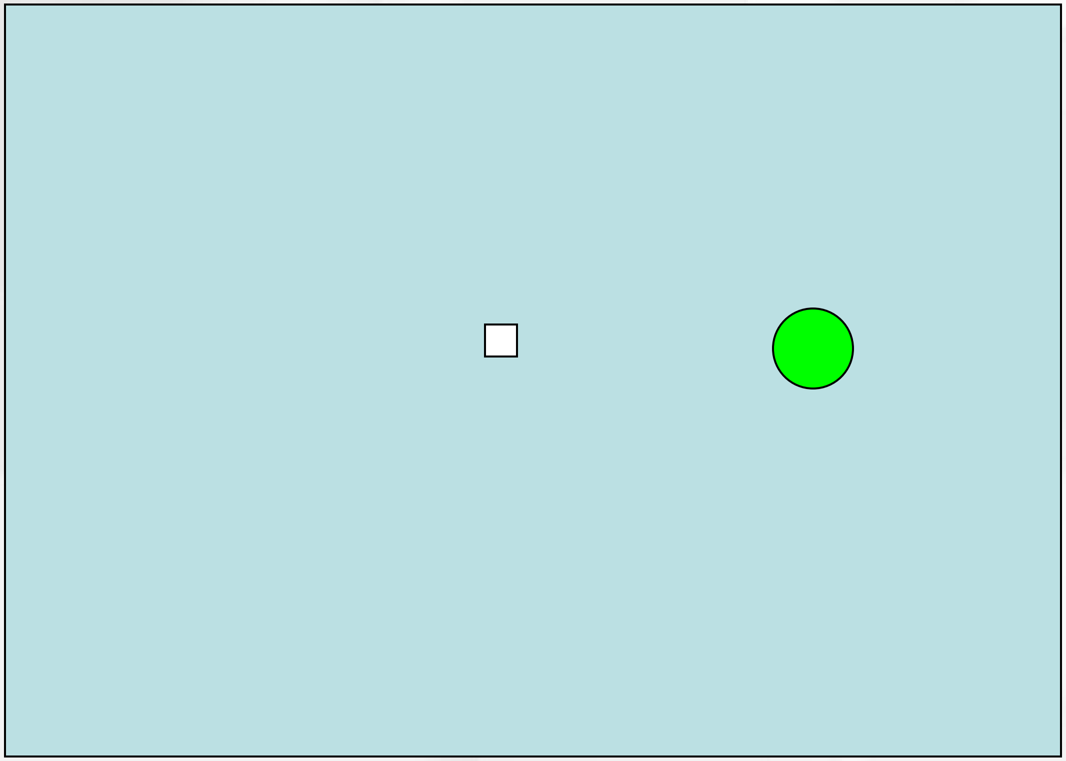
Blindsight: What happens when V1 is damaged?

- Individuals who have experienced a stroke that has selectively damaged area V1, or who have had V1 removed surgically, report being blind in the affected part of visual space (e.g., damage to left V1 affects the right visual field).
- However, if these individuals are asked to point to an object to reach out and grasp an object in the "blind" field, they can do so accurately, even though they claim they are just guessing.

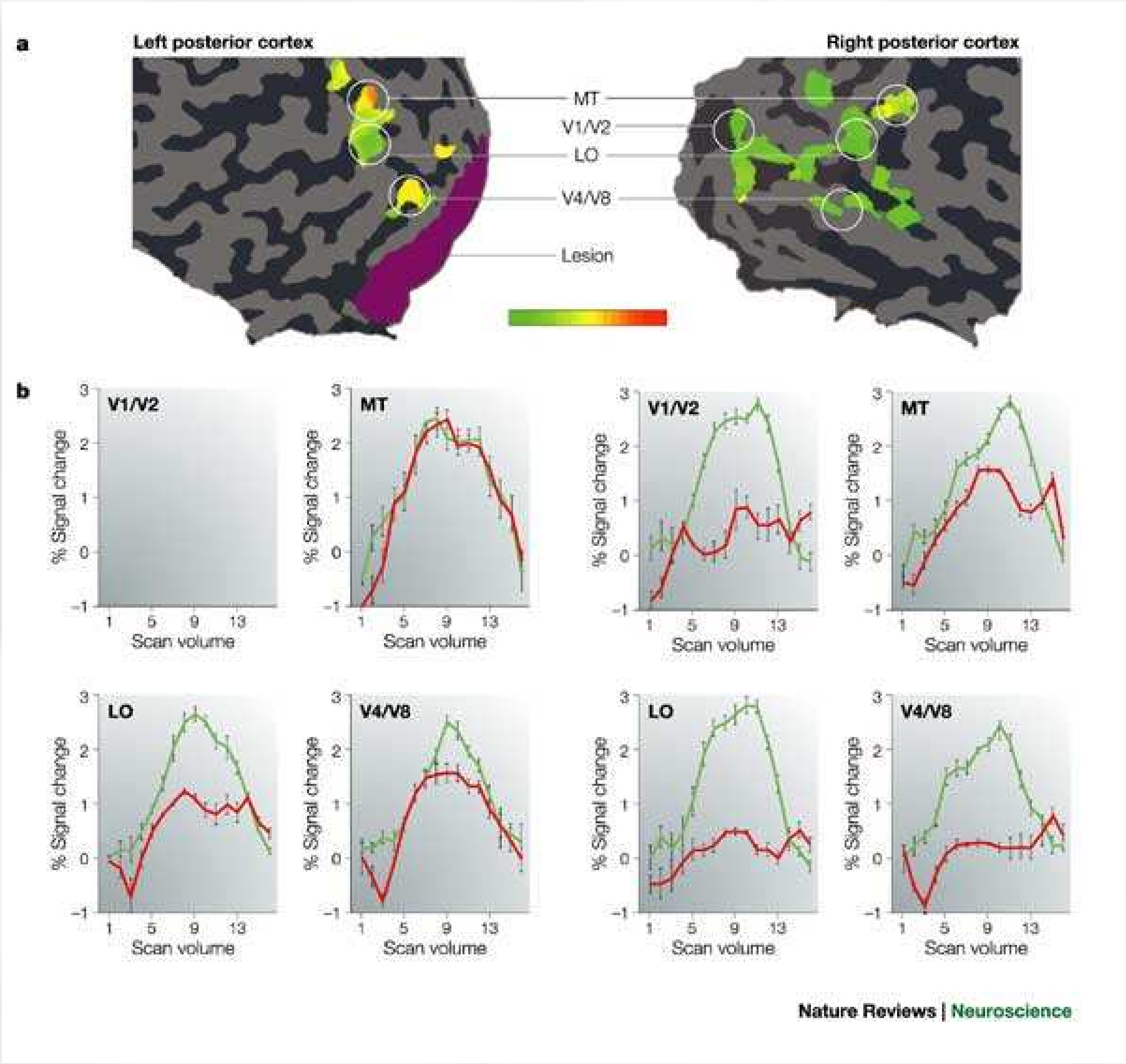
Blindsight: What happens when V1 is damaged?

- Similarly if they are asked to report on an object in the good visual field, the presentation of objects in the impaired field can influence those reports (e.g., responses to objects in the good field are slowed down when another object is presented at the same in the bad field compared to when it is shown alone).
- Some visual information is getting through to the parts of the brain that control action, but not entering awareness.
- Does this mean that V1 is necessary for visual awareness?

Blindsight patient GY has a lesion in left V1. He reports being blind to objects in the right visual field, yet he can correctly point to and grasp them.



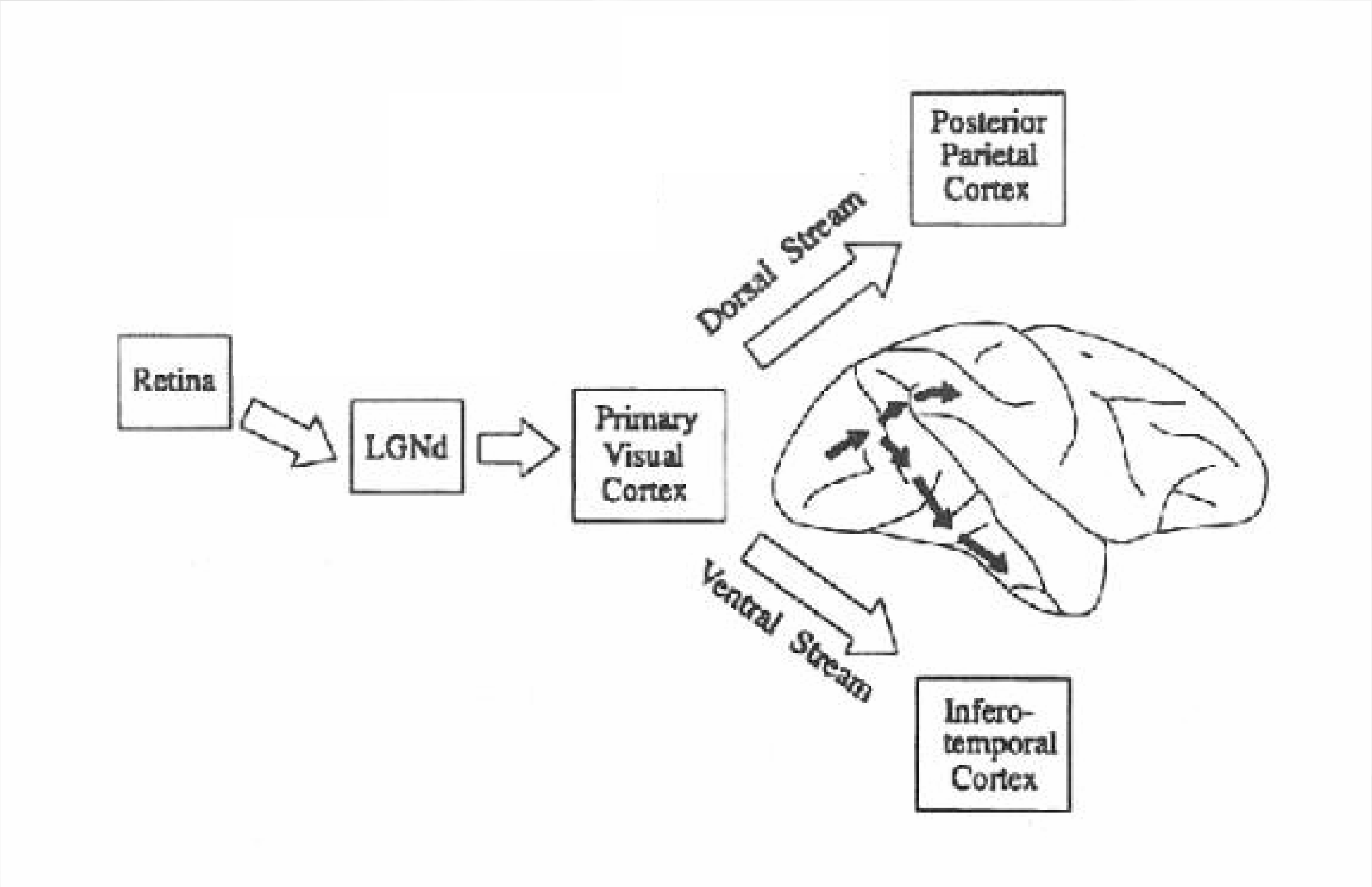
These fMRI scans show robust activity in extrastriate visual areas when stimuli were presented in the ‘blind’ region.



Without V1, how did these signals get to the dorsal pathway?

There's a second pathway to the dorsal stream that bypasses V1!

Retina – Superior Colliculus - Pulvinar

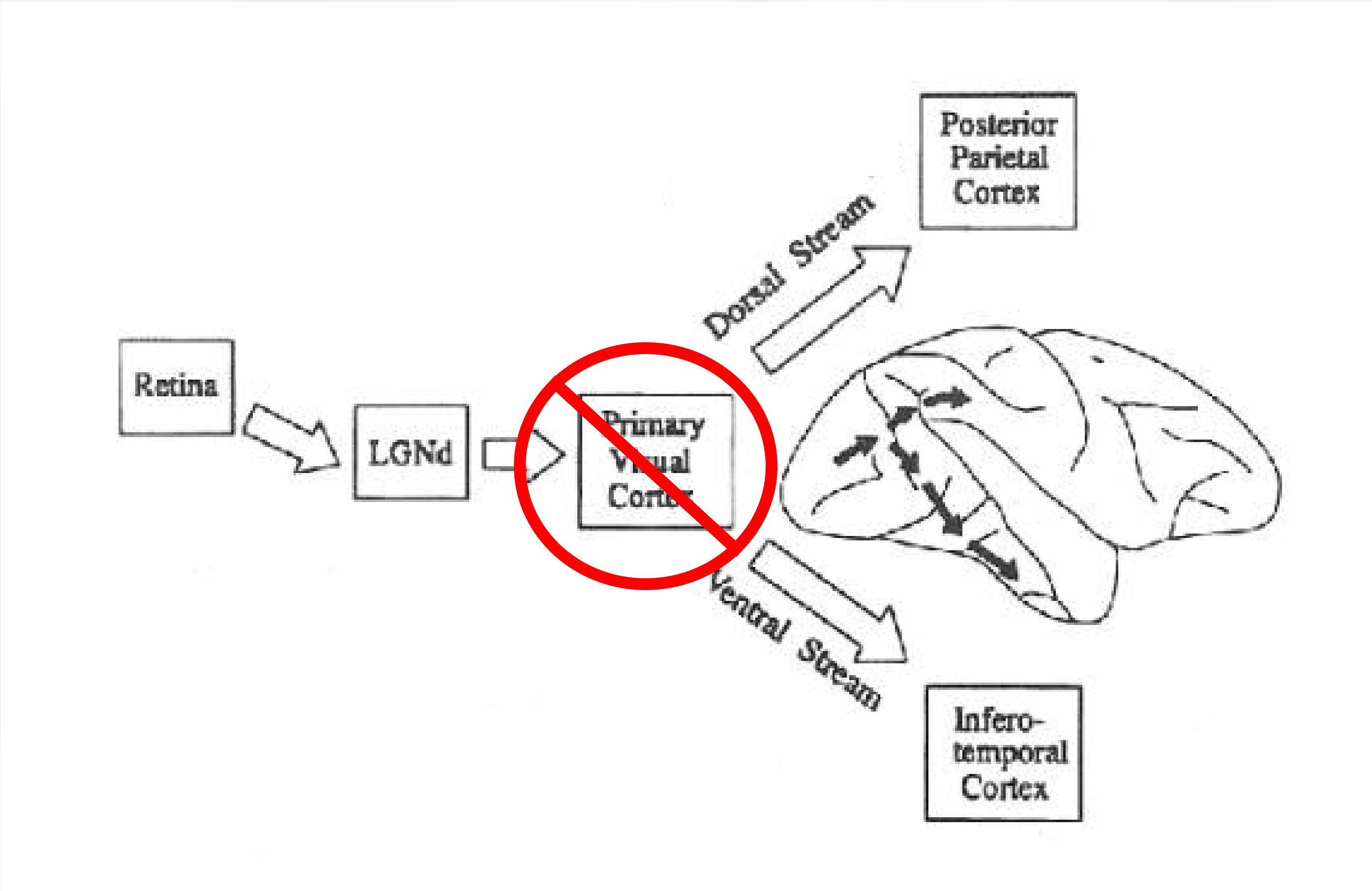


So damage to V1 can lead to sight without awareness (blindsight).

