

cartographic artifacts

HYPERMEDIA REVIEW

Interactive Color: A Guide for Color in Computer Graphics
Version 1.0 San Diego
Supercomputer Center.

Reviewed by Cynthia A. Brewer
Department of Geography
San Diego State University

Interactive Color is an excellent hypermedia application about color produced by the San Diego Supercomputer Center. It is available free over Internet and runs on color Apple Macintosh computers (the Appendix lists information on obtaining the application). The application is structured into ten chapters on color with each chapter offering explanation of four to sixteen topics. Most topic discussions are described on one card (one screen-size display of text, sound and graphics). Interactive portions of cards allow you to elaborate on specific aspects of a topic by changing the coloring of a graphic or revealing further written description. *Interactive Color* runs as a stand-alone SuperCard application and thus requires no additional software for its use. This is a big file (3,680K with a 798K sound file), so throw away all those silly inits, novelty fonts, and years-old manuscripts that are clogging up your hard disk and set yourself up for some serious learning.



The application includes a nicely designed help screen that explains buttons and check boxes (places on the screen to which you move the cursor and click the mouse to initiate a change, animation, or presentation of a new card). The application is well structured and that structure is made obvious to you by the series of chapter icons arranged in an ever-present strip at the bottom of the display. This menu ensures that you are always aware of which chapter you are examining and allows you to move to another chapter without having to view all cards in the current chapter. Each chapter begins with a table-of-contents card displaying buttons for major topics in the chapter. Thus, you can step through the cards in sequence using arrow buttons or you can move directly to a topic of interest. The cards are designed with a consistent format such that you always know what objects and buttons are interactive and you don't have to try clicking on everything.

The application offers chapters on both technical and perceptual topics. All presentations of topics are summary in nature, roughly equal in depth. The suite of information establishes a complete context within which a novice student of color may decide what aspects need further attention to satisfy her curiosity or address a specific color-use problem. If you are more experienced with color, the project will help you fill some of those inevitable holes in your knowledge. The technical chapters on **Color Models**, **Color Physics**, and **Color Media** present objective information useful to cartographers. The chapters on **Color Attributes**, **Color Illusions**, and **Color Harmony** provide information on the subjective aspects of color, with which cartographers must also grapple. The **Color Perception** chapter provides information on the workings of

the human visual system. The chapters titled **Design Principles** and **Color Examples** are primarily a forum for presentation of elaborate graphics produced at the San Diego Supercomputer Center and serve a secondary gee-whiz purpose to teaching color. The graphics of the **Examples** chapter are wide-ranging in topic and color use. Of fifteen discussions of **Design Principles**, only three (harmony, dominance, and light) include explicit mention of color use. This final chapter strays off the topic of the project and I feel it should have been omitted (with the advantage of reducing the size of the application on disk).

The **Color Models** chapter provides a good example of using hypermedia to trace logical paths through a structured collection of information. The contents card for the chapter lists the following topics: primary and secondary colors, additive colors, RGB color model, HLS color model, CIE color model, subtractive colors, Munsell color model, and process color. The discussion of primary and secondary colors includes buttons that take you directly to the cards on additive colors and subtractive colors. The subtractive-colors card includes button links to cards on printing primaries and on painters' primaries (don't miss the goofy paint-mixing sound effect). The printing-primaries card includes a button that takes you to the color printing card in the **Media** chapter. The printing-primaries card at the end of the **Models** chapter is great. You can click on patches of yellow, magenta, and cyan primaries and drag them around on the screen to see the correct mixture results where they overlap. This ability to interact with full color images is available throughout the application and drives home the advantage of learning color in an interactive, color environment. This demonstration is much more memorable than the overused

text-book diagram of three intersecting circles with color names typeset in each partition (because the publisher is too cheap to spring for color printing). My shelf is loaded with books on color that include only a narrow signature of color images stuck conveniently, but out of context, between signatures (true to its medium, my dissertation on color also contains no color images).

The four models presented in the **Color Models** chapter are RGB, HLS, CIE, and Munsell. Red-Green-Blue and Hue-Lightness-Saturation cards offer demonstrations with interactive mixture bars that let you set amounts of RGB or HLS to see resulting colors. The CIE and Munsell cards offer static portrayals of these color systems. The CIE description could be improved by providing an indication of the three-dimensional nature of CIE-xyY and mention of the useful, perceptually-scaled derivatives of the system (CIELAB and CIELUV). Otherwise, the basic set of models, of which cartographers should be aware, are summarized.

The brief chapter on **Color Physics** includes a dramatic interactive split of a beam of 'sunlight' through a prism followed by a listing of wavelengths associated with hues. The electromagnetic spectrum is demonstrated with a scrolling sequence that extends from radio waves to gamma rays to set the context of the narrow range of visible radiation. The discussion of reflection and absorption is nicely augmented with an interactively changing surface that alters the combination of wavelengths reflected to a viewer. An advantage of this sort of interaction is that you can use it as you might use flash cards. You click on a button next to the surface-color name to show the wavelengths reflected and absorbed by an appropriately colored surface,

and thus you may pause to predict the result and test your understanding. This advantage for learning is more difficult to obtain with a printed demonstration.

Color Media presents an interesting collection of technical information. The description of how computer-monitor colors are created with red, green, and blue is well done. You click on color examples to see demonstrations of the mesh of phosphor dots that produce the monitor color. The problems of transferring monitor colors to video and the different mixes of primaries needed to approximate desired colors is demonstrated with many examples. On the film structure card, added depth of information is available; as you click on each of nine layers within the cross-section of color film, different descriptions appear in a window on the card. Additional information on color film and discussion of color printing and film recorders complete this chapter.

