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Effect of Arrangement of Design Elements on Recognition of Complex Signs

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ABSTRACT

Due to the expansion of cities and the increasing number of large-scale and complex public spaces, there is an increase in public signage. Moreover, the information described on these signs tends to be diverse and complicated. Complex signs that contain multiple destinations or other information must be considered to determine not only the proper size, color, etc. but also the most effective arrangement of design elements. In the previous research, the cognitive utility of complex public signs was estimated using computer simulation software. In the current research, we focused on the objective estimation of the effectiveness of the results obtained in the previous research utilizing an eye mark recording system. Two cognitive engineering experiments clarified five points for improvement in the usability of complex signs, as follows: 1) Parallel construction of characters and pictograms is more efficient. 2) Grouping elements result in rapid recognition of information chunks. 3) Visual characters and pictograms are effective, along with proper density of information. 4) Specific arrangement of sign arrows is effective. 5) Figures on signs influence the sequence of information searches.

Keyword: Complex sign, Cognitive engineering, Eye mark recording system

1. Introduction

Due to the expansion of cities and the increasing number of large−scale and complex public spaces such as large railway stations and airports, there is an increase in public signage. Moreover, the information described on these signs tends to be diverse and complicated. A traveler must choose an appropriate sign among several such signs in order to seek his or her destination. It is, therefore, indispensable to design public signage based on the sensory, cognitive, and motor characteristics of the users in such spaces.

Numerous studies have determined guidelines and methods for designing noticeable and effective signs based on psychology, cognitive engineering, and ergo−nomics. These guidelines and methods are, however, restricted to the design of specific elements, i.e., the proper size, color, combination of characters and picto−grams displayed in the signs etc. They are most useful for simple signs indicating a single destination. However, complex signs that contain multiple destinations or other such information(Figure 1) must be also considered to determine the most effective arrangement of design elements.

2. Steps of the research

In the previous research[1] the cognitive utility of complex public signs was estimated using computer simulation, because it was difficult to estimate the validity of the design of these signs in actual public

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Figure 1. Example of a complex sign.

spaces. The cognitive engineering experiments resulted in the determination of five main factors for the design of complex signs.

a. Selection of characters or pictograms
b. Knowledge of pictogram
c. Information chunk
d. Color
e. Position of design element

Results also showed that the strength of each factor's effectiveness increases from "e" to "a".

In the current research, we focused on the objective estimation of the effectiveness of the main factors determined in the previous research utilizing an eye mark recording system. The research consisted of two experiments.

3. Experiment 1

The purpose of this experiment was to verify the results of previous research objectively.

3.1 Methods

3.1.1 Participants

Seven female students (23~25 yrs) participated in the experiment.

3.1.2 Apparatus and Tasks

The authors used Visual Basic 6.0 to develop the simulation software for the task. Several simulations of complex signs were designed for the experiment.

Each participant was mounted with an eye mark camera and then sat down in front of a personal computer display (Figure 2). First, the name of a destination was displayed on the computer (Figure 3). The participant clicked the start button using a mouse as soon as she recognized the destination. Second, a complex sign that included the same destination was displayed on the

Figure 2. Apparatus of experiment.
An eye mark camera is mounted upon the participant

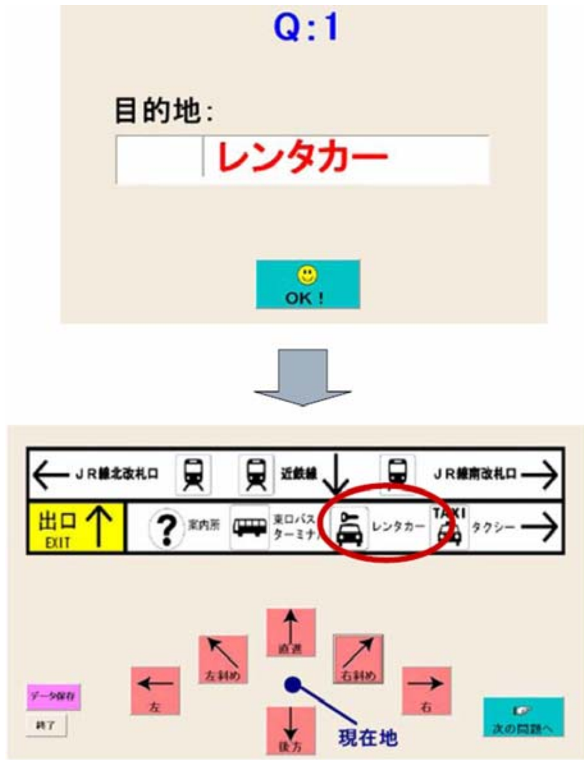

Figure 3. Example of task.

computer. The participant then had to choose as quickly as possible the correct button for the direction of the destination she had identified previously.