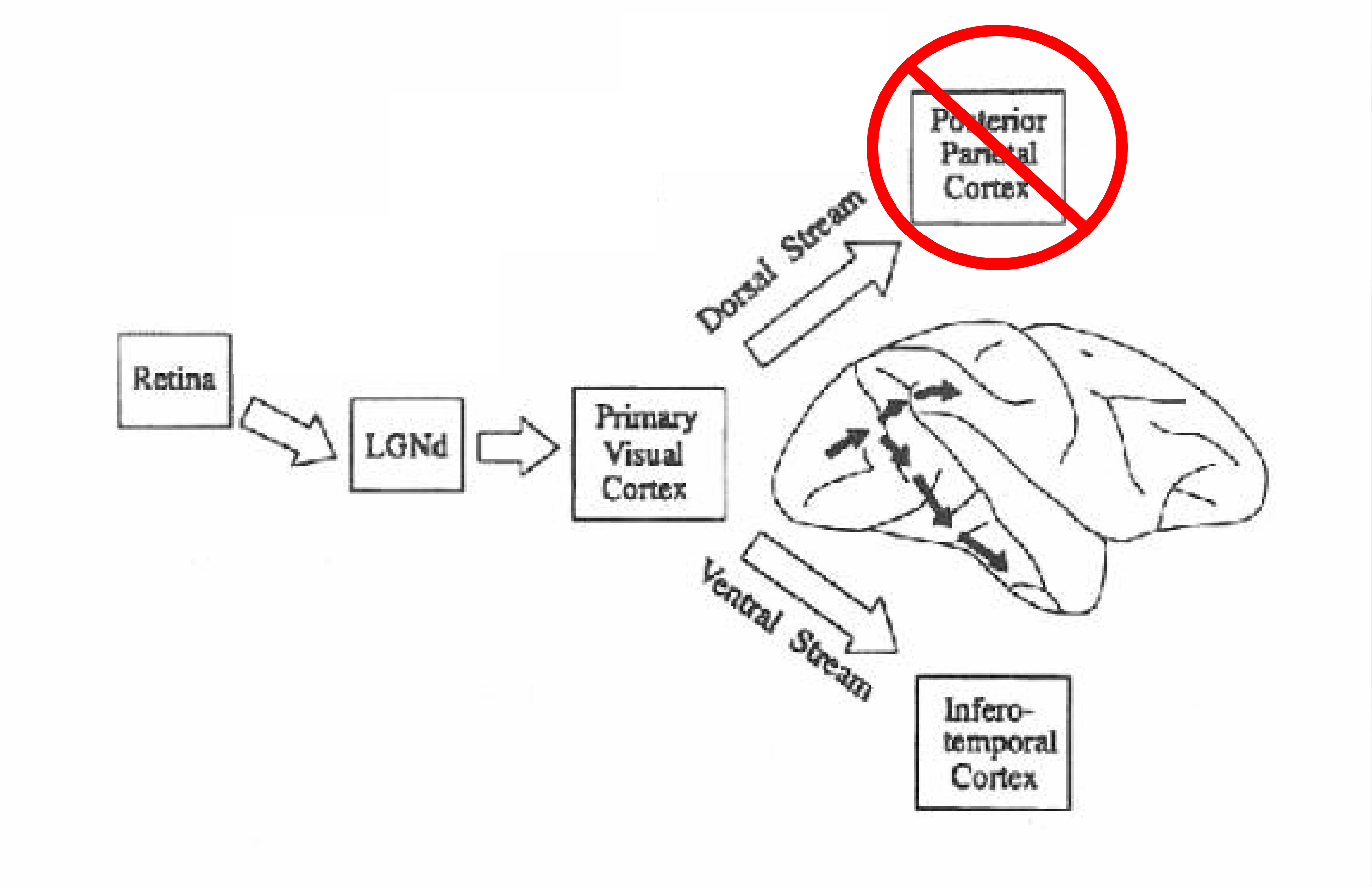
But damage to the (usually right) parietal lobe can lead to the opposite problem, called ***anosognosia*** – which is when you don't know that you don't know something.

These patients can be blind, but insist that they can see. They'll often confabulate stories or excuses to prevent them from demonstrating their disability.

This means that an intact V1, but a damaged parietal lobe can lead to awareness without sight!

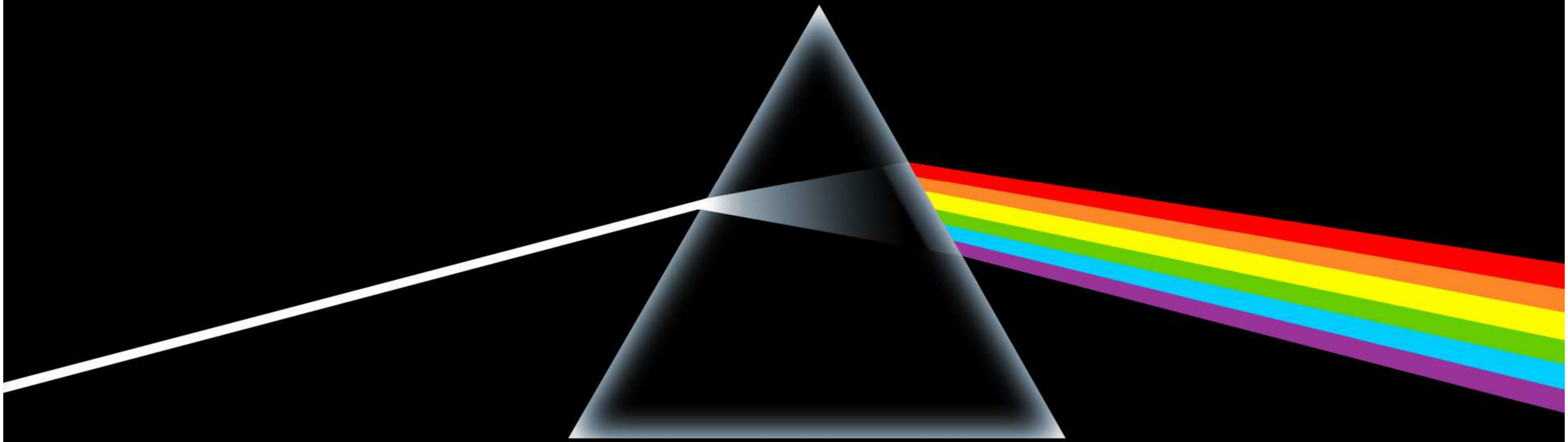


Damage to V1:
Some sight without awareness

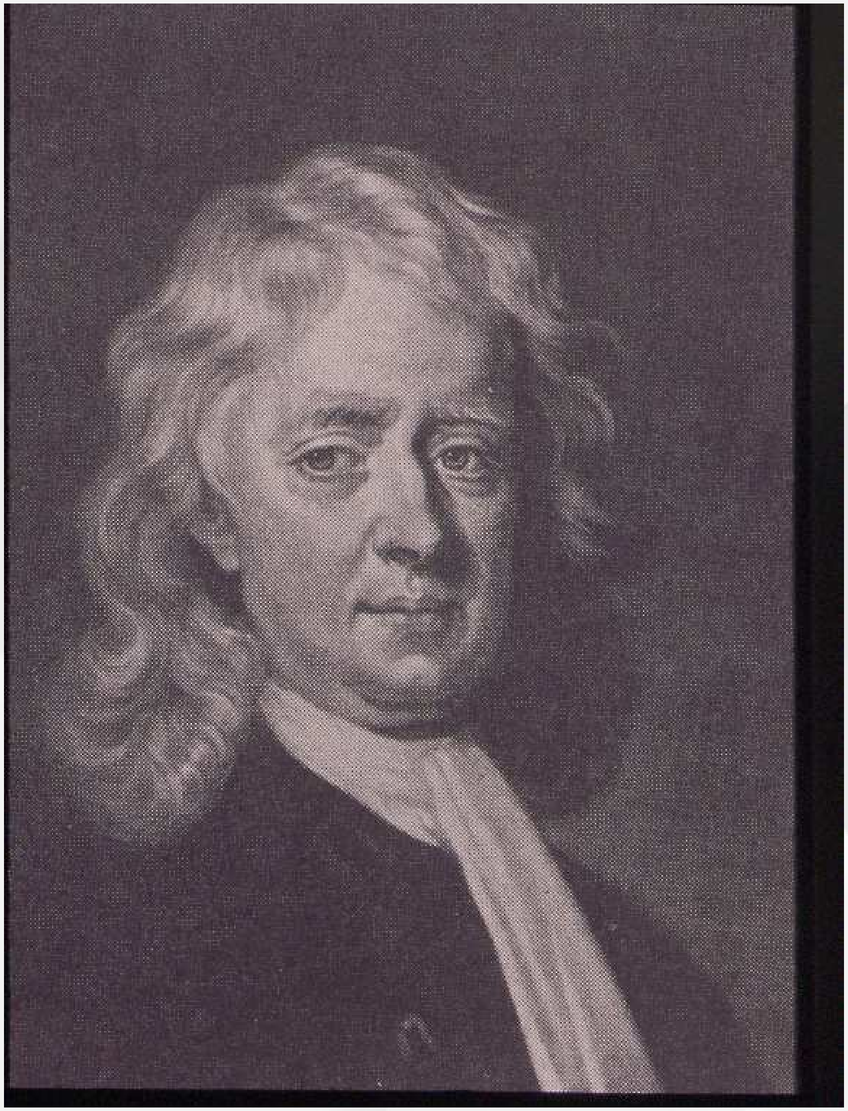


Damage to parietal cortex (dorsal stream):
Awareness without sight

Chapter 7: Perceiving Color

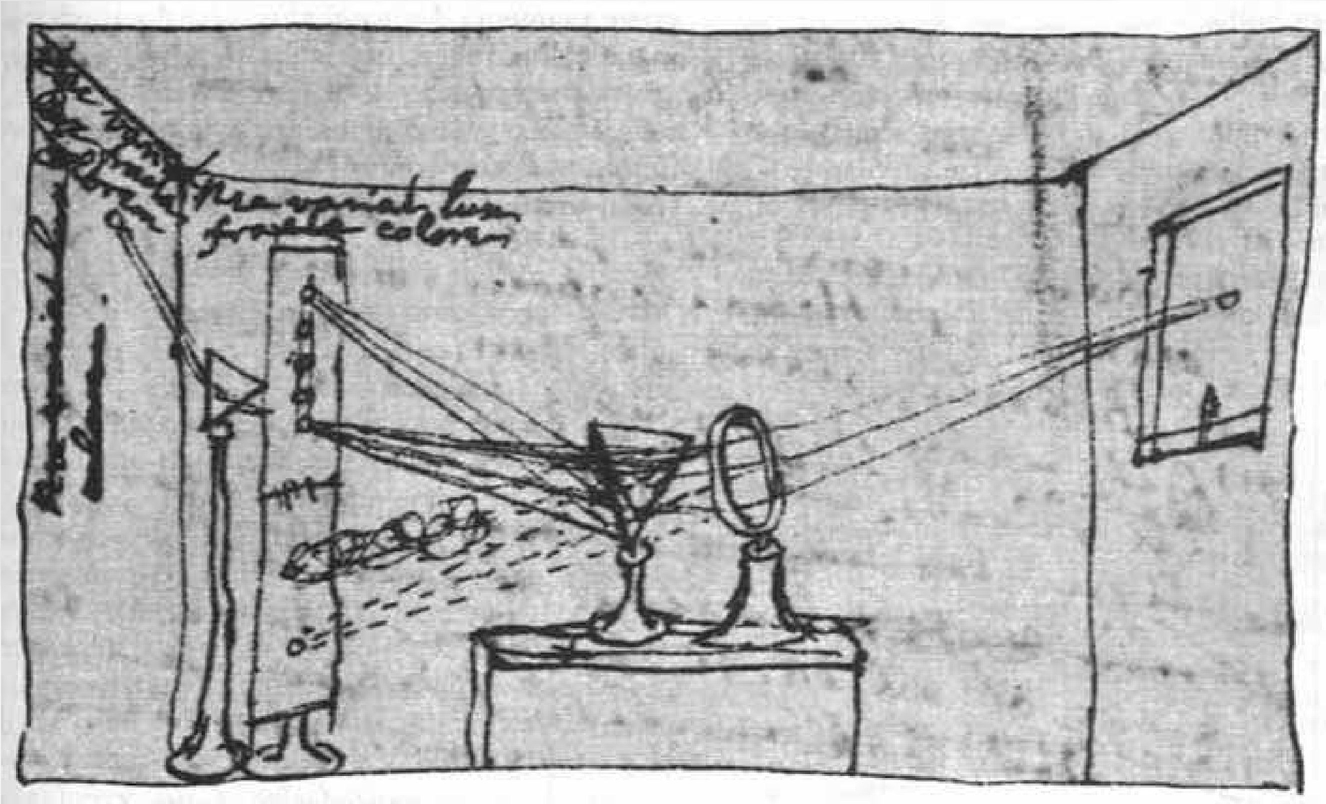


-The physical dimensions of color
-The psychological dimensions of color appearance
(hue, saturation, brightness)
-The relationship between the psychological and physical dimensions of color
(Trichromacy Color opponency)
- Other influences on color perception
(color constancy, top-down effects)

