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INDOOR ILLUMINANCE LEVEL PROPER FOR ELDERLY PEOPLE TO SEE SIGNS FROM OUTDOOR

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1 Introduction

People get cataract in their eyes when aged. The most serious impediment from the cataract is the light entering the eyes from environment scatters into the eyes and covers all over the retina causing scene foggy. It also desaturates colors[1], and blurs the retinal image[2]. When elderlies look at a dimly illuminated indoor from a very bright outdoor the indoor appears only a dark space and they cannot recognize objects in the space, while young people have no such inconvenience because of no scattering light in their eyes. One way to solve this problem is to increase the illuminance in the indoor space. The present paper investigates how much illuminance should be increased for elderlies compared to young people by simulating the cataract with cataract experiencing goggles[3].

2. Method

Two-rooms technique was employed composing of a subject and test room as shown in Fig. 1. The subject room was 4 m long, 3 m wide, and 2 m high, and the test room 1.8 m long. At the separating wall 17 fluorescent lamps FL of 40 W each and the daylight type were attached facing a subject to simulate the environment light. The vertical plane illuminance at the subject eyes were variable from 0 to a little over 1,000 lx when the subject sat at the distance 3.3 m from the separating wall. Five illuminance levels were investigated, 0, 259, 528, 789, and 1054 lx. The inside of a building was simulated by the test room, which was illuminated by 12 fluorescent lamps of 20 W and the daylight type. Two of them, Ft were adjustable for their intensity by a knob operated by the subject. A test stimulus T was placed against the back wall of the subject room and the subject observed it through an opening D of which width was 50 cm. The vertical plane illuminance was measured at the test stimulus every time when the subject set. Figure 2 is a photograph to show the environment lighting at 1054 lx and a test stimulus in the test room through the window.

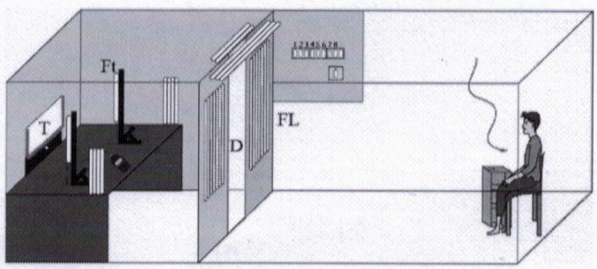


Fig. 1 Experimental room.

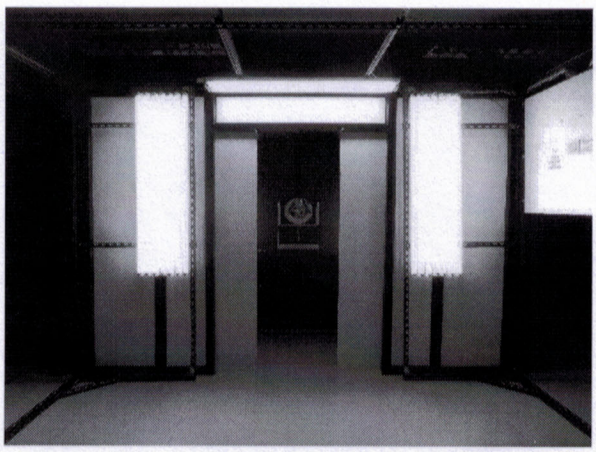


Fig. 2 The environment light in the front wall of the subject room.

The subject task was to adjust the illuminance of the test room by a knob at the level when he/she could understand the contents of the stimulus easily for the decision whether he/she visits the building when he/she happened to pass by the building. This was not a threshold for readability of the stimulus and rather a vague criterion. We wanted to simulate real situation of elderly people on streets in town. The adjustment was done with naked eyes and with cataract experiencing goggles for five times at different experimental sessions.

