THE EFFECTS OF ARCHITECTURAL TREATMENTS ON REDUCING OPPRESSED FEELINGS CAUSED BY HIGH-RISE BUILDINGS

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Abstract
The authors conducted an experiment to examine the effectiveness of architectural treatments in reducing oppressed feelings caused by high-rise buildings along city streets. To create a virtual experience on the streets, computer graphic images of the streets were projected on an immersive projection display (6.3m x 4.0m) that enabled a wide field of vision, and the image moved according to the subject's walking pace on the stepping sensor placed in front of the display. The results indicated that arcading and installing transparent glass on lower levels of buildings significantly reduced oppressed feelings. The effectiveness of the treatments was found to depend on the extent of the subjects' visual awareness.

Introduction

Recently, many high-rise buildings have been built in cities. These buildings make urban public space uncomfortable for some visitors because they are much larger in comparison to the human-scale. Oppressed feelings caused by these high-rise buildings became a serious factor of urban discomfort**.** Therefore, reducing oppressed feelings to make the urban space more friendly and comfortable is important.

Some researches have been conducted on oppressed feelings caused by high-rise buildings. For example, Takei (1977) found the relationship between oppressed feelings and configuration factors of the buildings. He also discovered that trees covering the buildings would significantly reduce oppressed feelings (Takei 1983). However, these studies have discussed specific buildings seen in a static viewpoint**,** while using a slide projection.

We usually experience cities by moving, for example walking down streets. In such settings, we spontaneously choose information from surrounding environments that change dynamically with our movement. Therefore, it is important to discuss human perception in the cities in terms of not only static views, but also moving sequences**.**

Our previous research (Yonemoto et al 2002) investigated the relationship between architectural factors and visual awareness while walking in streets using a visual simulator. It was revealed that eaves and arcades attached to lower levels of buildings tended to suppress people's awareness of vertical direction. Based on this finding, it is hypothesized that some architectural treatments given on lower levels of the buildings can control people's visual awareness of vertical direction**,** and reduce oppressed feelings caused by high-rise buildings. We conducted an experiment to examine the effectiveness of such architectural treatments using a visual simulation system that allowed a subject to virtually walk though a street created by computer graphics.

Experimental Setting

Images of three streets that have buildings with different heights were made by computer graphics, as shown in Fig. 1. The width of the streets was 5m and the heights of the buildings along the streets

Figure 1: Elevation of the streets shown to the subjects

were designed either 35m or 7m**.** According to the results of previous researches, 35m high buildings caused stronger oppressed feelings than 7m high buildings.
As shown in Fig. 2, four architectural treatments that were expected to reduce oppressed feelings caused by high-rise buildings were given to the lower levels of the buildings. “Arcades” and “Eaves” attached to the lower levels of buildings to cover upper space were expected to restrain subjects’ awareness of vertical direction. “Window displays” provided much elemental information at the ground level**,** and were expected to make subjects aware of the surfaces of the buildings**,** and to reduce vertical awareness. “Transparent glass” installed on the walls of the ground floors of buildings give spatial extension to eye level**,** and is expected to increase awareness of a horizontal direction. In order to compare the efficiency of these architectural treatments in reducing oppressed feelings, we had a section of streets with “no treatment.” “No Treatments” means that no architectural treatment is given to the buildings in this section. In a section with one architectural treatment, there were two places where the height of the buildings changed from 35m to 7m and from 7m to 35m. We investigated whether subjects’ perceived atmosphere was influenced by the height of the buildings along the streets.

Visual Simulation System

In our simulated experiment evaluating oppressed feelings on walking on streets, it was important to express continuous sequential scenes in a wider field of vision; the images of the streets were shown to the subjects with a visual simulation system called “D-vision” (Fig. 3). The system had a hybrid screen (6.3m wide X 4.0m high)**,** which was composed of a flat and cylindrical screen**,** and enabled a wide field of vision (180 degree both horizontally and vertically). To get both a bright and high**-**resolution image, the screen was divided into 16 areas**,** and the image was projected by 24 video projectors. In 8 areas in the center of the screen, a subject wearing polarization glasses could see

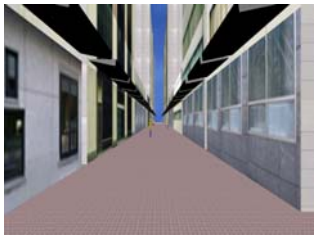
Architectural Treatments		Characteristics	Expected Effects
Arcade		Attaching arcades at the height of 3.5m of the buildings. The maximum height of the arcades is 7.0m	Controlling subjects' awareness to vertical direction by covering the upper space.
Eaves		Attaching eaves (0.75m long) at the height of 3.5m of buildings at both sides.	Limiting subjects' awareness within lower levels of the buildings.
Window Displays		Placing window displays, which have much elemental information, on first floor of the buildings along the street.	Leading people's attention to the windows of the first floor by increasing information.
Trasnparent Glass		Installing transparent glass on the first floor of the buildings and giving spatial expansion horizontally.	Reducing people's awareness to vertical direction by using horizontal spatial expansion.