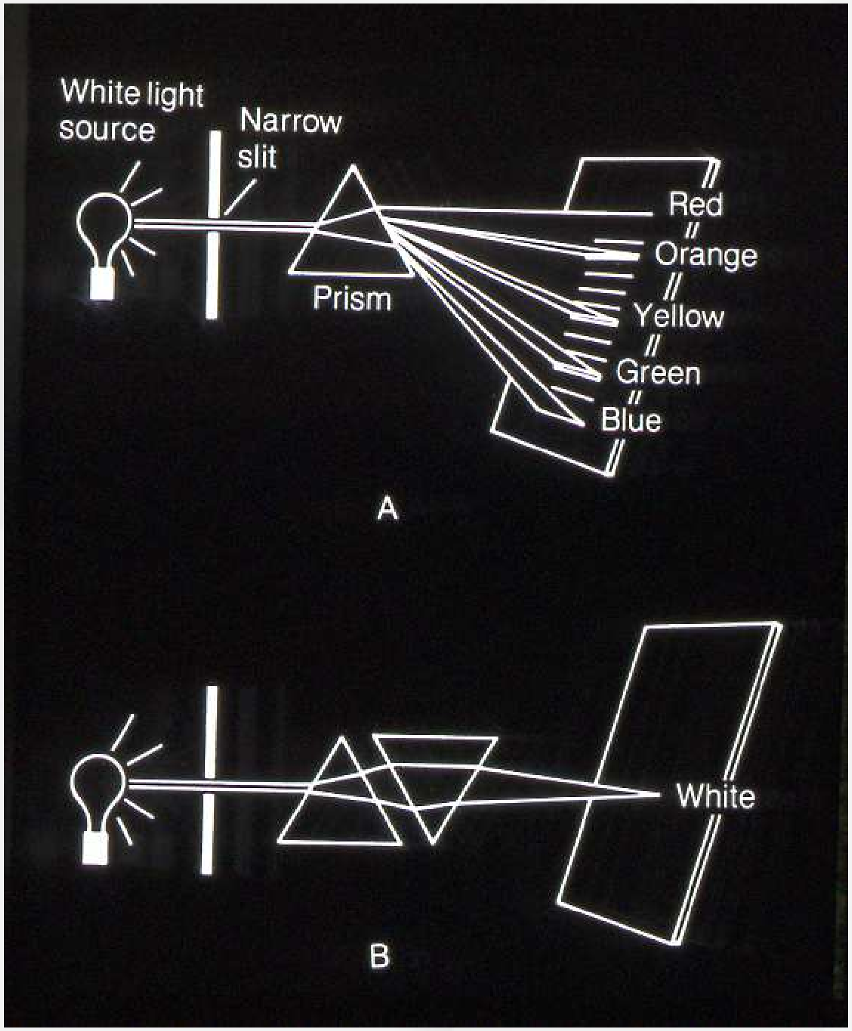


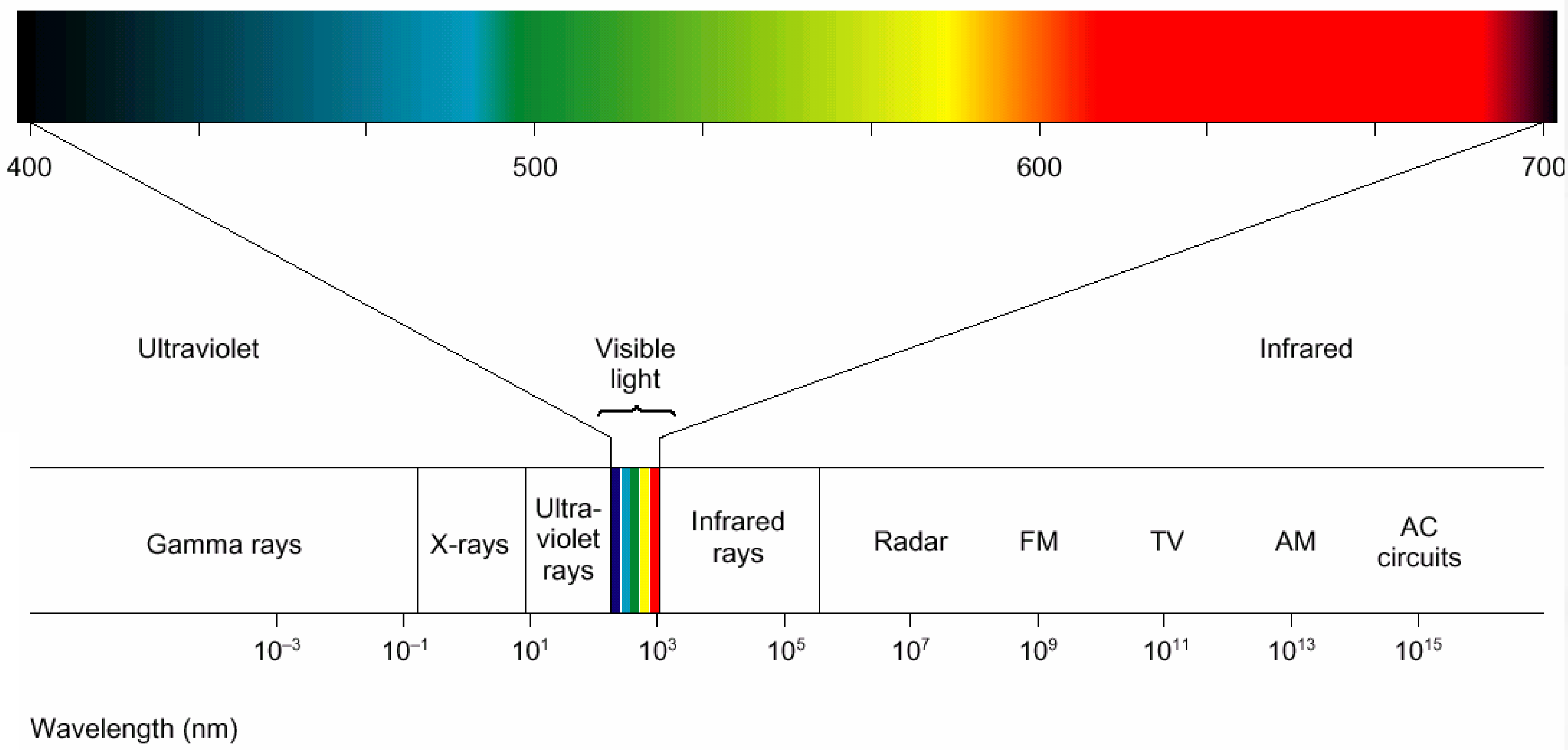
Sir Isaac Newton

Newton’s Prism Experiment (1704)



White light is composed of multiple colors





400
500
600
700
Ultraviolet
Visible light
Infrared
Gamma rays
X-rays
Ultra-violet rays
Infrared rays
Radar
FM
TV
AM
AC circuits
10^{-3}
10^{-1}
10^{1}
10^{3}
10^{5}
10^{7}
10^{9}
10^{11}
10^{13}
10^{15}
Wavelength (nm)

Light

Monochromatic light: one wavelength (like a laser)

Physical parameters for monochromatic light

1. Wavelength
2. Intensity

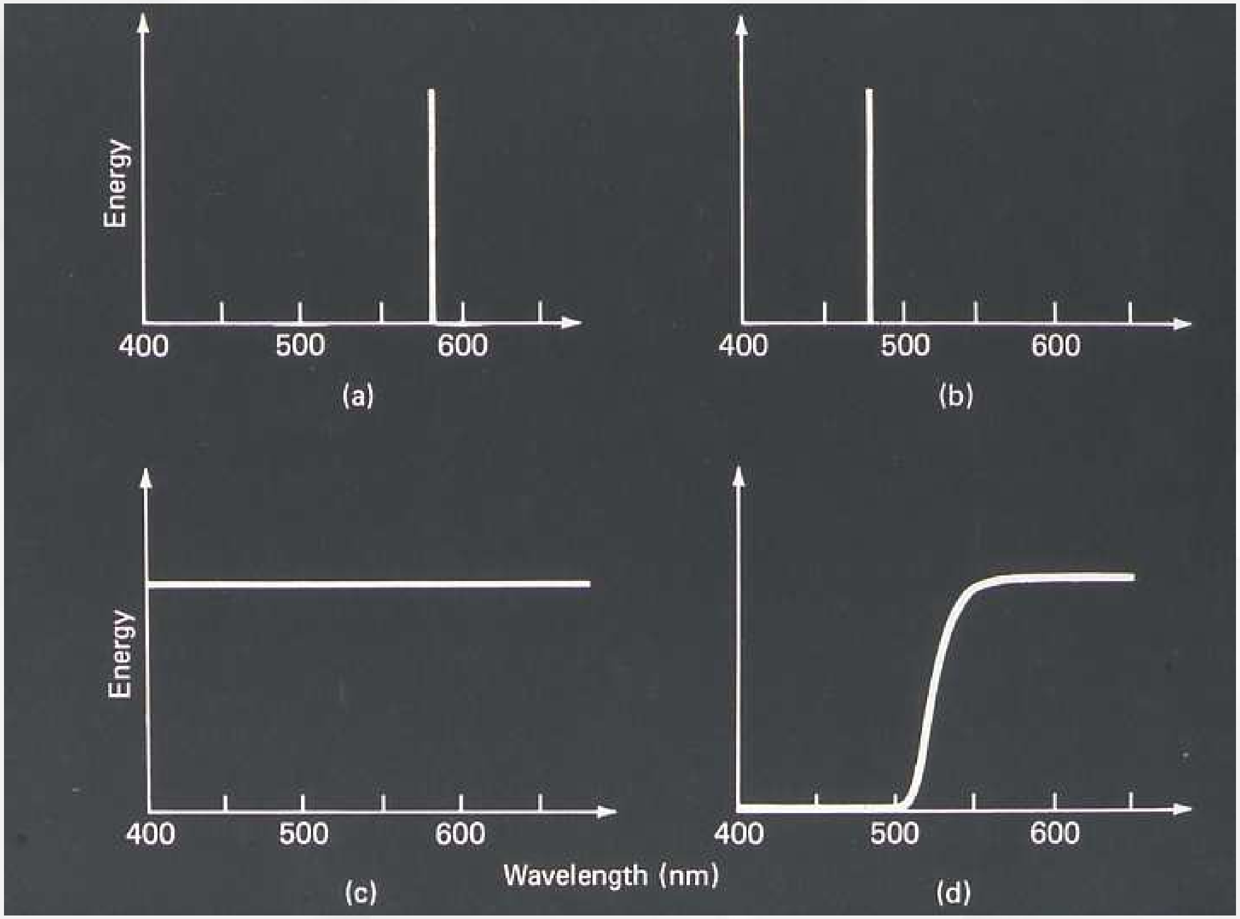
Heterochromatic light: many wavelengths (normal light sources)

For heterochromatic light

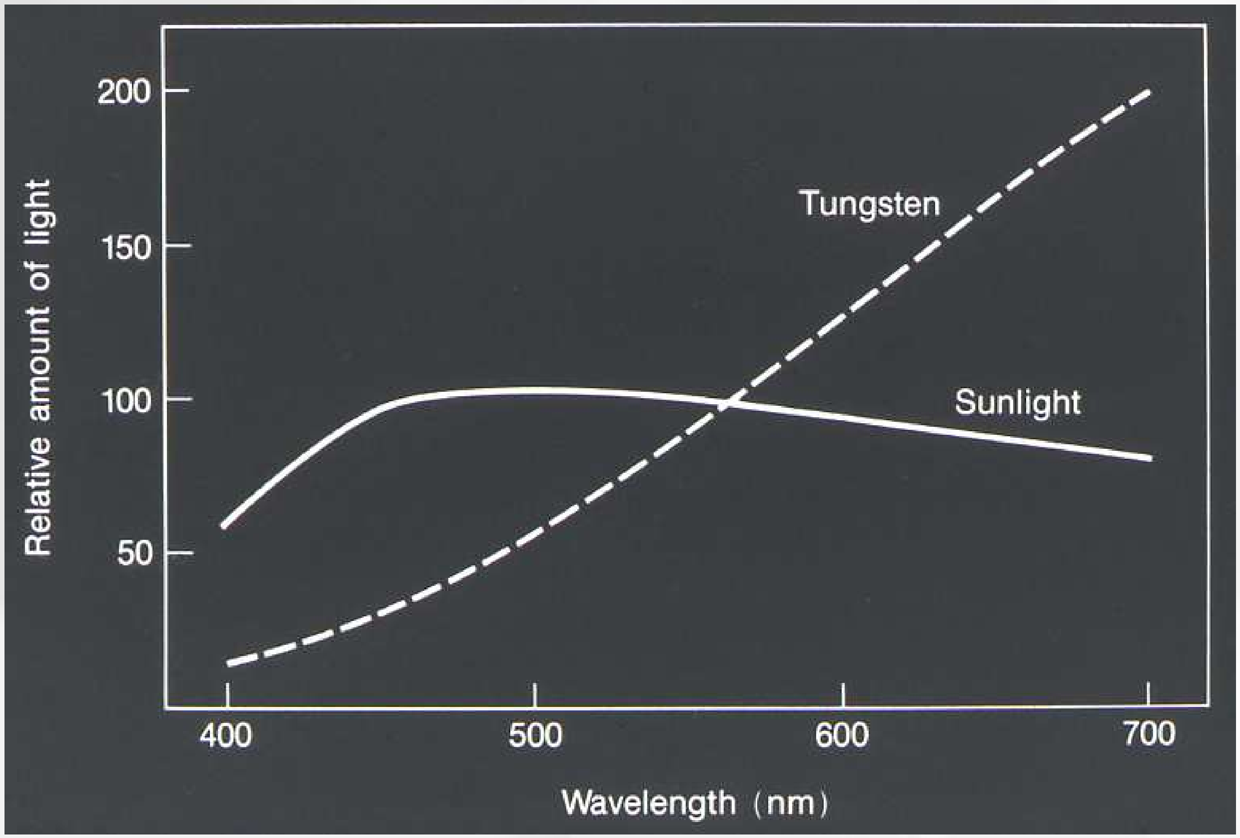
The spectral composition gives the intensity at each wavelength

