Seeing the world in color

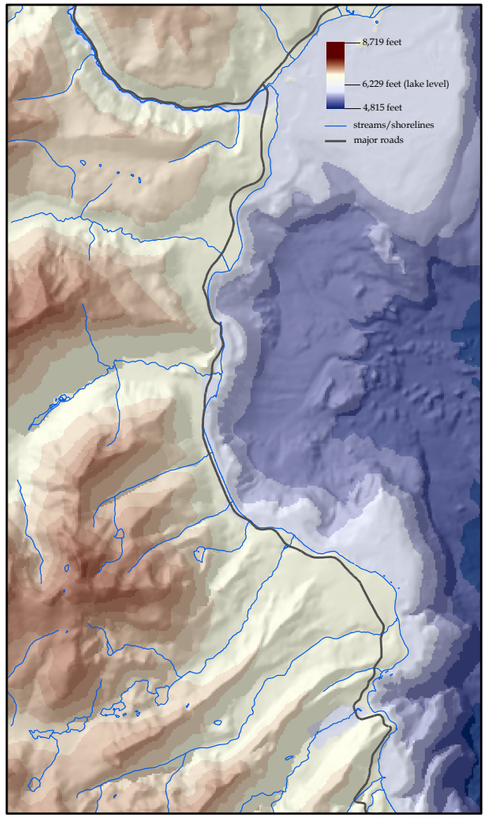
Maps have a broad visual appeal. Maps in color have a greater appeal still. A full-color map can be almost seductive. But the use of color introduces risks as well. Color carries social and cultural implications, with particular colors raising expectations of meaning. The relationship of colors can carry meaning as well; and not everyone perceives colors the same way.

Color can be analyzed into three perceptual components: hue, saturation, and value. Hue, the most recognizable component of color, is what distinguishes a dark red from a dark purple, or a light green from a light blue. Saturation, also known as chroma, is what distinguishes a grayish-red from a true red. Value, also known as lightness, is what distinguishes pink from red, or gray from black. The word 'color' can mean a specific combination of hue, saturation, and value, or it can mean an entire family of such combinations, attached to a single hue or even a group of hues.

Among the systems for expressing the full range of colors are HSV, CMYK, and RGB. HSV, for hue-saturation-value, specifies the perceived qualities of color directly, with the hues arranged as points on a circle and designated in degrees. CMYK, for cyan-magenta-yellow-key (black), originates in the offset printing process, in which the three subtractive primaries of cyan, magenta, and yellow combine to filter white light and reflect back a specific color; black ink is used for perceptually-purer colors. RGB, for red-green-blue, is based on light-generating devices like computer monitors, which produce combinations of the three additive primaries of red, green, and blue light.

Collected on this page are examples, good and bad, of color use in maps. While some of the problematic illustrations may be visually appealing, each presents a specific issue, which the accompanying illustration is meant to address.

