

1. Introduction to Graphic

“Computer graphics refers to using a computer to create or manipulate any kind of picture, image, or diagram”. The process and art of combining text and graphics and communicating an effective message in the design of logos, graphics, brochures, newsletters, posters, signs, and any other types of visual communication. The five elements of lines, shapes, mass, texture, and colour are the building blocks of design for desktop publishers. Sometimes a designer uses a line alone to divide or unite elements on a page. Lines can denote direction of movement (as in diagonal lines and arrows) or provide an anchor to hold elements on a page (such as lines at the top, bottom, or sides of a page).

Circle, square, and triangle are the three basic shapes used in graphic design. Perhaps the most familiar shape to desktop publishing is the square (and rectangle). Most text blocks are square or rectangular. While you may encounter printed projects cut into other shapes, most circles, triangles, and freeform shapes in desktop published materials are found on many magazines or websites within the graphics or in the way the elements are placed.

When discussing about graphic we can divide into two sections these graphics. Those are Vector & Raster.

1.1. Vector Graphics

Vector graphic is made of geometrics which based on mathematical equations. Vector graphics are created and manipulated using drawing programs. Instead of using pixels to describe the image, it describes the image using shapes.

1. Circles
2. Lines
3. Curves

Vector-based images are not made up of a specific number of dots, they can be scaled to a larger size and not lose any image quality. This makes vector graphics ideal for logos, which can be small enough to appear on a business card, but can also be scaled to fill a billboard.

These can be assigned for re-shape, colour, and fill to each tracks. Vector files aren't heavy files as all the facts are positioned in to a structure. Easy to change parts of the image since each part is stored as a different shape. Most vector graphic editing programs allow to rotate, skew, changing Z order, stretched etc. W3C standards for the vector is SVG (Scalable Vector Graphics).

1.2. Raster Graphics

Most images you see on your computer screen are raster graphics. Raster graphics are Digital images created or captured. Often they are called Bitmap graphics. When you create a Raster graphic you are basically creating a bunch of coloured dots. The bitmapped graphic is stored as an array of dots, or pixels. The larger the image, the more disk space the image file will take up.

Each pixel gets assigned a specific colour. The more pixels you have, the more detailed the image can be Imagine only have one pixel, all you get is a dot. Bitmap images normally stored as individual bitmap or else as a video. These Raster images stored as variety of file formats. In printing industry these raster images known as CONTONES.

These raster images can't be stretched as these are working with pixels. Used most commonly, especially on the web. Raster graphics can typically be scaled down with no loss of quality, but enlarging a bitmap image causes it to look blocky and "pixelated".

Bitmap was the original term used for identifying an image with an array of bits. These images are uncompressed pieces of information. The most common and comprehensive form of storage for images on computers is bitmap image. Bitmap use combination blocks of different colours (known as pixels) to represent an image. Each pixel is assigned a specific location and colour value. They are also called pixelized or raster graphics.

Bits: are pieces of stored information

- 8 bits = 1 byte
- 1000 bytes = 1 kilobyte
- 1000 kilobytes = 1 megabyte

- 1000 megabytes = 1 gigabyte
- 1000 gigabytes = 1 terabyte
- 1000 terabytes = 1 petabyte

1.3. Colour Theory

Sir Issac Newton who designed the colour diagram in 1672, which was a basic model for the colour systems. Modern version of the colour wheel is made up of 12 colours, which is based on the RYB (RED, YELLOW, BLUE) colour model.

Primary Colour Mode

RYB (RED, YELLOW, BLUE)

Secondary Colour Mode

These colours are made by mixing with primary colours:

Green = yellow + blue

Orange = yellow + red

Purple = blue + red.

