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AUTHOR Pett, Dennis
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ABSTRACT

This paper reviews two studies of color preference and the relationships between color and legibility. The Gustin study in 1991 dealt with the legibility of and preference for projected slides with colored backgrounds and white text. The order of background color preference was cyan, blue, green, yellow, magenta, and red. The follow-up study by Cuttill in 1991 focused on the same variables viewed on a cathode ray tube. The order of background color preference was blue, cyan, magenta, red, green, and yellow. Based on the overall results of these studies, letter size and adequate contrast between lettering and background are the two most important criteria for producing materials with white lettering on colored backgrounds. (Contains 6 references.) (JLB)

White Letters on Colored Backgrounds: Legibility and Preference

by Dennis Pett

RR 2, Box 120
Brattleboro, VT 05301

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Dennis Pett

Introduction

There have been numerous studies of color preference and the relationships between color and legibility that have been reported in the literature. Although there is evidence that color preferences change with age and are influenced by cultural differences and individual characteristics, studies show that cool colors are generally preferred. It is difficult to compare color preference studies because methodologies have varied and the colors used have not been adequately specified (DeSantis and Pett, 1980).

In addition, it is important to recognize the fact that color preferences, as measured in most controlled research studies, may not be related to the preferences that would be indicated in real life conditions where colors are seen in a context. A color that is preferred in one situation may not, and probably would not, be preferred in another situation.

In general, studies have tended to show that acuity is greatest for colors in the middle of the spectrum.

However, most studies did not deal with projected images. Two studies dealing with projected images were found in the literature. Snowberg (1971) reported that when black letters were used on colored backgrounds the order of legibility from most to least was white, yellow, green, red, and blue. These results probably relate to brightness differences between lettering and background. These differences were not indicated. Snowberg also reported color preferences which, from most to least preferred, were blue, green, red, and yellow. These preferences were based on viewing colored chips.

Sanner (1973) conducted a study using black letters on colored backgrounds. The order reported from most legible to least legible was white, green, red, yellow, and blue.

In recent years, white letters on colored backgrounds have been increasingly used for slides; however, no studies of legibility or preference for this configuration have been reported. Similarly, no studies of white letters on colored backgrounds viewed on a cathode ray tube (CRT) have been reported. A study completed by Gustin in 1991 dealt with legibility of, and preference for, projected slides with colored backgrounds and white text. A follow-up study by Cuttill in 1991 focused on the same variables viewed on a CRT.

Gustin Study

Fifty adults with normal color vision participated in the experiment. To test legibility, slides with white lettering on red, green, blue, cyan, magenta, and yellow backgrounds with carefully controlled low, medium, and high brightness levels were produced on a slide duplicator (Figure 1). It should be noted

that yellow of a low brightness would usually be called brown. The colored backgrounds were produced by using sharp cutting primary color filters, red #25, green #58, blue #47B, cyan #44A, magenta #32, and yellow #12.

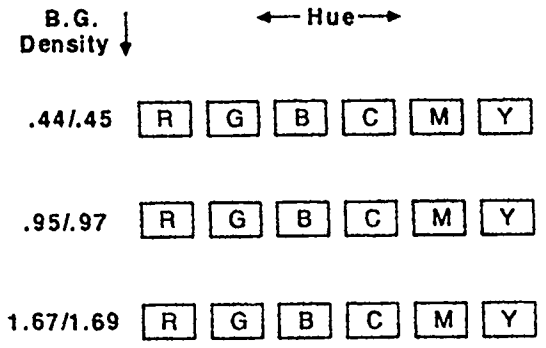

Figure 1

Lettering was produced on a Macintosh computer using the bold Helvetica typeface in the MacDraw software program. The selected letters were limited to the ten letters that make up the Sloan test letters (Sloan, 1951). From the viewing position, the letter sizes corresponded to 20/30, 20/20, 20/15, 20/10, and 20/7.5. The position of each letter on each slide was randomized. Figure 2 shows the lettering of a sample slide.

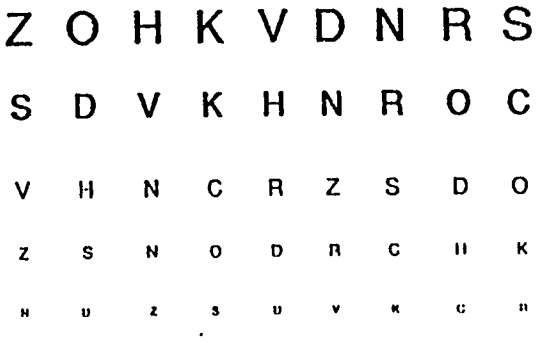

Figure 2

Subjects viewed the slides and responded by reading the letters from left to right and from top down. The top six slides, in order of legibility, are noted in Figure 3. A graph of the interactions between hues and background brightness levels is shown in Figure 4.

