Color Images

Color

Color Depth

Color Space

RGB

Additive color

Subtractive Color

Color Channels

24 bit

LUT

Color Depth

The range of color values that can be represented by a single pixel/voxel.

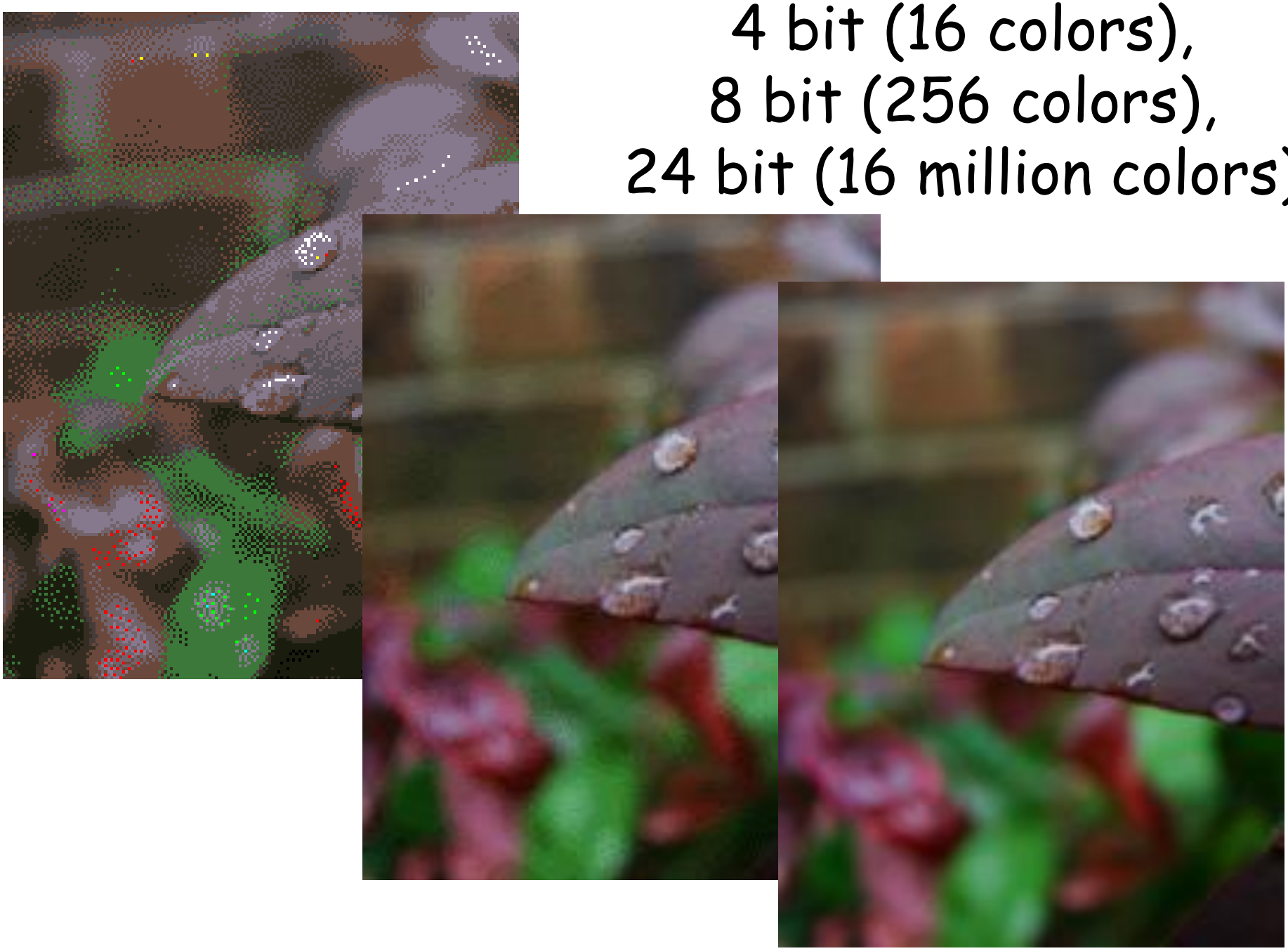
More values (depth) make a nicer picture.

Each pixel/voxel making up the image increases in size as color depth is increased.

