Designing and Finding Optimal colour Displays

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Introduction

Articles have recently appeared which introduce basic technical aspects of colour display technology and present examples of its use for geophysical data and mapping. Many helpful books and articles are available in several diverse fields such as computer science, graphic arts, medicine, physics, and psychology. These contain a wealth of theoretical and practical knowledge about colour vision, graphic displays, and design. Here we present a distillation of some of this information in the form of display examples created with a small set of colour map editing tools that can be implemented on colour workstations. The required step-by-step process using such a tool kit is presented. This permits the successful interactive design of, or search for, effective displays with a minimum expenditure of time. The recommended tool set is designed to make it easy to use powerful graphics design principles for the efficient interactive creation of optimal technical displays.

Colour Maps

A colour map is a table that permits a specific colour to be associated with each possible datum value in the data set being displayed. It will be assumed here that up to 256 distinct colours can be simultaneously displayed by the display hardware and that a very much larger set of colours (the palette) is available, from which these colours may be selected. Each colour can be completely specified with a triplet of (single byte) values for red (R), green (G), and blue (B). This is the "additive colour" system used in most workstations.

Selecting a Set of Colours

There are $2^{24}$ distinct RGB triplets. Although these could all be defined as different colours, it is sometimes convenient to use a classification scheme that makes a distinction between "colour" (which is basically the frequency of the light received by the eye) and the brightness or intensity of the light received. In this scheme, the triplets (100,0,0) and (200,0,0) are both described as red and are thought of as different intensities of the same colour. It is important to realize that all such classification schemes (there are many) are arbitrary conventions that depend greatly on the language the user speaks and the field of technology in which the user is engaged. The physical concept of colour (corresponding to frequency), as above, really only makes sense for monochromatic (single frequency) light. When colour is used with this approximate meaning of frequency, we will borrow the term "value" from the graphic arts to indicate the relative intensity of the colour. Physically, a higher value means that more photons per second are detected.

Ordering the Set

Once a set of 256 colours is selected from the palette of $2^{24}$ colours, an ordering must be specified to establish the map from the data values to the set of colours selected. This map is generally not one-to-one since there are usually many more than 256 possible distinct datum values.