Psychological evaluation of street lighting environment at night

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1. Introduction

Recently, new lighting technologies such as light emitting diodes (LEDs) have started to be used for street lights. These technologies would enable us to design new street lighting systems more flexibly in terms of spatial arrangement. They also allow us to use more colors for street lights. Many studies related on influence of street lights on psychological or physiological responses have been conducted. Light sources that provide perception of greater brightness than others at the same luminance are likely to be perceived as producing a safer environment[1][2]. Other study reported that lighting colors affect visibility, brightness and physiological responce [3]. However, it is not known exactly the relationship between the impresison on street at night and characteristic of street lights, and also not known the evaluation structure of street at night.

The aim of this study was to clarify how the lighting environment would influence our psychological impressions at night, and to clarify the relationship of the impressions.

2. Expermental Method

Subjective assessments were carried out using images of street scenes in residential and commercial areas at night. Subjects evaluated the 62 images presented by a LCD projector on a screen in random order as shown Fig.1. The screen and the projector were set in a darkroom. Subjects were students and a staff of the department of Architecture (4 male and 6 female). They gave scores for 7 evaluation items, "Clear", "Active", " Bright ", "Glaring", "Safe", " Comfortable ", and "Like" with 6 steps on a categorical scale. These items are often used in evaluation of night scenes.

3. Luminance Measurement Result

To clarify the influence of luminance of a street on each evaluation, the averages of luminances were calculated. The two-dimensional distribution of luminances of each image presented on the screen was measured with color luminance meter (KONIKA MINOLTA CA-2000). The images were divided into the grid of 2 deg view field (16 x 25 grids) as shown Fig.2a. The maximum luminances in each grid were calculated, and the images were divided into three areas; upper, center and lower, as shown Fig.2b. Then the average luminance in each area was calculated by using the maximum luminance of each grid.

4. Result and Conclusion

Figure 3 shows the relationship between the luminance of each area and evaluations. It was shown that all evaluations were higher as the average of luminance was increased. In "Clear", "Active", "Bright" and "Safe", the luminances of

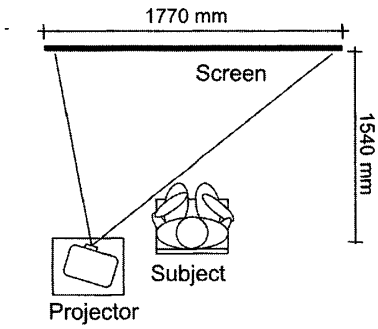
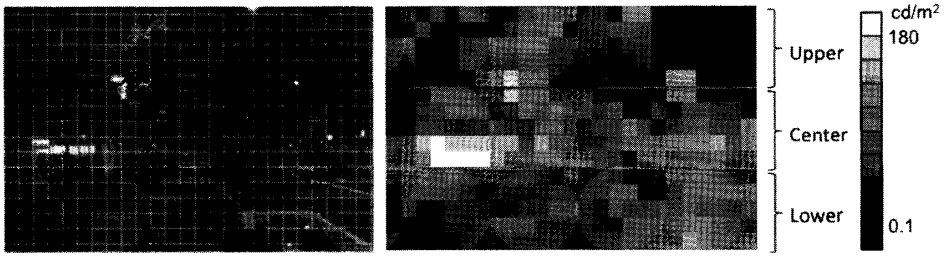


Fig.1 Experimental Setup



a) Divided into the grid b) Maximum luminance of each grid

Fig.2 Method of Luminance Mesurement

brightness of road surface significantly affected on the evaluations. In "Glaring", the luminances of center area had a higher correlation with the evaluation. It suggests that there were many light souces in the area.such as electronic signage and light from the buildings and houses. In "Comfortable" and "Like", the evaluations were variable. This is because other factors affected on the evaluations.

Table 1 shows the correlation matrix of evaluation items. It was shown that "Safe" correlated more highly with "Like" and "Comfortable". It suggests that "Safe" affected these evaluations. In addition, "Like" and "Comfortable" have a high correlation. Thus, evaluation structure of street at night could be reorganized.