Tertiary Colour Mode

These colours are made by mixing with the Secondary colours:

Yellow-orange

Red-orange

Red-purple

Blue-purple

Blue-green

Yellow-green

1.4. Color Modes

Before we start processing images, we need to talk about how computers represent colors as numbers. Three common colour models;

- **RGB (Red, Green, Blue):** An additive model
- **CMYK (Cyan, Magenta, Yellow, Kilo/Black):** A subtractive model
- **YUV (Luminance/Brightness & Chroma)**

For variables of class uint 8 (and 8-bit images). 0-255 are the possible integer values (same for the uint 8 class). 0 is minimum for any RGB colour. 255 is max for any RGB colour. To define any colour, you must specify the **Red (R)**, **Green (G)**, and **Blue (B)** values. Grayscale images only need one value (0 = black, 255 = white).



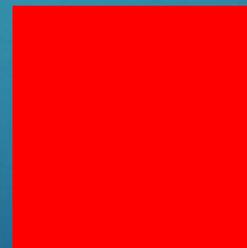
[0 0 0]



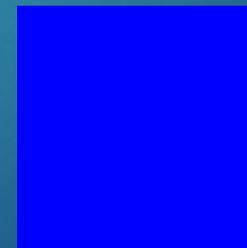
[255 255 255]



[75 75 75]



[255 0 0]



[0 0 255]



[0 255 0]

Addictive Mixing

White Light: It consists of energy throughout the visible light spectrum. Primary colours: Red (*R*), Green (*G*), and Blue (*B*) are three primary colours. Additive Mixing: All the colours in the spectrum can be created with the primary colours. This is called additive colour property and it works for the mixing of primary colour that are emitting light. Example, mixing *R* and *G* yields yellow. When *R*, *G* and *B* colours all mixed together, an entire spectrum of colours can be created.

Subtractive Mixing

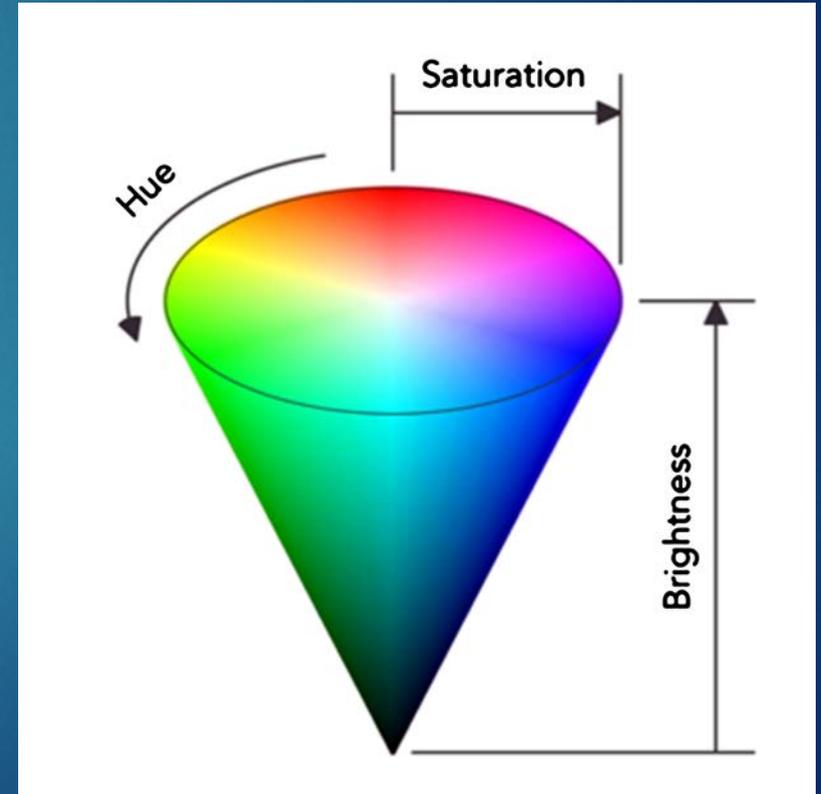
Secondary colours: Cyan, Magenta and Yellow (*CMY*) are secondary colours or subtractive primary colours. Subtractive Mixing: Subtractive colour mixing is based on reflective colours rather than emissive colours. It generates colour by mixing secondary colours. For example, mixing magenta and yellow yields red. In subtractive mixing, unwanted colours are selectively absorbed and the required colour is reflected. The yellow colour absorbs the blue component, and the magenta absorbs the green component, resulting in red.