Monochromatic light

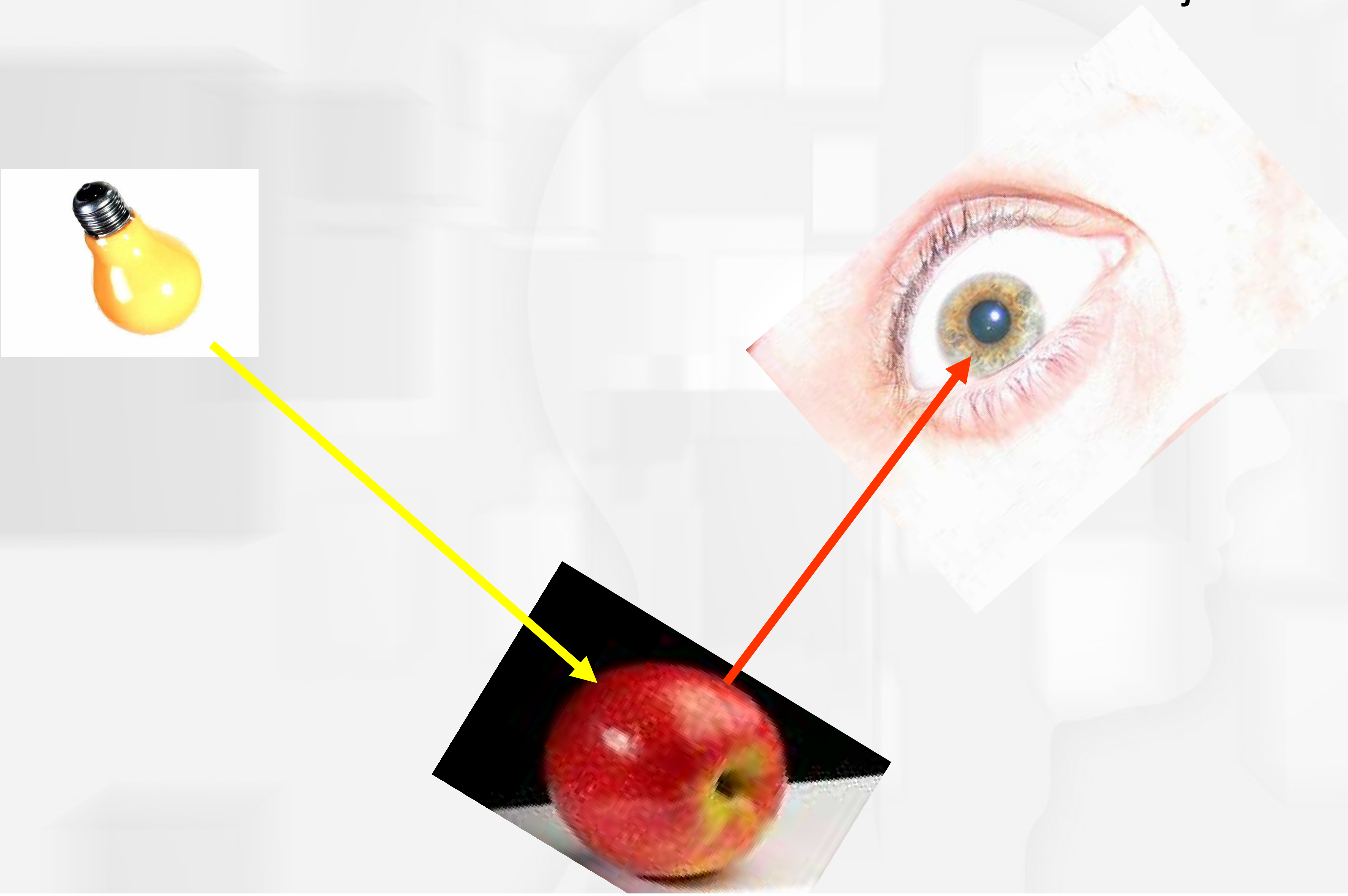
Heterochromatic light



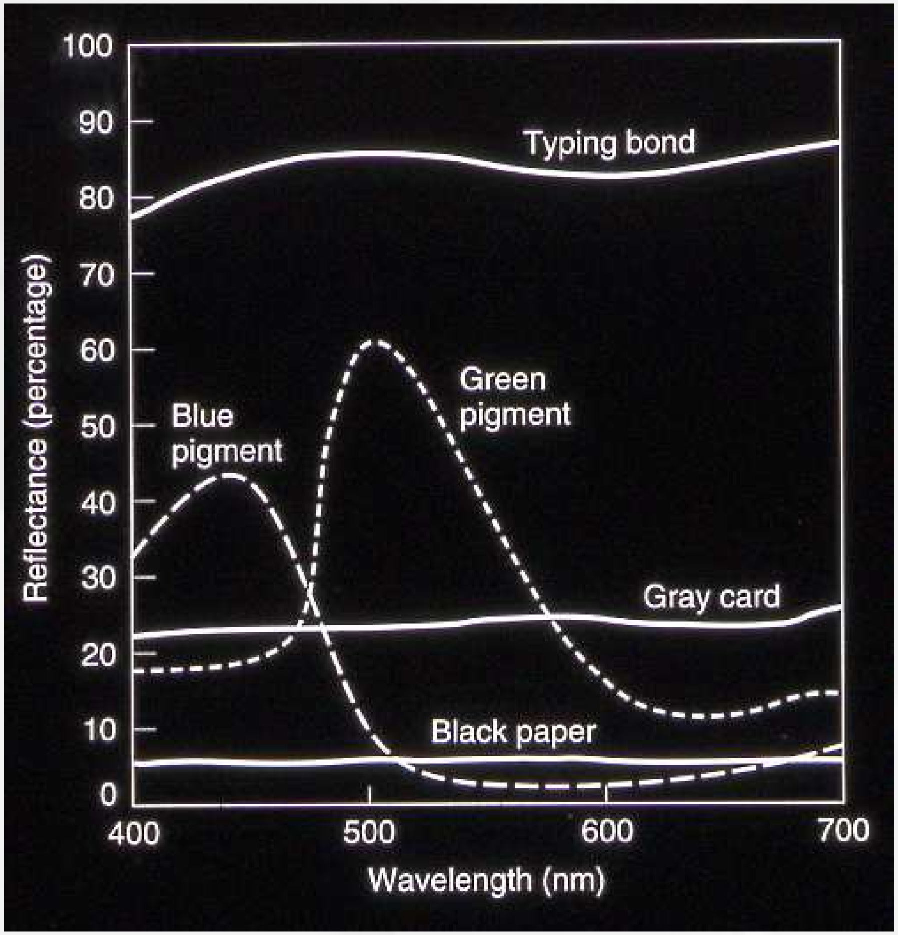
Spectral composition of two common (heterochromatic) illuminants

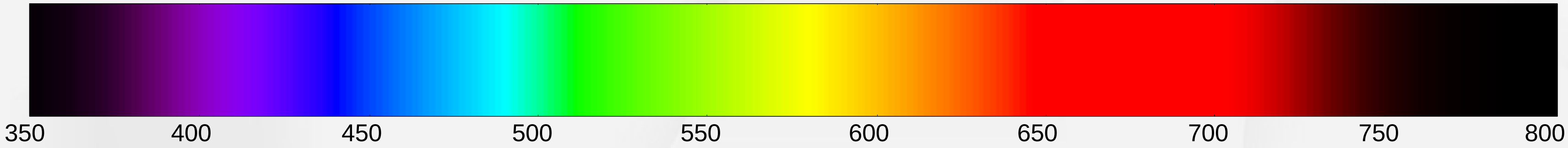


The spectral components of light entering the eye is the product of the illuminant and the surface reflectance of objects.

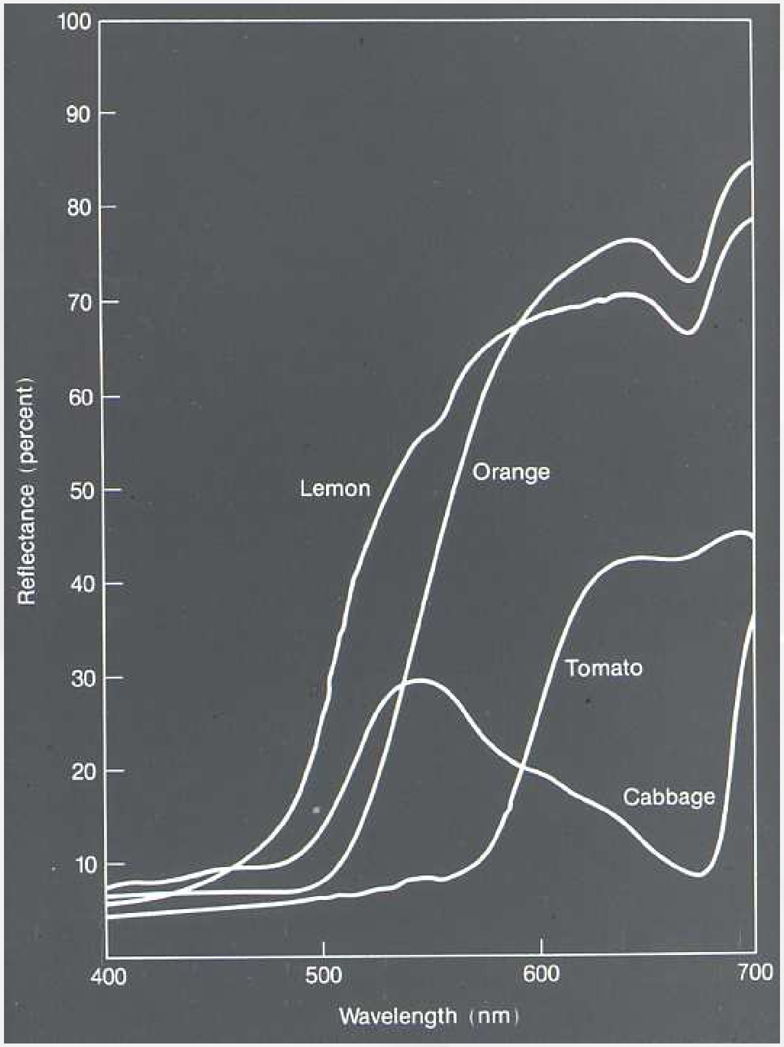


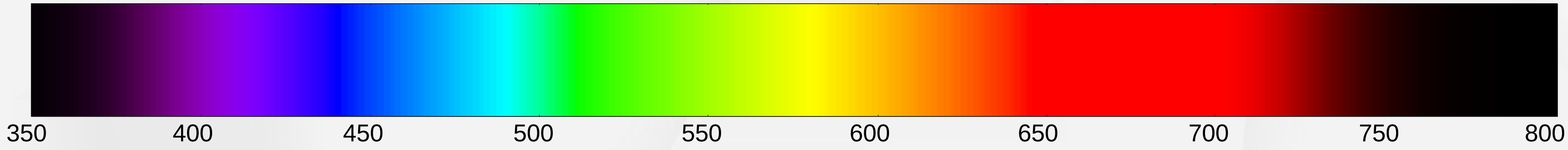
Reflectance of some common surfaces and pigments





Surface reflectance of some common objects



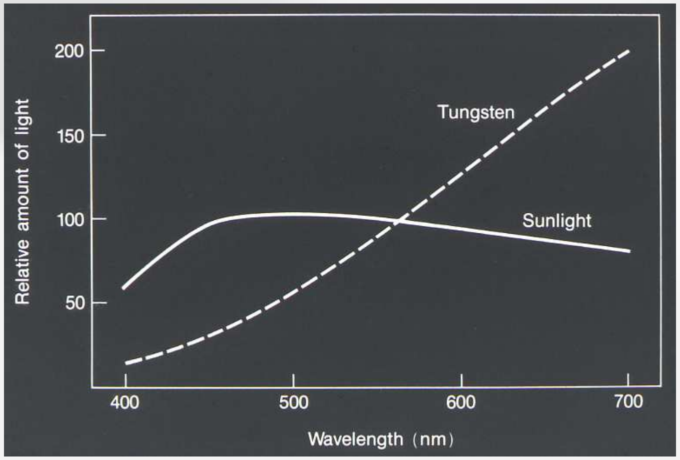


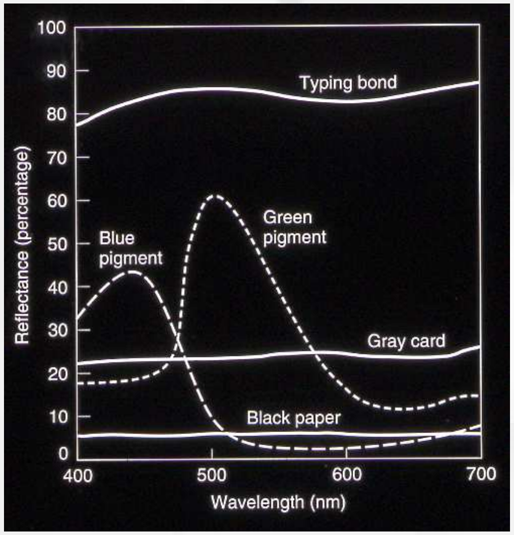
Spectral composition of light entering the eye after being reflected from a surface =

Spectral composition of the illuminant

X

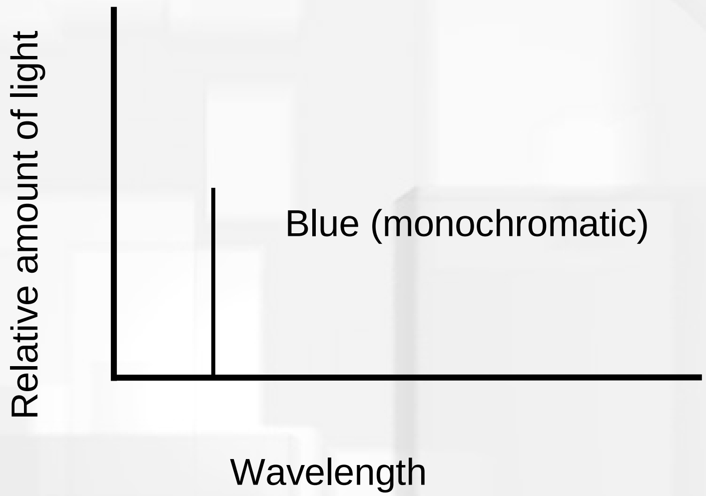
Reflectance of the surface

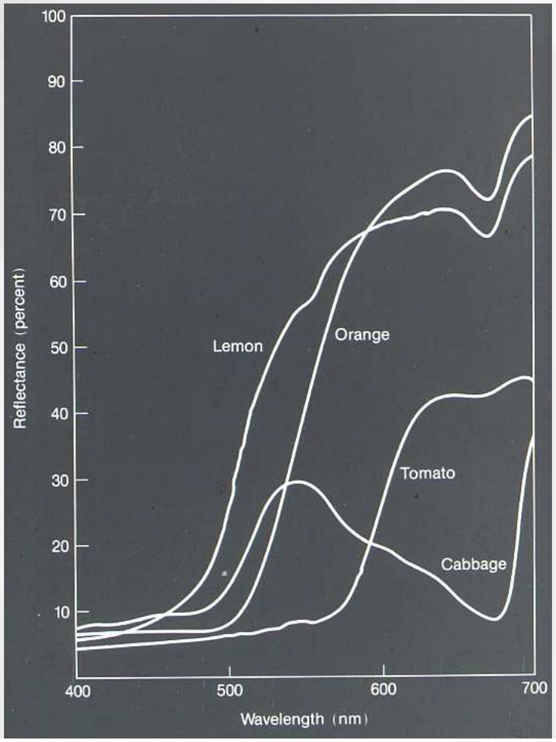




Consider a ripe banana illuminated with a bright monochromatic blue (420 nm) light. What color will the banana appear to be?

a. bright orange
b. dark/dim orange
c. black
d. dark/dim blue



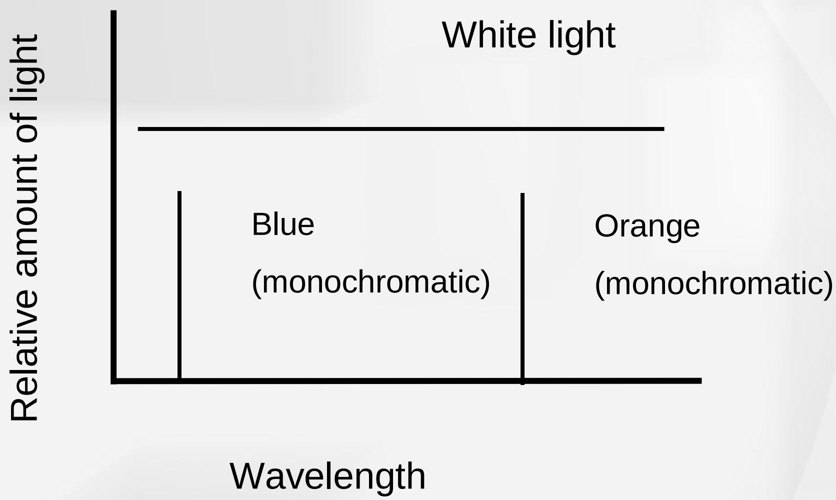


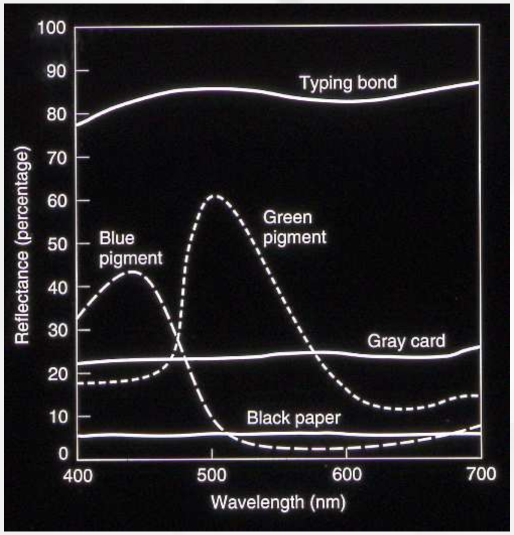
Spectral composition of light entering the eye after being reflected from a surface =