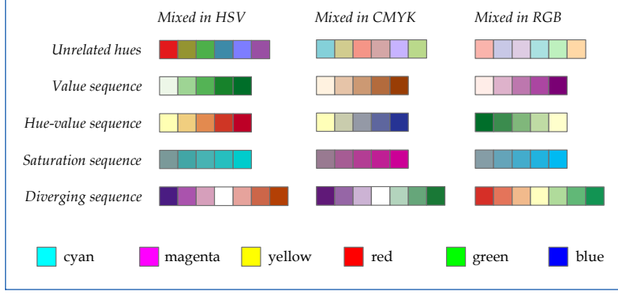
Prepared by O.T. Ford, 2007 December 5



Source: US Geological Survey

Form and function

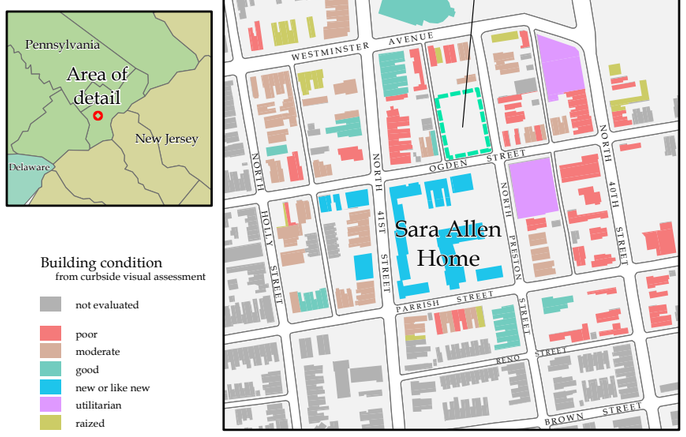
This map of elevation on the West Shore of Lake Tahoe uses a diverging sequence to depict elevations above and below shore level, as well as gray shading, and creates an appearance both effective and dramatic.



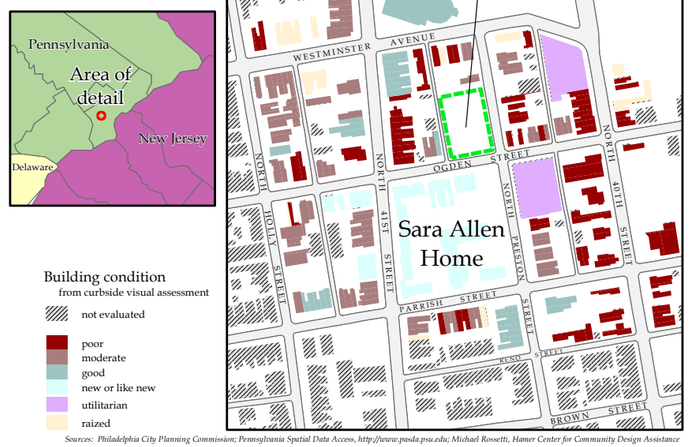
The color sets at left were mixed using different color specifications, but the results are comparable.

Unrelated hues are suitable for nominal or categorical data. Sequences are suitable for numerical data of particular kinds, though saturation sequences can be difficult to distinguish and are more often used to increase distinction within other sequences.

Problematic:
Colors are difficult to distinguish



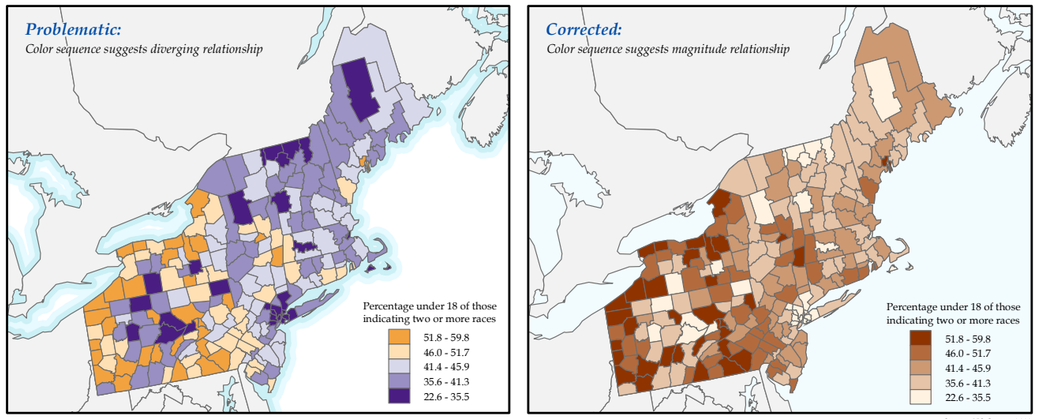
Corrected:
Colors are separated by value and pattern



Sources: Philadelphia City Planning Commission; Pennsylvania Spatial Data Access, http://www.pasda.psu.edu; Michael Rossetti, Hamer Center for Community Design Assistance