Figure 2: Architectural treatments expected to reduce oppressive feelings caused by high-rise buildings

stereoscopic images made by 8 pairs of projectors, each showing a left-eye image and a right-eye image. The motion of the image projected on the screen was synchronized with the subject's steps on a pressure sensor (Stepping interface) set in front of the screen (Fig. 4).

Procedure

At first, the subjects practiced using a stepping interface, and then walked through the three streets in order. While walking through the streets, they were asked to ring a bell held in their hands when they felt that the atmosphere of the street had changed. The experimenter recorded the points where they rang the bell. After they had finished walking through all of the streets, the experimenter asked the subjects why they felt that the atmosphere had changed, while showing the image of the street on the

Figure 3: Visual Simulation System, "D-vision"

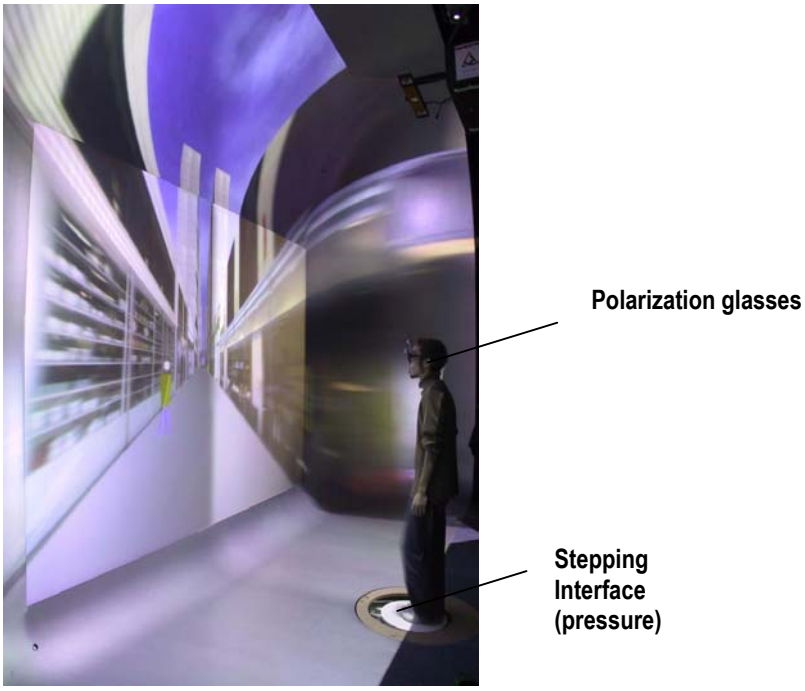


Figure 4: A subject in the experiment

screen so that they could remind them of their original experience. 28 students were employed in the experiment.

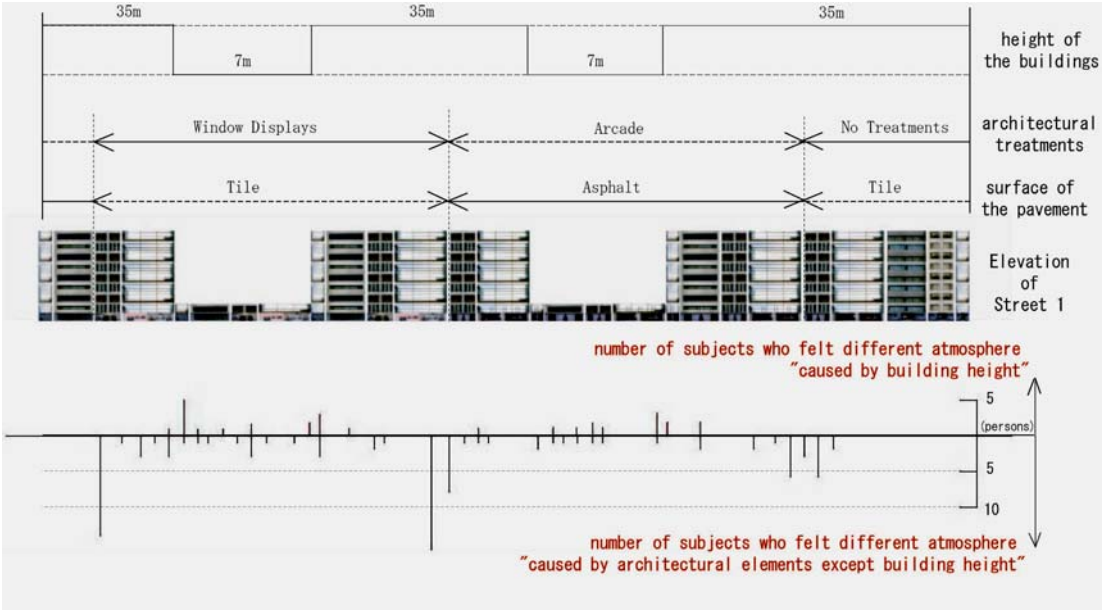
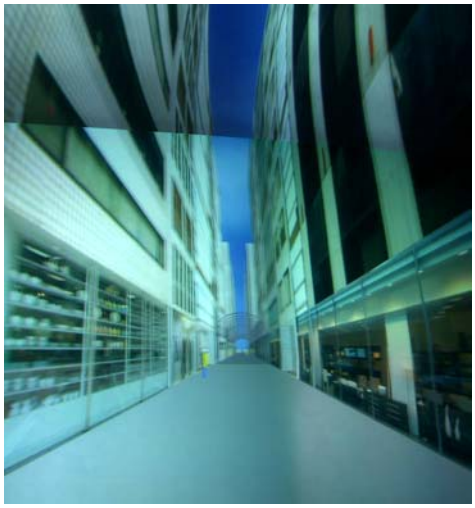