Spectral composition of the illuminant

X

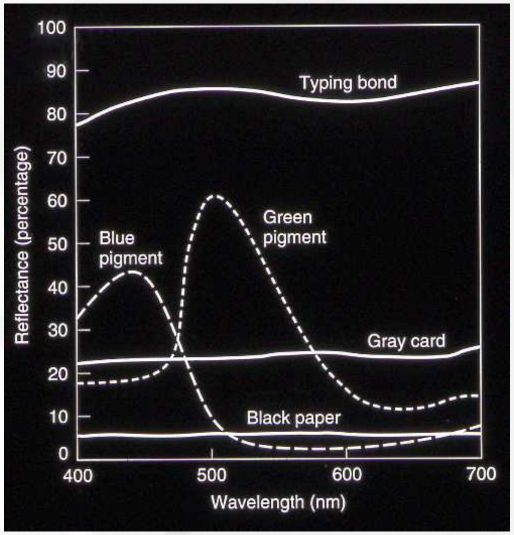
Reflectance of the surface





Psychology and Color

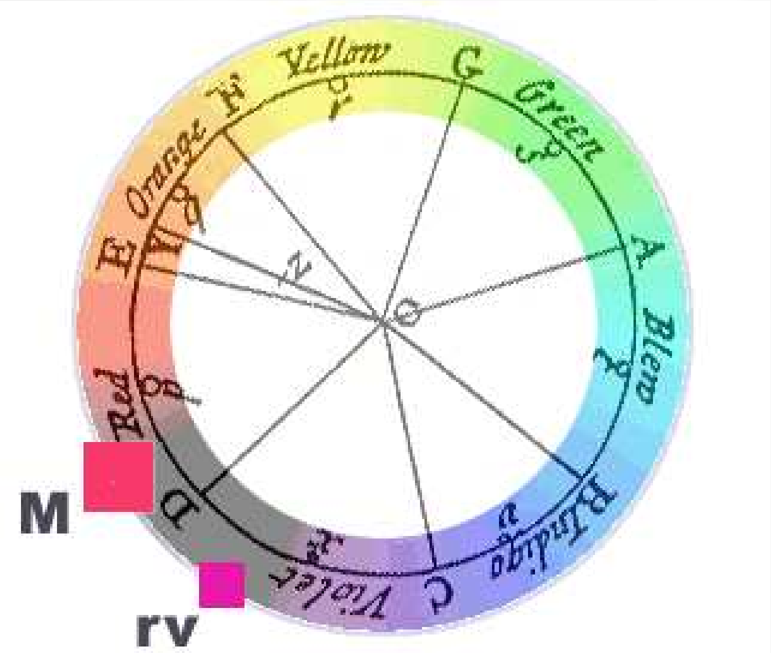
- Physical dimensions of color
  Spectral composition
  light source X reflectance



- Psychological dimensions of color
  1. Hue (e.g., red, blue, green)
  2. Saturation (e.g., pastel, ‘deep & rich’)
  3. Brightness (e.g., dim, bright)

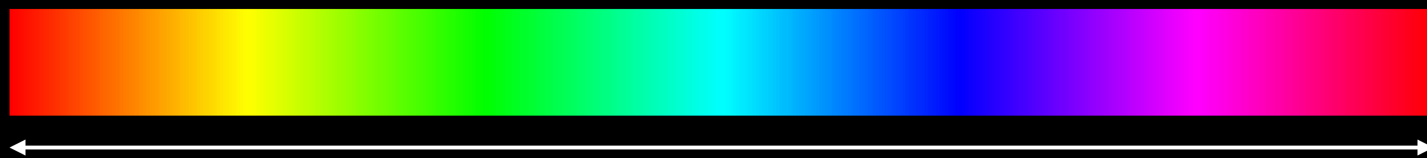
Psychological dimensions of color

Newton noticed that the color spectrum could be represented in a circle.