HSB/HSL Colour Scheme

Hue: It is the colour sensation produced in an observer due to the presence of certain wavelengths of colour. Each wavelength presents a different hue. Hue is based on a vector value moving from 0 to 360 degrees on a colour wheel.

Saturation: This is a measure of colour intensity, for example, the difference between red and pink. Although the two colours have the same predominant wavelength, one may have whiter colour mixed in with it and hence appear less saturated (100% = pure colour, 0% = black, white, gray).

Intensity / Luminance or Brightness: This is a measure of the light emitted or reflected by an object. Certain colours appear brighter than others as the human eye does not respond in the same way to all colours. The human eyes see finer details in image scene more because of brightness variations than because of colour variations.



YUV Colour Scheme

This is the basic colour format used by composite colour TV standards (NTSC, PAL and SECAM). Y represents the luminance/brightness and can be thought of as containing black and white or gray-scale information. U and V carry the chrominance or colour information. There are a variety of YUV-like colour models.

The Colour Wheel

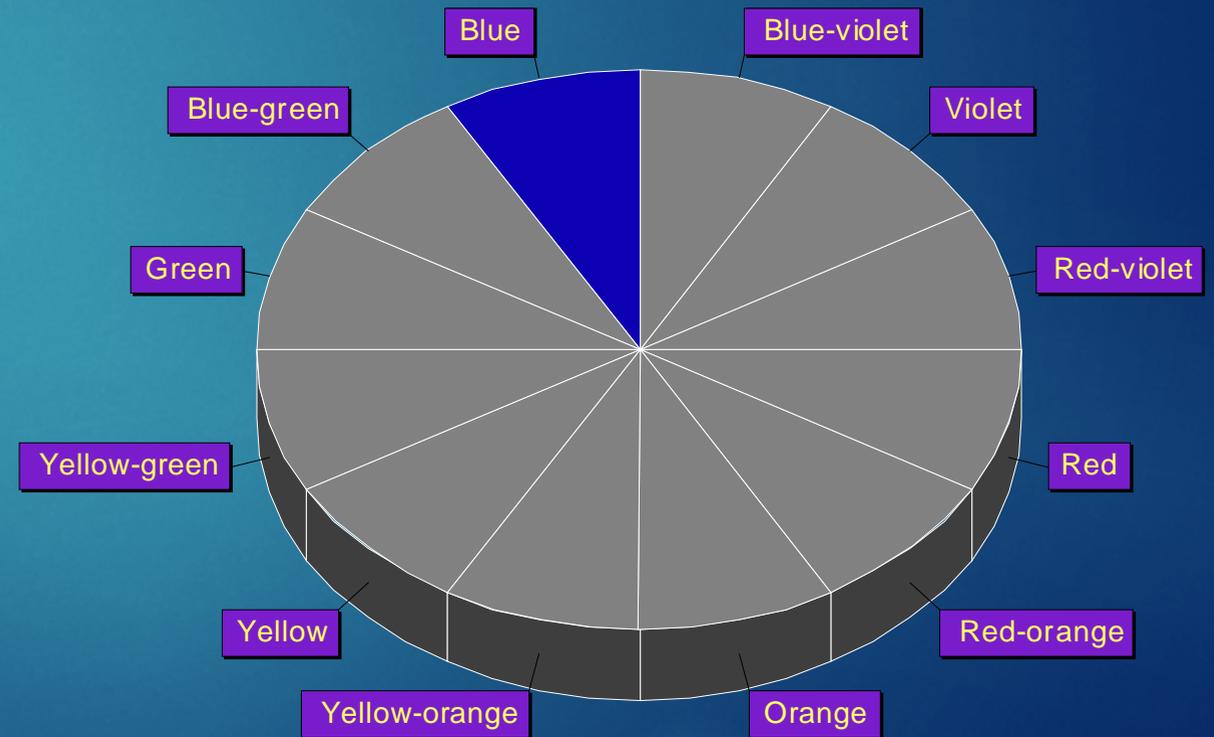
Colours on the wheel can be described using three parameters:

