HSV to RGB Conversion

Input, H, S, V [Assume $0 \leq H < 360$, $0 \leq S \leq 1.0$ and $0 \leq V \leq 1.0$]

Output R, G, B

$C = V \times S$

$X = C \times (1 - |(H / 60^{\circ}) \bmod 2 - 1|)$

$m = V - C$

$$(R', G', B') = \begin{cases} (C, X, 0), & 0^0 < H < 60^0 \\ (X, C, 0), & 60^0 < H < 120^0 \\ (0, C, X), & 120^0 < H < 180^0 \\ (0, X, C), & 180^0 < H < 240^0 \\ (X, 0, C), & 240^0 < H < 300^0 \\ (C, 0, X), & 300^0 < H < 360^0 \end{cases}$$

(R,G,B) = ((R'+m), (G'+m), (B'+m))

HSL/HLS Color Model

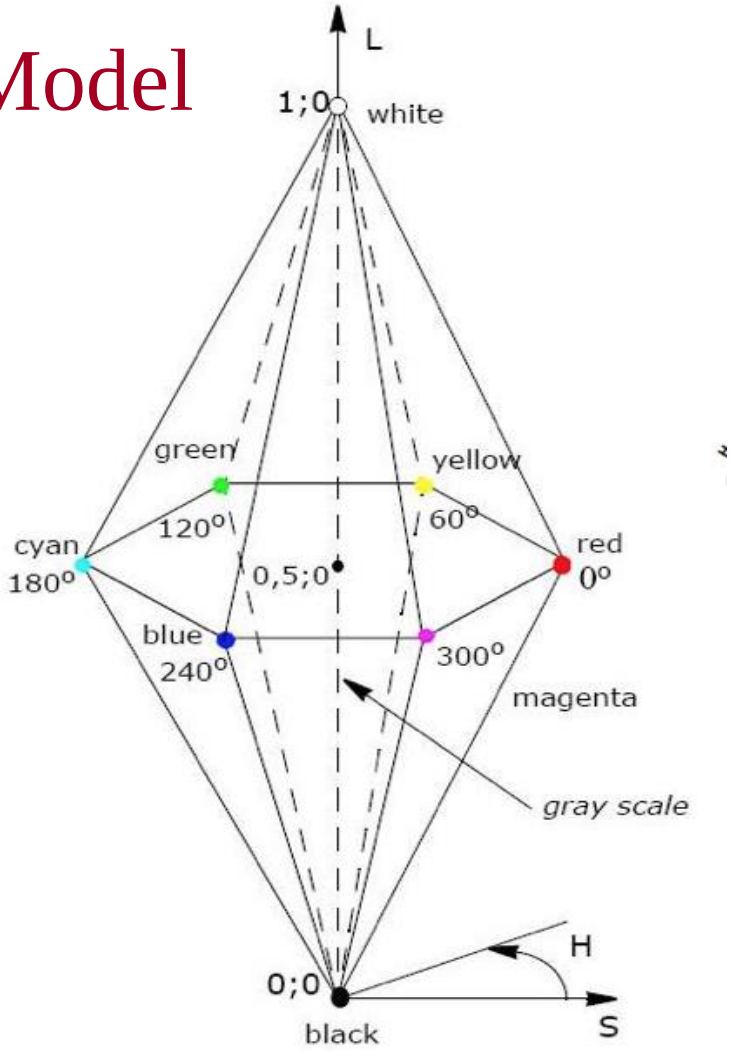
- Unlike RGB and CMY, which use primary colors, HSL is also closer to how humans perceive color.
- It has three components: Hue, Saturation, and Luminas (driven from RGB).
- This color space describes colors (hue or tint) in terms of their shade (saturation or amount of gray) and their brightness value.
- Luminas is not like value. Here L=0 means black and L=1 mean white.

How to Use the HSL Color Model

- The HSL color wheel sometimes appears as a double-cone, but always with these three components:
- Hue: Same as HSV:
- **Red** falls between 0 and 60 degrees., **Yellow** falls between 61 and 120 degrees, **Green** falls between 121 and 180 degrees, **Cyan** falls between 181 and 240 degrees, **Blue** falls between 241 and 300 degrees, **Magenta** falls between 301 and 360 degrees.
- Saturation: Saturation describes the amount of gray in a particular color, from 0 to 100 percent, but the conversion principle is little different.
- Reducing this component toward zero introduces more gray and produces a faded effect. Sometimes, saturation appears as a range from 0 to 1, where 0 is gray, and 1 is a primary color.
- Luminas (or Brightness): Value works in conjunction with saturation and describes the brightness or intensity of the color, from 0 to 100 percent, where 0 is completely black, and 100 is the brightest or white.

The HSL Color Model

- Hue, Saturation, Luminas (Lightness)
- One such perceptual color model is HSL (also called HLS), which is an acronym for hue, saturation, and lightness.
- Originally, it was introduced by Joblove and Greenberg as "hue/chroma/intensity“



RGB to HSL conversion

$$L = \frac{\max(R,G,B) + \min(R,G,B)}{2}$$

$$S = \begin{cases} 0 & if\ L = 0 \\ \frac{1}{2} \times \frac{\max(R,G,B) - \min(R,G,B)}{L} & if\ 0 < L < 0.5 \\ \frac{1}{2} \times \frac{\max(R,G,B) - \min(R,G,B)}{1 - L} & if\ 0.5 < L < 1 \\ 0 & if\ L = 1 \end{cases}$$

Calculation of H is same like HSV

RGB to HSL conversion

$C_{max} = max(R,G,B);$

$\Delta = C_{max} - min(R,G,B);$

$L = (C_{max} + C_{min})/2 ;$

if $(L < 0.5)\{$

if $(L == 0)\ S = 0;$

else $S = \Delta / 2L ;$

$\}$

else $\{$

if $(L==1.0)\ S = 0;$

else $S = \Delta / 2(1-L);$

$\}$

if $(S == 0)\ H = undefined;$

else $\{$

if $(C_{max} == R)\{$

$$H = \left(\frac{G-B}{\Delta} \times 60\right);$$

if$(H<0)\ H+=360;$

$\}$

else if $(C_{max} == G)\{$

$$H = \left(\frac{B-R}{\Delta} \times 60\right) + 120;$$

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else $\{$

$$H = \left(\frac{R-G}{\Delta} \times 60\right) + 240;$$

$\}$

RGB to HSL

R	G	B	H	S	L
0.3	0.97	0.67			