Figure 5: Relationship between architectural elements of Street 1 and number of subjects who felt different atmosphere

The side of the high-rise buildings seen ahead in focal vision



The walls seen aside in ambient vision

Figure 6: The ways to perceive the change of the building height

Result and Discussion

Reasons for feeling the change of atmosphere:

Fig. 5 shows how many subjects felt the atmosphere of the street had changed on a certain spot on the street. According to the interview of the subjects, the cause of why they felt the different atmosphere was classified into two types. One was the change of a building's height along the streets, and the other was such architectural factors such as the change of architectural treatments and the change of surface of the pavement. The figure shows that more people felt a different atmosphere when the architectural factors had changed. However, there were some people who felt a different atmosphere caused by the change of the building height. These subjects mentioned in the interview, "I felt an oppressed feeling," "The sky became narrower," or "The tall building was coming closer," etc. It follows from this that high-rise buildings somehow force people to feel oppressed, and bring the streets into a negative atmosphere.

On the other hand, the spots where the subjects felt a different atmosphere caused by the buildings' heights varied from person to person. Some people pointed out where the building heights changed, but others pointed out where the heights were constant. The interviews also revealed that there were two different ways to perceive the changes of building heights. One is based on the side of the high-rise buildings seen ahead in focal vision, and the other is based on the walls seen aside in ambient vision when passing in front of the buildings (Fig. 6). Subjects depending on the former pointed out the change of atmosphere before arriving to the spot where the building height changed, and the subjects depending on the latter pointed out just around where the building height changed.

Effects of architectural treatments on reducing oppressed feelings:

Fig. 7 shows the ratio of the subjects who felt the change of atmosphere caused by building height in each architectural treatment. Although not a large portion of people felt the change of atmosphere when the building height became lower, the ratio was low in all architectural treatments compared to

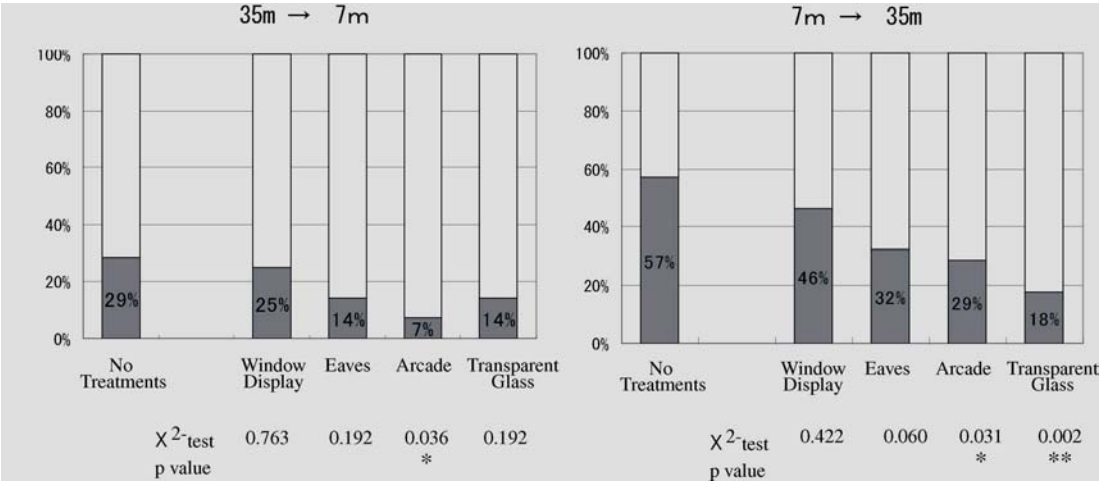


Figure 7: The ratio of the subjects who felt the difference of atmosphere caused by the change of building height

"No Treatments." Moreover, statistical analysis showed that the ratios in "Arcade" and "Transparent glass" were significantly lower than in "No Treatments." This suggests that covering the upper space with arcades and giving spatial expansion horizontally by installing transparent glass at the ground floors of the buildings can control people's awareness of vertical direction and significantly reduce oppressed feelings.