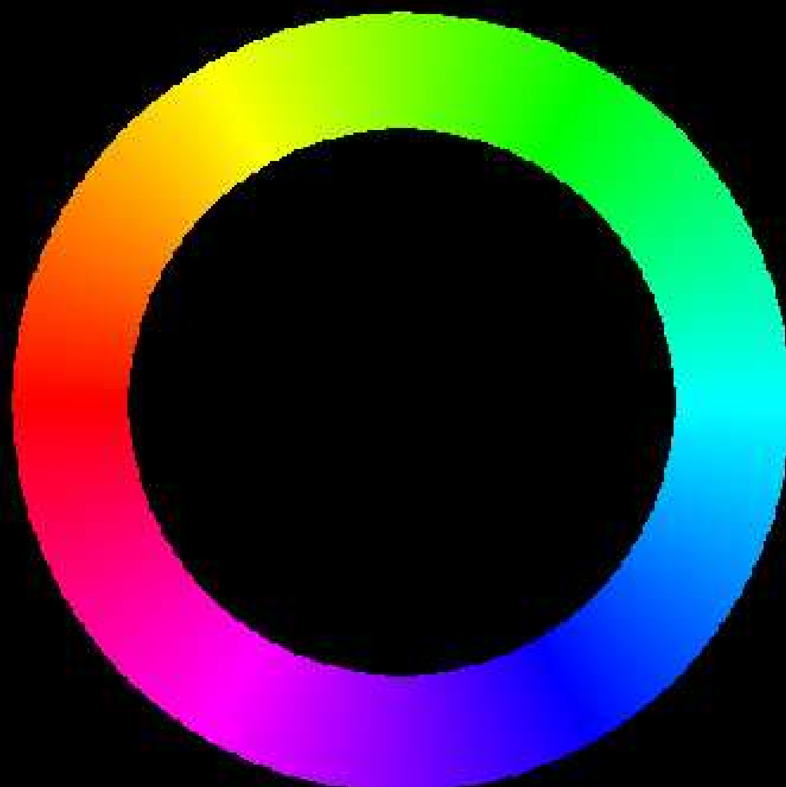


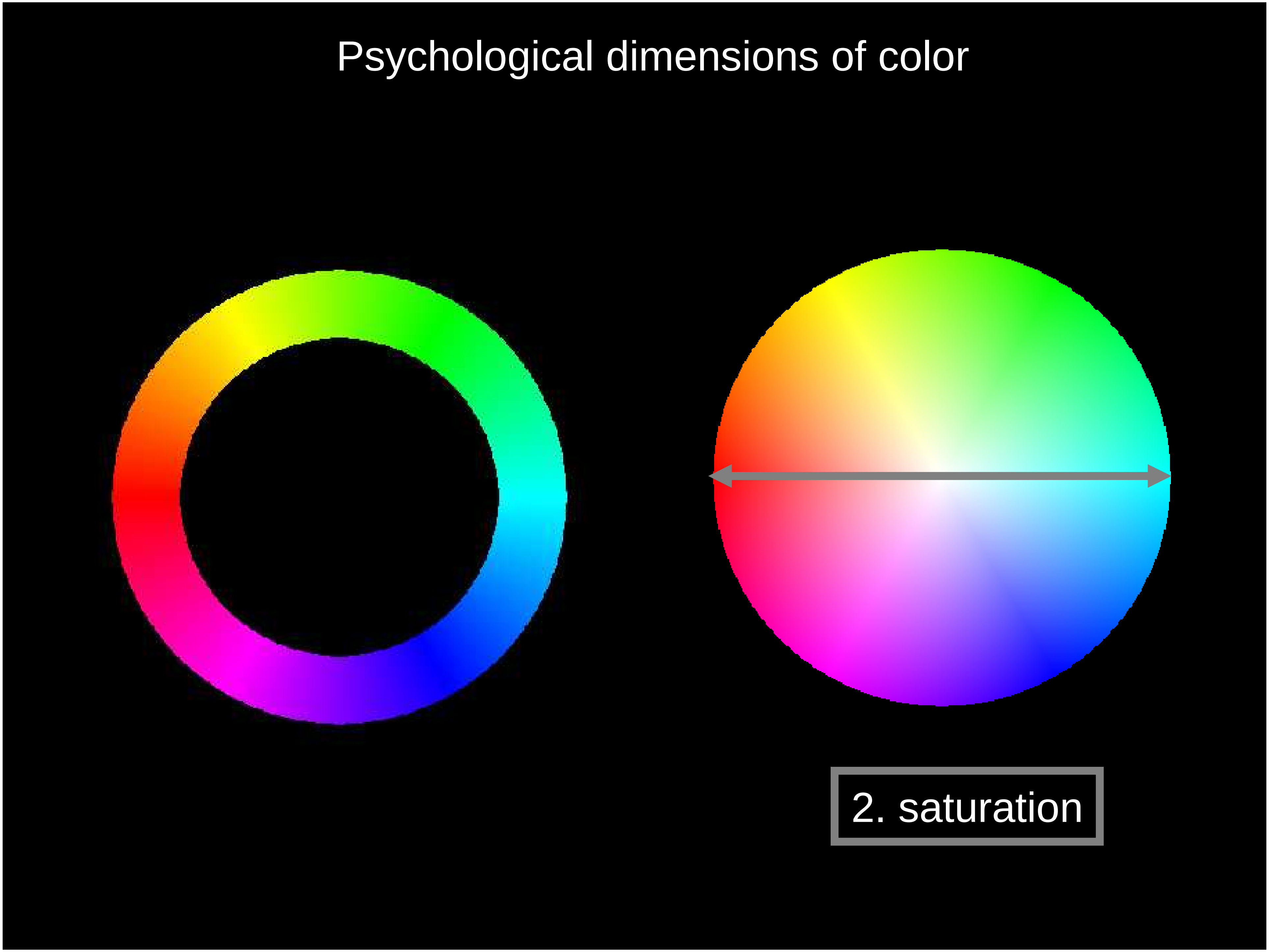
Newton, 1703

Psychological dimensions of color



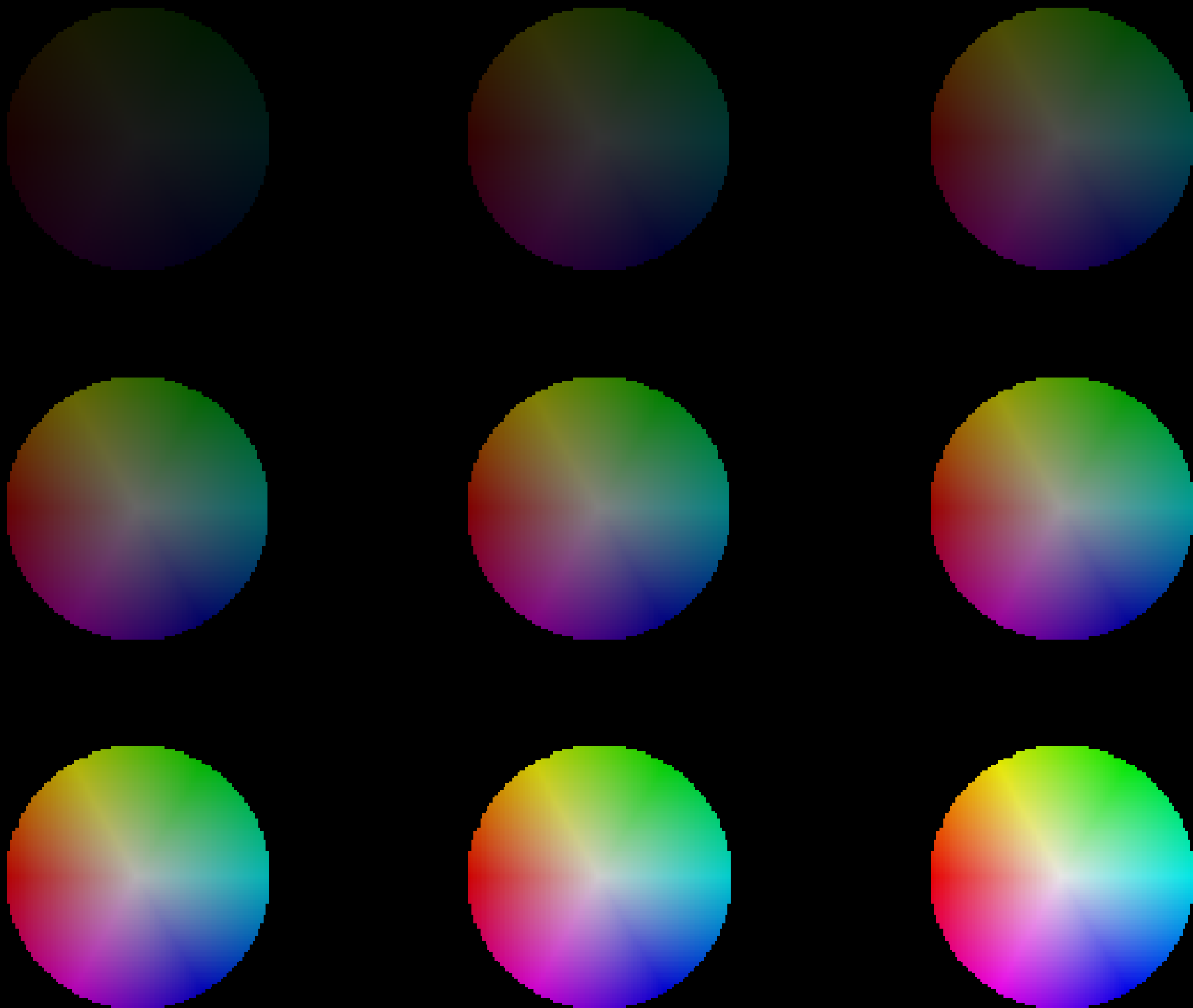
1. hue



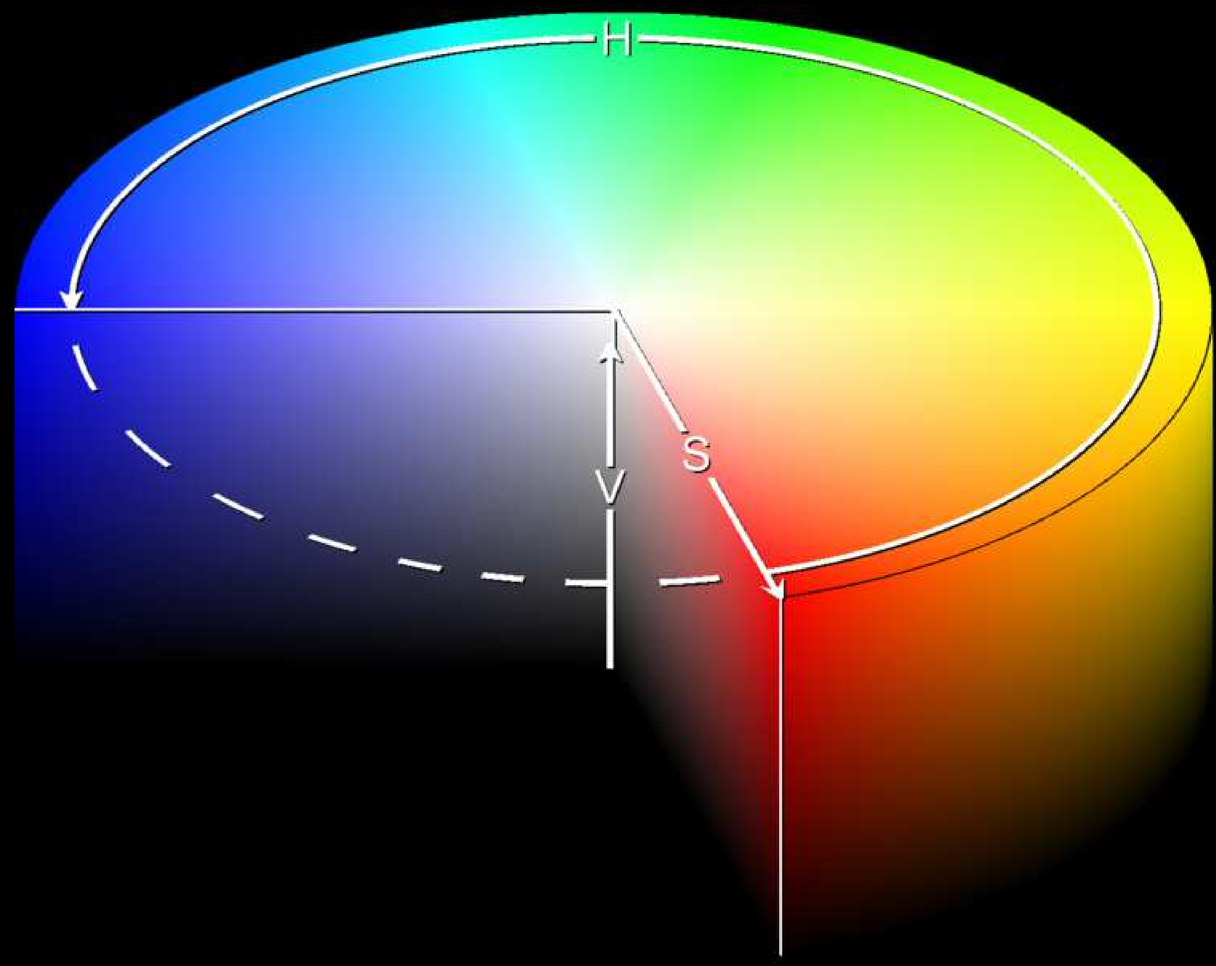

Psychological dimensions of color
2. saturation

Psychological dimensions of color

3. brightness

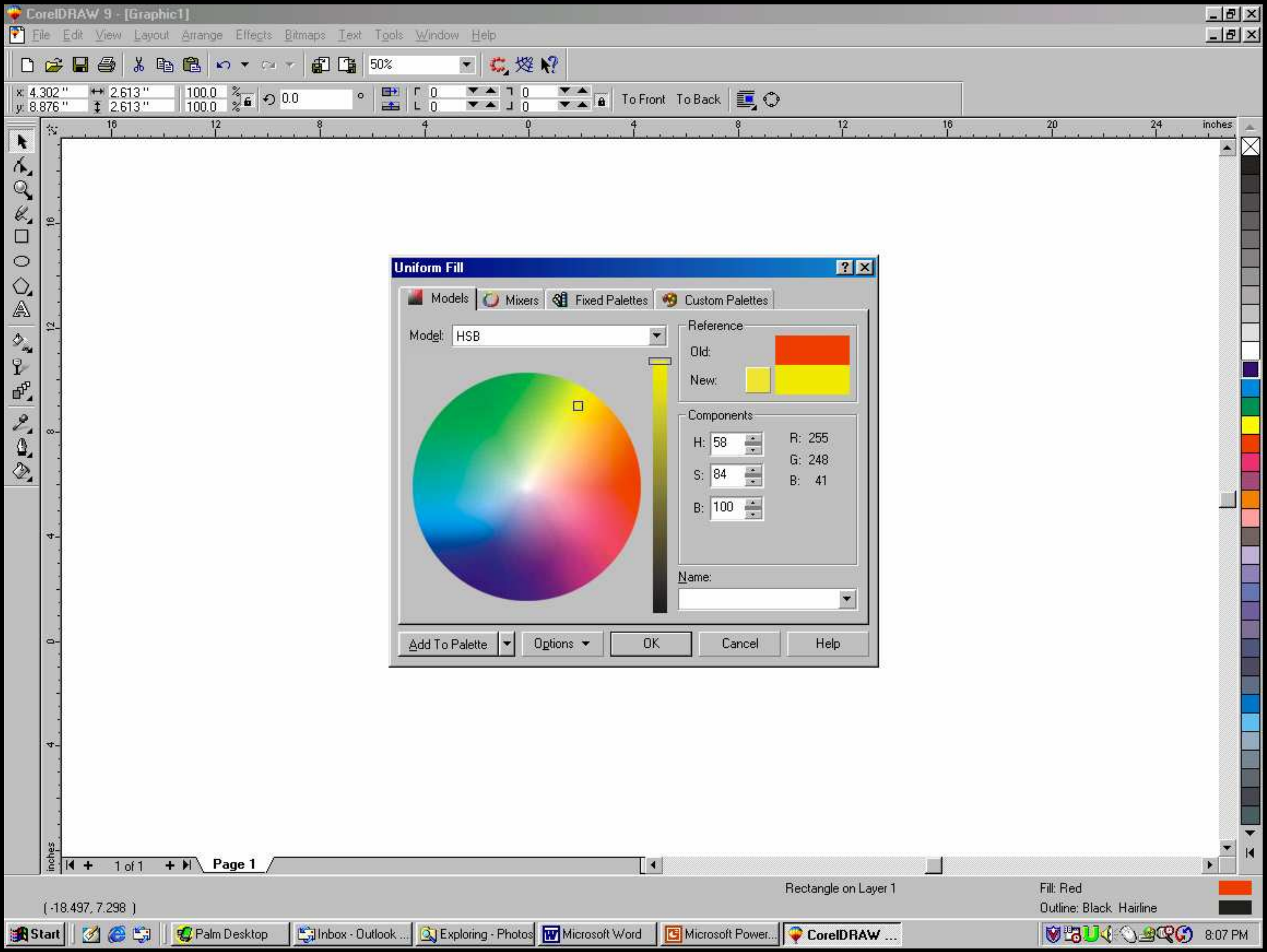


Psychological dimensions of color

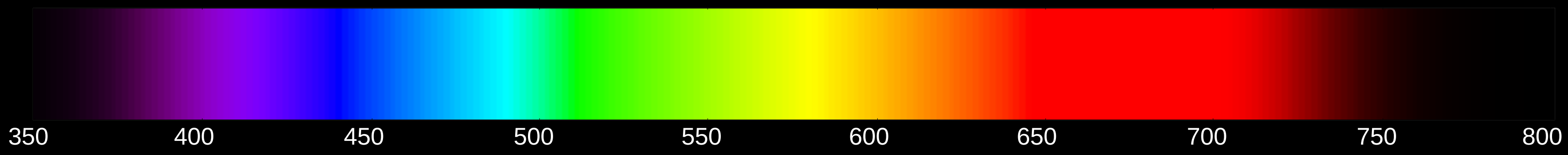


The color solid.

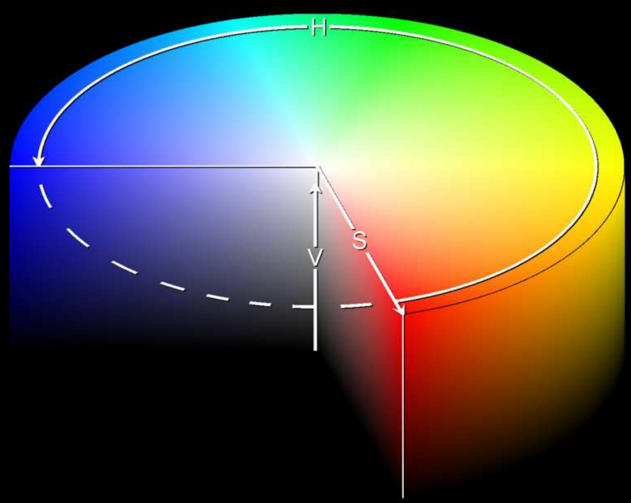
Graphics programs allow you to pick colors by hue, saturation and brightness from a color circle.



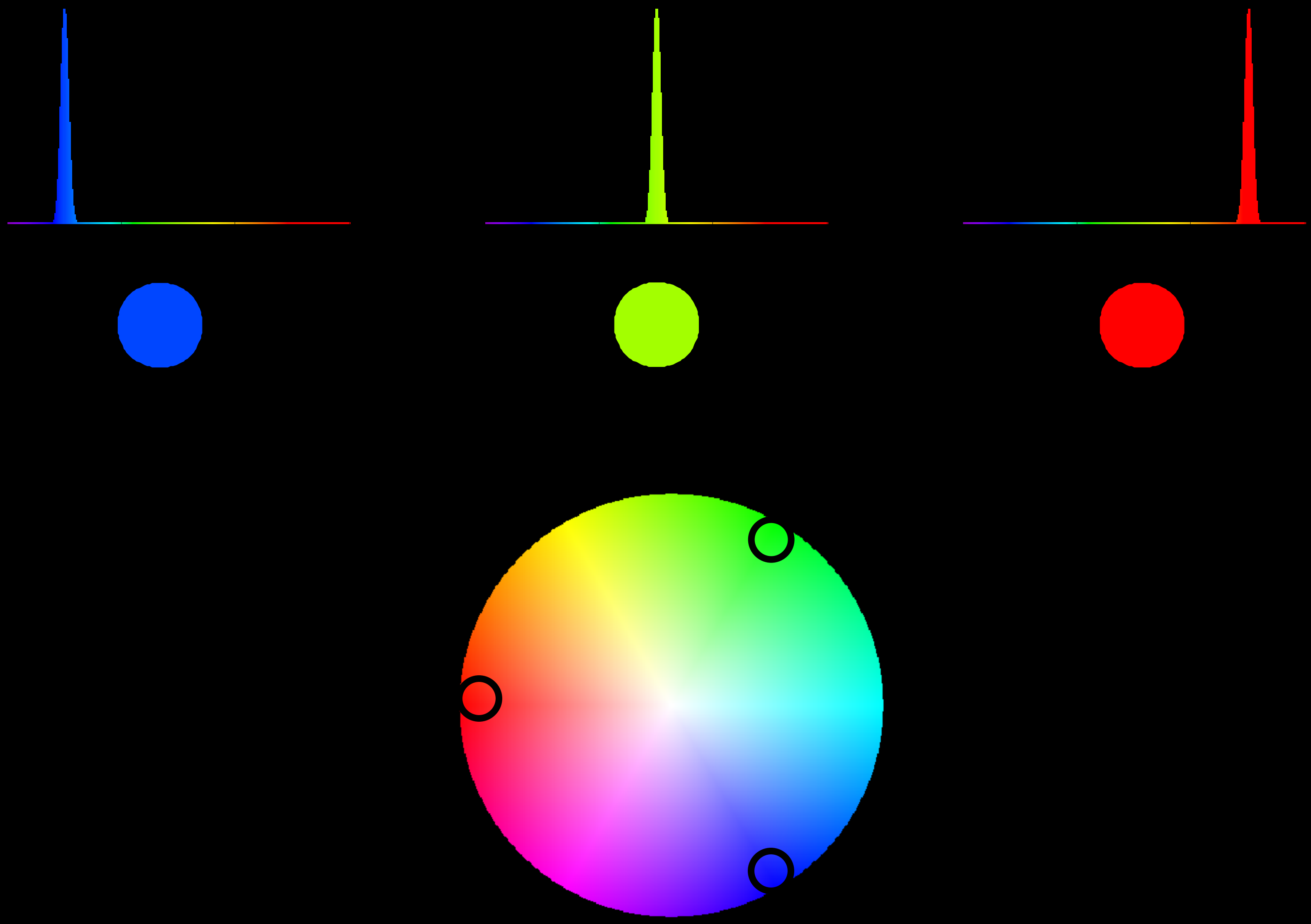
How do we get from the physical properties of light:



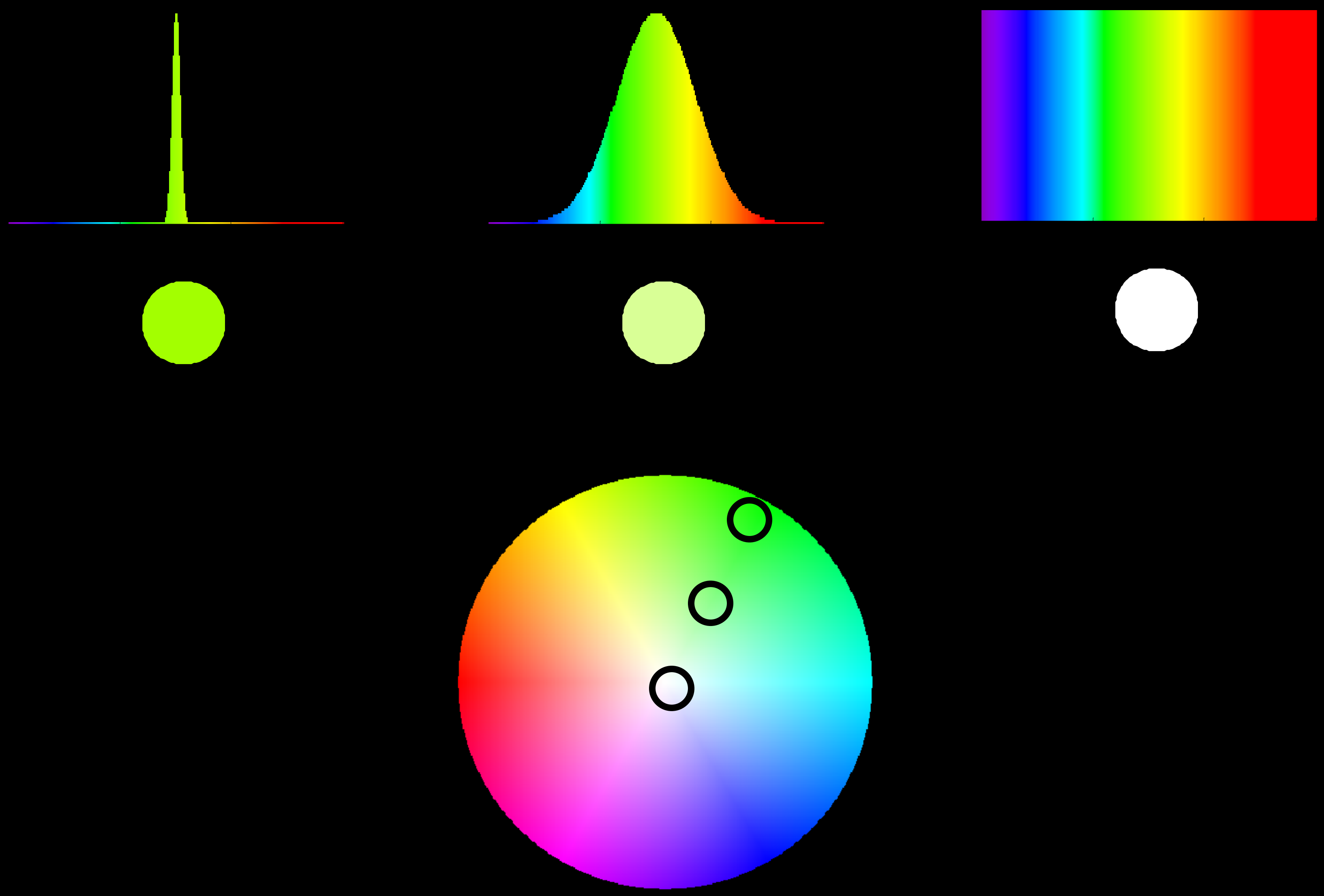
To the psychological dimensions of color?