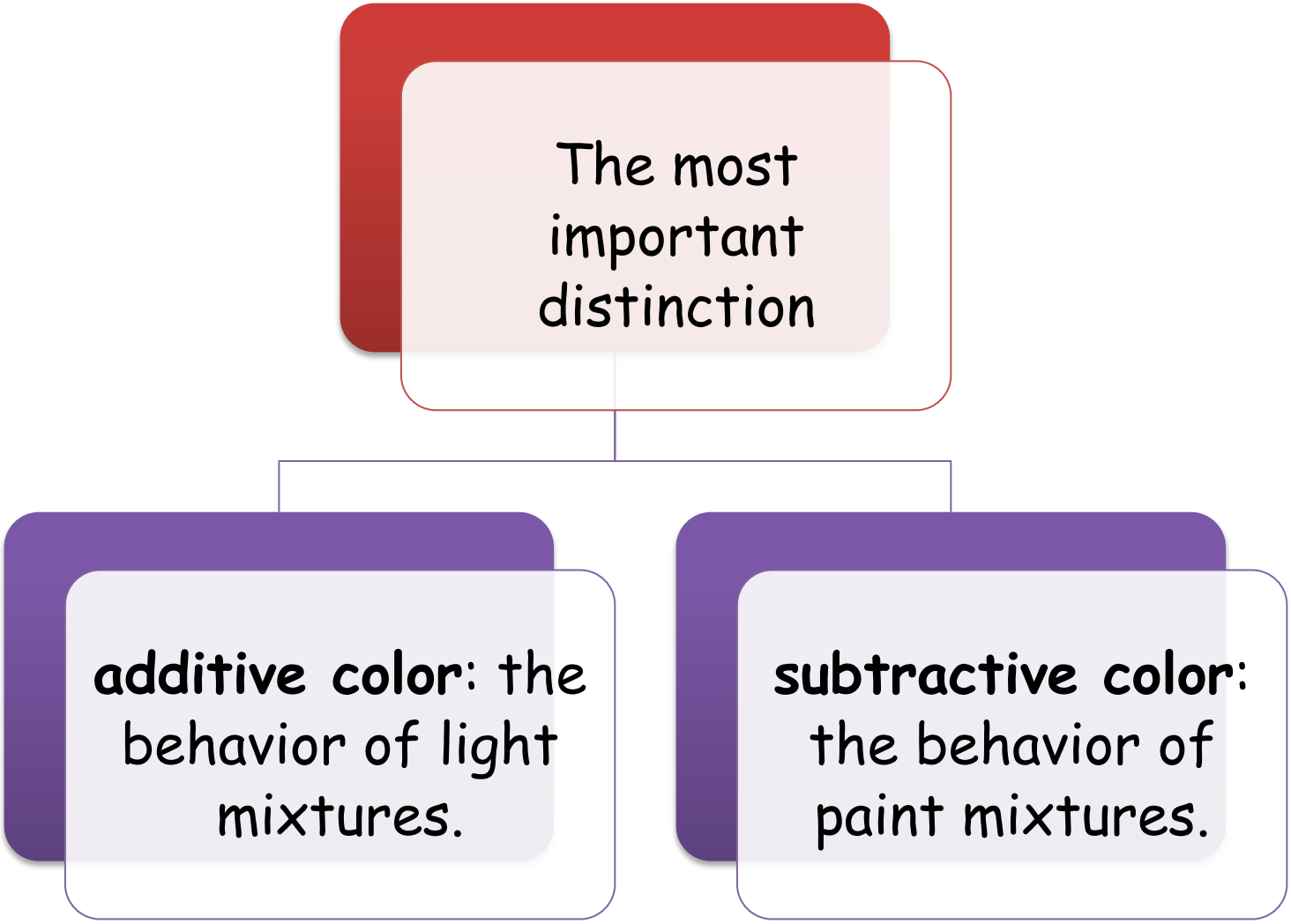
An 8-bit pixel (1 byte) can store 256 colors

a 24-bit pixel/voxel (3 bytes) can store 16 million colors.

4 bit (16 colors),
8 bit (256 colors),
24 bit (16 million colors)