Hue: degrees from 0° to 360°

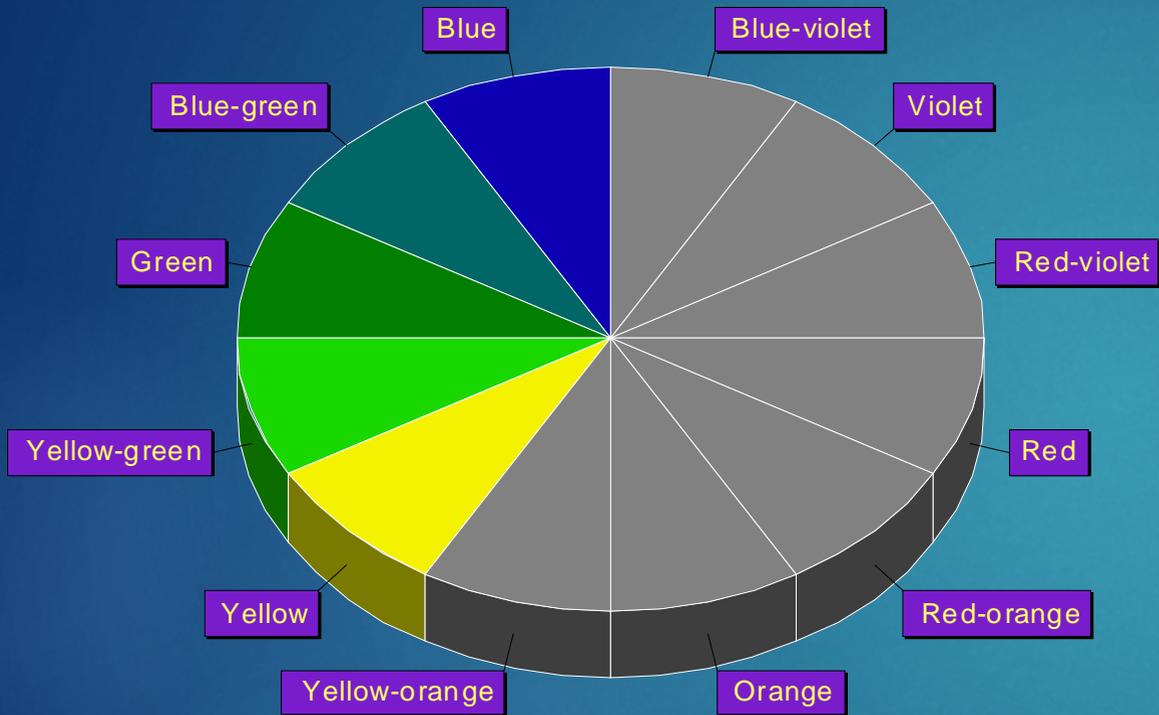
Saturation: brightness or dullness

Value: lightness or darkness

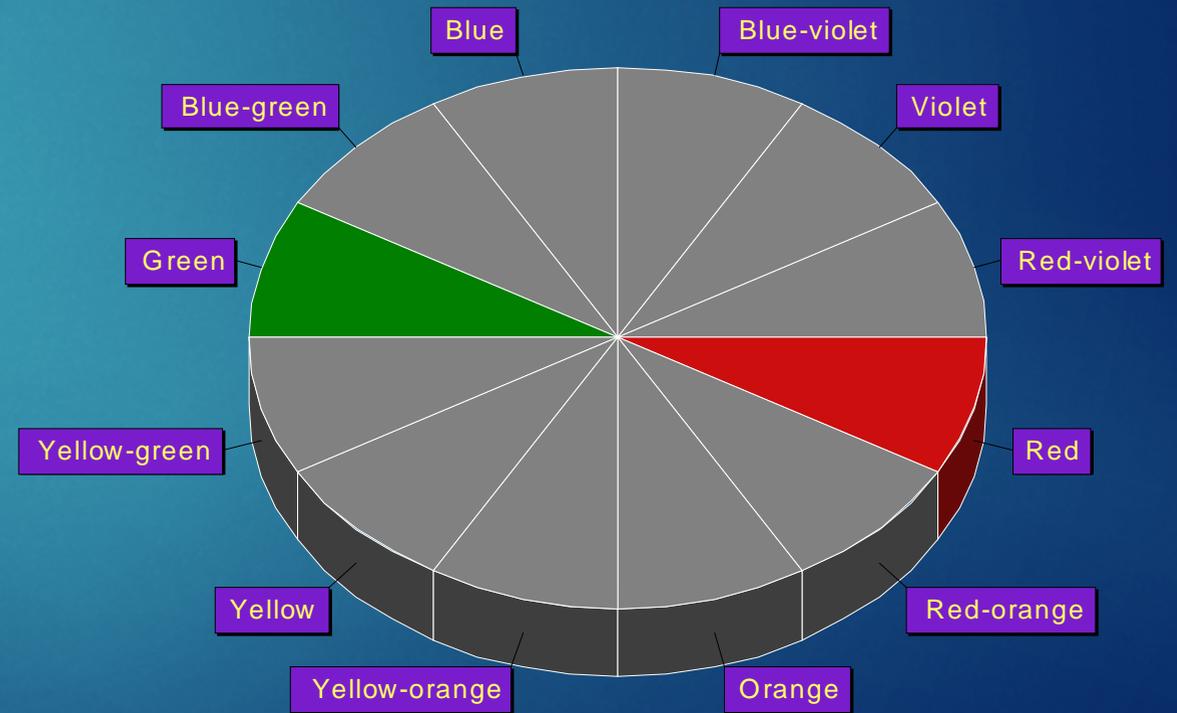