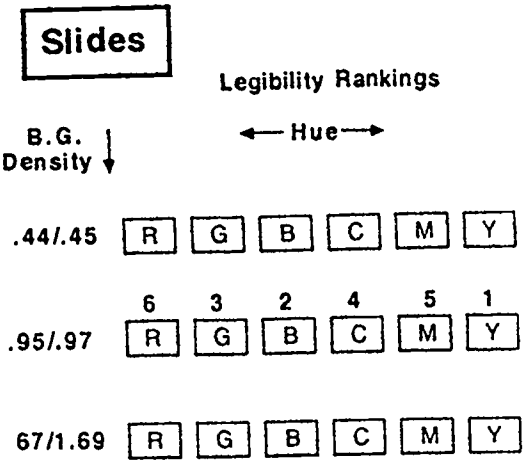

Figure 3

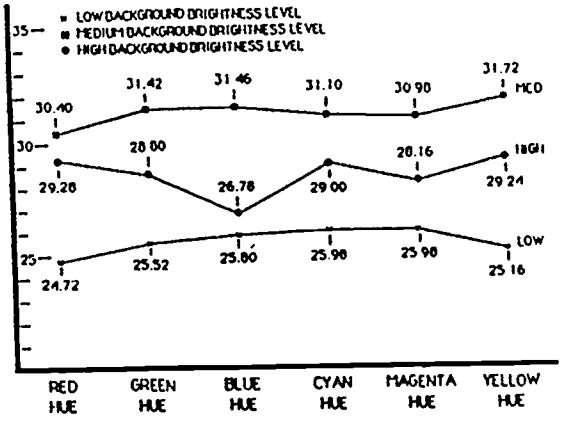

Figure 4

The numbers represent the average number of correct responses for each of the 18 cells (six hues and three brightness levels). A medium background density was significantly better than either a high or low density and a high background density was significantly better than low density in facilitating legibility. Yellow, blue, green, cyan, and magenta at medium background

densities were significantly better in facilitating legibility than any hue at low or high background densities. Across the three background densities, yellow and cyan were significantly better in facilitating legibility than red or blue, and green was significantly better than blue.

To test color preference, slides were produced with split halves of R, G, B, C, M, Y. This provided 15 pairs of colors. Each pair was produced in two versions with the right-left position alternated for a total of 30 pairs. All slides were produced with the medium brightness range used in the legibility portion of the study. Subjects viewed the projected pairs and reported their preference for one color in each pair. The order of background color preference was cyan, blue, green, yellow, magenta, and red (Figure 5). Cyan and blue were significantly preferred over yellow, magenta, and red. Green was significantly preferred over red.

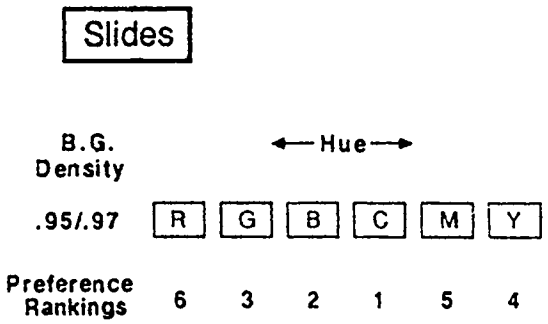

Figure 5

Cuttill Study

The Cuttill (1991) study followed procedures of the Gustin (1991) study. Background colors were adjusted to match, as nearly as possible, the colors used by Gustin. These would vary slightly, depending on the monitor used. The six colors that ranked best in facilitating legibility are shown in Figure 6. Across the three brightness levels, magenta, blue, and yellow were significantly better than cyan and green, and red was significantly better than green.

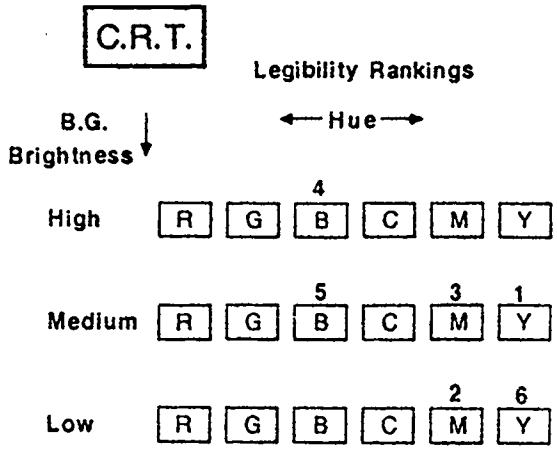

Figure 6

The order of background color preference was blue, cyan, magenta, red, green, and yellow. Blue and cyan were significantly preferred over red, green, and yellow. Magenta was significantly preferred over green and yellow (Figure 7).

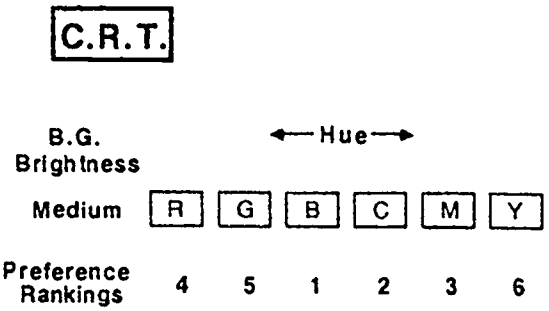

Figure 7

Observations

It is interesting to note that white letters on a yellow background of medium density ranked most legible in both slide and CRT formats. However, the yellow background was significantly less preferred than cyan or blue in either format.

On slides, all six hues were more legible on medium density backgrounds than on backgrounds of high or low brightness, while on a CRT lettering on medium and low brightness backgrounds was significantly more legible than lettering on a background of high brightness. This suggests that producers should be careful to maintain medium to high contrast between lettering and background while avoiding extreme contrast for slides. This would also be helpful for color-deficient viewers who depend on value differences rather than hue differences to differentiate between lettering and its background.

It is also interesting to note that for both slides and CRT, the preferred background colors were blue and cyan. Green and cyan ranked high for both preference and legibility as background colors for white lettering on slides, but ranked low for legibility on a CRT.

In looking at the overall results of these two studies, it can be said that letter size and adequate contrast between lettering and background are the two most important criteria for producing materials with white lettering on colored backgrounds.

There seems to be no adequate explanation for the differences reported in the Gustin (1991) and Cuttill (1991) studies. Although the hues were slightly different in the two studies, these differences would not seem to be sufficient to cause either preference or legibility choices to differ. Replication of the studies might shed light on the cause of the differences.

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