EFFECTIVE VISUAL CLUE ON RECOVERING ORIENTATION IN AN INTERIOR SPACE

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Abstract: Our previous study revealed that people tended to lose orientation after such vertical traveling as stairs, elevators and escalators, and that some of the subjects could recover it by environmental information. Although the result suggested that the source of information for recovering differed with person and space, we could not specify effective information.

The present research intends to clarify influential visual information on recovering orientation using a visual simulator that enables a subject wearing a Head Mounted Display to walk through and to look around in a model space freely. Three settings of scale models of a two-story library were used in the experiment. Subjects were led from a start point on the first floor to a destination on the second floor, and then they were asked to go back to the start point. In order to provide a possible visual clue to find the start point, the scene that the subjects saw when they got off the elevator on the first floor was differentiated with left and right side by the following spatial elements: A) windows, B) walls with different colors, C) walls with same color and furnishing (no differentiation) .

The results indicates that almost all the subjects could find the start point in the setting with windows, whereas 60% of the subjects succeeded in the setting with walls with different colors and less than 50% did in setting with no differentiated visual information. The interview conducted after the experiment reveals that more than 90% of the subjects used the windows to identify where the start point is, however, less than 60% used different colors on the wall. These results show that visual information provided by spatial elements helps people to recover orientation in the space, and that the windows are more effective for recovering orientation than the changes of colors on walls. It is concluded that it is important for legible interior space to arrange windows at the place where people tend to lose orientation.

1 Introduction

In recent years, travel in multilevel buildings is increasing because of the construction of complex and gigantic architecture. In this case, we seem to lose our way in inter-floor travel. Our previous study (Soeda et al, 1997) investigated the influence of such vertical traveling as stairs, escalators and elevators on wayfinding performance by conducting some experiments including pointing task and drawing sketch maps in a department store and campus buildings. The results showed that people tended to lose orientation after vertical traveling and some of them could recover it by environmental information. It also suggested that the source of information for recovering differed with person and space, however, we could not

specify effective information.

Although a large number of studies have been made on the relationship between spatial conditions and wayfinding behavior (Weisman, 1981; Peponis & Choi, 1990; O'Neill, 1991; Golledge & Gale, 1993; Haq, 1999), almost no studies have showed effective visual clue for recovering orientation in terms of inter-floor traveling. The present research intends to clarify influential visual information on recovering orientation, conducting wayfinding experiment in which visual information that is seen after vertical traveling are varied using a visual simulator.

2 Method

An experiment was conducted using a visual simulator that allows a subject wearing a Head-Mounted Display to walk through and look around in a model space visually. Images of the model space are taken through an endoscope connected with a CCD camera and are projected on the Head-Mounted Display. The subject's head motion (looking around) is synchronized with viewing direction of the endoscope and the subject can move the endoscope forward and backward by clicking either right or left button of a mouse. (Fig. 1)

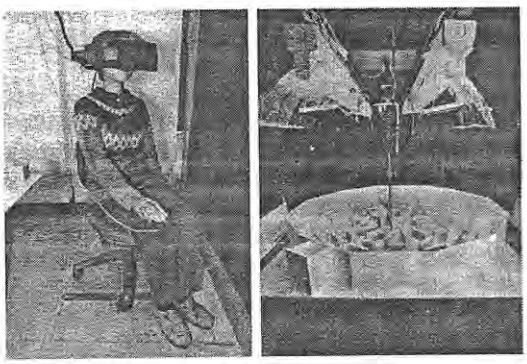


Figure1. A Subject Wearing Head-Mounted Display and Endoscope Inserted in the Scale Model

Three settings of scale models of a two-story library were used in the experiment. In each setting, subjects were led from a start point on the first floor (information desk) to a destination on the second floor (a bookshelf) via elevator, and then they were asked to go back to the start point by themselves (Fig.2) . In order to provide a possible visual clue for the subjects to find the start point, scenes that the subjects saw when they got off the elevator on the first floor were differentiated with left and right side by changing the design of the walls. Three settings tested here are: A) windows providing outside scene, B) walls with different colors (no windows), C) no differentiated walls (walls with same colors and same finishing) . (Fig.3)

All the floor plans of the models are designed as dodecagon shape and all the bookshelves are placed radially in the space, in order not to give the subjects any visual clue for recovering orientation besides the differentiated walls. The route to the destination in setting A and setting B are symmetric with respect

to the elevator in order to make the difficulty of the task of getting back to the start equal in the both settings. In setting C, the route was designed as the shortest among the three as it has no visual clue for recovering orientation.

