The Effect of Correlated Color Temperature on Discomfort Glare for Elderly

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Abstract
It is well known that elderly people are more sensitive to discomfort glare than young people. This sensitivity is one of the visual problems that go with aging. In order to clarify the quantitative relationship between the discomfort glare and the correlated color temperature of light sources, we conducted a series of experiments on the discomfort glare for light sources with different correlated color temperatures.

Keywords: Correlated Color Temperature, Fluorescent lamp, Discomfort Glare, Elderly

1.INTRODUCTION

On the relationship between discomfort glare and an observer's age, Benett[1)] has already investigated the effects of BCDs (the borderline between comfort and discomfort) related to increased age and found a quantitative relationship between the BCD and aging.

However, in those experiments, the experimental condition of the color temperature was kept constant, so it was not clear whether BCD would change or not related to the color temperature.

To investigate the interaction of the correlated color temperature and the extent of discomfort glare for elderly and young persons, a series of experiments have been carried out in the laboratory.

2.EXPERIMENT

2.1 Experimental set-up

The experimental apparatus was composed of an observation area and a control area as shown in Figure 1[2)].

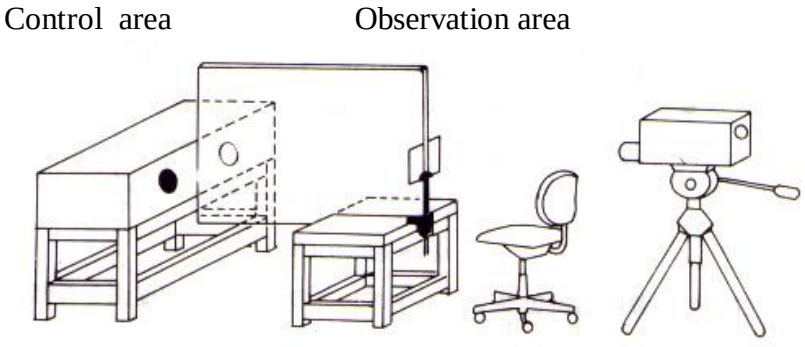


Figure 1 Experimental set up

The control area had two targets. The left side of the target was called the reference source. The right side of the target was called the test source. The size of each target was set 2 degrees, respectively. The correlated color temperature of the reference source was kept at 3000 K constantly. On the other hand, the correlated color temperature of test source was changed from 3000 K to 7000 K. In that range eleven different correlated color temperature were presented to the observers in random order. The luminance of test source could be varied in the range of 20 cd/m^2 to 10000 cd/m^2.

2.2 Procedure

In the experiments, each observer was asked to observe the left side of the target for one minute. The luminance of the target was set at the same luminance as the BCD that was deduced by Benett.

After pre-adaptation, the observers were asked to answer whether the luminance of the target was high enough to feel glare or not. If the observers answered it was, the luminance of that target was set as the luminance of the reference source. If the luminance wasn't high enough to feel glare, the observer was asked to adjust the luminance of the target up until he felt glare and that was set as the luminance of the reference sources.

The observers were asked to observe the reference source with the left eye and the test source with right eye. The observers were asked to compare the two and adjust the luminance of the test source so the glare matched with that of the reference source.

After this matching was completed, the luminances of the test source were measure with a luminance meter. The observations were repeated for six times by each of the observers for each experimental condition. In this way 660 combinations (10 observers x 6 times x 11 conditions) of luminances for the test source were matched (Lt) and the luminance of the reference source (Lr) were obtained. Based on the measured results, ratios (Lt/Lr) were calculated.

