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RGB color model

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Анотація: RGB — адитивна колірна модель, що описує спосіб синтезу кольору, за якою червоне, зелене та синє світло накладаються разом, змішуючись у різноманітні кольори. Широко застосовується в техніці, що відтворює зображення за допомогою випромінення світла.

Ключові слова: адитивна кольорова модель, субтрактивна кольорова модель, кольоровий трикутник, відтінок, інтенсивність, насиченість.

Abstract: The RGB color model is an additive color model in which red, green and blue light are added together in various ways to reproduce a broad array of colors. The name of the model comes from the initials of the three additive primary colors.

Keywords: additive color model, subtractive color model, color triangle, hue, intensity, saturation,

The ***RGB color model*** is an additive color model in which red, green and blue light are added together in various ways to reproduce a broad array of colors. The name of the model comes from the initials of the three additive primary colors, red, green and blue.

The main purpose of the RGB color model is for the sensing, representation and display of images in electronic systems, such as televisions and computers, though it has also been used in conventional photography. Before the electronic age, the RGB color model already had a solid theory behind it, based in human perception of colors.

RGB is a *device-dependent* color model: different devices detect or reproduce a given RGB value differently, since the color elements (such as phosphors or dyes) and their response to the individual R, G and B levels vary from manufacturer to manufacturer, or even in the same device over time. Thus an RGB value does not define the same *color* across devices without some kind of color management.

To form a color with RGB, three light beams (one red, one green and one blue) must be superimposed (for example by emission from a black screen or by reflection from a white screen). Each of the three beams is called a *component* of that color, and each of them can have an arbitrary intensity, from fully off to fully on, in the mixture.

The RGB color model is *additive* in the sense that the three light beams are added together, and their light spectra add, wavelength for wavelength, to make the final color's spectrum.[1,2] This is essentially opposite to the subtractive color model that applies to paints, inks, dyes, and other substances whose color depends on *reflecting* the light under which we see them.

Zero intensity for each component gives the darkest color (no light, considered the *black*), and full intensity of each gives a white; the *quality* of this white depends on the nature of the primary light sources, but if they are properly balanced, the result is a neutral white matching the system's white point. When the intensities for all the components are the same, the result is a shade of gray, darker or lighter depending on the intensity. When the intensities are different, the result is a colorized hue, more or less saturated depending on the difference of the strongest and weakest of the intensities of the primary colors employed.

The RGB color model itself does not define what is meant by *red*, *green* and *blue* colorimetrically, and so the results of mixing them are not specified as absolute, but relative to the primary colors. When the exact chromaticities of the red, green and blue primaries are defined, the color model then becomes an absolute color space

The choice of primary colors is related to the physiology of the human eye; good primaries are stimuli that maximize the difference between the responses of the cone cells of the human retina to light of different wavelengths, and that thereby make a large color triangle [3].

The normal three kinds of light-sensitive photoreceptor cells in the human eye (cone cells) respond most to yellow (long wavelength or L), green (medium or M), and violet (short or S) light (peak wavelengths near 570 nm, 540 nm and 440 nm, respectively [3]). The difference in the signals received from the three kinds allows the brain to differentiate a wide gamut of different colors, while being most sensitive (overall) to yellowish-green light and to differences between hues in the green-to-orange region.

The RGB color model is based on the Young-Helmholtz theory of trichromatic color vision, developed by Thomas Young and Hermann Helmholtz in the early to mid nineteenth century, and on James Clerk Maxwell's color triangle that elaborated that theory (circa 1860).

Photography

The first experiments with RGB in early color photography were made in 1861 by Maxwell himself, and involved the process of combining three color-filtered separate takes [4]. To reproduce the color photograph, three matching projections over a screen in a dark room were necessary. The additive RGB model and variants such as orange-green-violet were also used in the Autochrome Lumière color plates and other screen-plate technologies such as the *Joly color screen* and the *Paget process* in the early twentieth century.

Television

Before the development of practical electronic TV, there were patents on mechanically scanned color systems as early as 1889 in Russia. The color TV pioneer John Logie Baird demonstrated the world's first RGB color transmission in 1928, and also the world's first color broadcast in 1938, in London. In his experiments, scanning and display were done mechanically by spinning colorized wheels.

1. Charles A. Poynton (2003). *Digital Video and HDTV: Algorithms and Interfaces.* Morgan Kaufmann.

2. Nicholas Boughen (2003). *Lightwave 3d 7.5 Lighting.* Wordware Publishing, Inc

3. R. WG Hunt (2004).*The Reproduction of Colour* (6th ed.). Chichester UK: Wiley–IS&T Series in Imaging Science and Technology.

4. Robert Hirsch (2004). *Exploring Colour Photography: A Complete Guide.* Laurence King Publishing.

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