

## Color Models

Chromatic colors follow the tri stimulus theory of the human brain that states that the color of light is perceived by the brain as a combination of three primary colors: red, green and blue

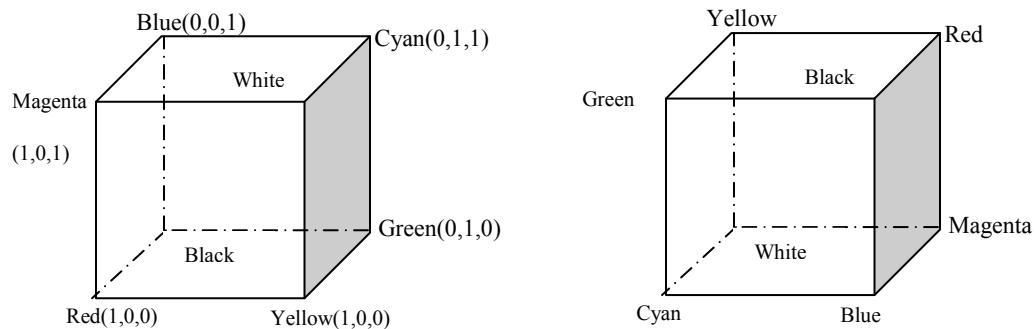
The description of color generally includes three properties : hue , saturation and brightness defining a position in the color spectrum, purity and the intensity value of a color

### The RGB Model

Represents color as a point in three dimensional space obtained from the three RGB component red, green and blue

Here the individual contributions of each primary color is added together to yield the result

The color black is located at the origin (0,0,0) of the RGB model and white is at the point (1,1,1) all other colors are represented by points inside the cube.



### CMYK Model

Uses the colors cyan , magenta and yellow which are the complement of RGB color model

The white is located at the origin (0,0,0) and black at (1,1,1) which is just the opposite of the RGB model

This is a subtractive model and is popular in hard-copy devices which work with pigments e.g. ink used in a printing press

$$\text{Cyan} = \text{White} - \text{Red} = \text{Blue} + \text{Green}$$

$$\text{Magenta} = \text{Red} + \text{Blue} = \text{White} - \text{Green}$$

$$\text{Yellow} = \text{Red} + \text{Green} = \text{White} - \text{Blue}$$

RGB to CMY

$$\begin{vmatrix} C \\ M \\ Y \end{vmatrix} = \begin{vmatrix} 1 \\ 1 \\ 1 \end{vmatrix} - \begin{vmatrix} R \\ G \\ B \end{vmatrix}$$

CMY to RGB

$$\begin{vmatrix} R \\ G \\ B \end{vmatrix} = \begin{vmatrix} 1 \\ 1 \\ 1 \end{vmatrix} - \begin{vmatrix} C \\ M \\ Y \end{vmatrix}$$

## HVS Color Model

Both RGB and CMYK are hardware oriented but HVS is user oriented

It is based on shade and tone and the coordinate system used is cylindrical

The hexcone or six sided pyramid is used for this

The top of the hexcone corresponds to  $V=1$  which contains the relatively bright colors

Hue or  $H$  is measured by the angle around the vertical axis with red at 0 degree and green at 120 degree and so on

Complimentary colors in the HVS hexcone are 180 degree opposite one another

The value of  $s$  is a ration ranging from 0 on the center line to 1 on the triangular sides of hexcone

Saturation is measured relative to the color gamut represented by the model

The hex cone is one unit high in  $v$  with the apex at origin

The point at the apex is black

At this point  $H$  as  $S$  are irrelevant so  $S=0$  and  $V=1$  is white

Intermediate values of  $V$  for  $S=0$  are Gray

When  $S=0$   $H$  is irrelevant and when  $S$  is not zero  $H$  is relevant

Pure red is at  $H=0$   $S=1$  and  $V=1$

The top of HVS hexcone corresponds to the projection seen by looking along the major diagonal of the RGB color cube

Each plane of constant  $V$  in HVS space corresponds to such a view of sub cube in RGB space

The main diagonal of RGB space is the  $V$  axis of HVS space

