Where are the spectral colors?

Not all spectral colors can be matched by mixing primary colors.

The hues obtained mixing primaries are less pure than their spectral corresponding colors (dominant wavelengths) particularly in the blue-green region.

Spectral colors have to be *desaturated* (made less pure) before they can be matched by a mixture of primaries for our example:

\[ S = aR + bG + cB \]

the amount of red \((a)\) must be negative.

All spectral colors lie outside the triangle, so do the purples. The horse-shoe area below is the area of human color vision.
Where are the **browns**, the **grays**, the **olives**?
The **color triangle** does not indicate intensities!

- white = 255R + 255G + 255B
- gray = 100R + 100G + 100B  
  - gray and black lie on the same spot as white on the color triangle
- orange = 200R + 100G + 0B
- brown = 100R + 50G + 0B  
  - brown is low intensity orange

Additive color mixing works for mixing lights examples: projectors, color TV, computer monitors

Inside a TV set

**phosphor screen**
**electron beams**
**cathode ray tube**

Each pixel is divided in R, G and B sectors
Cat’s eye is optimized to see in dim light:

- has small f# (vertical slit instead of round pupil, for larger lens aperture D)
- has a tapetum to reflect light back to the retina
- has a majority of rod cells (few cone cells)

Fast camera lens f/1.4  
Human eye f/2.4  
Owl 1.3  
Cat f/0.09