

Grasping the Components of Constructing Mental Model in Operation of the Equipments

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Abstract: In this study, we examined the components of the constructing Mental Model in the operation of the equipments. As an experiment, we asked 12 participants to operate the digital camera. The Participants needed to describe the reason of each operation. The components which would affect the constructing Mental Model were extracted from their utterance. As a method of analysis, “Key Graph” which is one of the text data mining techniques was used. By “Key Graph”, the frequently-appearing words and the characteristic words were extracted and their relationship was considered to consider the components of constructing Mental Model. As a result, the eight components of Mental Model in the operation of the equipments were grasped. (The eight components are as follows. Prediction of the Operation, Judging and Understanding the Situation, Modifying the Mental Model, Understanding the Indication, Considering conceptually, One’s Use Experiences, Motivation, Behavior for the equipments)

Key words: *Components, Constructing Mental Model, Key Graph.*

1. Introduction

In these years, the electric products around us become increasing range of functions and complicated operations with advance of the functions. Actually, many users can not overtake the advances. So, they don’t know how to operate the equipments or only use the basic functions. The cause of the problem is that designers can’t fully understand the User’s Mental Model when they design the equipments. These problems would be able to resolve if the user’s Mental Model coincides with the designer’s Mental Model. Therefore, the Designer must understand more the User’s Mental Model and devise to help users. Because of such background, it is clear for the design of products that grasping the components of constructing Mental Model is very important.

That’s why we tried to examine the events as the components which are needed in the process of constructing the Mental Model through operating the products. We asked the participants to operate the digital camera and grasp the 8 components which we think they are needed to construct the Mental Model in operation of the equipments.

2. Test Method

In this study, we proceeded the operation using the digital camera test for the participants. Twelve working people (male:9 female:3) participated in this experiment. Their age is 26 to 50. As experiment, we asked the subjects to operate the digital camera to achieve the tasks. There were ten tasks. As the tasks progress, the tasks became more complicated. Before each behavior, subjects had to speak purposes of the operation and reasons to select the buttons. Their air and voice were recorded with digital video camera.

3. Results

All users' utterances in each task were changed into text data and analyzed using the "Key Graph" visualization methodology.

3.1 What is Key Graph

"Key Graph" is a text data mining method which was developed by Mr.Osawa (Tokyo Univ) in 2003. The method can extract the frequently appearing words and the characteristic words from documents and utterances [1]. Then, it shows the relationship among them for visualizing. The good point of the method is that it can find the information which wasn't read out from source document because it can look at the structure of the document with a bird's-eye. For this reason, by using "Key Graph", we tried to consider and to extract the components which need to construct Mental Model in operation of the equipments.

3.2 Results of the Key Graph

All tasks proceeded were examined the components by using "Key Graph". This paper shows the result of a task 8 as an example. The task 8 is "When it takes a minute, the liquid crystal display monitor goes off and be a standby condition." Figure 1 shows the results of the achiever's utterance on task8. Figure 2 shows the results of the NOT achiever's utterance on task8.