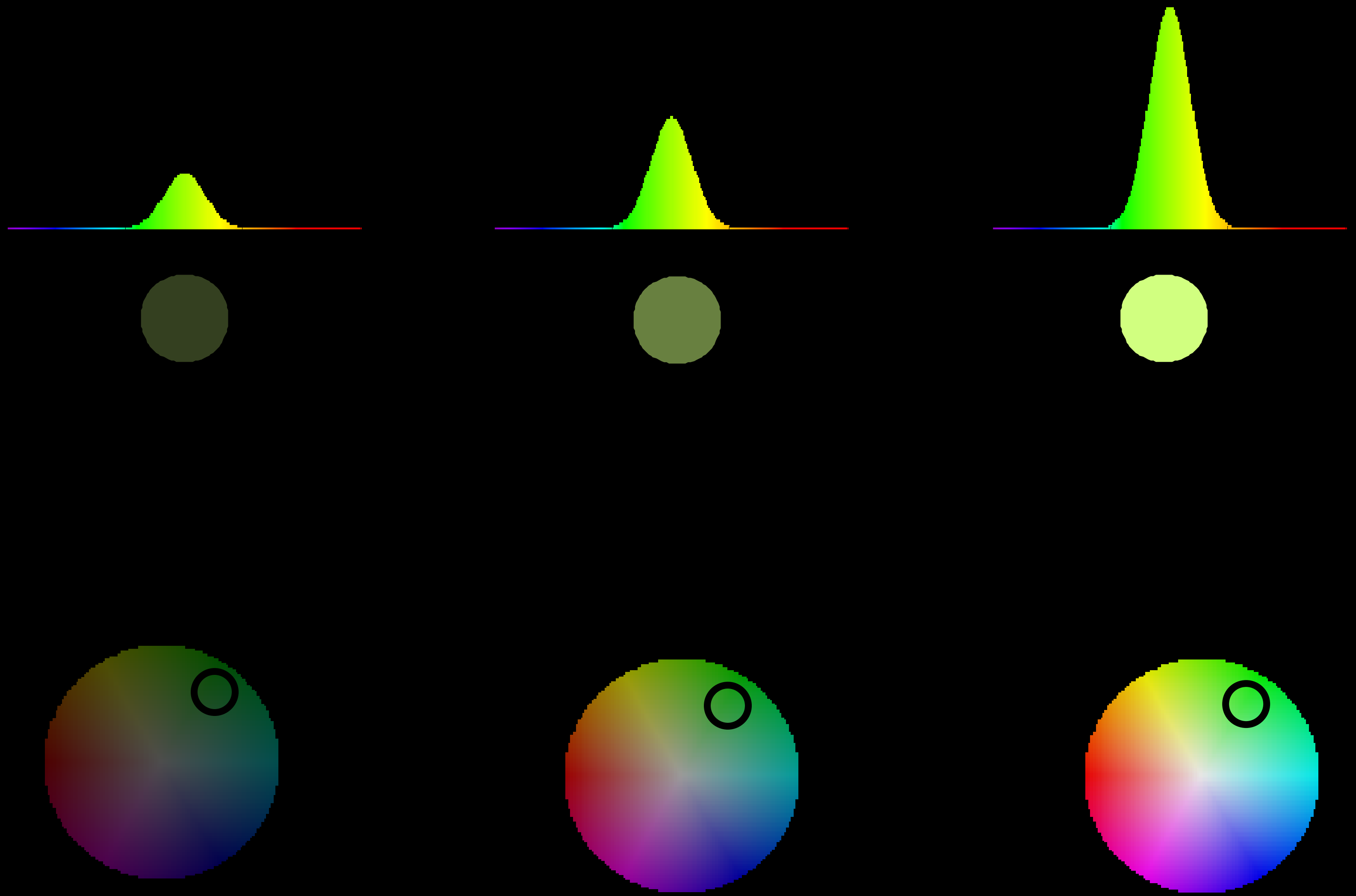
Hue: peak (center) of spectral distribution



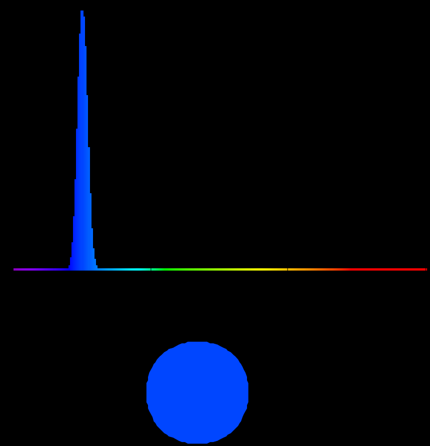
Saturation: spread (variance) of spectral distribution



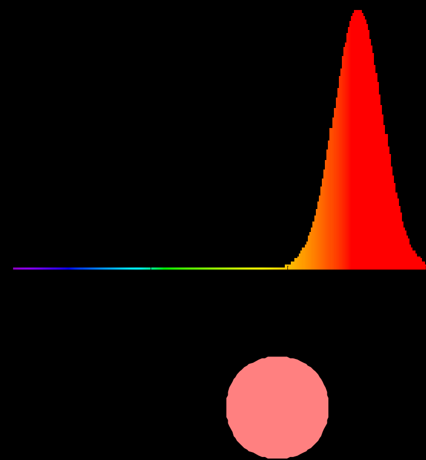
Brightness: height of spectral distribution



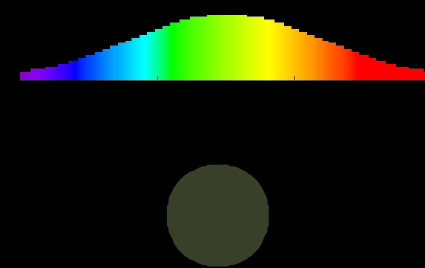
These rules of hue, saturation and brightness are useful for simple (univariate) spectral distributions:



Bright, saturated blue

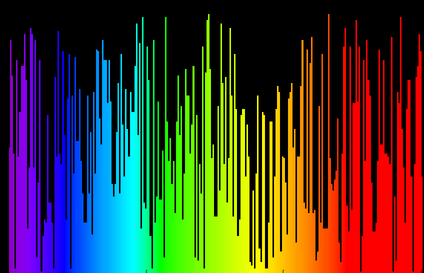


Bright, partially desaturated red (pink)



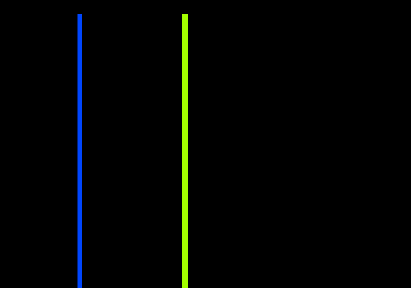
Dark, desaturated green

But what about any arbitrary distribution?

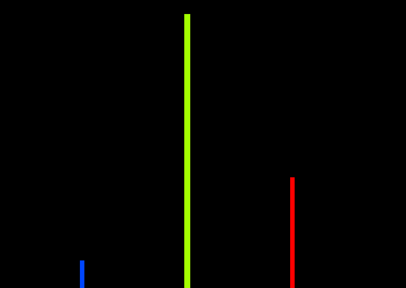


random

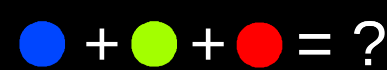
?



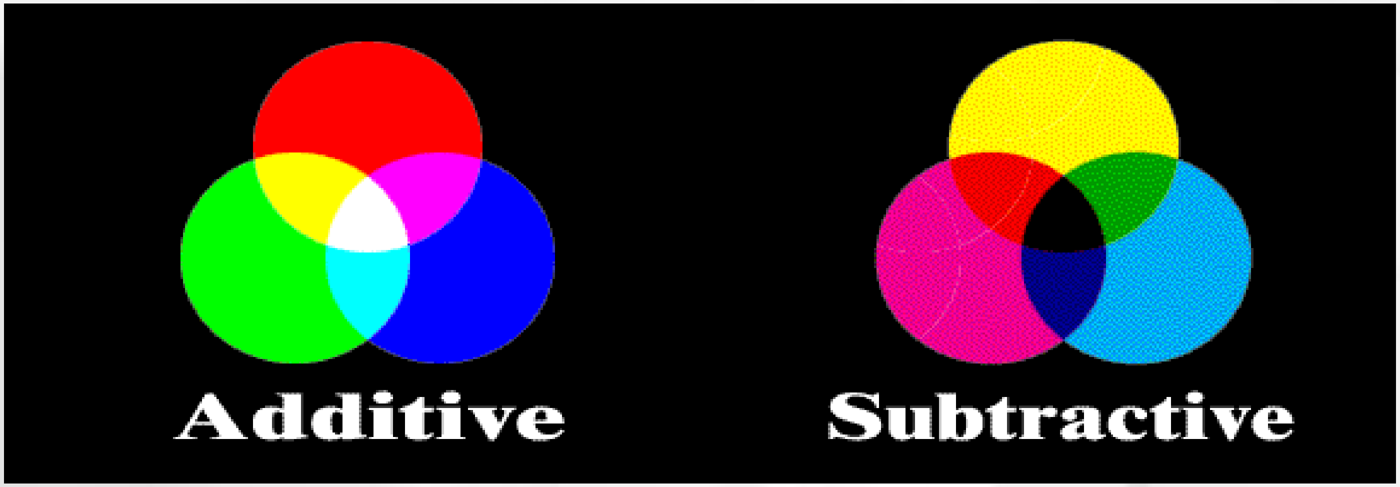
two primary colors

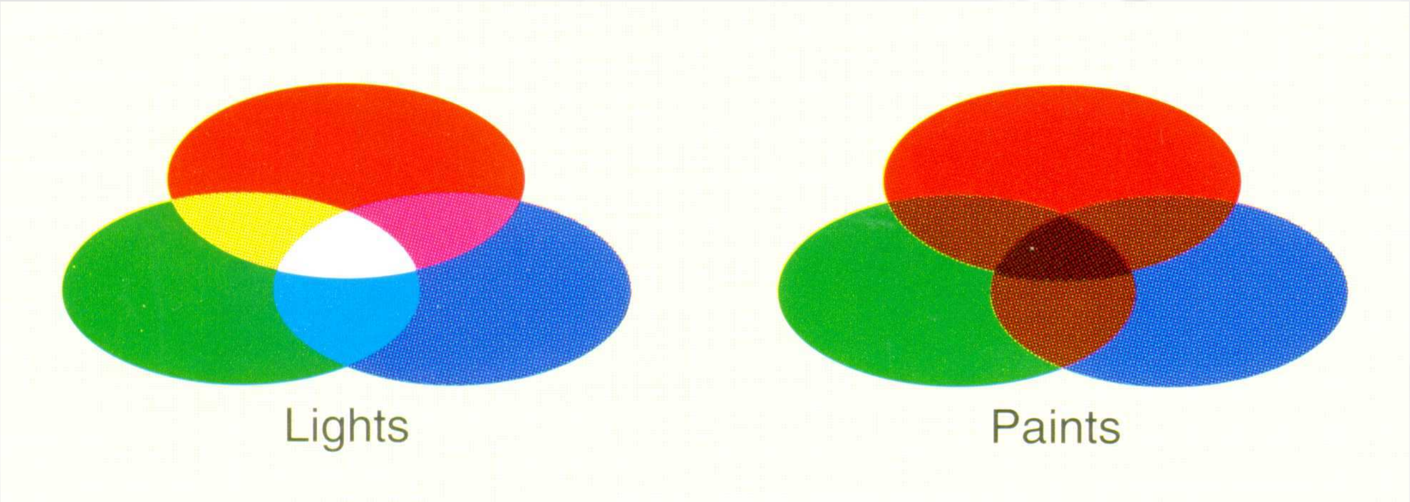


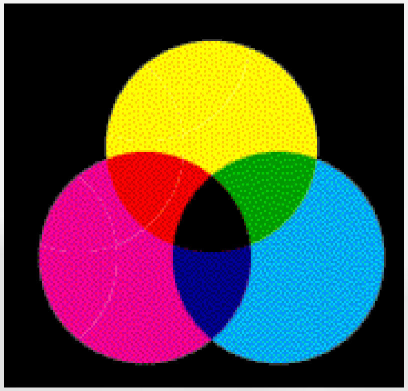
three primary colors



Color mixtures



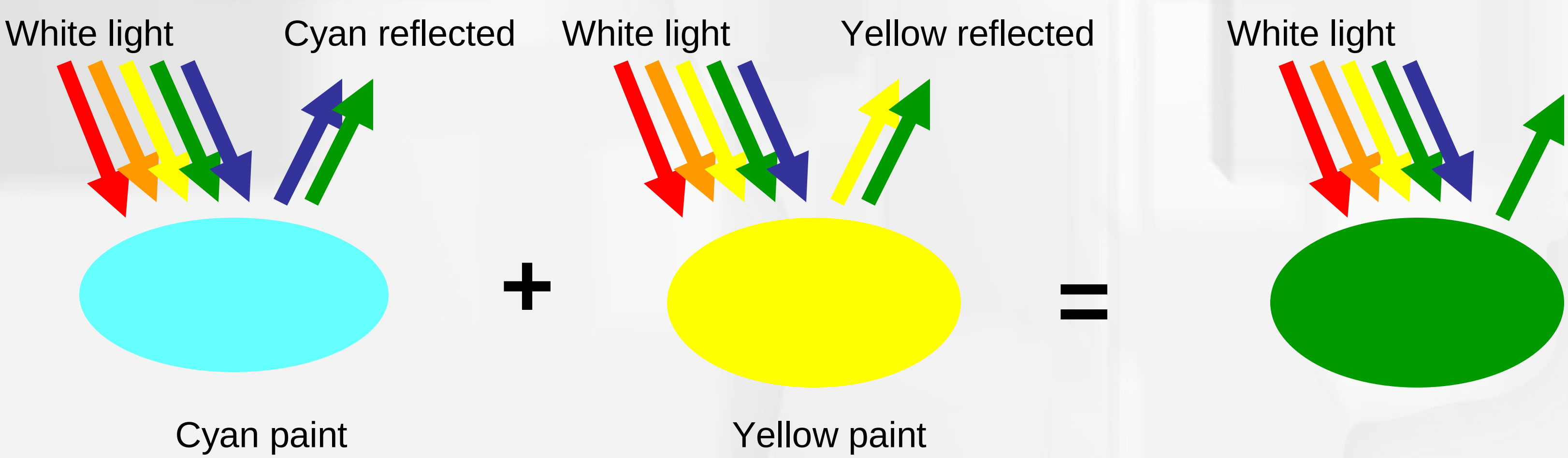


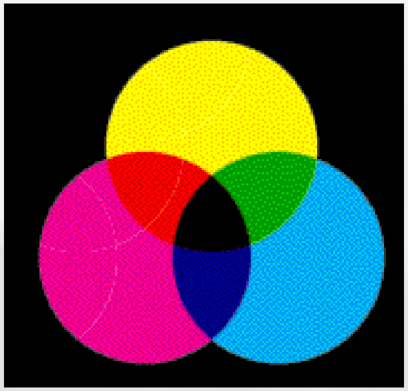


Subtractive mixtures

Occur with paints (pigments) and filters

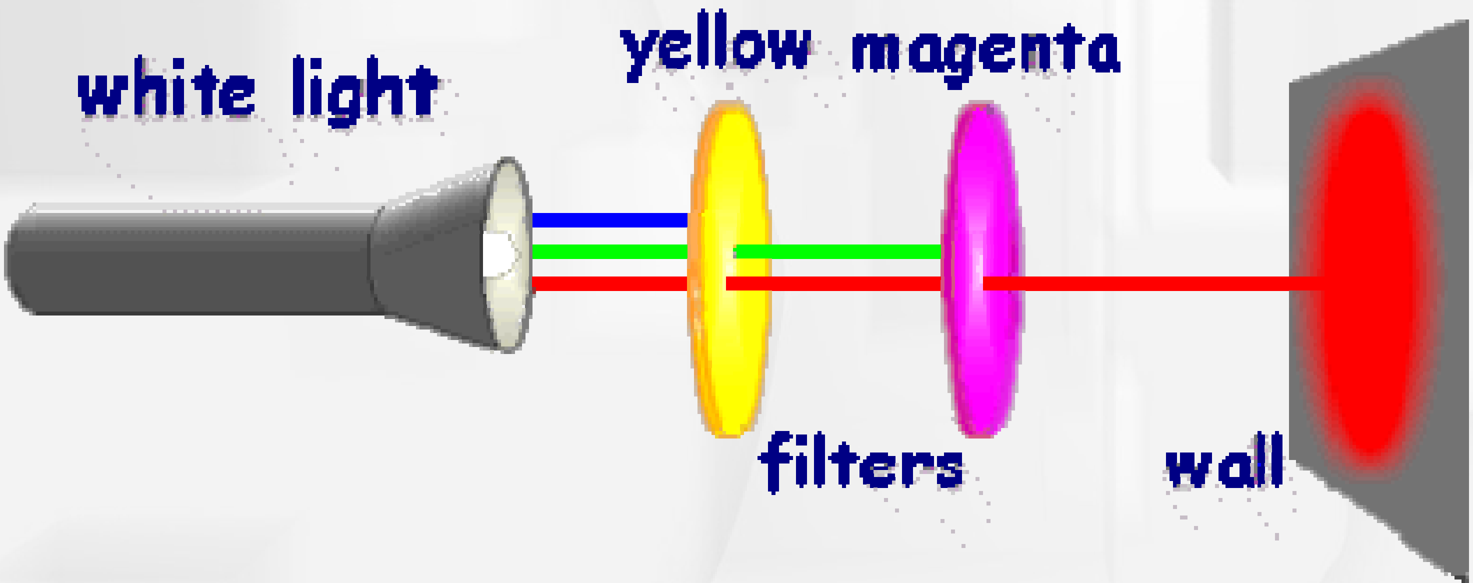
For pigments: In the mixture, the only wavelengths reflected by the mixture are those that are reflected by all components in the mixture.

