

# Color Smart: Design Applications for Effective Visual Communication

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## Abstract and Introduction

Design applications using color to communicate, not to decorate.

This paper reports proven benefits of communicating with color, and emphasizes software-independent color graphic design principles.

The live presentation illustrates effective color communication with examples. *Because the paper is not being published in color, no illustrations can be included.* However, upon request, the author may be able to provide some of them.

This paper also covers key technical aspects of color communication implementation, some in the context of, or unique to, SAS/GRAPH\* software.

Though color printing has been available more than fifteen years for computer graphic applications, only in the last few years have manufacturers been producing moderately priced full-color laser printers that use toner (not wax or wax transfer) and plain paper, and comparatively cheap ink jet printers that produce good to excellent quality hardcopy (but may require special paper for best results). Advances in color printer technology will continue to provide increasing quality, speed, and functionality at decreasing prices. The new technology is reliable, and probably fast enough for typical personal or workgroup printing needs. Ease of use varies by brand. But be aware that some brands are built over the same print engine, so certain performance or use characteristics may be similar, if not identical.

Industry analysts point out that untrained users are unlikely to improve productivity or competitive position with color. Effective use of color requires good design.

## Always Remember These Facts about Color

Prof. Jay Neitz of the Eye Institute of the Medical College of Wisconsin: 8 out of 10 males have some form of color blindness, but, due to genetic differences, women rarely have any.

The commonest form of color blindness cannot distinguish red from green.

## Is There Anything Color Cannot Do?

According to various studies, color:

- increases readership
- increases reading speed & comprehension
- speeds up learning
- reduces errors
- improves recognition
- improves recall
- prompts people to act

## Jan White on Color Communication

- When everybody screams, all you get is noise
- Use less color rather than more--the less you use, the more valuable/effective it is
- Use color consistently to provide recognition
- Use color to sort and/or link information
- Make large areas pale, small areas bright
- Colored text or lines must be thicker than black
- Don't waste color on titles--they should already stand out (if necessary, use large or bold print, not color)
- On a graph, use color to emphasize an important visual message

## Michael Turton on Color Communication

- Color works better with some space around it
- Color is more effective in bigger masses, since it is less dense than black
- Color can prioritize information, whether meant to or not
- Color is more effective if it has some function; it can confuse if used chaotically or arbitrarily
- Color can guide the viewer through information

## Aaron Marcus on Color Communication

- Use blue for large areas, not text or lines. Blue-sensitive color receptors are the least numerous in the retina's central focusing area.
- Use red or green in the center of the visual field. The edges of the retina are not very sensitive to these colors.
- Use thin, light text or lines on dark backgrounds for viewing in low light situations; use dark text or lines on light backgrounds for viewing in high light situations.
- In an image, use the highest contrast for text.

## LeRB on Color Communication

- Color does not improve bad design.
- Design color applications to communicate, not to decorate.

## When to Use Color on a Graph

- No response levels or categories--black & white
- Few levels or categories--gray shades maybe
- Many levels or categories--color necessary
- Black-and-white hardcopy is:
  - faster, cheaper, more reliable;
  - easier to use--simpler equipment,  
no agonizing over color strategy;
  - more copyable--more, cheaper, faster BW  
copiers available--*good graphs get copied*

## Color Differs on Different Media

With hardcopy vs. transparency or slide, the same color may look different due to the difference between reflected and transmitted color.

With monitor vs. hardcopy or transparency, the same color may look different because a monitor uses Red, Green, and Blue (RGB) additive primaries to mix colors, whereas printing uses Cyan, Magenta, Yellow, and Black (CMYK) subtractive primaries.

Furthermore, with different technology from different vendors, even for devices in the same class the same color may look different.

Given such confusion, it should be no surprise that many vendors of software and hardware that use color have begun to adopt standard ways and tools to specify and calibrate colors across all the facilities one might use, so that a color will (should) look same wherever you display it. For more information about this rapidly developing situation, consult the author.

## Use Reliable SAS/GRAPH Color Names

- For good control of color design, use *Hhhhllss* color names, if available for your device
  - hhh* = Hue
  - ll* = Lightness
  - ss* = Saturation
- *hhh*, *ll*, *ss* are hexadecimal values  
*hhh*, *ll*, *ss* ranges are 000-168, 00-FF, 00-FF
- *hhh* 000-168 is "wheel of hues", 0-360 degrees (this makes sense when you see the illustration)
- *ll* = 00 (0%) is always black  
*ll* = FF (100%) is always white
- *ss* = FF (100%) is full saturation  
*ss* = 00 (0%) is always gray
- *llss* = 80FF is what I call the "true color"

## Beware of Confusing SAS/GRAPH Color Names

Consider the pair

C = VIOLET (violet)  
C = LIV (light violet)

"Under the covers", HLS colors assigned are (spaces inserted in color name for clarity)

C = H 01E B0 67 for VIOLET  
C = H 022 75 4E for LIV

Since 75 < B0, it's no surprise that "Light Violet" is darker than Violet. And why does hue vary?

*Use HLS Color Names--they are reliable.*

## SAS/GRAPH Names for Grays

- For GRAY, "light", "medium", and "dark" do work as expected, but, even with WHITE and BLACK, may not provide enough colors
- If so, use color names of form GRAY//, where // is hexadecimal with range 00-FF

FF - 0% gray (white)  
D5 - 17% gray  
CC - 20% gray  
C0 - 25% gray  
AA - 33% gray  
99 - 40% gray  
80 - 50% gray  
66 - 60% gray  
55 - 67% gray  
40 - 75% gray  
33 - 80% gray  
2B - 83% gray  
00 - 100% gray (black)

## How To Choose and Use SAS/GRAPH Grays

Gray shades too close together are difficult or impossible to distinguish. Decide how many grays are needed for the chart (say N), divide 256 by N-1, and use the quotient (in hexadecimal) as increment from 00 to FF for // in GRAY// assignments.

Subsets of the values listed in the section above can produce equally spaced grays for sets of 3, 4, 5, 6, or 7 PATTERN statements.

Black area-fill on a map will hide shared boundaries.

Sometimes gray shades do not photocopy well.

## How to Choose Colors

This deserves a treatise in itself. And if you are concerned about color significance across national boundaries, it's a real quagmire. If you don't trust your intuition, ask the author for some references.

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