Ten test stimuli were prepared composing of two types of pattern; 4 posters and 6 dishes. Examples of a poster and a dish are shown in Fig. 3. The poster was to invite people to a seminar held in the building and the dish was a Thai food "somtum" that was available in a restaurant in the building. The goggles had haze value of 18% that shows the degree of scattering light and the photopic luminous transmittance 63%. The goggles simulate the cataract eyes that just start to cause inconvenience in daily life.

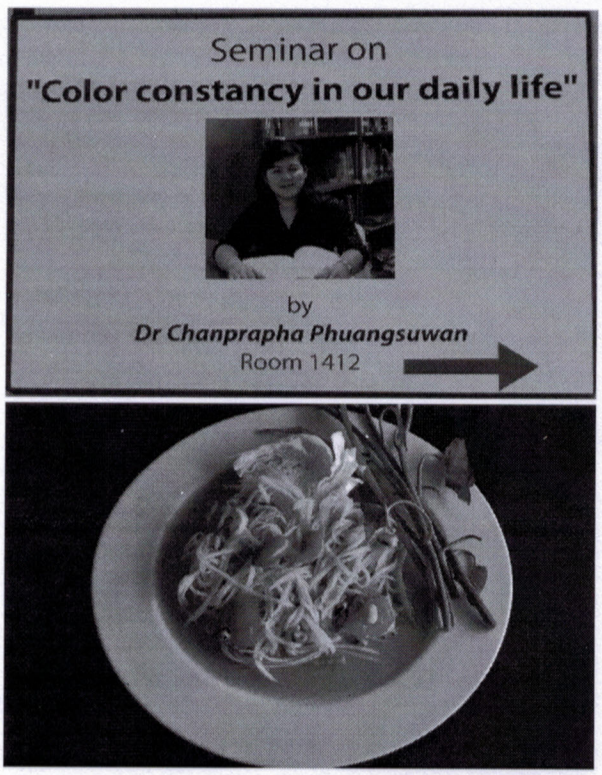


Fig. 3 Stimuli, a poster (top) and a dish "somtum" (bellow).

Five subjects participated in the experiment, four young Thai and one elderly Japanese whose eyes were installed with intraocular lenses after operation for the cataract.

3. Results and Discussion

Results of the subject CP and MI are shown in Fig. 4 for the test stimuli of six dishes. The illuminance of the subject room is taken along the abscissa in lx and that of the test room along the

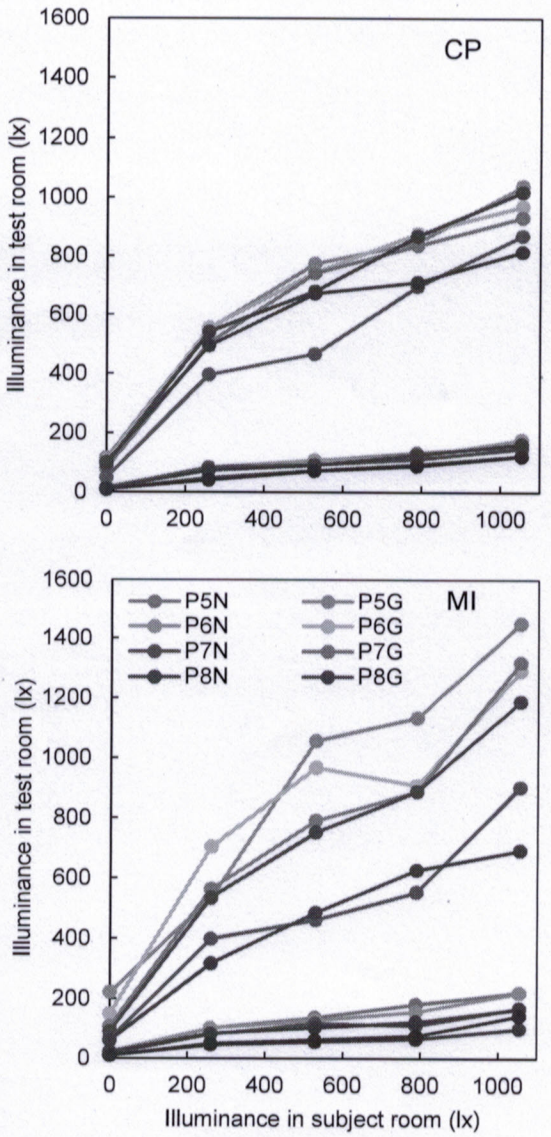
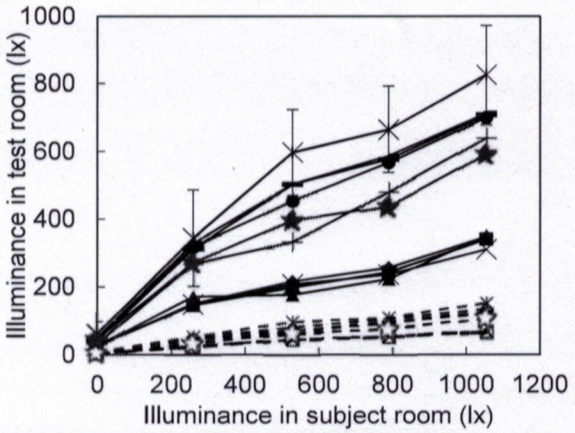