3 Procedure

At first, the subjects practice to control the simulator, and then they are given an instruction of the task by the experimenter. In each setting, the subjects control the simulator by themselves following the guidance showing the way. On arriving at the destination on the second floor, they are asked to go back to the start point (information desk) by the shortest course. If the subjects give up finding the start point or cannot find it in 180 seconds after leaving the elevator, the experimenter stops the task. All the subjects try all the three settings in order of Setting A, B and C. At the end of the experiment, the reasons of route choice are interviewed, showing their behavior (images they saw on the task) recorded on videotape. 46 graduate students were enrolled in the experiment.

4 Results and Discussion

4.1 Influence of Visual Information

Figure 5 shows the subject's performance in each setting. In setting A, more than 90 % of the subjects could find the start point successfully, however, only 60% of them succeeded in Setting B and less than 50% did in Setting C. The interview conducted after the experiment revealed that more than 90% of the subjects utilized "windows" to identify where the start point is in Setting A, whereas, less than 60% of them used different color on the walls in Setting B (Fig. 6) . It also shows that almost all the subjects who did not use visual information mentioned above failed to find the start point. These results clearly indicate that visual information provided by spatial elements helps people to recover orientation in the space, and that the windows are more effective for recovering orientation than the changes of colors on walls are. The cause is considered to be the different "windows" to identify where the start point is in Setting A, whereas, less than 60% of them used different color on the walls in Setting B (Fig. 6) . It also shows that almost all the subjects who did not use visual information mentioned above failed to find the start point. These results clearly indicate that visual information provided by spatial elements helps people to recover orientation in the space, and that the windows are more effective for recovering orientation than the changes of colors on walls are. The cause is considered to be the different characteristics of the visual information. Windows give spatial expansion, landmarks seen outside and a view to outdoors and brightness to interior space. These characteristics of windows, which walls do not have, are considered to serve as an effective clue for orientation in an interior space. These results imply that it is important for legible interior space to arrange windows at the place where people tend to lose orientation.

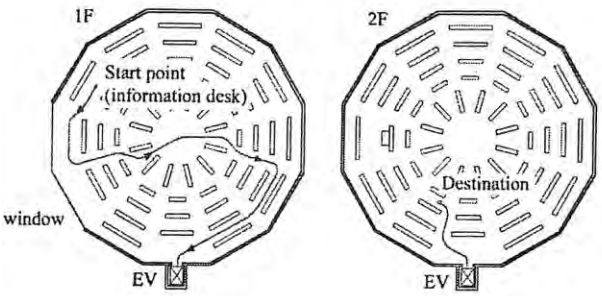
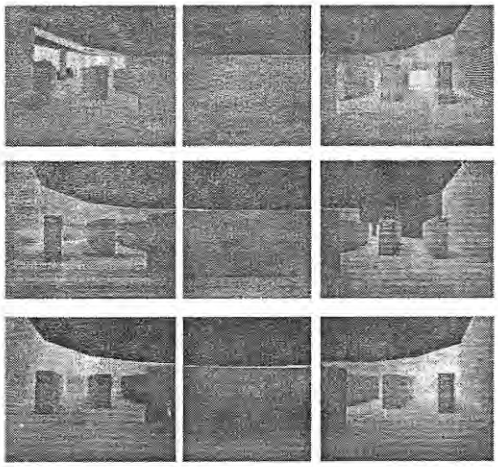


