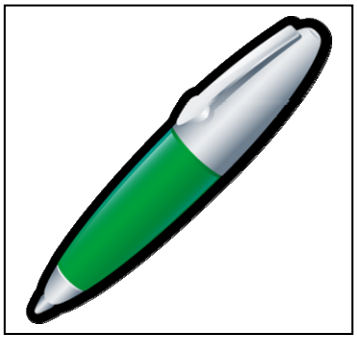
Colour and Web Colour



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Introduction

Colour is no simple matter. It isn't just a case of choosing what you like and then thinking about how nice it looks. Colour is all about what is it for, how will it be reproduced, what is being used to view it, and how big or little or how much detail it has. And, in the world of the web, it is ALWAYS *color*, not colour.

RGB Colour

The majority of colours perceived in the world can be represented by the use of amounts of red, green and blue light in any perceived colour. So, the 256 colour RGB model provides a simple way of representing colours in the digital medium. RGB colours are given in values of 0-255 (for red), 0-255 (for green), 0-255 (for blue). These values are known as decimal triplets. For example, pure 'red' is 255,0,0; pure 'green' is 0,255,0; pure 'blue' is 0,0,255.

Colour Depth

8 bit, 16 bit and 24 bit colour

In digitally reproduced colour, every pixel holds information about the colour it should represent. This is referred to as colour depth. There are levels of complexity to this, beginning with the lowest at 8 bit, and going to as high as 48 bit colour depth. The most commonly used levels of complexity are 8, 16 and 24 bit colour depth.

8 bit

8 bits is 1 byte per pixel. Each pixel would hold 1 byte of information with 8 bit 256 colour combinations from a standard palette.

16 bit

16 bit is 2 bytes per pixel. Though not divisible by 3, (i.e. the red, green and blue), it is usually shared as 5 bits each for red and blue, and 6 bits for green. This is because it is known that the human eye is very sensitive to green, and less sensitive to blue. 16 bit allows for 65,536 different combinations to be displayed.

24 bit

24 bit is 3 bytes per pixel. This allows for as many as 16.8 million colours to be reproduced using the 256 combinations of red, green and blue.

32 bit and higher

24 bit is sufficient to display more colours than the eye can see, but higher values such as 32 or even 48 bit are also used (for example the PNG format will go to 48 bit). This is because the more information in the original image file, the better the resolution quality when it has been compressed. It is also possible with very high colour depth to make very accurate distinctions between colours and therefore to use effects extremely accurately.

Millions of colours

Sometimes the term 'millions of colours' is used to refer to 24 bit colour depth, because it can offer 16,777,216 colour combinations. 'Thousands of colours' refers to 16 bit colour depth, though to be accurate, it should be tens of thousands, as 16 bit is 65,536 combinations. '256 colours' refers to 8 bit colour depth.

Truecolor and Hicolor

Truecolor is a term that strictly refers to 24 bit colour, hicolor refers to 16 bit colour. These terms are often used in marketing to indicate high specification reproduction printers or scanners and can be misused and misleading. It is therefore not necessarily reliable or consistent to use these terms for particular colour depths, and it is preferable to use the bit description as this is a more reliable indicator of colour depth.

Index Colour

Indexing colour was invented because of the World Wide Web. The need to replicate images over the internet network at qualities that did not compromise the content of the image meant that a system was needed to compress images and still use a colour depth of 24 bit.

Indexed colour uses the principle of 1 byte 8 bit colour per pixel (i.e. only 256 colours are used), to compress an image file. But instead of only using the standard palette associated with 8 bit colour, which would be very limited, it uses an indexed system to code the 8 bit information held in each byte per pixel, and reference a 24 bit colour table. This means that the colours used can be as complex as full 24 bit colour, but not have to store the full code for each colour.

To understand it easily, think of painting by numbers. Each colour of the image is coded with a number which corresponds to a pot of paint with the colour needed for that section. Only the colours used in the painting are included in the paint pots with the kit. This way, high quality colour definition can be achieved without having to include every colour in the spectrum. So it is with index colour. Index colour associates a *palette* of colours with an image, without having to hold the code of colours within the whole 16.8 million colour range.

Hexadecimal and Decimal Colour

We read earlier about decimal triplet RGB values. When we are developing images for the web or making digital images, we sometimes must use hexadecimal values, which are used in some computer applications and languages, like CSS, HTML or SVG.

A Hex Triplet, as it is sometimes known, is a value that represents the RGB decimal value. It is a 6 digit, 3 byte value, representing red, green and blue, in that order. A hex triplet has 00 to FF as its values. So, pure blue in decimal (0,0,255) is 0000FF in hex.