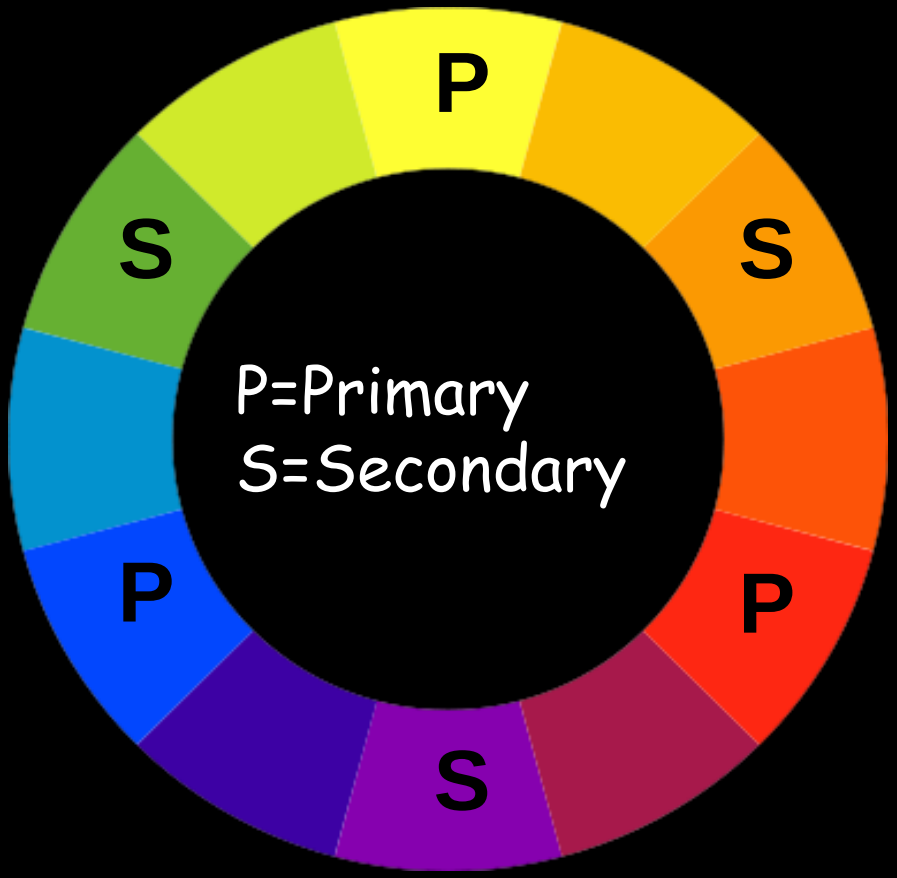


Representing Color in Images



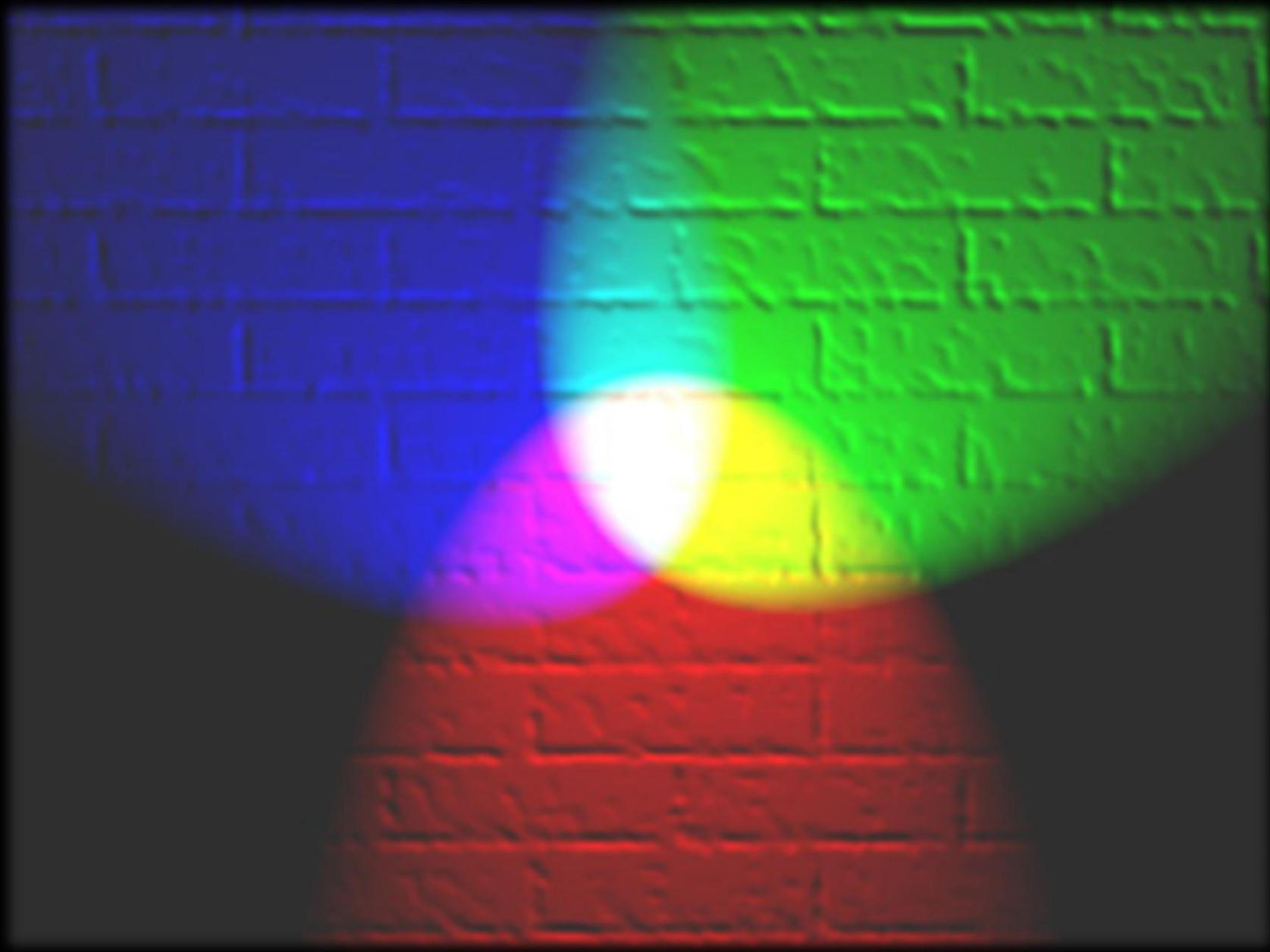
This distinction arises because the absorption of light by materials like paint follows different rules than the perception of light by the eye.

Subtractive Color (e.g., paint): primary colors, Red, Yellow & Blue combine to form the other colors



The RGB color model is additive.

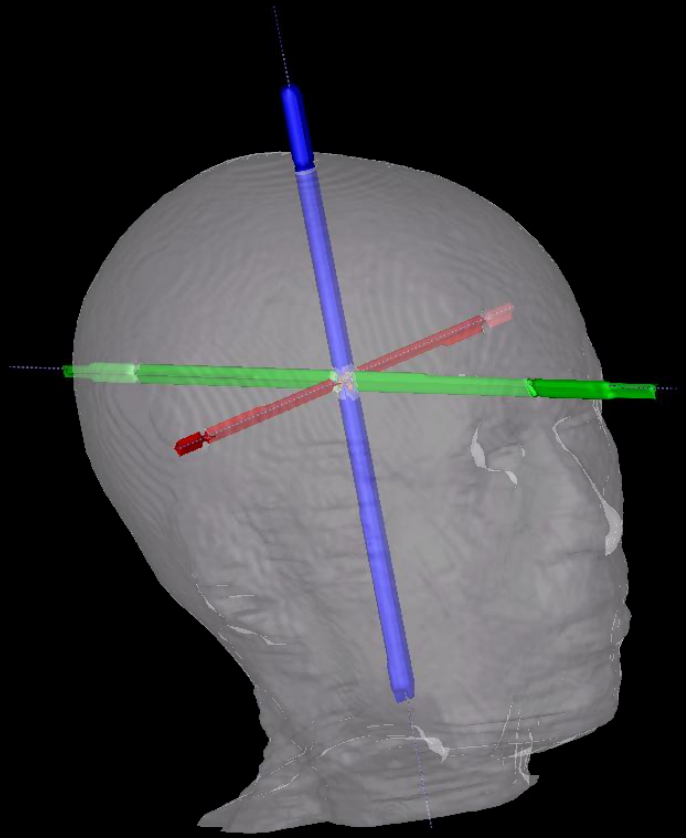
Red, **Green**, and **Blue** light are added together to reproduce a broad array of colors.