References

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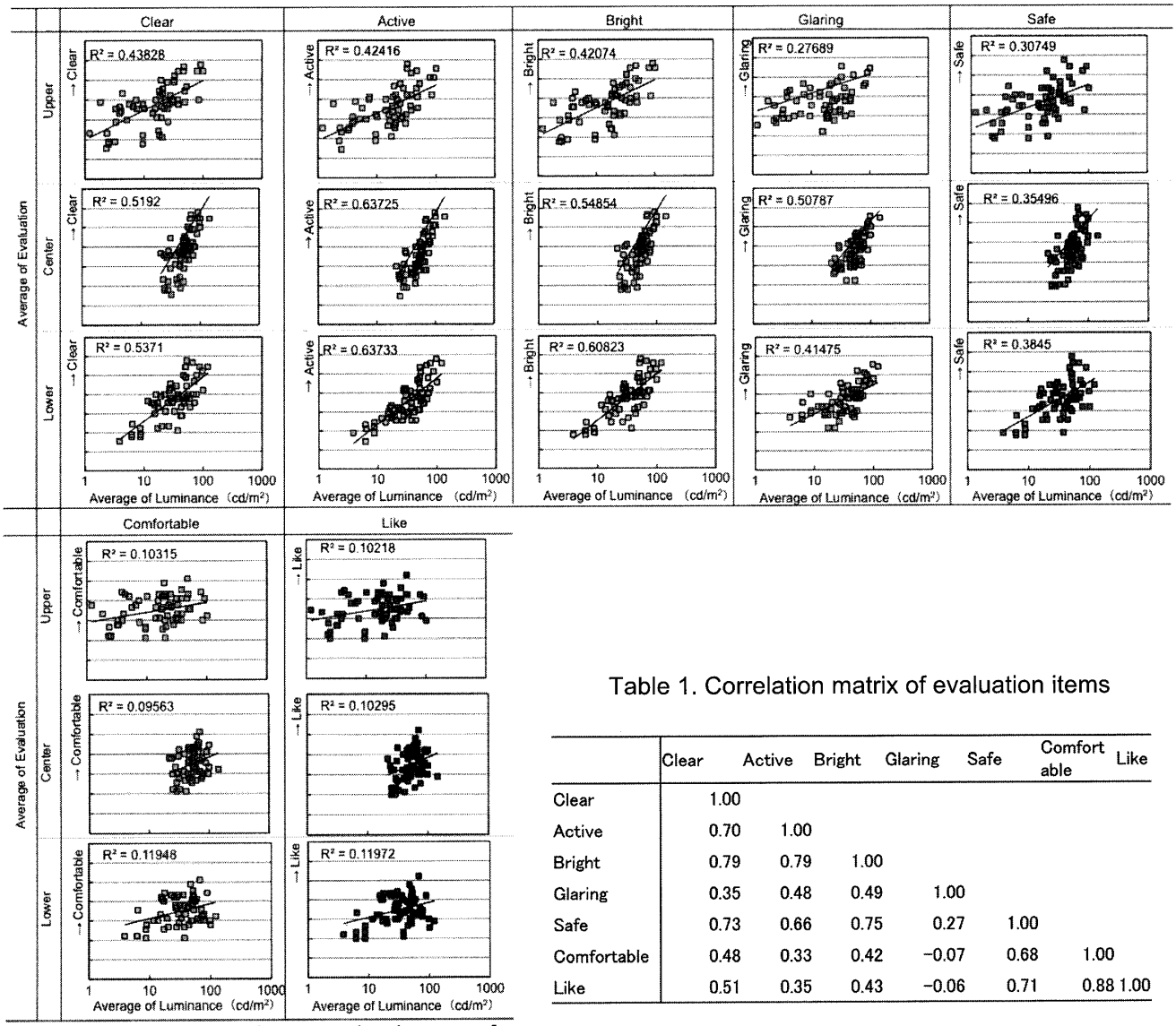

Fig.3 The relationship between luminance of each area and evaluations

Table 1. Correlation matrix of evaluation items

	Clear	Active	Bright	Glaring	Safe	Comfortable	Like
Clear	1.00						
Active	0.70	1.00					
Bright	0.79	0.79	1.00				
Glaring	0.35	0.48	0.49	1.00			
Safe	0.73	0.66	0.75	0.27	1.00		
Comfortable	0.48	0.33	0.42	−0.07	0.68	1.00	
Like	0.51	0.35	0.43	−0.06	0.71	0.88	1.00