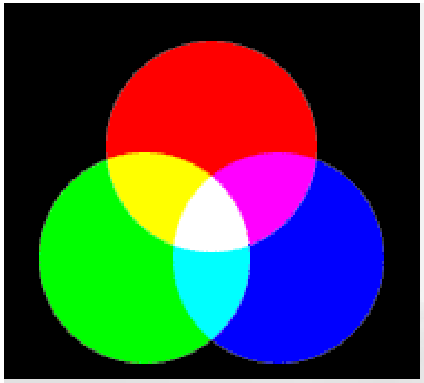




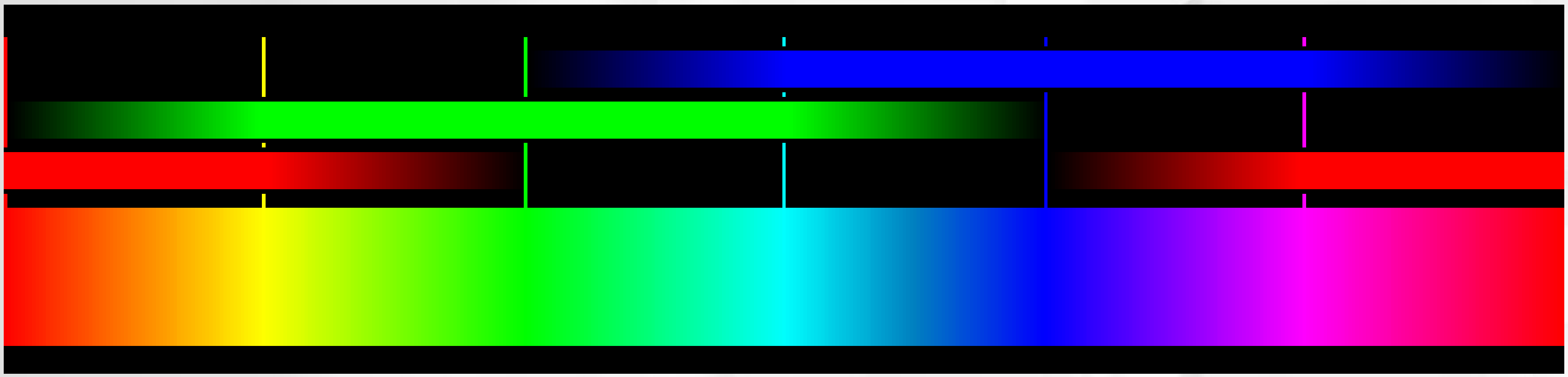
Subtractive mixtures

For filters: wavelengths in the ‘mixture’ are those that are passed by every filter in use.



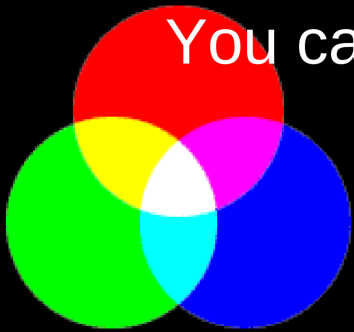


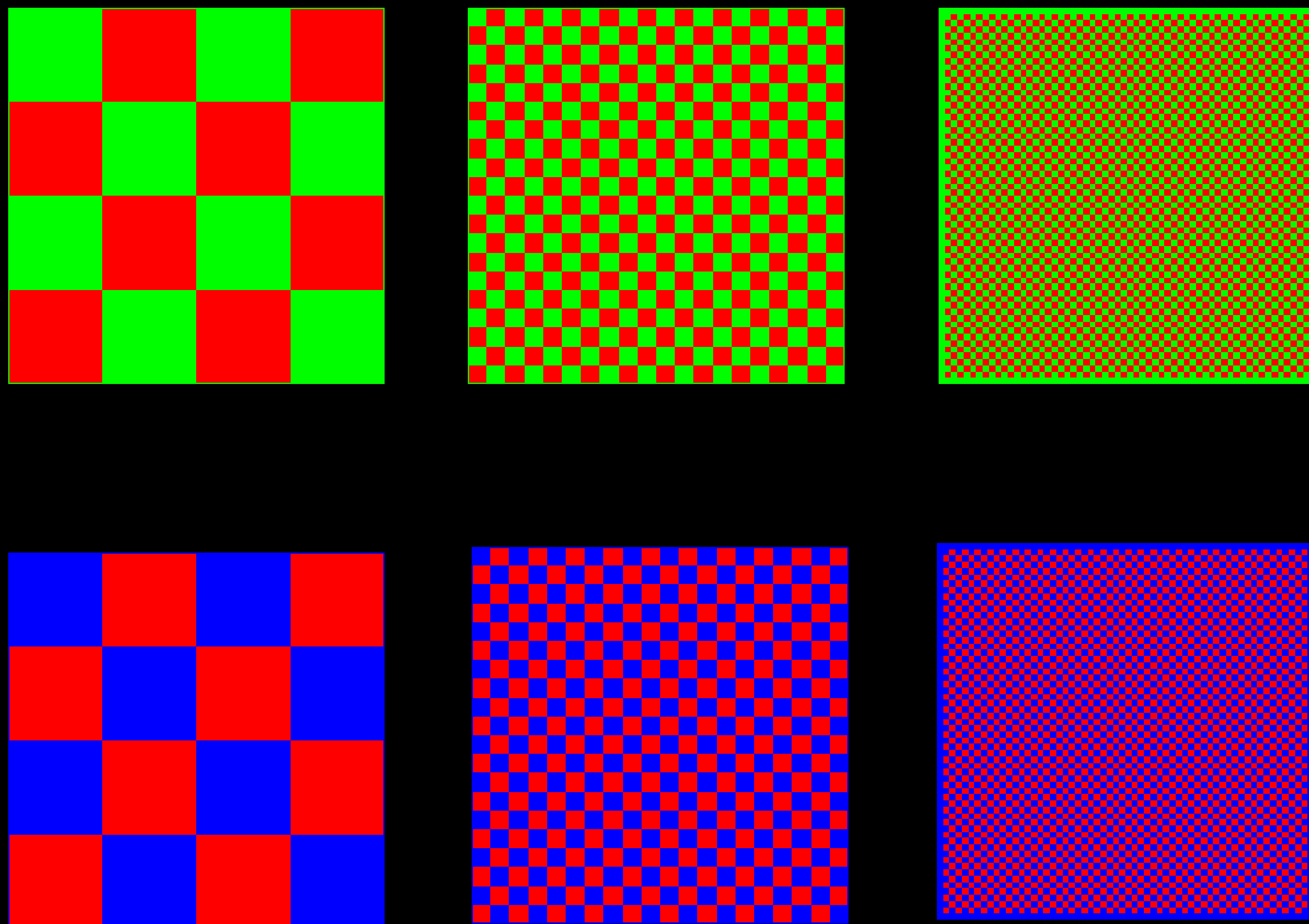
Additive mixtures



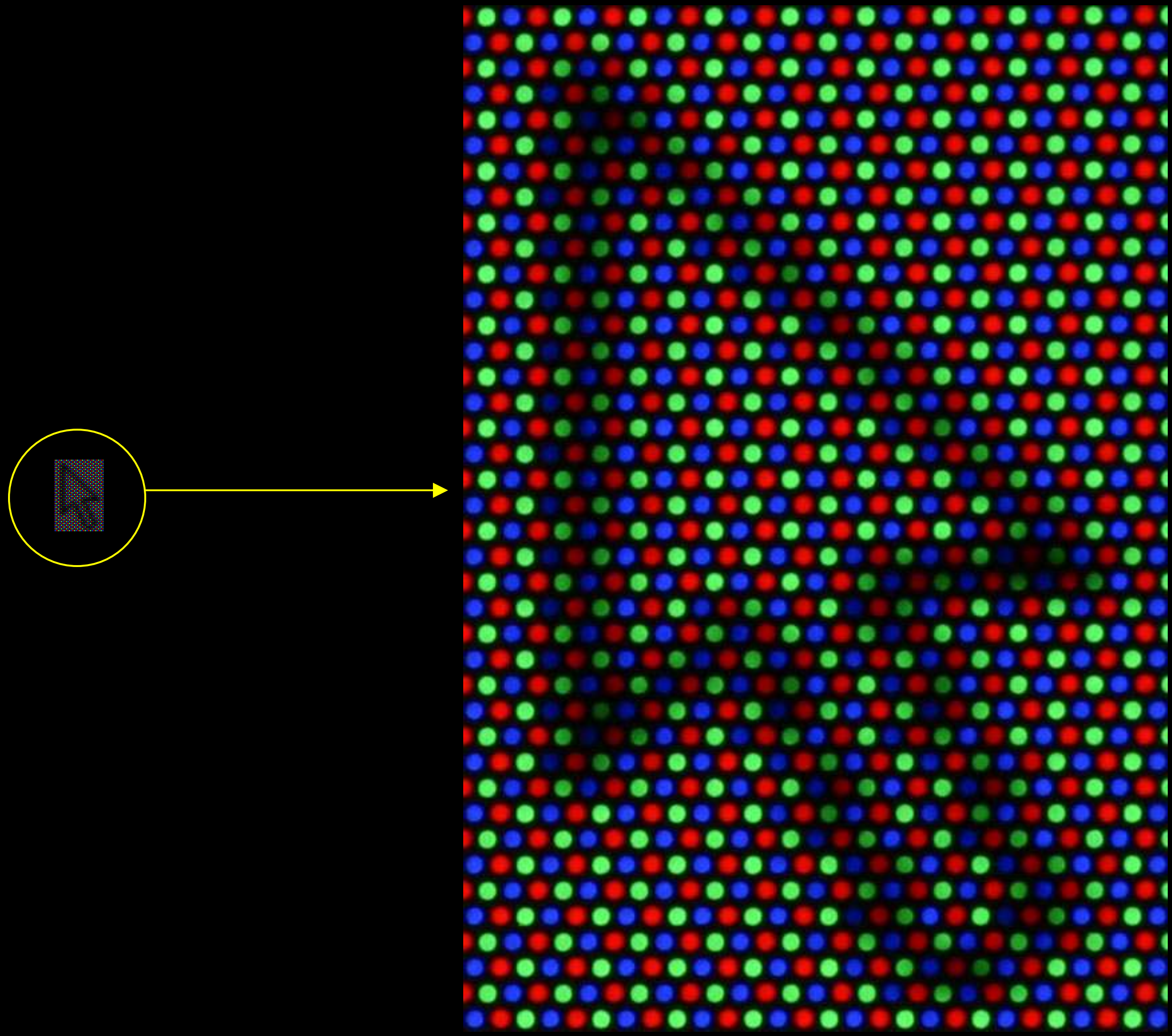
The spectrum above is created on an RGB computer monitor by additive mixing

You can create additive mixtures by putting pixels very close together

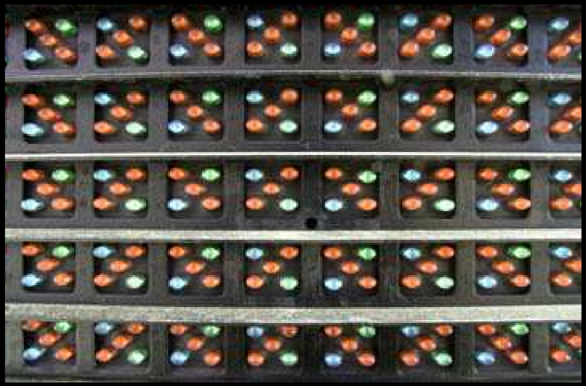




That’s how TVs and computer monitors work.

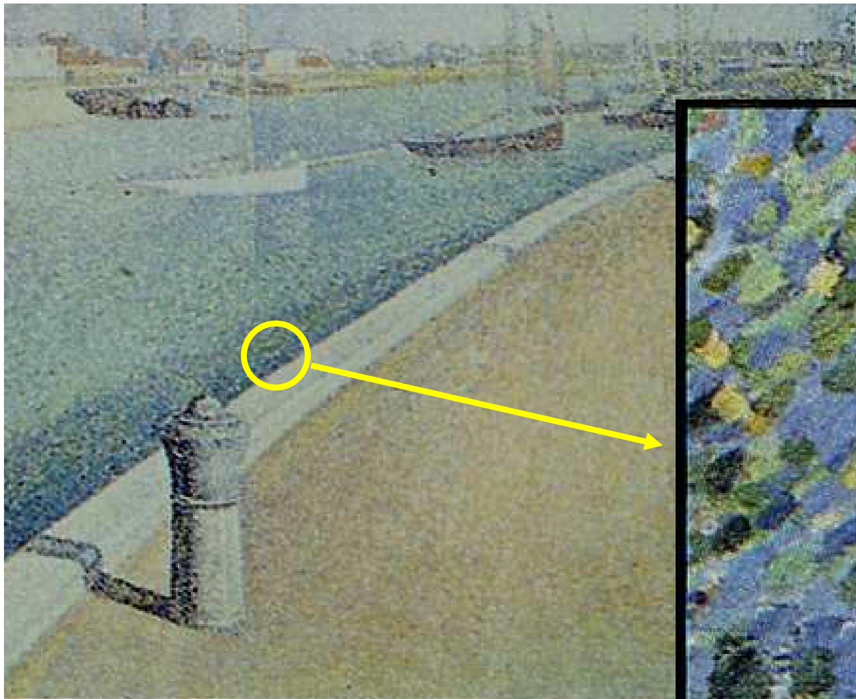


And stadium scoreboards



Georges Seurat, the French Pointillist Painter knew about this!

Georges Seurat, *The Channel of Gravelines* (1890)



Pointillism painters mixed colors additively rather than subtractively!

Closeup, Georges Seurat, *The Channel of Gravelines* (1890)

TV's with three phosphors work because almost any color can be generated by adding different amounts of the three primary colors.