Figure 2. Plans of the Scale Model and the Guided Route



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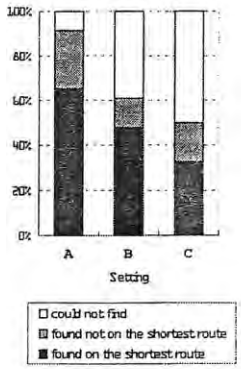

Figure 5. Subjects' Performance in Each Setting

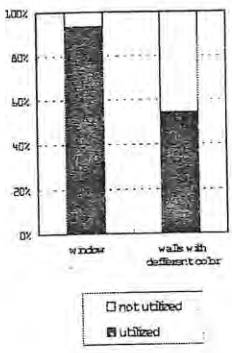

Figure 6. Utilization of Visual Information

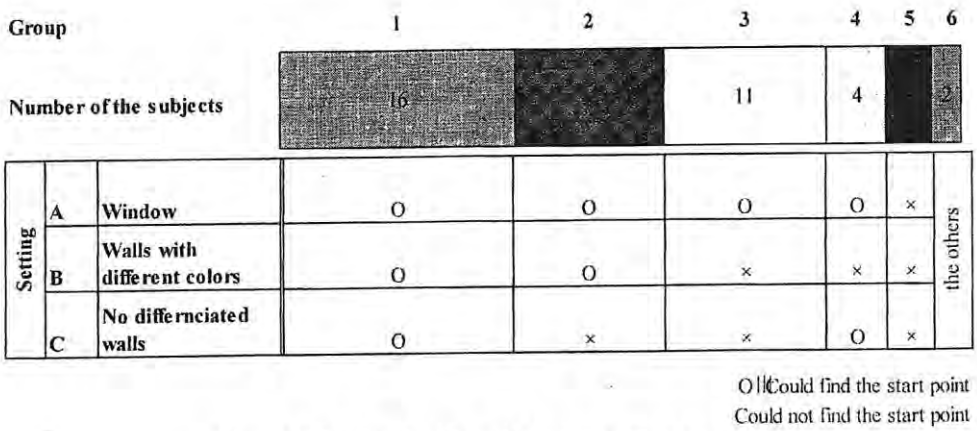

Figure 7. Results Classified with Individual Performance

4. 2 Analysis of Individual Strategies

According to individual performance of the experiment, the subjects were classified into some groups to investigate strategies to go back to the point (Fig. 7) . Subjects in Group 1 could successfully find the start point in all the settings. This results shows that they can recognize the correct orientation not only in allocentric system by utilizing visual information in the space but also in egocentric system relying on optical flow as they move, as they could successfully get back to the point even in Setting C that gave no visual clue in the space. On the other hand, Group B who failed in setting C can be said that they cannot keep the orientation in egocentric system.

Subjects in Group 3 who failed the task in setting B and C told during the later interview that they did not notice "walls with different colors" in setting B. Group 4 who succeeded in Setting C can be said their results are same as Group 3, as they told during the interview that they could accidentally find the point in Setting C. According to these results, it can be said that these subjects can utilize such visual information that gives spatial expansion to recover orientation, however, they cannot know the orientation from wall surface. This indicates that the difference of visual clue acquired from the environment can heavily affects wayfinding behavior of some people and that it is very important to know such mutual relationship between spatial features and people to design universally legible space. In addition, the result that there are a few subjects who could not find the start point in all the settings (Group 5) suggests that the spatial design cannot always solve all the wayfinding problems.