3.1.3 Measurement items

The reaction times between the click of the start button and that of the direction button and some indices of eye mark tracking, such as fixation duration, gaze velocity, gaze locus were automatically recorded in the computer memory.

3.2 Results and Discussion

Reaction times tended to increase in signs that comprised 1) notes without characters and with pictograms and 2) destination names separated from the arrows indicating that name. In these inappropriate signs, the fixation durations were prolonged, and the gaze loci became longer and tended to be complicated. The validity of the five main factors for the design of complex signs established by previous research is thought to be supported by these results.

Figure 4 shows examples of appropriate design for complex signs, including the parallel placement of characters and pictograms, simple arrangement of design elements, and close positioning of the destination name and its arrow.

Figure 4. Examples of appropriate and inappropriate complex signs(*see text*)

4. Experiment 2

Characteristic patterns of eye mark trajectory were observed in experiment 1, which showed that on complex signs, the participants tended to search in horizontal directions at first, and then in vertical directions. This tendency may be influenced by the fact that we usually read sentences laterally. The purpose of experiment 2 was to investigate the order of eye movement when searching for directions on complex signs.

4.1 Methods

4.1.1 Participants

Seven female students and one male student(23~24 yrs) participated in the experiment.

4.1.2 Apparatus and Tasks

The apparatus and tasks were the same as those in experiment 1. In addition to the horizontal complex signs used in experiment 1, four vertical complex signs were added in experiment 2(Figure 5).

Figure 5. Examples of oblong and longwise complex signs used in the experiment

4.1.3 Measurement items

The reaction times and eye mark tracking indices were recorded in the same way as in experiment 1.

4.2 Results and Discussion

The reaction times and fixation durations tended to decrease in the signs that were characterized by appropriate divisions of information chunk. For example, as shown in Figure 6, the reaction time of type B was shorter than that of type A. The locus pattern of gaze in type B was also simple and smooth, which supported the reaction time results.

As determined from locus patterns of gaze on many cases of complex signs(Figure 7), initial information searches were performed in the horizontal direction first and then in the vertical for oblong complex signs. For longwise complex signs, they were performed in the reverse order. It appears that the information on complex signs is searched crudely at first and then each design element of these signs is scanned in detail.

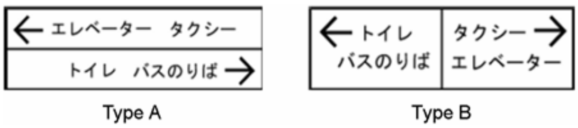

Figure 6. Examples of the divisions of information chunk.

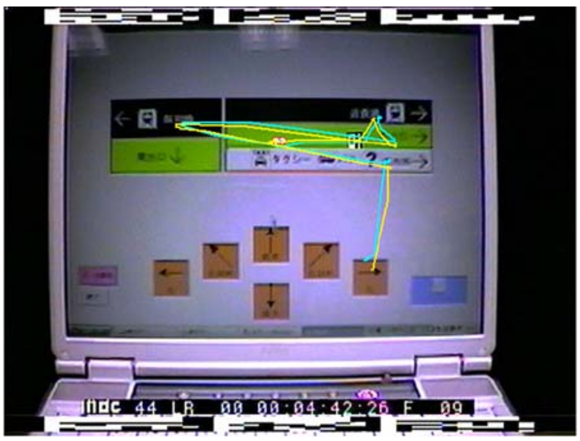

Figure 7. Locus patterns of gaze on the complex signs.

5. Conclusions

Experiments using an eye mark recording system and computer simulation software clarified five points for improvement in the usability of complex signs, as follows:

1) Parallel construction of characters and pictograms is more efficient.

2) Grouping elements result in rapid recognition of information chunks.

3) Visual characters and pictograms are effective, along with proper density of information.

4) Specific arrangement of sign arrows is effective.

5) Figures on signs influence the sequence of information searches.

The current research estimated the effective design of complex public signs using a computer simulation. It is, therefore, not clear whether the results of this research apply to signs placed in actual complex public spaces. Future research will attempt to verify these results in public spaces.

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