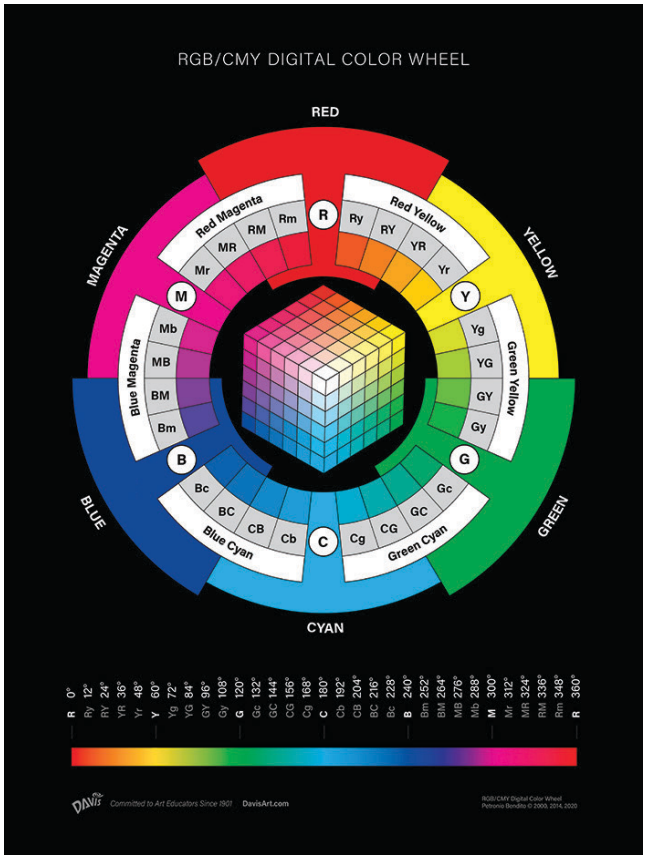
PRINT POSTER + DIGITAL GUIDE

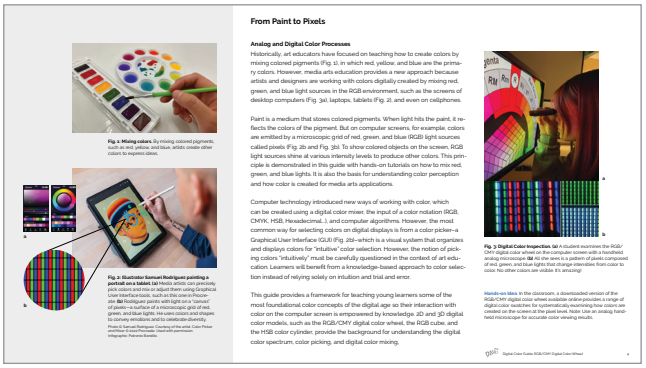
RGB/CMY DIGITAL COLOR WHEEL

By Petronio Bendito

Artists and designers often use color wheels to determine color relationships, but digital media is changing how we use and even see color. This means it's changing how we teach color theory and color design methods as well. Traditionally, students learn how to create colors by mixing pigments in the primary colors (red, yellow, and blue). However, **digital media provides new approaches**; today artists and designers work with colors created by mixing red, green, and blue light sources from the screens of computers, tablets, and cellphones.

The RGB/CMY Digital Color Wheel poster and teacher's guide provides a framework for teaching learners some of today's most foundational color concepts to ensure their interaction with color on digital screens is based on understanding digital color as opposed to intuition or trial and error.




From Paint to Pixels

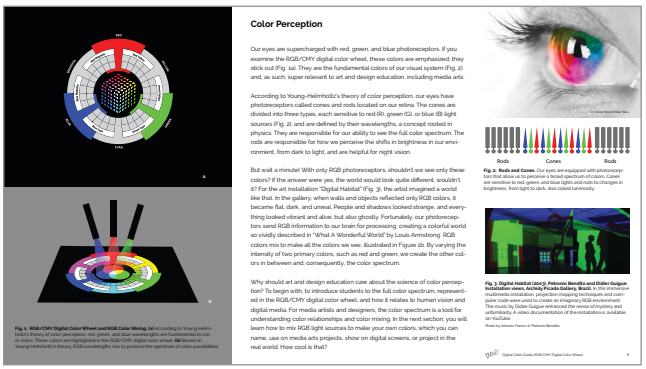
Analog and Digital Color Processes

Historically, art educators have focused on teaching how to create colors by mixing colored pigments (Fig. 1), in which red, yellow, and blue are the primary colors. However, media arts education provides a new approach because artists and designers are working with colors digitally created by mixing red, green, and blue light sources in the RGB environment, such as the screens of desktop computers (Fig. 3a), laptops, tablets (Fig. 2), and even on cellphones.