Monochromatic - A colour scheme using one colour, and tints, tones and shades of that colour.



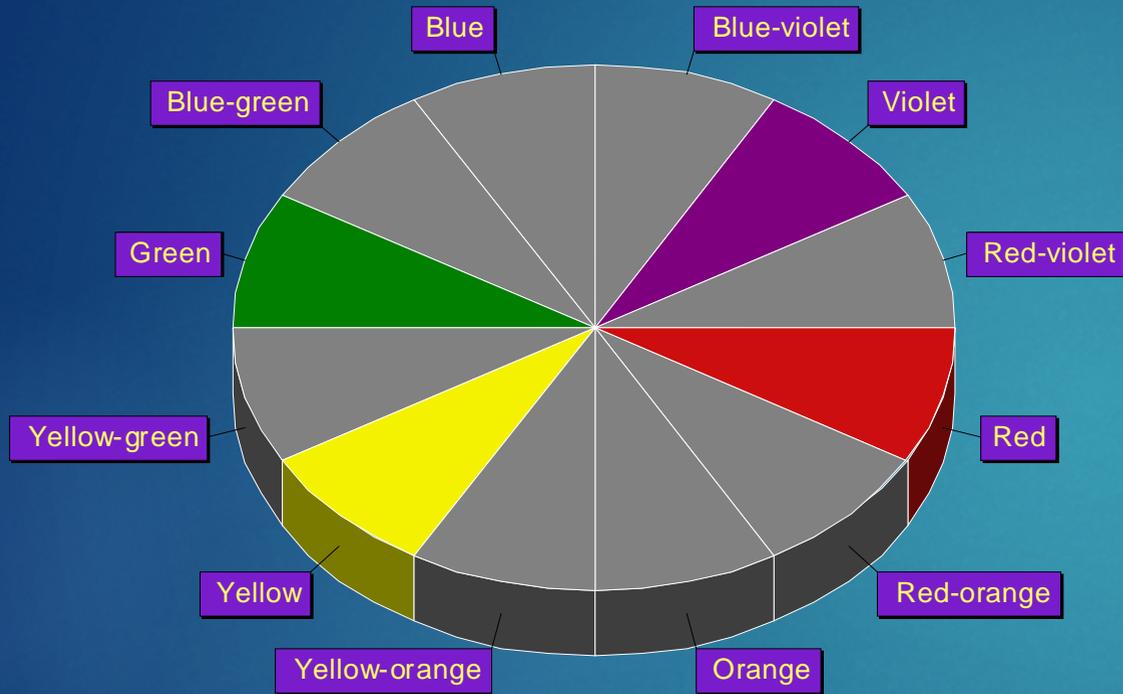
Analogous - A colour scheme using 3 or more colours next to each other on the colour wheel.