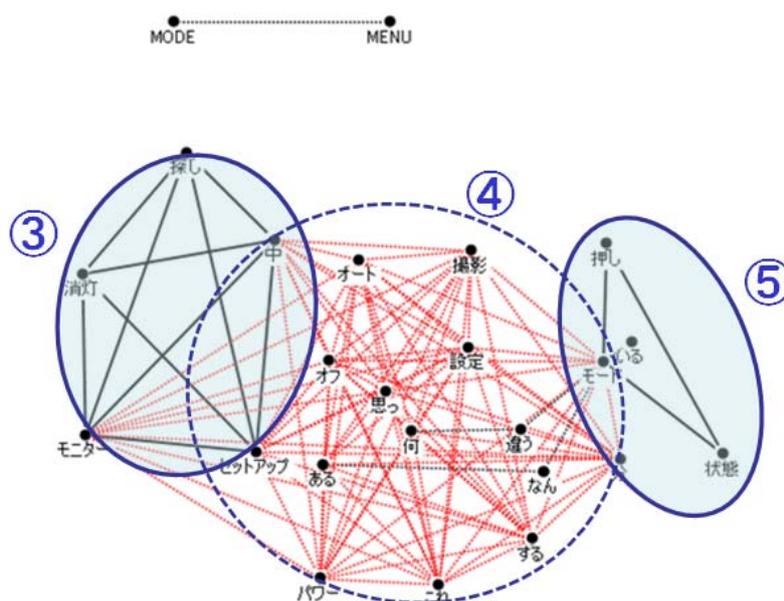


Figure.1 The result of The Achiever's utterance on task 8

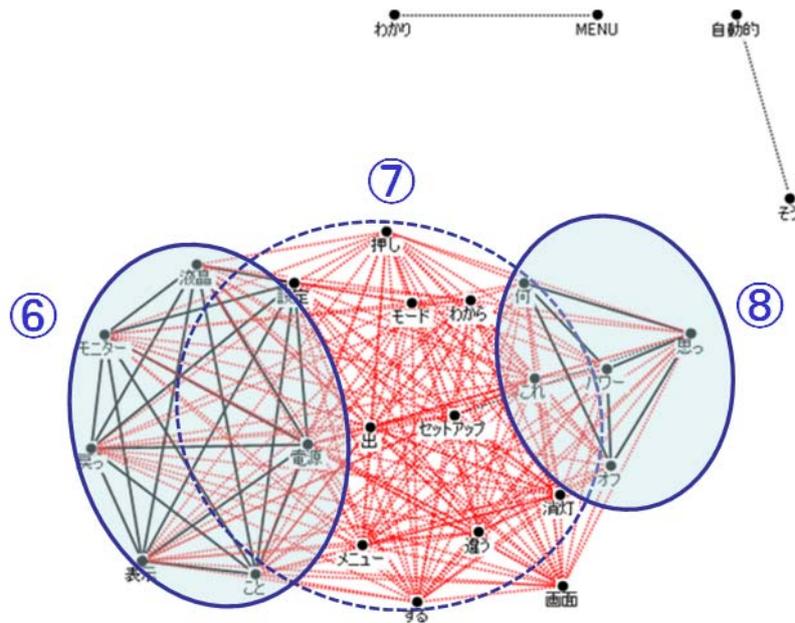


Figure.2 The result of The NOT Achiever's utterance on task 8

Next, we will now examine the result of the analysis about task 8. First, the results of the achiever's utterance will be explained. We considered the relationship between circle-2 and circle-3 from the achiever's utterance (Fig.2). In the circle-3, the words ("Set up", "Monitor", "Looking for~") about the utterances where of looking for the objective display were extracted as the frequently-appearing words. As the utterance which connect up the circle-3 and the circle-4, the words ("Think", "Doing") about the utterances of the calculation of operation were extracted as the characteristic words. For this reason, as a Components of Mental Model, "Calculation of the Operation" is considered. In addition, the words ("situation", "being", "push") about the utterances concerning the situation where he/she was were extracted as the characteristic words in the circle 5. And, the words ("What", "Difference", "Come out") about the utterances concerning the situation which user judged own situation from the change by operation of the products were extracted as the characteristic words in the circle 4. For this reason, "Judging and Understanding the Situation" is considered as a Components of Mental Model.

On the other hand, the different characteristics had been found in the result of the NOT achieved subject's utterance (Fig.3). In the circle-6, the words ("the Liquid Crystal Display", "Monitor", "Setting") about the name of the buttons which are calculated from the sentence of the task by user were extracted as the frequently-appearing words. And in the circle-8, the words ("Power", "Off") about the name of the buttons which should be used to achieve the task were extracted as the frequently-appearing words. As the utterances which connect the circle-6 and the circle-8, "Can not figure out" was extracted as the frequently-appearing words in the circle-7. That is to say, user remarked "Auto-Power-Off" which is correct button but cannot right judge. In this case, the right judge is that the name of the button which is calculated from the sentence of the task by user is different, the right name is "Auto-Power-Off". So, some user got confused. For the utterance which has focus on the name of buttons, "Understanding the Indication" is considered as a Components of Mental Model.

The primary reason why some participants cannot achieve the task is that they decide all buttons or contents are different to the one's aim except the button and the content which are imaged by oneself. In fact, they didn't try to change their Mental Model. This fact reminded me that "Modifying the Mental Model" is also one of the components of constructing Mental Model.

4. Conclusions

The purpose of this paper is to grasp the Components of Constructing Mental Model in Operation of the Equipments. To accomplish a purpose, the operation test using digital camera was proceeded. Then, we found that there were 8 components of the constructing Mental Model from the results of our study. The meaning of each Components of Mental Model is explained easily in the Table 1. “Motivation“and “Behavior for the Products“were referenced a literature [2].

4.1 Explanation of the components of constructing Mental Model

1. Prediction of the Operation: To predict the operation this is necessary to achieve and the aim.
2. Judging and Understanding the Situation: To aware of own situation and to understand it during the operation of the products.
3. Modifying the Mental Model: To select the next proper operation through the actual operation.
4. Understanding the Indication: To understand the meaning of the indications (words, icons and so on)which are specified on the part of the operation and the operation screen.
5. Con sidering con ceptually: T o lu mp some th ings t ogether and to build it up in th eir brain as a general knowledge.
6. One’s Use Experiences: The concrete knowledge and experiences concerning the products which user have used before.
- 7 Motivation: In daily life, the internal process which urge human to action and to go to the aim.
8. Behavior for the equipments: The emotion and the action to the products in the process to achieve the aim.

As a future prospect, we have to verify the validity of the eight Components of Mental Model. In addition, because the difference components were found between the results of the achiever and the NOT achiever, we expect that the new knowledge concerning the user’s Mental Model will have been found if the relationship between the operational performance and the components of constructing Mental Model will be examined.

5. References and Citations

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