Accuracy is weakest in the **Color Perception** chapter. The topics summarized are the eye, rods and cones, color shift, color blindness, chromodynamics, and color psychology. Scenes are altered in an inviting manner to show rod vision with high and low levels of illumination, cone vision with high and low illumination, and perceptions for different categories deficient color vision. However, rods function only at low levels of illumination and cones function only with adequate illumination. The over-simplistic graphic presentation of the distinctions between these receptor systems is misleading. Likewise, color blind people with protanopia do have faulty long-wavelength sensitive cones but that does not render them literally red-blind, as suggested in the altered color scene (and neither are deuteranopes green-blind). Both protanopes and deuteranopes are termed red-

green deficient, meaning sets of reds and greens look the same to them. A correctly altered full-color scene would be very interesting because it is not only reds and greens that are confused by people with color deficient vision (color vision deficiencies are commonly described by families of lines radiating across the entire CIE-xy chromaticity diagram and involving all hues, not just red and green). An opportunity was missed to surprise us with an intriguing look through another's eyes. With the discussion of color shift you learn of the importance of illumination for hue perception with an opportunity to change scene illuminants.

The **Color Attributes** and **Color Harmony** chapters present an interesting suite of descriptions. Color attributes are numerous and the chapter deals with a reasonable subset: hue, saturation, value, color temperature (warm-cool), complementary colors, monochromatic colors, achromatic colors, analogous colors, neutralized colors, and color and line. Color harmony concepts are equally varied and adequately summarized with a focus on the work of Johannes Itten. Color dyads and triads are presented with an interactive additive color wheel and Itten's color wheel is the basis of the presentation of harmonies of contrast in hue, saturation, extension, light-dark, cool-warm, complementarity, and simultaneous contrast. In these two chapters, both additive complements and Itten's complements are presented, and a link back to the additive color card in the **Models** chapter is provided. An additional card distinguishing the different definitions of complementarity associated with the numerous color systems would be an appropriate addition to the application. Likewise, a distinction between lightness and brightness and a more accurate

definition of saturation (they use the limited white-to-intense definition from HLS) would be useful. The majority of cards in the **Attributes** and **Harmony** chapters allow you to select combinations of colors to compare contrast effects and color combinations.

The **Color Illusions** chapter is fascinating. Afterimages are demonstrated with a variety of colored forms that you stare at and then click to replace the image with a gray screen that lets you see a vivid complementary afterimage. Afterimages are also seen in the contrast reversal demonstrations. Simultaneous contrast effects are demonstrated with two identical grey lines on two colored patches. You are able to change the background colors and also drag one line over to the other to confirm that the hues induced into the gray are perceptual effects. Simultaneous contrast effects of black-and-white surrounds and black-and-white outlines are demonstrated under the heading of Bezold effects and simultaneous contrast is also used to make 'one color appear as two' (the demonstration offers the ability to change both background and center colors and move the affected squares to watch the instant effects of simultaneous contrast on color perception). The demonstration of spatial effects lets you experiment with advancing and receding hues, and the effects of area on color perception are investigated with the interactive contrast-of-extension card. All

of the illusion cards are interactive and allow you to try many color combinations that produce different magnitudes of effect. Your curiosity will be both piqued and sated by these flexible demonstrations. Being able to move affected colors into and out of their surroundings and experience the onset of the perceptual changes has a big advantage over demonstrating the effects on a static page (where you are likely to wonder if it really is the same color printed there). Adjust your room illumination to keep glare off your screen as you experiment with these sometimes-subtle perceptual illusions.

Finally, the application is blessed with an index we all wish every book could have. In the **Appendix** a scrolling alphabetical glossary presents words that you click on for a brief definition and you then have the option to find out more by clicking a button that takes you right to the appropriate card in the project. The bibliography card that complements the glossary is brief but includes a good cross-section of technical, psychological, and art references.

Summary

Interactive Color provides an even treatment of both scientific and artistic approaches to color. This hypermedia application has a consistent interface and good scripting (I encountered no programming bugs). It includes sophisticated graphics and opportunities for enlightening interaction. Turn the sound off from the control panel if you are using it in a public facility or everyone will be staring at you as the melodic earcons that introduce each chapter interrupt their train of thought. Then again, turn the sound up and maybe folk will come over to find out what this neat thing is that you are working with.

Details

System requirements to run *Interactive Color*: System 6.0.2 or later versions of Apple's system software, 4 megabytes (4096K) of memory minimum or more, 4.5 megabytes of free space on the hard disk, an 8-bit video card (256 colors). Recommended: fonts Avant Garde and Geneva, Adobe Type Manager or TrueType.

You can obtain *Interactive Color* via Internet or from SDSC directly. Download the application by anonymous ftp to sdsc.edu (132.249.20.22), login as "anonymous" and use your own name as the password. Then type the following:

```
cd [.sdscpub.applemac.graphics]
get interactive_color.hqx
```

The file "interactive_color.hqx" is a *Binhex* file containing the application and its support files. Copy it to your Mac using any file transfer program. Then launch *Stuffit*, or *BinHex* (version 4.0 or later), to uncompress the file and expand it onto your hard drive. There is no fee for your use and distribution of *Interactive Color* (they only ask that you do not sell it). Alternatively, SDSC will send you *Interactive Color* on two 3 1/2" high-density diskettes for \$10.00 to cover copying and handling (\$15.00 to Canada or international destinations). For more information, contact SDSC: Software Product Information, San Diego Supercomputer Center, PO Box 85608, San Diego, CA 92186-9784; (619) 534-5100, email: info@sdsc.edu

