Color Modeling

Color is the aspect of things that is caused by differentiating qualities of light being reflected or emitted by them.

Additive	Substractive
RGB, HSV, HSL	CMY, CMYK
Add colors to generate multiple colors	Substract colors to generate diff colors.
Active Display → TV, Mobile PC	Device that deposite → printer.
No data → black	No data → white
Increase brightness	Decrease Brightness.

Primary color of light (RGB) : Red (R), Green (G), Blue (B)

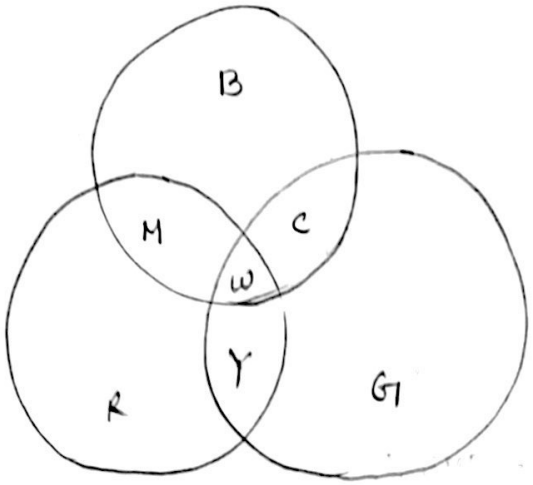
Secondary Colors of light (CMY):

→ Cyan → Green + Blue

→ Magenta → Red + Blue

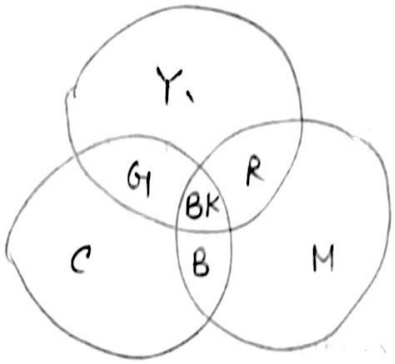
→ Yellow → Red + green.

RGB



Black

CMY



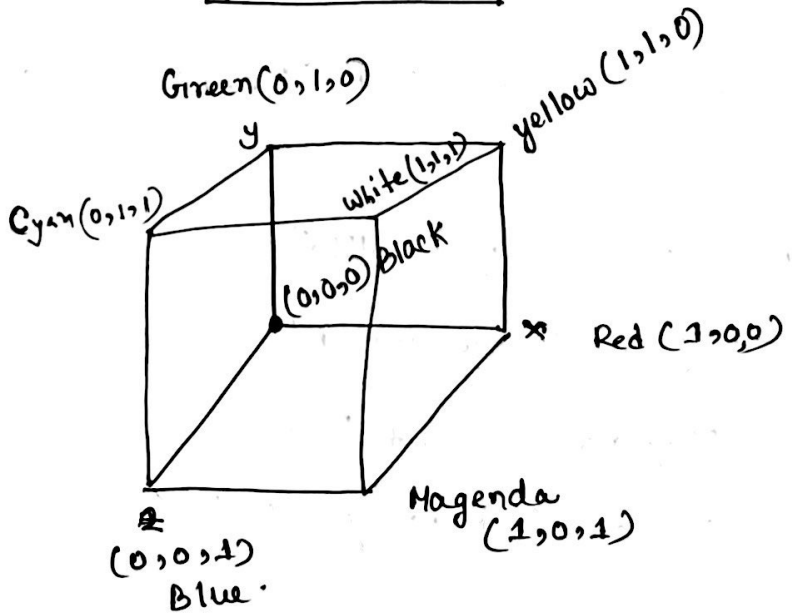
White

Monochromatic → Mono (single) chromatic (color) > a single light.

RGB (1,0,0) → Red (0,1)