Accommodating color vision impairment

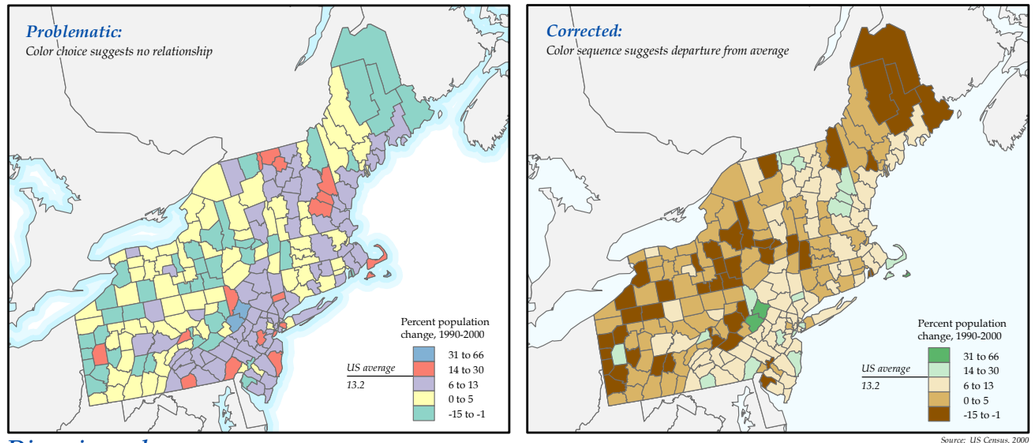
Color vision impairment (color blindness) affects the ability to perceive differences between certain pairs of colors. Color can be used to distinguish features or classes on maps; but in order to avoid confusion for those with limited color vision, colors should be chosen that differ sufficiently in value, or whose hues are separated sufficiently on the color spectrum.



Source: US Census, 2000

Sequential values

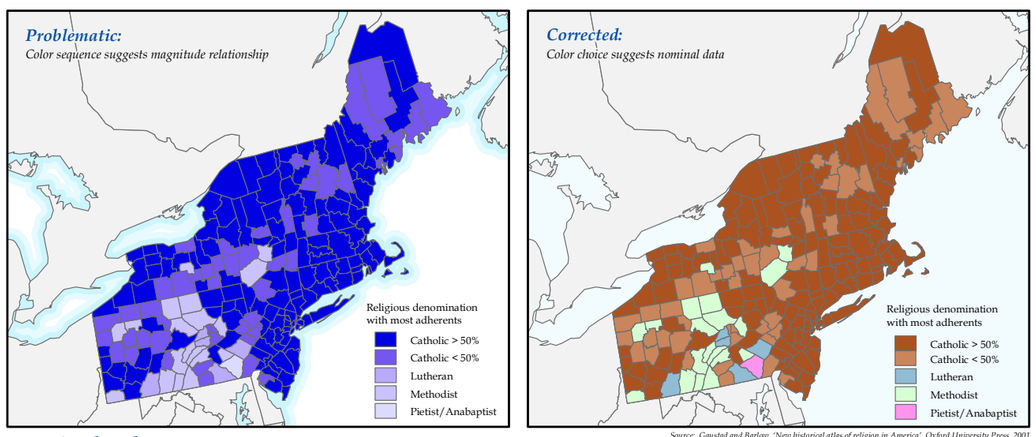
If color is used to represent numerical values that are to be compared on magnitude alone, the color range must suggest the numerical sequence, with each successive color being visually "more" than its predecessor. The left map above uses two hues diverging from a center that has no meaning.



Source: US Census, 2000

Diverging values

In the case of numerical data in which the divergence from a midpoint — an average, a median, or zero — is to be emphasized, the color scheme must represent both numerical sequence and direction. Here, direction is represented by hue, and distance from the central point is represented by lightness.



Source: Gaustad and Barlow, 'New historical atlas of religion in America', Oxford University Press, 2001

Nominal values

The data above are mostly nominal or categorical, and color should be used to suggest that, in fact, most of the map values are unrelated. But in the case of Catholicism, the colors should suggest the numerical relationship between the two values.