Paint is a medium that stores colored pigments. When light hits the paint, it reflects the colors of the pigment. But on computer screens, for example, colors are emitted by a microscopic grid of red, green, and blue (RGB) light sources called pixels (Fig. 2b and Fig. 3b). To show colored objects on the screen, RGB light sources shine at various intensity levels to produce other colors. This principle is demonstrated in this guide with hands-on tutorials on how to mix red, green, and blue lights. It is also the basis for understanding color perception and how color is created for media arts applications.

Computer technology introduced new ways of working with color, which can be created using a digital color mixer, the input of a color notation (RGB, CMYK, HSB, Hexadecimal...), and computer algorithms. However, the most common way for selecting colors on digital displays is from a color picker—a Graphical User Interface (GUI) (Fig. 2b)—which is a visual system that organizes and displays colors for "intuitive" color selection. However, the notion of picking colors "intuitively" must be carefully questioned in the context of art education. Learners will benefit from a knowledge-based approach to color selection instead of relying solely on intuition and trial and error.

This guide provides a framework for teaching young learners some of the most foundational color concepts of the digital age so their interaction with color on the computer screen is empowered by knowledge. 2D and 3D digital color models, such as the RGB/CMY digital color wheel, the RGB cube, and the HSB color cylinder, provide the background for understanding the digital color spectrum, color picking, and digital color mixing.


Color Perception

Our eyes are supercharged with red, green, and blue photoreceptors. If you examine the RGB/CMY digital color wheel, these colors are emphasized: they stick out (Fig. 1a). They are the fundamental colors of our visual system (Fig. 2) and, as such, super relevant to art and design education, including media arts.

According to Young-Helmholtz's theory of color perception, our eyes have photoreceptors called cones and rods located on our retina. The cones are divided into three types, each sensitive to red (R), green (G), or blue (B) light sources (Fig. 2), and are defined by their wavelengths, a concept rooted in physics. They are responsible for our ability to see the full color spectrum. The rods are responsible for how we perceive the shifts in brightness in our environment, from dark to light, and are helpful for night vision.

But wait a minute! With only RGB photoreceptors, shouldn't we see only these colors? If the answer were yes, the world would look quite different, wouldn't it? For the art installation "Digital Habitat" (Fig. 3), the artist imagined a world like that. In the gallery, when walls and objects reflected only RGB colors, it became flat, dark, and unreal. People and shadows looked strange, and everything looked vibrant and alive, but also ghostly. Fortunately, our photoreceptors send RGB information to our brain for processing, creating a colorful world so vividly described in "What A Wonderful World" by Louis Armstrong. RGB colors mix to make all the colors we see, illustrated in Figure 1b. By varying the intensity of two primary colors, such as red and green, we create the other colors in between and, consequently, the color spectrum.

Why should art and design education care about the science of color perception? To begin with, to introduce students to the full color spectrum, represented in the RGB/CMY digital color wheel, and how it relates to human vision and digital media. For media artists and designers, the color spectrum is a tool for understanding color relationships and color mixing. In the next section, you will learn how to mix RGB light sources to make your own colors, which you can name, use on media arts projects, show on digital screens, or project in the real world. How cool is that?

Designed to engage learners, this **full-size (18 x 24") poster** paves the way for exploring digital color. It comes with comprehensive support materials that provide innovative approaches to teaching digital color including a teacher's guide with:

- **Video Instruction** to help visualize important concepts, such as color mixing, formulas, the RGB color cube, digital color spectrum, and HSB color planes.
- **Practical activities and tutorials** for immediate use in lesson plans.
- **Detailed explanations** of RGB, CMYK, and HSB Color Systems.
- **Instruction** to increase color literacy for a better understanding of the expansion from traditional 10 and 12 step spectrums.
- **Guidance** for selecting and mixing colors in digital environments for use in media arts and design.

Learn more at DavisArt.com/ColorWheel.