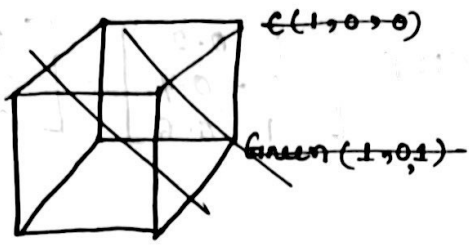
RGB (1,1,0) → Yellow

Color Cube

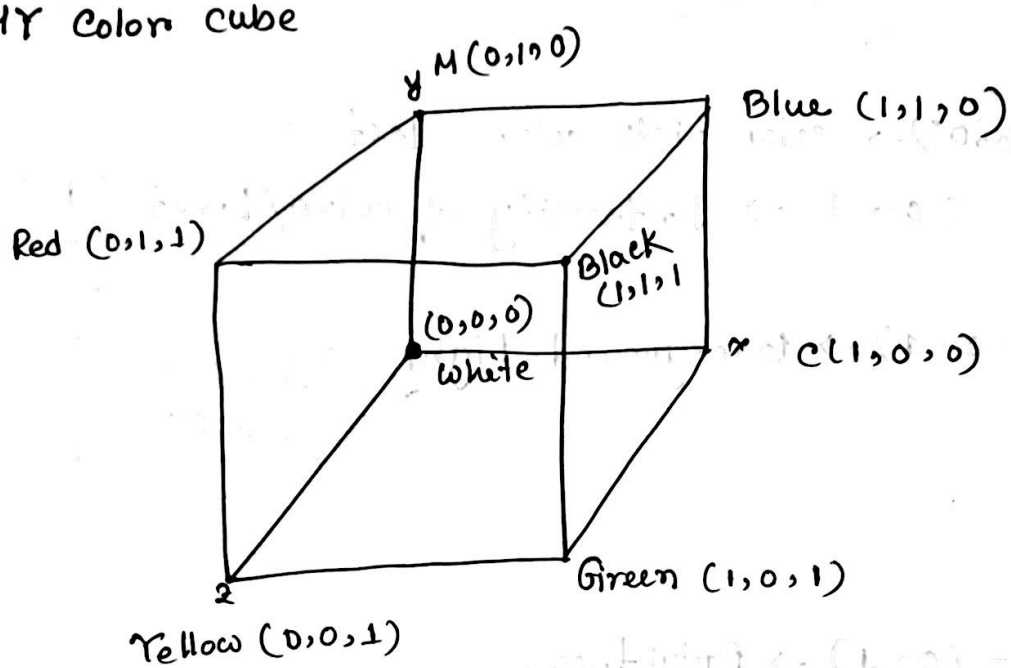


Each color 8 bit. Total combination = $2^8 \times 2^8 \times 2^8$ = 16 million

CMY Colon Cube :



CMY Color cube



RGB → CMY

$$\begin{bmatrix} R \\ G \\ B \end{bmatrix} = 1 - \begin{bmatrix} C \\ M \\ Y \end{bmatrix} \quad \Big| \quad \begin{bmatrix} C \\ M \\ Y \end{bmatrix} = 1 - \begin{bmatrix} R \\ G \\ B \end{bmatrix}$$

∴ Switching between RGB and CMY

Example : LET RGB (0.2, 0.7, 0.6)

Transfor this into CMY color model.

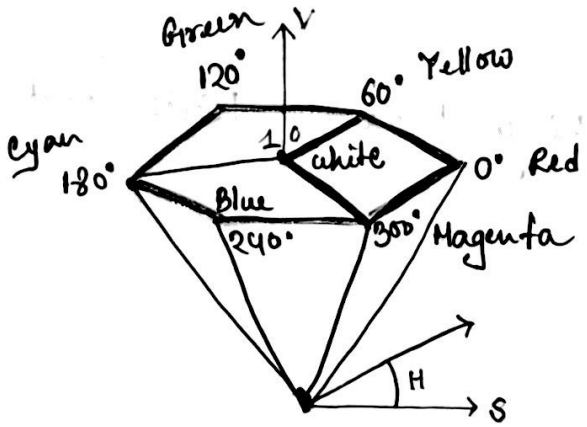
$$RGB = \begin{bmatrix} 0.2 \\ 0.7 \\ 0.6 \end{bmatrix} \quad \therefore CMY = \begin{bmatrix} 1-0.2 \\ 1-0.7 \\ 1-0.6 \end{bmatrix} = \begin{bmatrix} 0.8 \\ 0.3 \\ 0.4 \end{bmatrix}$$

HSL \ HSV

HSL
- Hue → (0-360°) → color pick color select.
- Saturation (0~1) → Intensity of color/Light → 1 → high int, 0 → Gray
- Lightness (0~1) → Background Light → 1 → white, 0 → Black

HS(V)
- Value ≡ (0~1) → Brightness

- The human life can see 128 different hues, 130 diff saturations and number of values between 16 (Blue) and 23 (yellow)



- Red (0-60°)
- Yellow (61-120°)
- Green (121-180°)
- Cyan (181-240°)
- Blue (241-300°)
- Magenta (301-360°)

RGB to HSL / HSV

Step 01 Find out the max and minimum value from RGB.

$Max = max(R, G, B)$

$Min = min(R, G, B)$

$l = Max - Min$

Step : 2 Find out linghtness and saturation for HSL
" " Value and Saturation for HSV

HSL → Lightness $\frac{Max + Min}{2}$

HSL → Saturation $\frac{l}{1 - |2L - 1|}$ here L = Lightness

HSV → Saturation $\frac{l}{Max}$

HSV → Value Max (Max Lightness)

Step 03

Calculate Hue

if R == Max : $H = \left(\frac{G-B}{l}\right) * 60^\circ$ [if $H < 0^\circ$ $H = H + 360$]

if G == Max : $H = \left(\frac{B-R}{l}\right) * 60^\circ + 120^\circ$ [By default add 120°]

if B == Max : $H = \left(\frac{R-G}{l}\right) * 60^\circ + 240^\circ$

HSL color Model