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EVALUATION OF DISCOMFORT GLARE FROM COLOR LEDS UNDER DIFFERENT ILLUMINANCE

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ABSTRACT

This experiment aim to investigate the discomfort glare from the color LEDs on young and elderly under 3 different illuminance, 0, 100 lx, and 800 lx. Four color LED lamps, red, green, blue and yellow were used as stimuli. Five young observers and 2 elderly with normal vision participated in the experiment. The intensity of the LED lamp was controlled to give 4 levels. The observers evaluated discomfort glare subjectively in 8 levels scale [1]. The experiment was repeated 5 times. The result shows that as the intensity of the LED increase the degree of discomfort glare increases. By contrast, the illumination of the room, when the surrounding light increases, the degree of discomfort glare decreases. The discomfort glare affects the elderly more than the young subjects in most conditions. The blue LED causes discomfort glare more than the others.

INTRODUCTION

LEDs are increasingly used in various fields: entertainment, advertisement, house hold products automobiles and including traffic signs. As it is a kind of light source, it's ray shines directly into the eyes. Without precaution this might cause discomfort glare. Many research works concerned discomfort glare of automobiles have been published [1]. Glare occurs when scattered light in the optic media reduces the clarity of visual images. These effects on young and older adults are different in degrees. Beginning in the fifth decade, age-related changes increase a person's sensitivity to glare and time required to recover from glare [2]. Functionally, these age-related changes can significantly affected the person's ability to read signs, see objects, drive at night and maneuver safely in bright environment. This experiment was aimed to investigate discomfort glare of color LEDs in young and elderly people under different illumunance 0,100, 800 lx.

EXPERIMENT

LED stimuli preparation: The LED stripes, red, green, blue and yellow were arranged into array of 7 by 6, 7 lines each line contained 6 LED lamps. They were pasted on 8 x 8 cm^2 a white rigid plastic plate. One color was on one plate. They were separately wired and connected to a control knob which was used to adjust the intensity of the LEDs. Each LED plate was placed in a slot fixed behind the wall of the experiment room.

Table 1 LED luminance.

Log Luminance of LED			
Y	**G**	**R**	**B**
2.1	2.1	2.1	1.7
2.7	2.7	2.7	2.1
2.9	2.9	2.9	2.7
3.1	3.7	3.1	2.9

The experimental room was constructed in dimensions of 1.5 m width x 2 m length x 2.15 m height. The walls were covered with near neutral white wall paper. And it was decorated with pictures, bookshelf, dolls and flowers to look as a normal living room. There was 7 x 7 cm^2 hole on the wall at eye level when subject sitting. The subject could see the LED array through it. There were 6 fluorescent lamps on the ceiling. The intensity was able to adjust by the controller knobs.

Experiment conditions: The color LEDs were adjusted to obtain the 4 levels of log luminance as in Table 1. The researcher wanted to set the same 4 levels for all color LEDs but there were limitation of the LEDs. The blue LED could be adjusted as high as 2.9 cd/m^2. Thus the blue was set start from log 1.7, cd/m^2. The other LEDs were not able to adjust at this point because they blinked. The color luminance meter, Minolta CS-A100 was used to measure the LED arrays randomly at 3 positions and then averaged and marked on the control knob .The luminance was checked from time to time during the experiment. The illuminance of the subject room were set at 3 levels,0 lx, 100 lx and 800 lx, measured at the fixed position on the shelf in front of the LED slot. The each test stimuli was randomly presented at a time under each illuminance level. The distance between LED and observer was 1.5 m.

The 5 young student's age 20 – 23 years and 2 elderly age 62 and 68 years, with normal vision, participated in the experiment. They were instructed to evaluate the discomfort glare of the LED stimuli subjectively in 9 scales as the Kimura-minoda and Ayama's experiment [1]. However, in this experiment only 8 scales could be evaluated because of the different technique of presenting the LED. The scales ranged from unbearable, disturbing, just acceptable, satisfactory and just noticeable (9) was omitted. The young subjects repeated all combinations 5 times. The two elderly repeated only 3 times.

