to the mental model. Next, they estimate a tough mental model using the sub information. The sub information can be constructed based on the related information available. As the main information can be constructed based on the sub information, they will finally be able to construct the mental model.

4.3. Mental model construction process

The mental model changes accordingly through time. When the mental model is applied to systems such as services, users are able to estimate the mental model using two approaches; a top down approach and bottom up approach. Especially the first step of the top down approach will enable users to experience the whole and ambiguous image of the system. Next they will grasp the mental model through the three steps of the bottom up approach(Fig.3).

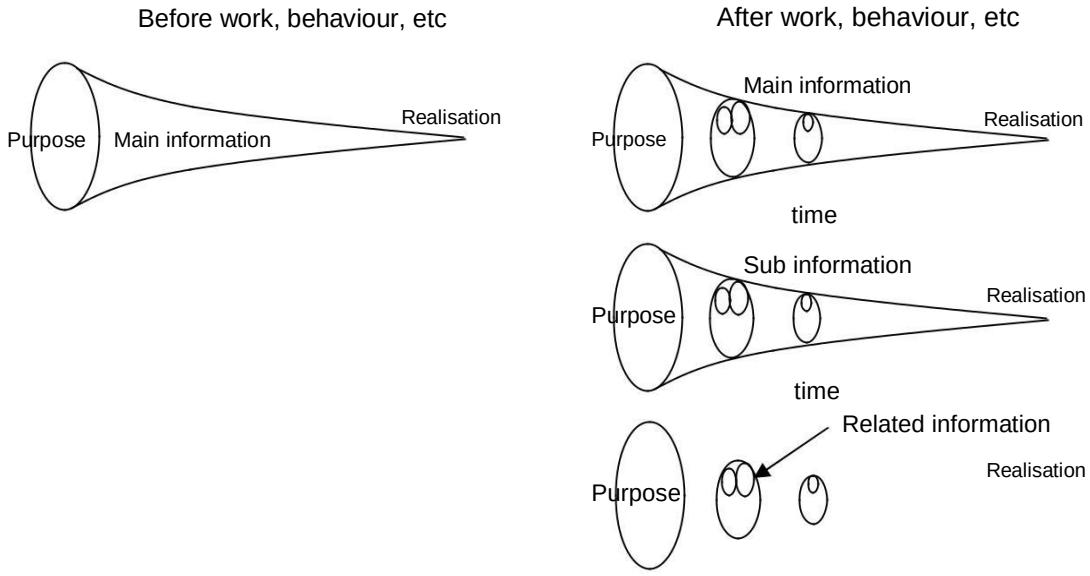

Figure 3: Mental model construction process

5. EVALUATION OF MENTAL MODEL

The evaluation method of the mental model is constructed according to the mental model construction process that is shown in (Fig.3). The evaluation items in terms of pre-evaluation are “Understand the system very well”, “Understand the system”, “so-so”, “Don’t understand the system”, “Don’t understand the system definitely”. The evaluation of pre-evaluation is done using the five evaluation items in the main, sub, related information. The main, sub and related information are weighted according to the situation. The evaluation items in case of ex-post evaluation are “Understood the system very well”, “Understood the system”, “so-so”, ”Didn’t

understand the system", "Didn't understand the system definitely". The evaluation of ex-post evaluation is done using the five evaluation items in the main, sub, related information. Table 1 shows the score of a mental model of a user regarding a high class restaurant that he / she has never visited. As the main information and sub information is important since they each carry 40 % out of the total score.

Table 1. Evaluation table of mental model

Pre-evaluation of mental model	Main information (40%)	Sub information (40%)	Related information (20%)	score
Understand the system Very well (4 points)				
Understand the system (3 p)				
So-so (2 p)	0.8	0.8	0.2	1.8
Don't understand the system (1 p)				
Don't understand the system definitely (0 p)				
Total score				1.8

Ex-post evaluation of mental model	Main information (40%)	Sub information (40%)	Related information (20%)	score
Understood the system Very well (4 points)				
Understood the system (3 p)		1.2	0.6	1.8
So-so (2 p)	0.8			0.8
Didn't understand the system (1 p)				
Didn't understand the system definitely (0 point)				
Total score				2.6

6. CONCLUSION

The framework of constructing a mental model was completed by using both top down and bottom up approaches. The evaluation table is constructed in order to evaluate the mental model from viewpoint of the difference between pre-evaluation and ex-post evaluation.

7. ACKNOWLEDGMENTS.

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