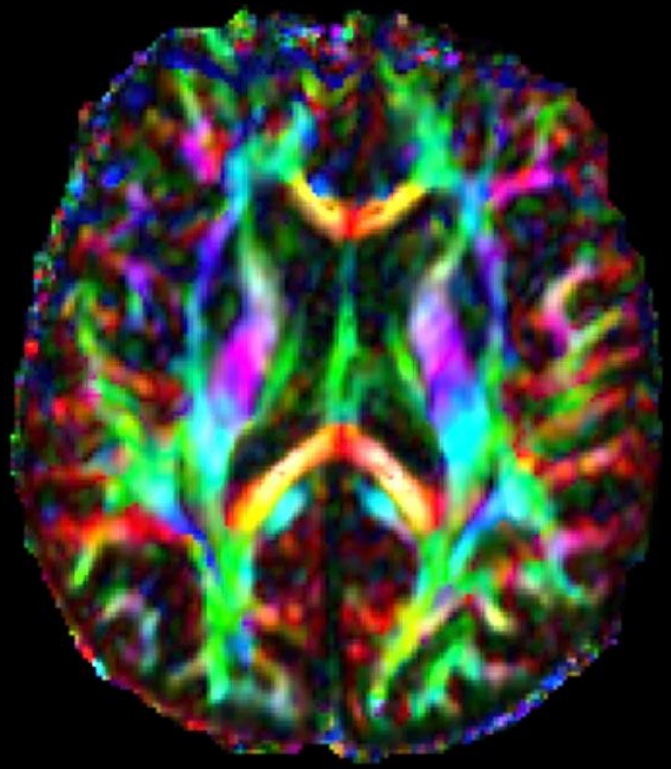


The RGB model is common and useful.

One variety of MR image, the Diffusion Tensor Image (DTI), uses the RGB color model to represent fiber direction.

