

Optimizing subjective near acuity by choice of background color in normal sighted individuals

Gregory L. Goodrich¹, Ph.D., Peter Borden² Ph.D., Michele Klein²

¹Formerly with VA Palo Alto Health Care System, ²Jasper Ridge Inc., Menlo Park, CA USA

Hypothesis

We hypothesize that background colors other than white may improve visual performance.

Purpose

The most common background for near tasks is white with color temperature range of 3,000 to 6,500°K. Previous studies have suggested that other colors may be preferred¹, or may improve near acuity². Here we investigate preferred background color with subjective near acuity as the evaluation criterion.

Methods

In a preliminary study, subjects are presented with a LuxIQ™ system, placed over a high contrast Colenbrander 40cm acuity chart. The LuxIQ was modified to provide red, green and blue, spanning a large portion of the CIE color space. Illuminance is set at a constant 5000 lux independent of color, to minimize the effect of illuminance. Background illuminance is <200 lux. Subjects are asked to systematically adjust color to their best acuity. No attempt was made to measure actual acuity gain.

Results

Figure 1 shows the chosen CIE color coordinates for 40 normal subjects (no color vision defects), aged 15-89, 16 male and 24 female. For reference, the locus of 3000-6500°K white and the colors reproducible with a standard RGB monitor are also shown. No one chose a hue on the white locus. With two exceptions, all chose hues with added green, with 33 of the 38 outside the sRGB triangle. Figure 2 shows the distribution of primary colors in the chosen hues. Green is preferred over red and blue, with a mean content of 54%, versus 23% for red and blue ($p < 10^{-7}$) (pure white contains equal amounts of red, blue and green).

Conclusions

These preliminary results suggest non-white background hues, especially with added green, improve near visual performance. This implies properly chosen tinted lenses may improve near visual performance over clear lenses. The spread of chosen hues suggests the need to measure an individual's best hue before making a recommendation. A more formal study needs to quantify gains and account for additional effects such as eye strain and contrast acuity.

Support

Jasper Ridge Inc.

Disclosure

Gregory L. Goodrich has no financial interest in this work. Peter Borden and Michele Klein are employees of Jasper Ridge Inc.

1. G.L. Goodrich, Envision 2014.
2. G.L. Goodrich, AAO, Denver 2014.

Figure 1: Chosen hues plotted in CIE color space. White 3000-6500°K and the standard white for a monitor (D65) are shown for reference. sRGB monitor colors lie within the black triangle. The black cross shows the mean hue.

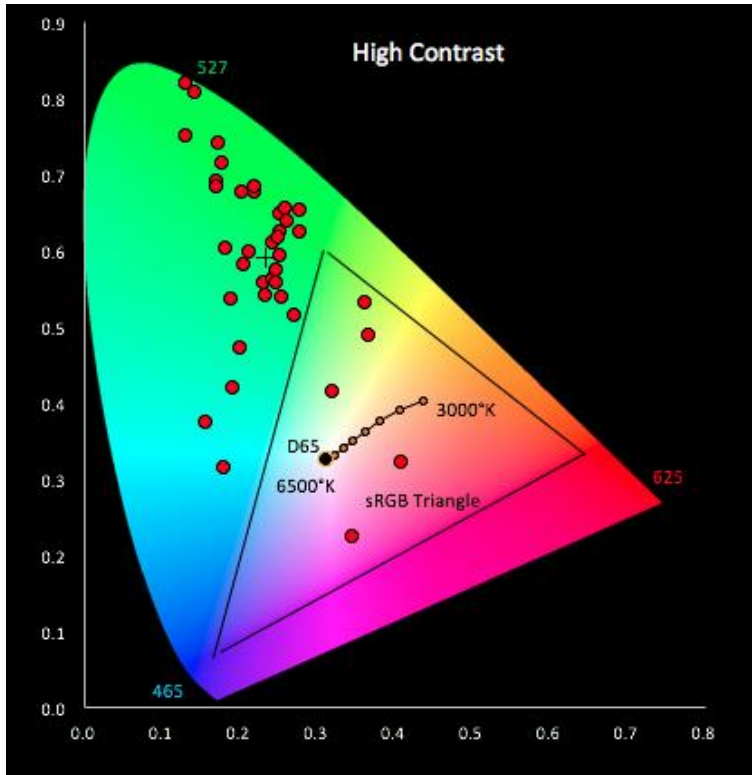


Figure 2: Distribution of primary colors (525nm green, 625 nm red, 460 nm blue) within the 40 chosen hues. Mean green content is 54% (vs. 33% for pure white).