Calculating hex and decimal code from RGB

Hex triplets are made up of 0-9 and A-F. In hex triplets we need A-F to represent the numbers from 10 to 15 so we can convert the corresponding RGB decimal numbers. We divide the RGB decimal number by 16 and then add the remaining figure to give the 2 hex digits. E.g. 4,8,16 in decimal is 04,08,10 in hex; 15 in decimal is 0F in hex. If any RGB triplet number is less than 16, it is preceded by a 0 in the corresponding hex, as every number must be 2 digits, to make 6 in total. Likewise, every hex triplet number that is less than 10 must be preceded by a 0, to also be a 2 digit number.

1. To find out more about the mathematical process of conversion for more complex combinations, please refer to:
   http://en.wikipedia.org/wiki/Websafe#Hex_triplet
2. To save time and work, there are plenty of applications available on the web to help us convert RGB decimal triplets to hexadecimal triplets, here are 2 very good ones:
   http://www.psyclops.com/tools/rgb/
   http://www.aditsite.co.uk/html/rgbdecimal.html

Websafe Colours

Websafe colours refer to colours that can be reliably reproduced using computer systems or other digital screens. Browsers (for example Internet Explorer, Firefox or Safari) can be very different in how they 'parse' colour. For this reason, a table of websafe colours has been developed that can be reasonably relied upon to be consistent with systems and browser use variations. There are 216 colours in the websafe palette. There are 22 REALLY safe colours for true cross browser reliance, and only 16 are recommended by W3c. Here's the palette:
http://www.aditsite.co.uk/html/rgb_hex.html

Cross browser testing and knowing your audience

It's very important to test your colour choices as well as your image format choices across as many browsers and computer screens as you can. Everyone sets up their screen differently, and there is no such thing as a default setting that applies to all screens of a particular type (i.e. LCD screen does not mean that all LCD screens are the same for brightness, contrast etc.)
If you really want to comprehensively test your web pages for colour and image formats, go to:
http://browsershots.org/

Web Colour Wheels

Colour wheels are widely used to choose good colour themes and also to obtain the RGB hexadecimal code easily, without having to calculate it yourself every time. Adobe offer a very comprehensive colour wheel (http://kuler.adobe.com/) however you need to use Flash Player version 10 to access it. Colour wheels I would recommend are:

1. Fully featured colour wheel offering theme suggestions and a look at what the colours look like to people with different sight capabilities.
   http://wellstyled.com/tools/colorscheme2/index-en.html
2. Colour wheel with good comparison of websafe versions of similar colours, and a temporary memory of what you've looked at.
   http://ficml.org/jemimap/style/color/wheel.html
3. A very comprehensive list of colour reference links can be found here
   http://www.forwebdesigners.com/colors/
4. An accessibility colour wheel is here
   http://gmazzocato.altervista.org/colorwheel/wheel.php

Colour Look Up Table

CLUT is a system in hardware or some software applications, like Photoshop for example, that is used to look up the colour value being called by the image or application. Depending on the capability of the screen, different colour depths can be represented. Therefore 24 bit video cards/screens can display 24 bit depth colour, 16 bit video cards/screens display 16 bit colour, etc. it is now commonplace to have 32 bit 'brightview' screens in many laptops.

Graphics cards use CLUT to display the colours on a computer screen, and take the pixel byte information embedded in each pixel of an image and use VRAM to create that colour on the screen. Not all colour systems use CLUT, and sometimes CLUT can be embedded in image formats like TIFF. Software applications can use their own system of CLUT reference to display and manipulate colours as you work with images and effects. For more information start here:
http://en.wikipedia.org/wiki/CLUT

Further Resources

A few useful resources for definitions and further information on other terms and types of colour, including websites and useful reference books.

Web Resources

Lab Colour Space
http://www.broadhurst-family.co.uk/lefteye/MainPages/Lab.htm

Spot Colour
http://en.wikipedia.org/wiki/Spot_color

Pantone
http://www.pantone.com/pages/MYP_mypantone/mypInfo.aspx?pg=20525&ca=75
Pantone colours are the intellectual property of Pantone and therefore are not allowed to be used for free. However, you can get Pantone colour matchers from many sources (such as DIY paint shops) for free, to use for reference.

Colour Chart
http://en.wikipedia.org/wiki/Color_chart

Index Colour
http://www.anu.edu.au/ITA/corecomputer/notes/index_colour_cc.html

Web Colours, including web safe information
http://en.wikipedia.org/wiki/Web_colors

Books

Chapman, J and N, 2008, Digital Multimedia, Wiley & Sons (chapter 6)
Chapman, J and N, 2006, Web Design, Wiley & Sons (chapter 5)

/Pen Lister Nov 2008