Individual difference of awareness of vertical direction:
To investigate the relationship between effects of architectural treatments on reducing oppressed feelings and individual awareness of vertical direction, the subjects were classified into 5 groups. These groups were grouped according to the atmosphere the subjects felt while walking through the setting of "No Treatments" (Table 1). In the cases where the building height changed from 7m to 35m, the way they perceived the change of the building height, which is either "walls seen ahead" or "walls seen aside," is reflected in the classification.
Although a clear relationship is not observed, some tendencies are suggested in the following results. Subjects in Group E felt no changes of atmosphere caused by the change of building height in the setting of "No Treatments." They also did not feel oppressed in other settings except for a couple of cases. This suggests that there are some people who do not pay attention to the building height. In contrast, subjects in Groups A and B felt the change of atmosphere whenever the building height changed in the setting of "No Treatments." They also felt the change of atmosphere caused by the building height in almost all of the other settings. This suggests that there are some people who are especially sensitive to the height of the building, and architectural treatment is not effective for such people in reducing oppressed feelings. Finally, moderating subjects in Group C felt the change of atmosphere depending on the walls seen aside when the building height changed from low to high in the setting of "No Treatments." However, they did not feel the change of atmosphere caused by building height in cases where the building height changed from low to high in the setting of "Eaves." This suggests that eaves attached to the lower levels of the buildings tend to suppress awareness to the walls seen aside in the peripheral vision field. As a conclusion, effectiveness of architectural treatments seems to have a relationship with the individual tendency of visual awareness to vertical direction; however, more experiments need to be conducted to show a clearer relationship.

Conclusion

A simulated experiment was conducted to examine the effectiveness of architectural treatments in reducing oppressed feelings caused by high-rise buildings standing along a street. The results indicated that arcading and installing transparent glass on lower levels of buildings significantly reduced oppressed feelings. It was also suggested that the effectiveness of the treatments depended on the extent of subjects' visual awareness.

Table 1: Individual differences of awareness to vertical direction

GrOup	Subjects	NO Treatments			35m→7m				7m→35m			
		35m→7m	7m→35m		WindOw Display	Eaves	Arcade	Transparent Glass	WindOw Display	Eaves	Arcade	Transparent Glass
			walls seen aside	walls seen ahead								
A	17	O	O	O	O	×	×	O	O	O	O	O
	19	O	O	O	O	×	O	×	O	×	O	O
	8	O	O	O	O	×	O	O	×	O	O	O
	13	O	O	O	O	O	×	×	O	O	O	×
	14	O	O	O	×	×	×	×	×	×	×	×
B	20	O	O	×	×	×	×	×	O	O	O	O
	3	O	O	×	×	O	×	O	O	O	×	×
	18	O	O	×	×	×	×	×	×	O	×	×
C	21	×	O	×	×	×	×	×	O	×	O	×
	24	×	O	×	O	×	×	×	O	×	×	×
	2	×	O	×	×	×	×	×	O	×	×	×
	22	×	O	×	O	O	×	×	×	×	×	×
	23	×	O	×	×	O	×	×	×	×	×	×
D	1	×	×	O	×	×	×	×	O	O	×	×
	9	×	×	O	×	×	×	O	O	O	×	×
	16	×	×	O	×	×	×	×	×	×	×	×
E	10	×	×	×	O	×	×	×	O	×	×	O
	11	×	×	×	×	×	×	×	O	O	×	×
	15	×	×	×	×	×	×	×	O	×	×	×
	12	×	×	×	×	×	×	×	×	×	O	×
	4	×	×	×	×	×	×	×	×	×	×	×
	5	×	×	×	×	×	×	×	×	×	×	×
	6	×	×	×	×	×	×	×	×	×	×	×
	26	×	×	×	×	×	×	×	×	×	×	×
	27	×	×	×	×	×	×	×	×	×	×	×
	7	×	×	×	×	×	×	×	×	×	×	×
	28	×	×	×	×	×	×	×	×	×	×	×
	25	×	×	×	×	×	×	×	×	×	O	×
Total		8	13	8	7	4	2	4	10	6	7	4

O : felt different atmosphere caused by the change of building height
X : did not feel different atmosphere caused by the change of building height

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