DTI Images

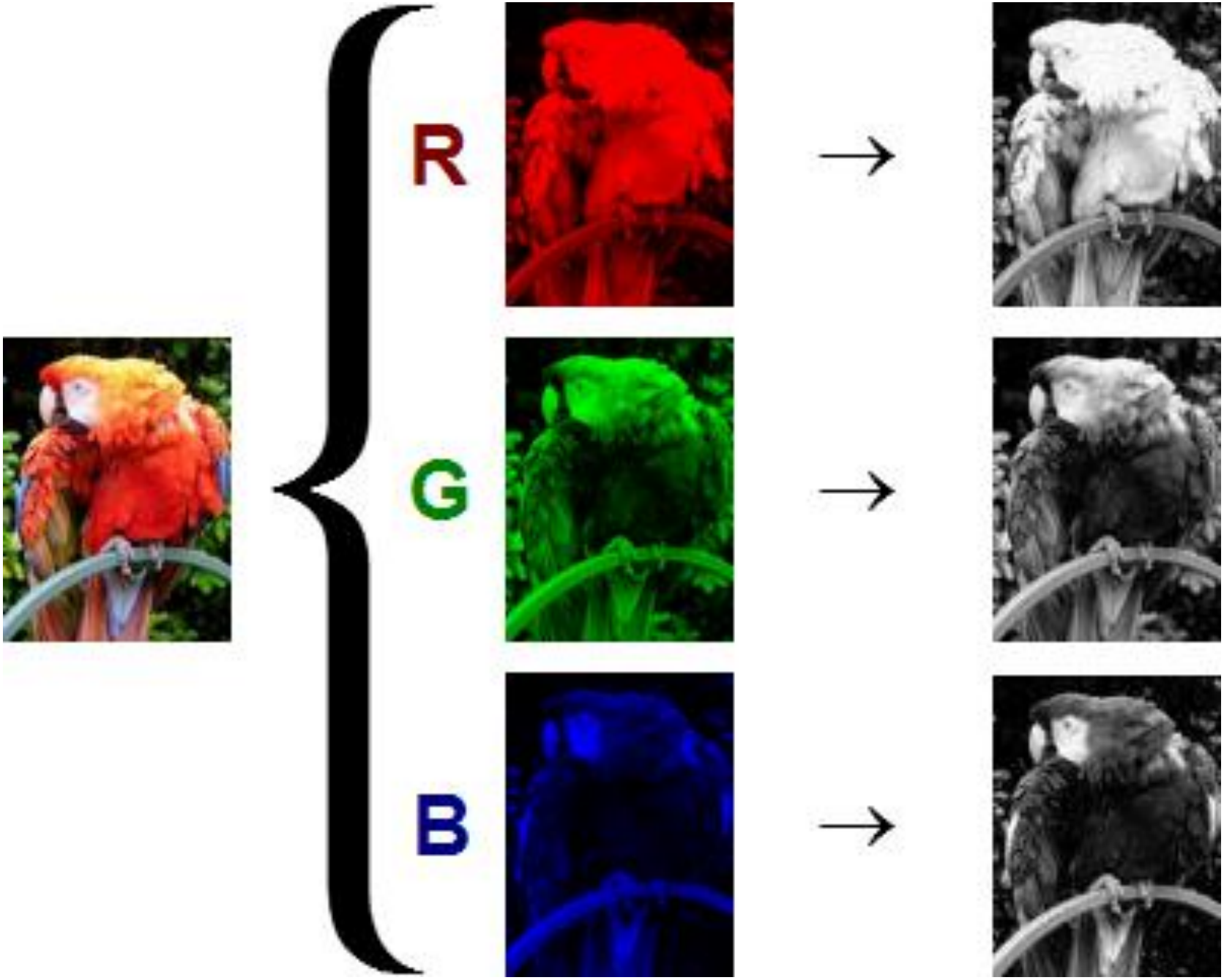


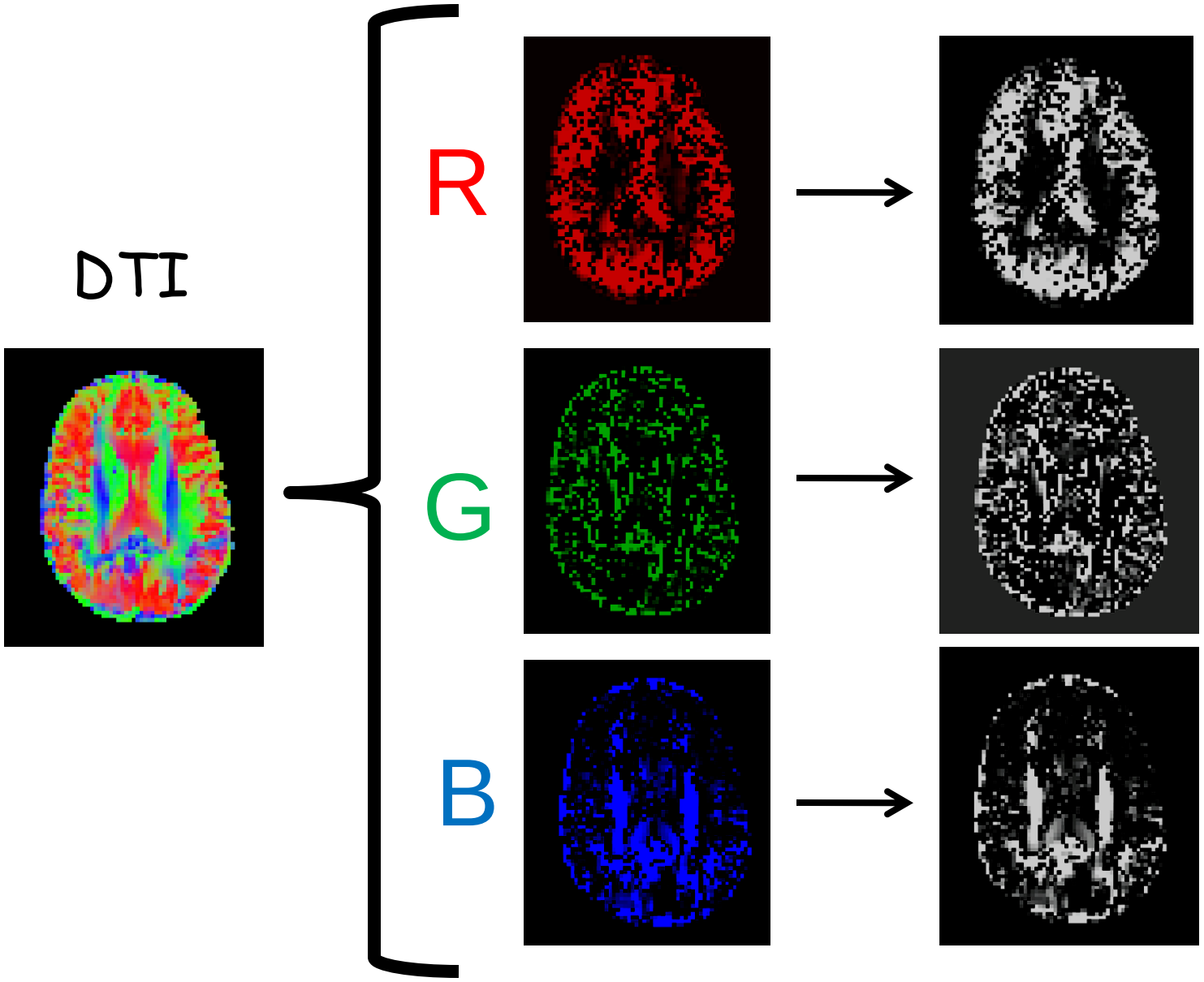


In addition to DTI, you will find many software tools that give you control over color that assumes you understand the RGB model.

RGB images are composed of three independent channels for red, green and blue components.

Because each channel is a single sample, they can be managed easily as independent grayscale images.