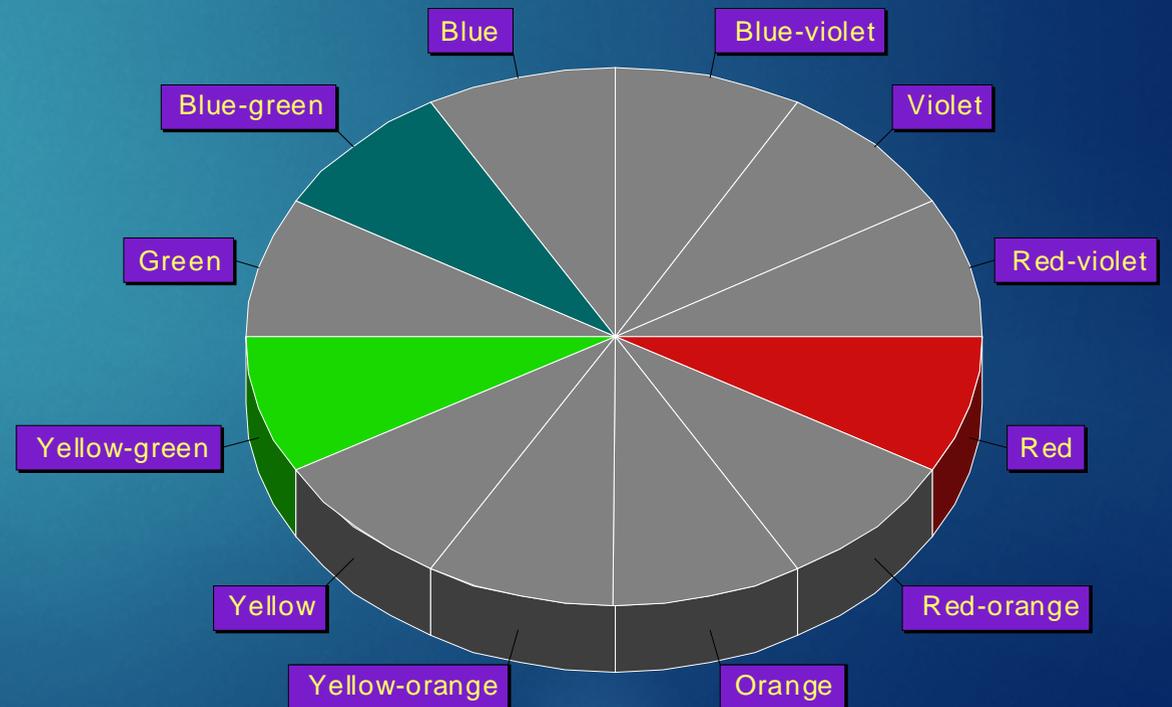
Complementary - A colour scheme using colours opposite each other on the colour wheel.



