Age related changes in perceived display brightness

G. Ikaunieks, I. Krastina, R. Truksa and G. Krumina

Department of Optometry and Vision Science, University of Latvia

Gatis.ikaunieks@lu.lv

37th European Conference on Visual Perception, Belgrade, Serbia, 24-28.08.2014.

Introduction

Lighting conditions are important to minimize visual discomfort for computer users [1]. Optimal lighting conditions could be different for younger and older users [2]. The two main factors, which could change optimal lighting conditions with age, are:

decreased retinal illuminance due to a reduction in pupil size and to absorption of the lens;
increased ocular straylight which leads to glare complaints [3].

To minimize influence of both these factors on vision, different level of luminance is needed. To minimize impact of first factor on vision, luminance of the object should be increased. However in high luminance conditions older subjects often have complaints about glare which are due to the increased ocular straylight level.

The aim of this study was to assess how for computer users optimal lighting conditions (display brightness) change with age and which age related eye changes have the largest impact on visual comfort.

Method

18 younger subjects (average age 21.0±1.0) and 10 older subjects (age 62.3±7.5) participated in this research. 3 different measurements were done:

1. Preferred display brightness level was assessed using method of adjustment for different contrast texts:

a) for high Weber contrast text (>90%);
b) for low Weber contrast text (20%).

2. To evaluate effect of retinal straylight on visual discomfort, for younger subjects preferred displays brightness level was measured also with light scattering filter (light transparency 85%).

3. Diameter of eye pupil was assessed for each subjects and correlation with preferred brightness level was calculated.

Technical parameters

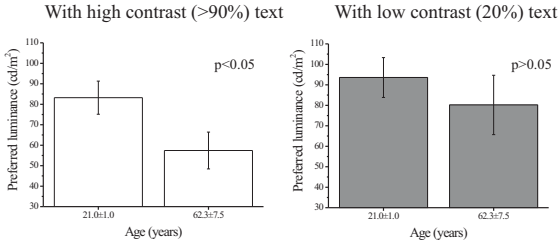
Measurements were done using CRT monitor, distance from monitor was 60cm. Room illuminance was ~15lx.

Preferred display brightness level was assessed using *Microsoft PowerPoint* presentation in which each slide was with different luminance (from 10 to 199 cd/m^2 with step 10 cd/m^2). When measurements were done with high contrast text, letters in each slide were dark, only luminance of background changed. When measurements were done with low contrast text, luminance of background and letters was changed in each slide to maintain constant Weber contrast (20%). 7 measurements were done in each conditions.

Pupil diameter was evaluated from pictures taken with CCD camera.

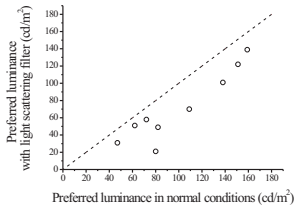
Results

1. Preffered display brightness measurements



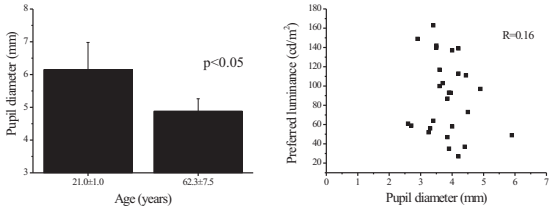
With high contrast text older subjects preferred lower display brightness than younger subjects. With low contrast text results were similar for both groups.

2. Preffered display brightness measurements with and without light scattering filter



Younger subjects chosed lower display brightness with light scattering filter than without it.

3. Pupil diameter measurements



As was expected, older subjects had smaller pupil diameter than younger subjects. Pupil diameter didn't show significint correlation with preferred display brightness level.

Conclusions

1. With high contrast stimuli comfortable display brightness level is lower for older than younger subjects. This fact is related with increased ocular straylight for older subjects.

2. In normal vision conditions for older subjects increased ocular straylight is more important factor which affects visual comfort comparing to decreased retinal illuminance

References

1. Hayes J.R., Sheedy J.E., Stelmack J.A., Heaney C.A. (2007). Computer use, symptoms, and quality of life. *Optom Vis Sci.* 84(8), 738-44.

2. Sheedy J.E., Smith R., Hayes J. (2005). Visual effects of the luminance surrounding a computer display. *Ergonomics.* 48(9), 1114-28.

3. Van Den Berg T.J., Van Rijn L.J., Michael R., Heine C., Coeckelbergh T., Nischler C. *et al.* (2007). Straylight effects with aging and lens extraction. *Am J Ophthalmol.* 144(3), 358-363.

Supported by ESF project No.2013/0021/1DP/1.1.1.2.0/13/APIA/VIAA/001