RESULTS AND DISCUSSION

Figure 1 and figure 2 show the subjective evaluations of a young observer AP and an elderly PP respectively. When intensity of the LEDs increases, the subjective evaluations decrease. As the illuminance of the experimental room increases the satisfaction increases, which means lesser discomfort glare. The results of average of 5 young, solid lines and subjects and 2 older adults, doted lines, are shown in figure 3. All the curves show the same tendency for all illuminance conditions. That means the stronger the LEDs' intensity the more discomfort glare occurs for both young and elderly subjects. But the degree of effect of these two groups is not the same.

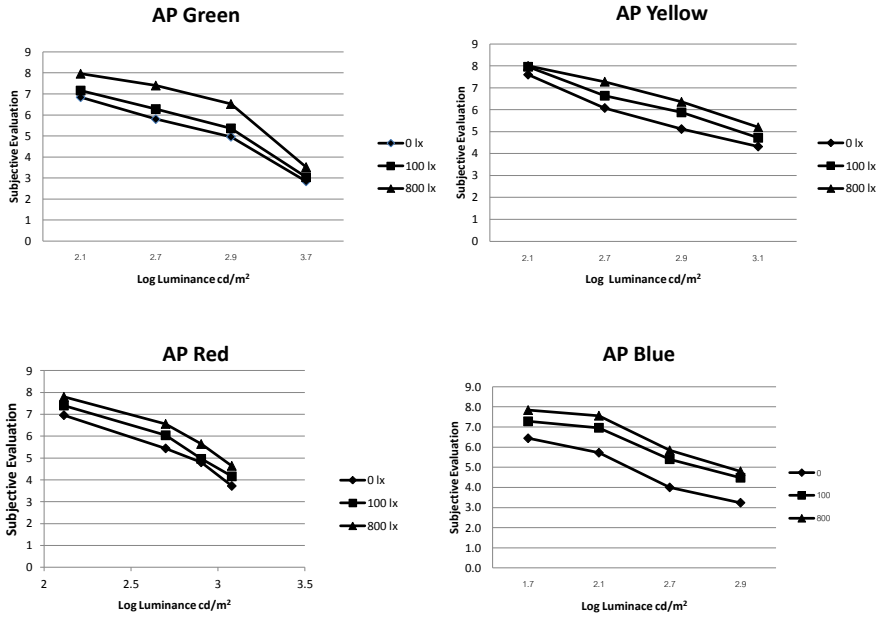

Figure.1 Subjective evaluation of AP

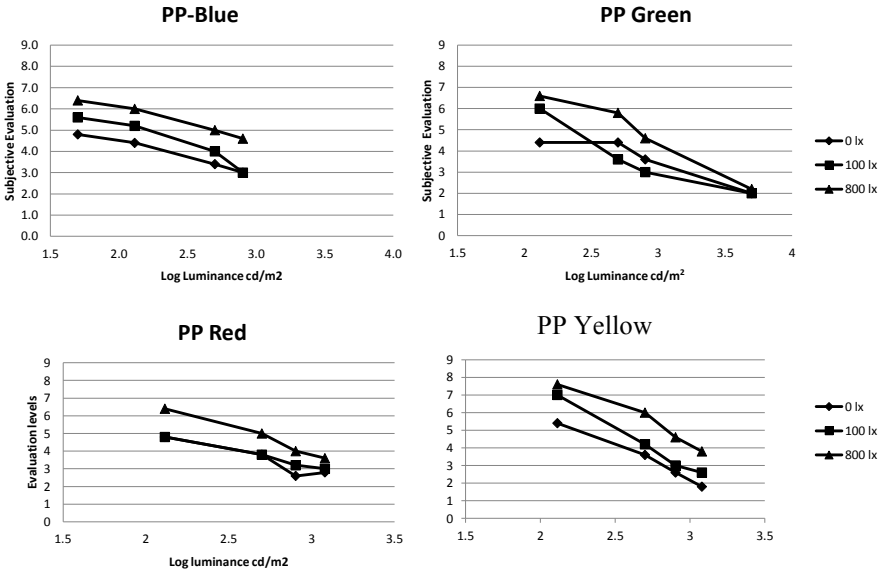

Figure.2 Subjective evaluation of PP

In figure 3, the dotted lines are lower than the solid lines. This mean the older subjects are more sensitive to discomfort glare than the young ones. This result agrees with the finding of Miller [2]. At 0 lx, discomfort glare has the strongest effect compare to 100 lx and 800 lx. The curves of yellow LED show that the illuminance conditions have very little effect on the young observers. The average subjective evaluations on color LEDs of 5 young subjects under 0 lx and 800 lx are shown in figure 4. The blue LED causes more discomfort glare than the other colors. Though at 800 lx, the effect of all color LEDs are almost the same

