RGB for color composition rather than primary hues

Asked 16 years, 2 months ago Modified 4 years, 11 months ago

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Why do computers use RGB (red, *green*, and blue) values for color composition rather than the primary hues, red, *yellow*, and blue?

graphics colors rgb

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asked Oct 23, 2008 at 3:07

Paul Reiners

7,856 ● 33 ● 122 ● 211

7 Answers

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10

The hues of magenta, yellow, and cyan are primary for subtractive combination (e.g. paints or inks) rather than additive combination such as light where red, green, and blue are primary.

Wikipedia has more detail on the whys and wherefores.

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edited Jun 22, 2010 at 12:13

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answered Oct 23, 2008 at 3:12

Jeff Yates
62.3k ● 20 ● 142 ● 192

2 To be more precise, the subtractive primaries are magenta, yellow and cyan - not red, yellow and blue. – Hugh Allen Oct 23, 2008 at 5:30

5

Computers use the additive colour model, which involves adding together RGB to form white, and is the usual way of forming colours when using a light source.

Printers use subtractive color, normally using Cyan(C), Magenta(M), and Yellow(Y), and often Black(K). Abbreviated CMYK

Cyan is opposite to Red, Magenta is opposite to Green, and Yellow is opposite to Blue.

This is a really simple explanation of a complex issue, the guy that came up with additive colour was James Maxwell (yes, that one), so if you dig into the many articles about him, that may explain much better.

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answered Oct 23, 2008 at 3:17

seanb
6,954 ● 2 ● 34 ● 34

3

Just for clarification, the primary colours you learn at school are incorrectly given as red, yellow & blue. In fact they are Cyan, Yellow & Magenta, just like your inkjet printer. As the previous posts state, Cyan, Yellow & Magenta are the subtractive prime colours; you see what the pigments reflect. Red, Green & Blue are the additive primary colours that CRTs, Plasmas & LCDs use.

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answered Oct 23, 2008 at 3:32

Mike Thompson
6,738 ● 3 ● 33 ● 39

My high-school art teacher told me that when crayons were starting to be marketed for children, there were no non-staining versions of Magenta and Cyan pigments. Permanent stains would have hurt the marketing effort to parents so they went with "close enough" colors for the small 8-color sets. Possibly apocryphal or at least wildly inaccurate. – willc2 Nov 2, 2009 at 2:16

2

For efficiency: the RGB model is additive. For example, superimpose pure red and pure blue light, and you get magenta. It's also easy to build into monitors. If you take a magnifying glass and look at your monitor, you'll be able to see individual red, green and blue dots that vary in intensity to compose the colors needed. As [ffpf] mentioned, check out Wikipedia. Here's a link to the article on the [RGB color model].

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edited May 23, 2017 at 12:01

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answered Oct 23, 2008 at 3:18
Scottie T
12.2k ● 11 ● 48 ● 59

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Computer screens emit light to display pixels. Mixing different colours of light is called [Additive colour](). Additive colour uses red, green, and blue as primary colours.

[Subtractive colour]() is how different colours of materials mix, such as paints. Subtractive colour uses red, yellow, and blue as primary colours.

How I think of it is that when light reflects off an object into your eyes, the object absorbs some of the colour, and reflects the rest to your eyes. So if an object's green, it means it's absorbing the red and the blue out of the white light. This is why mixing red, green, and blue light creates white light, but mixing red, yellow, and blue paint creates black (the mixed paint now absorbs all primary colours.) That is the reason for the difference between additive and subtractive light.

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edited Oct 23, 2008 at 3:29

answered Oct 23, 2008 at 3:21
Paige Ruten
176k ● 37 ● 182 ● 199

And white light being a mix of red/green/blue is a convenience, to do with the ranges of sensitivity of the light receptors in our eyes. An RGB mix looks white to humans, and so does blackbody radiation at certain temperatures, but the spectra are different as you could prove with a prism.
– Steve Jessop Oct 23, 2008 at 3:41

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Because combining light sources (which computer monitors do) does not work the same way as combining printed ink. It's just a guess.

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answered Oct 23, 2008 at 3:12

jmatthias
7,595 ● 7 ● 30 ● 37

0

Color is Not Real

Color is a perception. Light exists in different wavelengths or frequencies, but the only thing that makes a certain wavelength appear to be a "color" is the nature of human perception.

The Long, Medium, and Short of it

The eye has three types of "cone" cells where are sensitive to one of three bands of light, long, medium, or short wavelengths (about 700nm to 380nm). "Long" we think of as red, medium—green, and short—blue. But each cone type covers a wider band, and there is definite overlap, especially of the long and medium cones.

It's All In Your Head

Most of the human visual system (HVS) is in the brain (62% of the brain is involved in visual processing). The overlapping cone responses are filtered by ganglion cells in the back of the eye, sent over the optic nerve, and then further filtered and processed by the visual cortex.

No Such Thing As "Primaries"

While we may call some colors "primary", there is no set of just three real colors that can make up all other colors. Pantone requires 14 different dyes to make up that set of colors for instance, and a typical artist will load their paulette with a dozen colors from which to mix.

TVs/Monitors use red, green, and blue "primaries" with wavelengths chosen with the intent to stimulate each of the three types of cones in the eye as independently as possible. However this is impossible to achieve due to the cone bandwidth overlap.

As such, you "could" say that red, green, blue were the primary colors of light, but even that is not completely correct. Yellow stimulates the "red" and "green" cones about equally, in the middle of the cone overlap. When a computer monitor displays yellow, it is displaying separate green and red, which does not mix in the air to make yellow — it just stimulates the red and green cones causing the brain to *perceive* yellow.

We perceive yellow, and not a reddish-green nor a greenish-red, due to the opponent process of color that is a result of the ganglion cells in the back of the eye.

Red/Green is an opponent pair, and Yellow/Blue is an opponent pair, making up four "unique" colors (Red, Yellow, Green, Blue). Since Yellow is easily created with red and green light, additive color processes typically omit yellow.

Subtracting Light

Reflected surfaces (and transparent film) "subtract" light by absorbing it, reflecting (or transmitting) only certain wavelengths. As it turns out, we get the best gamut of colors using "primaries" cyan, magenta, and yellow when working with subtractive reflected/translucent colors, as opposed to emitted light colors where we are trying to selectively stimulate each of the three cone types using red, green, and blue.

Also, it is useful to note that cyan is the "opposite" of red, magenta "opposite" of green and yellow "opposite" of blue.

And for the record, in an sRGB monitor, the red is really a red/orange. The green is really a green/yellow, and the blue is more of a violet.

For either additive or subtractive processes, the specific colors chosen are (generally) intended for creating the widest gamut of color, limited by various reasons of economics and practicality.