5 Conclusion

This research conducted a wayfinding experiment using a visual simulator to clarify effective visual information for recovering orientation. The results show that windows are more effective for recovering orientation in a space than the changes of color on walls. The cause is considered to be the characteristics of windows that give a view to outdoors and bring brightness to interior space. It also revealed that individual difference in wayfinding performance could be explained by visual information picked up from the environment as a clue for recovering orientation. These results suggest that it is important to know the correlation

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References

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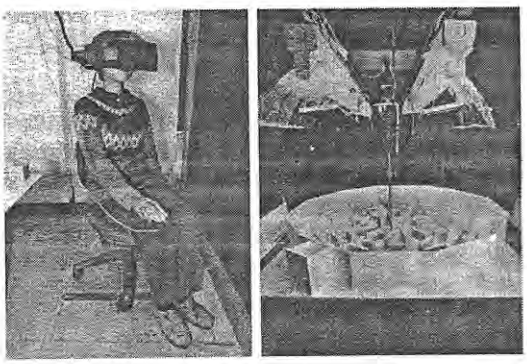

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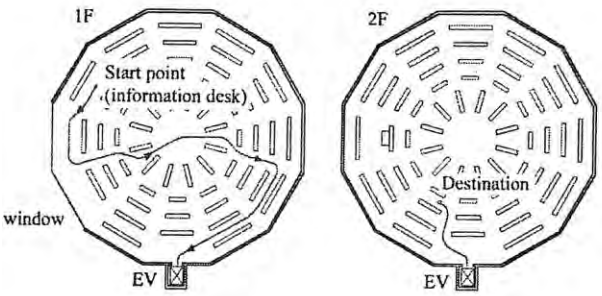

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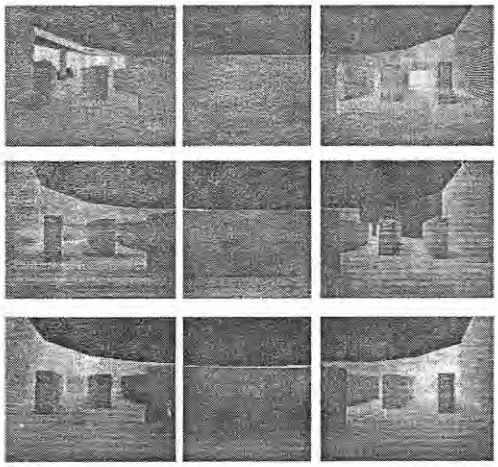

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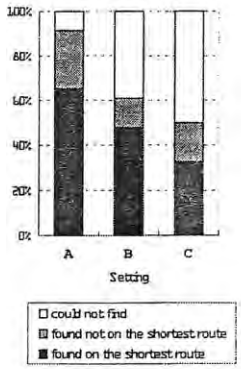

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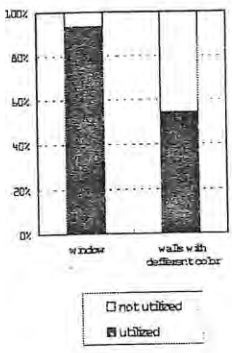

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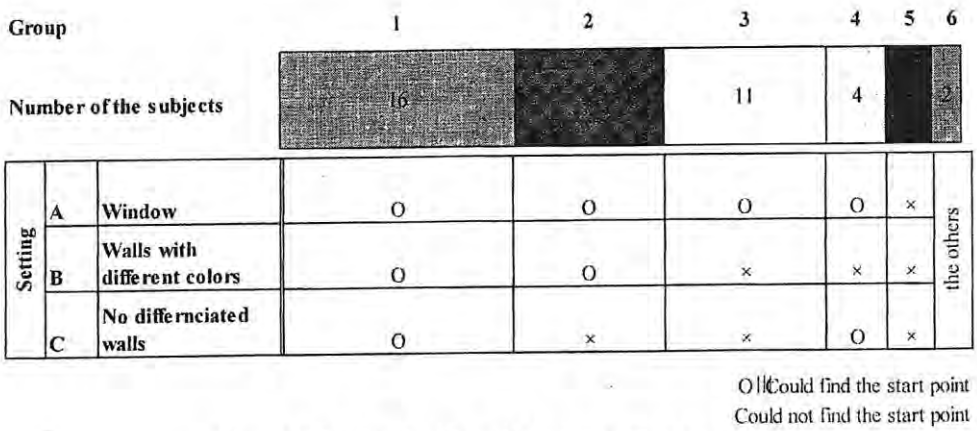

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