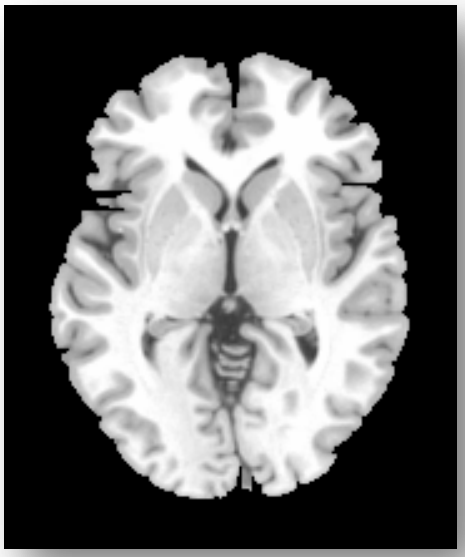

R
G
B

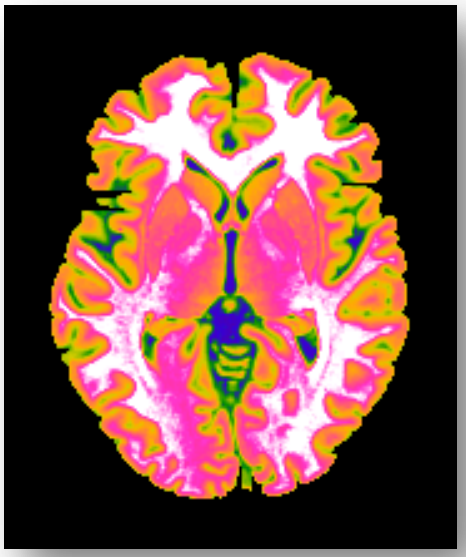

DTI
R
G
B

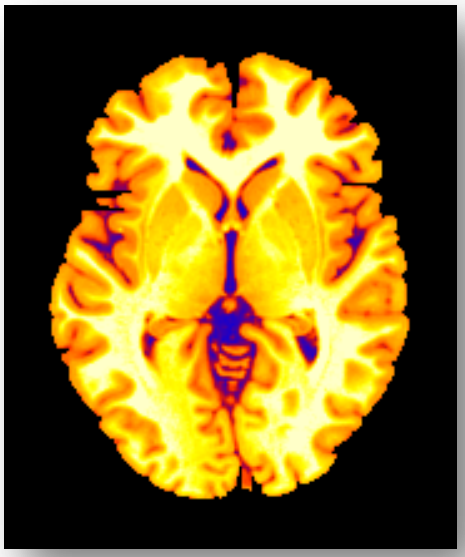
- RGB images are normally 24 bit.
- They consist of three 8-bit channels. (8*3=24)
- Like other 8-bit images, each channel's values range from 0-255.
- So, any RGB color can be expressed as a combination of three values, in order, Red, Green and Blue

Red	Green	Blue	Result
0	0	0	
255	255	255	
255	0	0	
0	255	0	
0	0	255	
255	255	0	
255	0	255	
0	255	255	

Since pixel/voxel values are stored as numbers, it is possible to assign a new set of colors to those numbers and change the look of the picture.