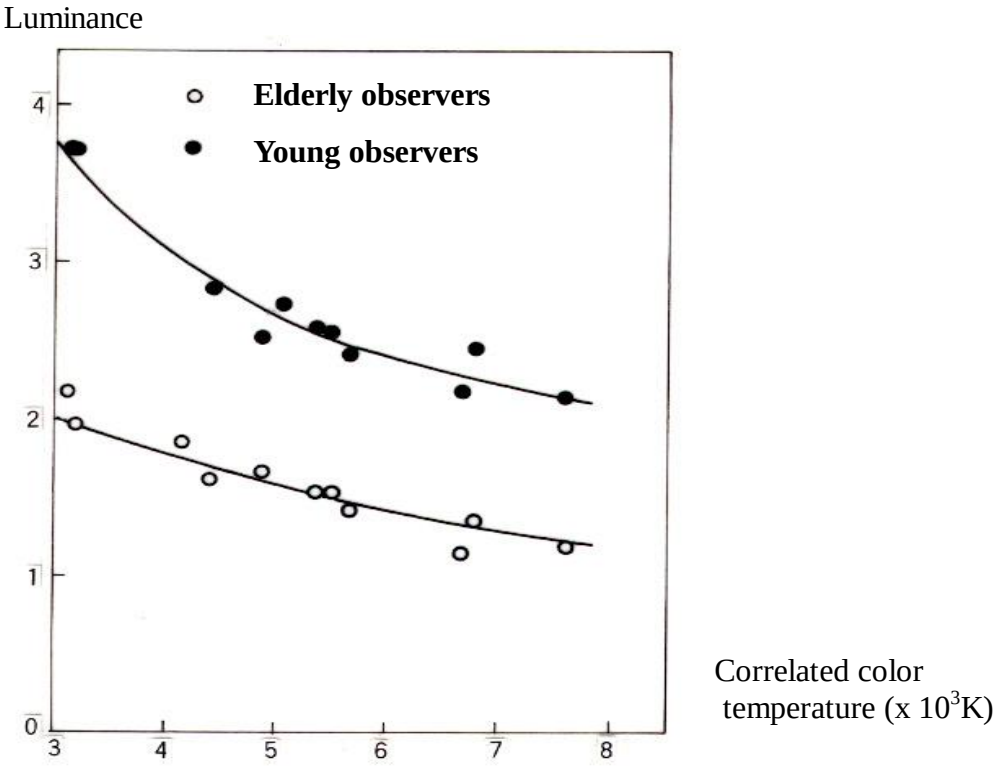
2.3 Observer

Six elderly observers, aged from 50 to 70, and four young observers, aged from 25 to 29, took part in the observations.

3.RESULTS OBTAINED

Figure 2 shows the results of the experiment. In figure 2, the horizontal line shows the correlated color temperature of the test sources used in this experiment. The vertical line shows the adjusted luminance of the test sources to feel the same glare sensation as that of the reference source. As shown in figure 2, it was found that the adjusted luminance of the test source matched by both the group of elderly observers and the group of young observers decreased, as the correlated color temperature of the test source increased. The luminance of adjusted the test source matched by the group of elderly observers were approximately 54% lower than the luminance of adjusted the test source matched by the group of young observers in each correlated color temperature. This means that the elderly person feels more glare as the correlated color temperature of light sources becomes higher.

Figure 2 Results of the experiment



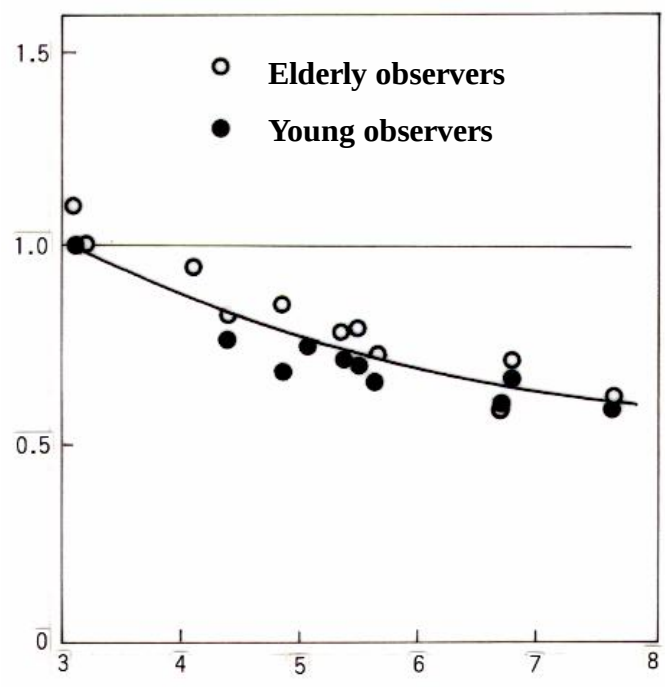


Figure 3 Relationship between the luminance ratio and the correlated color temperature

Figure 3 shows the relationship between the luminance ratios (Lt/Lr) and the correlated color temperature. As shown in figure 3, it was found that the relationship between the luminance ratio (Lt/Lr) and the correlated color temperature was similar with between the group of elderly observers and that of the group of young observers.

4.CONCLUSION

As a consequence of this series of observations, the following conclusions were obtained.
Both elder and young observers are more sensitive to discomfort glare for the light sources with high correlated color temperatures than for those with low correlated color temperatures.

2) The elderly observers feel more discomfort glare as the correlated color temperatures of light sources becomes higher.
3) No significant difference was found between the group of elderly observers and that of the young observers concerning the luminance ratios (Lt/Lr).

REFERENCE

1) Benett,C.A.: The demographic variables of discomfort glare, LD&A vol.7,No.1, 22-24 (1977)
2) Yano, T., Kanaya,S., Ichikawa, K.: The effect of correlated color temperature on discomfort for the aged, J.Illum.Engng.Inst.Jpn. Vol.77, No.6, 296-303 (1993)

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A PROJECT ON AUTOMATICALLY CONTROLLED OFFICE LIGHTING SYSTEMS

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ПРОЕКТ НА АВТОМАТИЧНО УПРАВЛЯЕМИ СИСТЕМИ ЗА ОФИС ОСВЕТЛЕНИЕ,

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