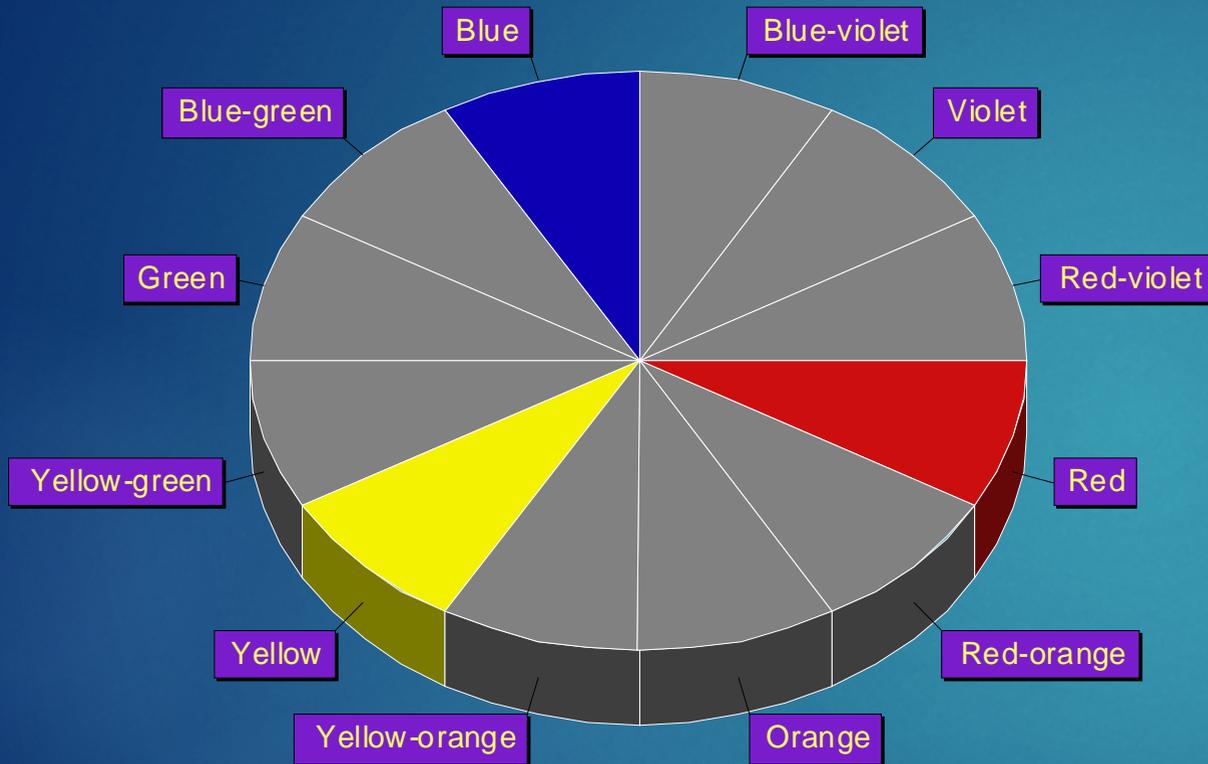
Double Complementary - A Colour scheme using two sets of complementary colours.



