A GUI DESIGN GUIDELINE TO CONSTRUCT MENTAL MODELS EASILY

Toshiki Yamaoka

Wakayama University, Faculty of Systems Engineering

Abstract

The design guideline to construct the mental model was proposed. The guideline was constructed from the viewpoint of the functional model and the structural model of mental model. And it was examined based on structure mapping theory. The guideline was described from the viewpoint of the design principles between screens and on screens. The guideline was evaluated for the validation. 7 UI designers and 22 usability engineers in Japan participated in the test for the guideline. The results were evaluated highly, however the concrete description and examples were pointed out to be needed.

Keyword: mental model, functional model, structural model, design guideline

1. Introduction

As user interface of modern products has became black box, users usually cannot operate such products easily. Especially under such situation users must depend on mental model to operate the products. This paper describes a design guideline to construct the mental model.

2. Functional model and structural model

The mental model in this paper is defined as operational image created when using products. The mental model is also similar to “representation”.

The mental model consists of a functional model and a structural model [1]. The functional model means how to use systems (Fig1), while the structural model means how systems work (Fig2).

As information boards for an example show usually station order as the functional model and railway map as the structural model especially in subways, users can understand how to get the station which they want to arrive at (Fig3).
3. A design principles based on functional and structural model

According to structure mapping theory [2], users reason one object (the target) from another (the base). The structural similarity which means the relationship between target and base of structure mapping theory is main function of the mental model when reasoning about operation (Fig4).

Design knowledge was extracted based on the characteristics of structural model. They are as follows.
1. The outline of system structure are provided.
2. The relationship between grouped information are made clear.
3. The structural model is constructed easily using “consistency”.
4. Sequential and parallel information presentation should be examined.

3.1 How to design from view point of structural model

1. The outline of system structure are provided.
2. The relationship between grouped information are made clear.
3. The structural model is constructed easily using “consistency”.
4. Sequential and parallel information presentation should be examined.
4. A design guideline to construct mental model

The GUI design guideline is proposed using the above-mentioned knowledge.

They are as follows.

**The GUI design guideline between screens**

1. The mental model is constructed by providing general information about system structure on first or the other screens.
2. The mental model is constructed by providing present condition about system on the screens.
3. The relationship between screens is clarified by visual clues and so on.
4. The consistency regarding GUI elements makes the context create and construct the structural model easily.
5. The sequential and parallel information presented are decided based on the GUI concept.

**The GUI design guideline on screens**

1. The information presented on screens is understandable for users.
   a. The information is structured by the classification of information, emphasis of important information and building the relationship between screens.
   b. The understandable words are used.
2. The present situation in the system is understood.
   a. The consistency, visual clue and context make users understand the present situation.
   b. The tab, the current location of information structure and the display of procedure make users understand the present situation.
   c. The metaphor is efficient for constructing the mental model.
3. The navigation makes users understand the relationship between the GUI elements.
   a. The visual clue, term, mapping, consistency, feedback and system structure make user navigate the screen.
   b. The important information is weighted.

5. The evaluation of the design guideline

The evaluation of the design guideline was done in order to confirm the validation.

**5.1 Method**

The questionnaires were delivered to 7 UI designers and 22 usability engineers in Japan.
The questionnaires are as follows.
Q1. The mental model is constructed by providing general information about system structure on first or the other screens.
Q2. The information presented on screens is understandable for users.
Q3. The present situation in the system is understood.
Q4. The navigation makes users understand the relationship between the GUI elements.
Q5. Provide feedback in order to confirm the operation.

The participants evaluated five questionnaires and were asked their opinions for five questionnaires.

Criterion of evaluation: very good (5 points),
good (4), so-so (3), bad (2), very bad (1)

5.2 Results and discussions

The average scores (table1) are as follows.

Table1. The average scores

Although the guideline was evaluated highly, some comments were pointed out.
The comments are as follows.
1. The concrete examples are needed for understanding.
2. The concrete method to construct the mental model is needed.
3. The strict definition of words is needed.
4. The concept of time is needed for the evaluation.
5. The characteristics of mental model depend on the products.

6. The guideline should be examined for the disabled.

6. Conclusion

The design guideline to construct the mental model was proposed. The guideline was constructed from view point of the functional model and the structural model. The guideline was evaluated for the validation.

7 UI designers and 22 usability engineers in Japan participated in the test for the guideline. The results were evaluated highly, however the concrete description and examples were pointed out to be needed.

References