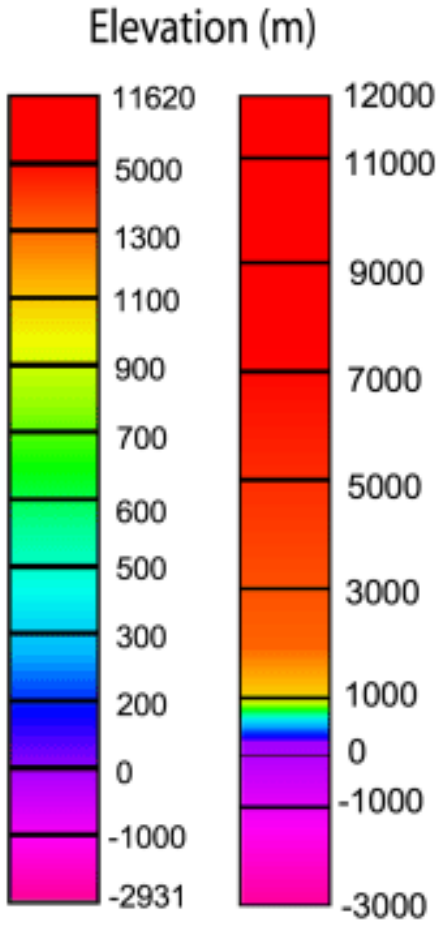




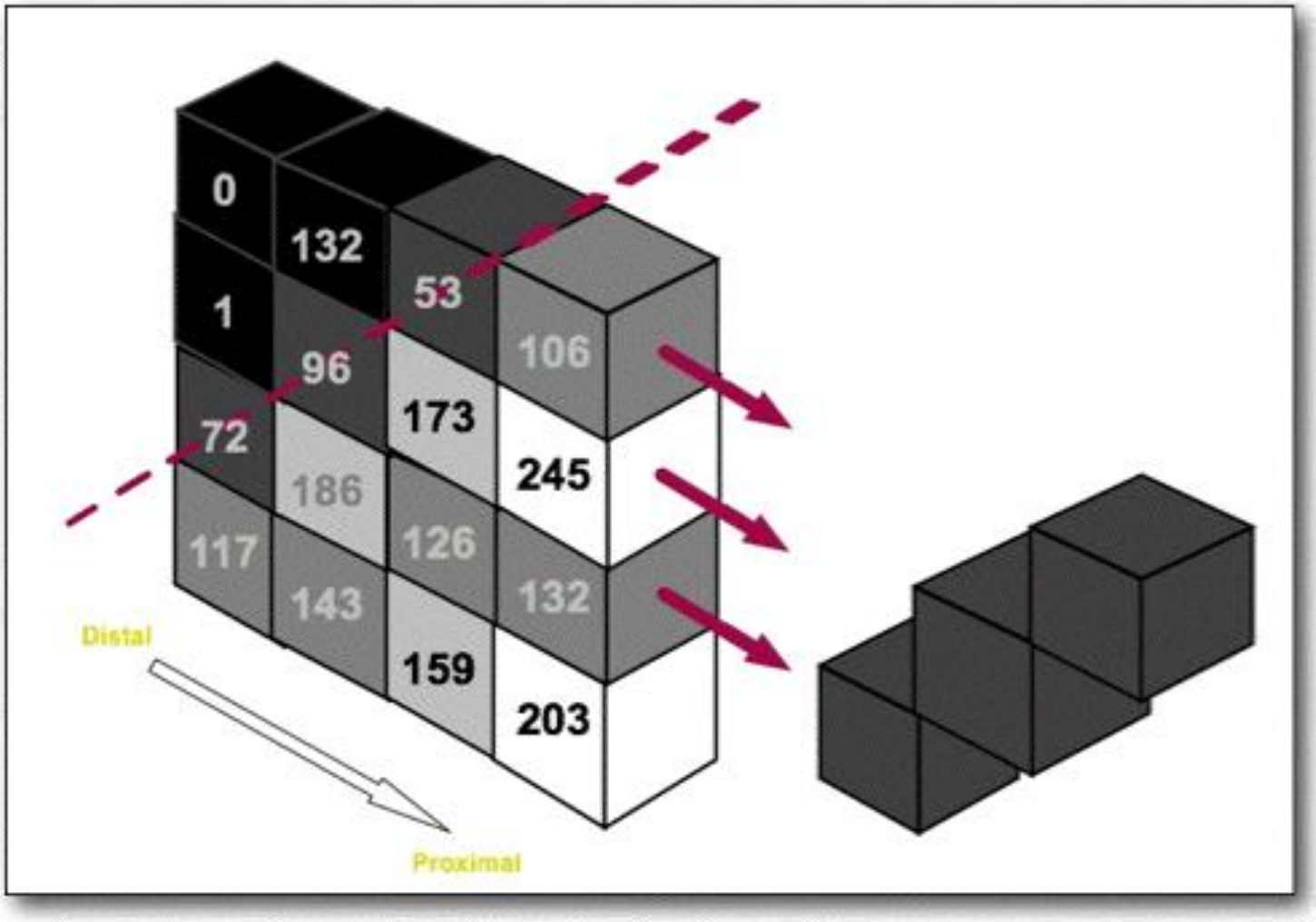


This remapping is accomplished by changing the Lookup Table (LUT).

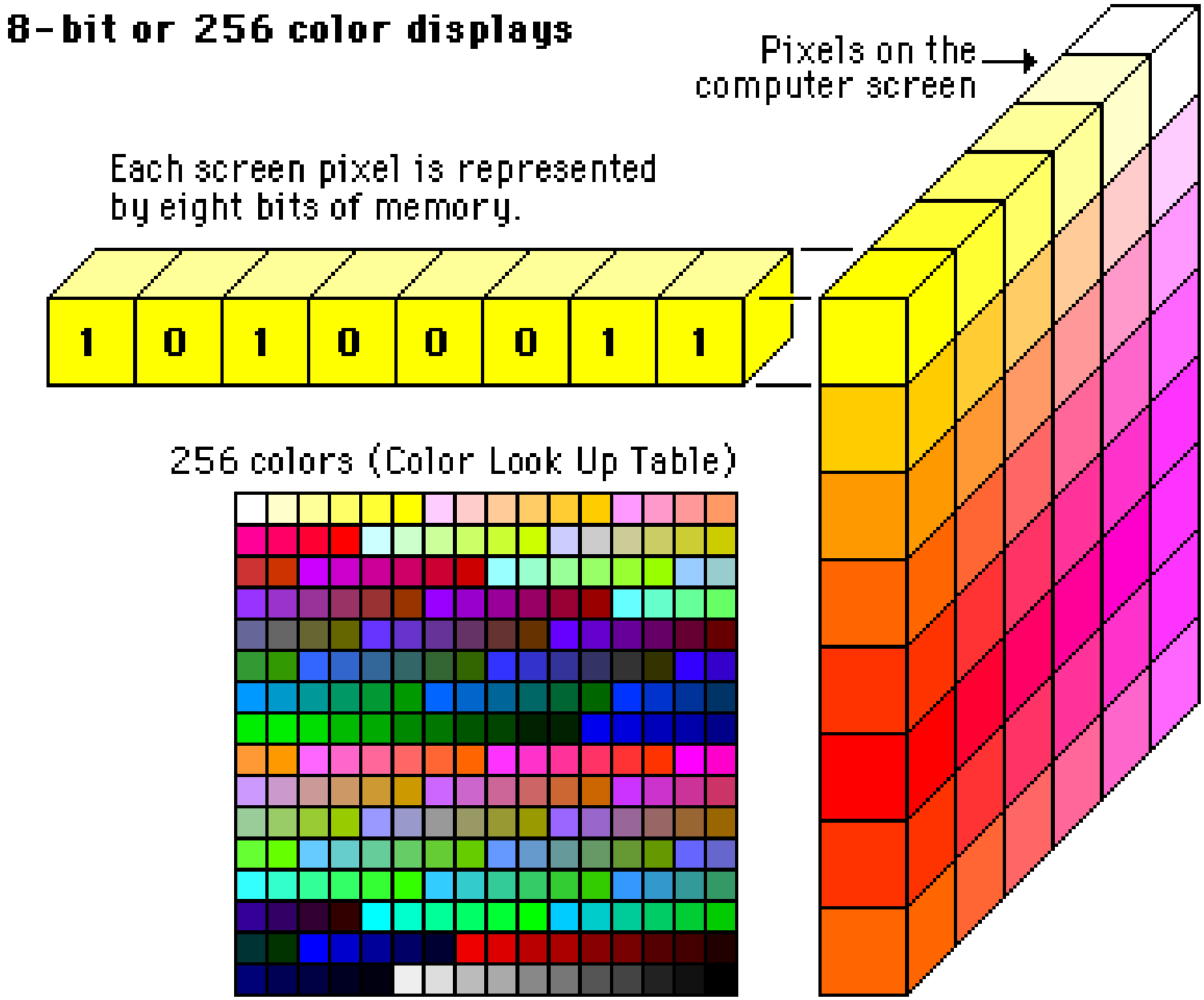
A LUT maps colors to numbers; or grayscale to numbers.