Fig. 4 Results of subject CP and MI.

ordinate. Six curves at low position were obtained with naked eyes and those at high with goggles.

The curves of both groups increased for higher illuminance of the subject room showing more illuminance was needed to recognize test

stimuli in the test room. It is clear that more illuminance was needed with goggles. We notice in the MI's results that there are two curves that locate low in both naked and goggles. The two dishes were "somtum" and "spaghetti", which the Japanese subject knew quite well and was easy for him to identify. Other 4 dishes were not familiar to him and higher illuminance was needed to identify the dishes. The Thai subject CP did not show such peculiarity about the dishes. Three other Thai subjects showed similar results with the subject CP though showing different illuminance in the test room. Average was taken for four Thai subjects and is shown in Fig. 5. Dotted curves



were from eyes without goggles. Four solid curves

Fig. 5 Average of four Thai subjects.

locating in the middle were for posters with goggles and it was easier to recognize them than dishes. Four dotted curves without goggles also showed low illuminance in the test room. For the uppermost curve the standard deviations among four subjects are shown by short vertical bars. Large SDs indicate large variance of individuals in adjusting the illuminance of the test room. The vague criterion given to subjects for the adjustment might have caused the variance.

In order to know how much illuminance should be increased with goggles compared with naked eyes the ratio of the illuminance with goggles to the illuminance with naked eyes was calculated for each test stimulus and the average of the ratio was calculated for all the five subjects. The result is shown in Fig. 6. Short vertical bars at each data point indicate the standard deviation among five subjects. Although the individual variance is not small the ratios remained relatively constant for the illuminance level of the subject room by having the average 6.5.

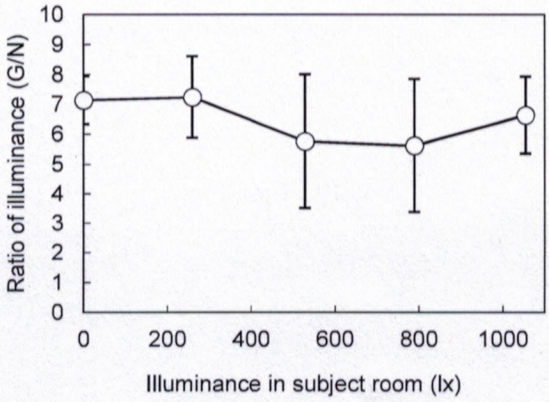


Fig. 6 The ratio of illuminance (G/N) from 5 subjects.

We can conclude that the illuminance in the building should be elevated about 6.5 times from the level designed for young people in order that elderly people also can recognize posters or pictures similarly to young people to assure their QOL.

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