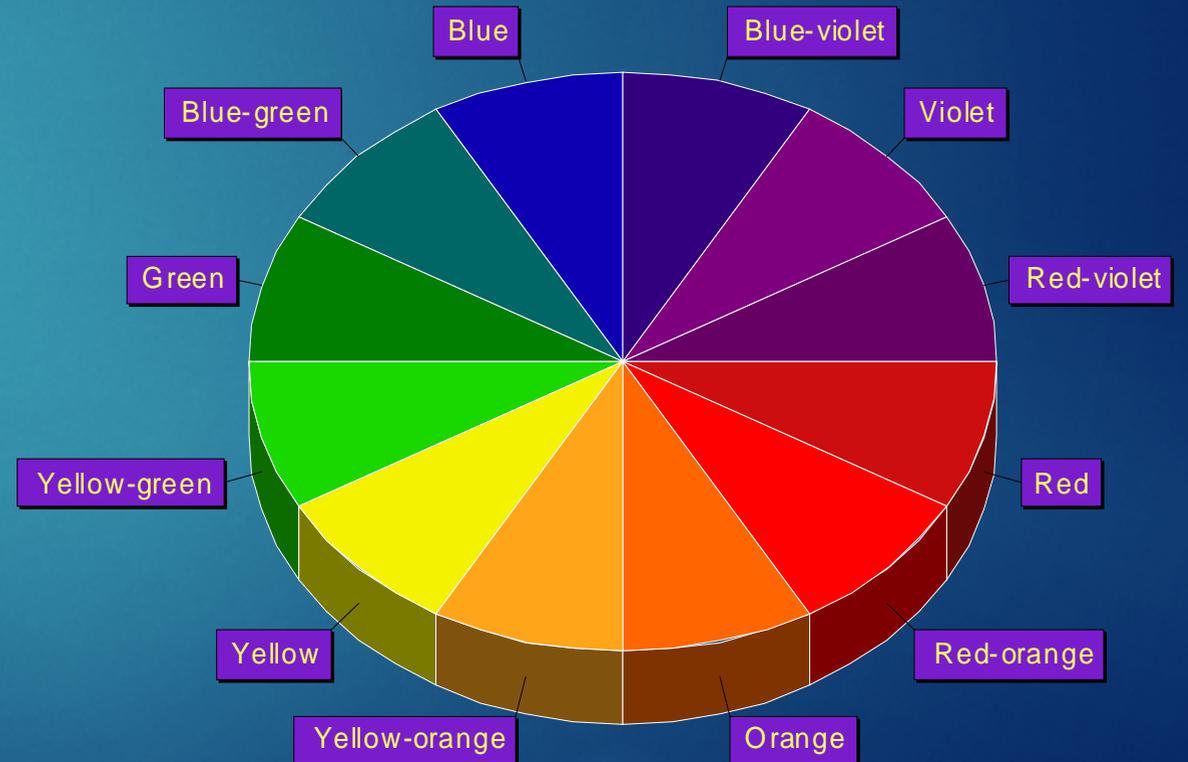
Split Complementary - A colour scheme using one colour, and the colours on either side of it's complement. This colour scheme, along with the double complementary are more difficult to achieve in a tasteful fashion.



Triad - A colour scheme using three colours equal distance from each other on the colour wheel.



Neutral - A colour scheme using whites, blacks, browns, grays and beiges, etc.



1.5. Resolution

There are three types of resolution measuring different aspects of the quality, detail and size of an image:

1. Image resolution
2. Display resolution
3. Colour resolution / Colour Depth

1. Image Resolution

The term resolution often associated with an image's degree of detail or quality. Image resolution measures the pixel dimension of an overall image or how many pixel the image has. Image resolution is measured in width and height. For example, 100 X 100-pixel image has a total of 10,000 pixels.

2. Display Resolution

Resolution can also refer to quality capability of graphic output (monitor). Display resolution is also measured in pixels in terms of height and width. Display resolution normally uses a setting of 640 x 480 (VGA), 800 x 600 (SVGA), 1024 x 768, etc. You can change the display

resolution under Display Properties in Control panel. If your image resolution is bigger than the display resolution, the result would be part of the image will be out of the display area.

3. Colour Resolution / Colour Depth

Colour depth describe the number of bits used to represent the colour of a single pixel.

The file size of a bitmap image (in bytes): Height X Width X (Colour depth / 8).

Each pixel can represent at least 2 possible colours or more. Colour resolution or Colour depth/ channel depth is measured in bits. Image formats will only allow a certain number of different colours for each pixel. Bit depth describes the number of colours that can be used in the image.

Colour Depth	Calculation	Number of Colours
1 bit	$2^1 = 2$	2 colours
4 bits	$2^4 = 16$	16 colours
8 bits (1 byte)	$2^8 = 256$	256 colours
16 bits (2 bytes)	$2^{16} = 65,536$	65,536 colours
24 bits (3 bytes)	$2^{24} = 16,777,216$	16,777,216 colours