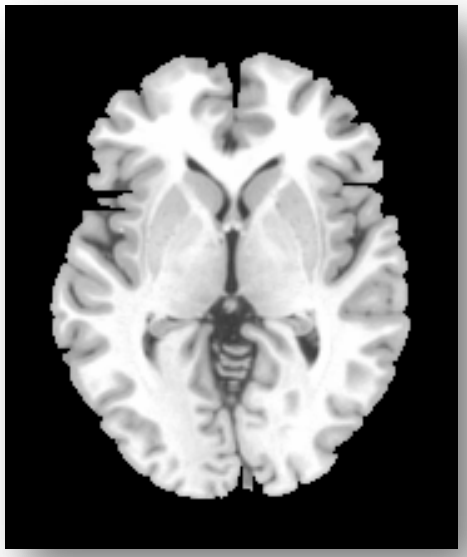
Intensity Values

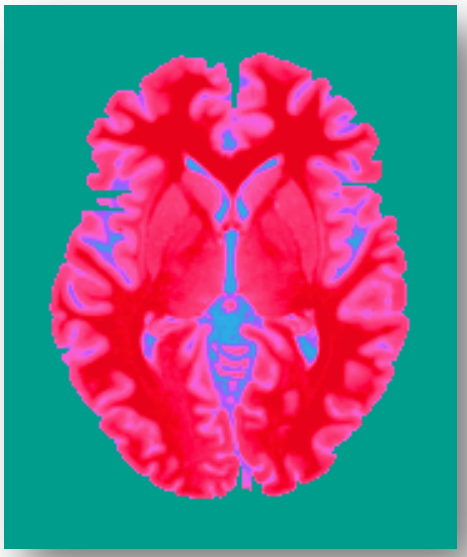


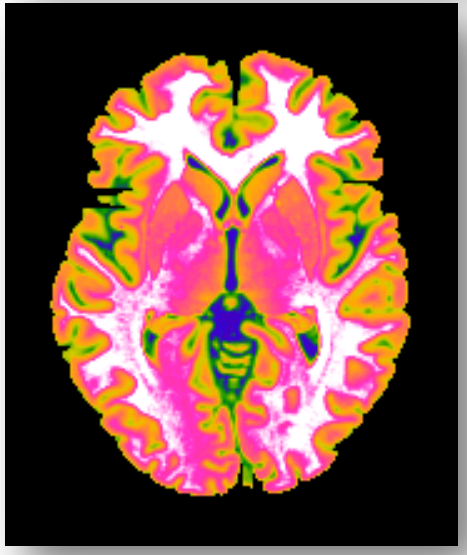
8-bit or 256 color displays

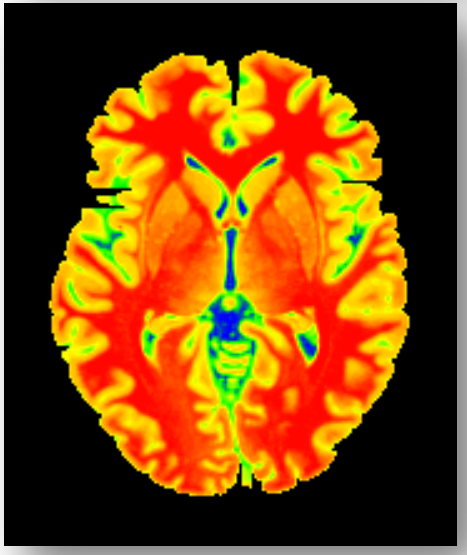


Here's the same brain slice, with different LUTs:









Summary

RGB color space is additive rather than subtractive.

If you work with color images then you need to understand the RGB color space

RGB images contain 3 channels, usually 8 bit images, representing the intensity of each color.

Finally, every image has a **L**ook **U**p **T**able, the table of colors used for the various values stored in the pixels.

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