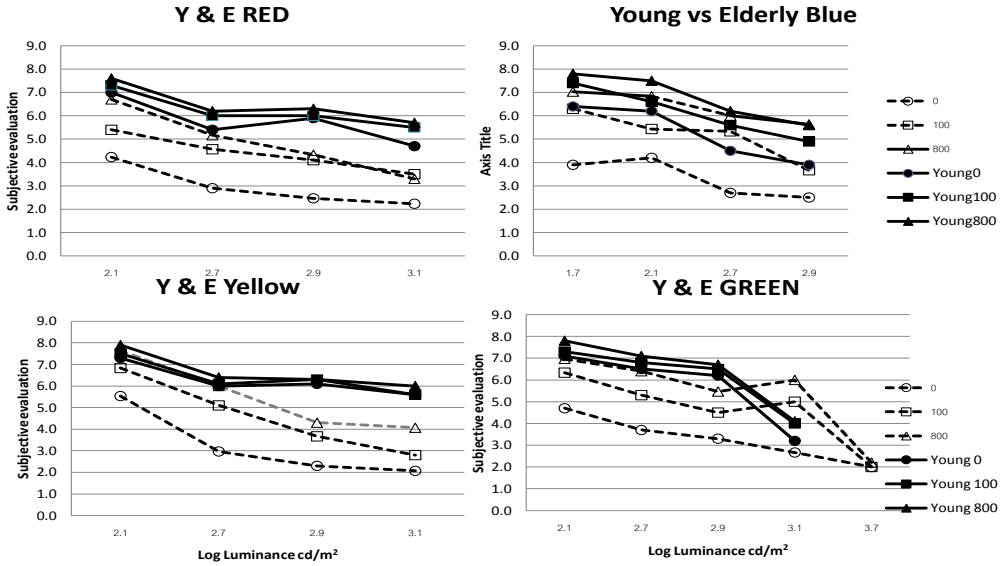

Figure 3 Average subjective evaluations of 5 young subject and 2 elderly.

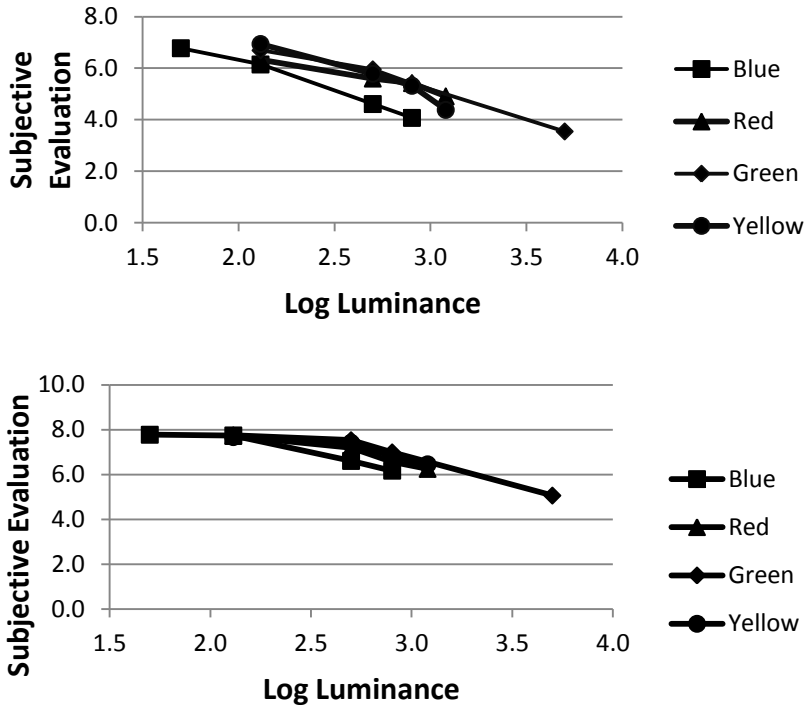

Figure 4 The average subjective evaluation of 5 young subjects under 0 lx and 800 lx.

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