Individual Differences in Perceptual Luminance

As we discussed in class, the "luminance" of a light is its physical intensity modified by the human sensitivity to the wavelengths composing the light. The luminance of a light is similar to, but not exactly the same, as its "brightness". When patterns are formed from colors having equal luminances (i.e. the colors are "**isoluminant**") the patterns have distinctly different temporal and spatial properties when compared to patterns arising from luminance variations (e.g. a pattern made from perfectly balanced red and green stripes versus a pattern of yellow and black stripes). This originates because in the visual system differing physiological pathways process isoluminant and luminance-varying information. These differing pathways and the resulting differences in perceptual properties will be discussed in class and in the student presentation.

The luminance of a pattern is attributable to the sum of its activation of L-cones and M-cones; two lights of differing colors the same total (L+M) activation will be **isoluminant**; two lights that have differing total (L+M) activation will have differing luminances. One does **NOT** obtain an **isoluminant** match by asking an observer for brightness comparisons, but by two empirical measures: heterochromatic flicker-fusion and motion-null (Anstis-Cavanagh technique).

For this project students will measure an observer's Isoluminance ratio for red and green chromatic stimuli. They will utilize two psychophysical methods, flicker fusion and motion null, and compare results both between methods and among data collected from differing observers. The experimental measurements will be conducted in Professor Switkes' vision laboratory (157 PSB).

The two students pursuing this project will be responsible for the following *experimental procedures*:

- Learn how to use the Switkes lab psychophysics display to conduct Isoluminance measures
- Conduct experiments to assess "what intensity of a green light will be **isoluminant** with a 20 cd/m^2 red light"
- Measure from 8-10 classmates and friends
    - Red-Green isoluminant balances by flicker-fusion
    - Red-Green isoluminant balances by motion null
- Analyze the data and compare how, for individual observer, the measured balances compare for the two methods
- Analyze the data for 8-10 observers and compare the measured values among observers

The two students doing this project will *understand and present to the class*:

- What are the two visual pathways one that process luminance only and the other color (and ~luminance)?
- What perceptual properties differ for luminance and isoluminant pattern?
- Why does flicker fusion measure only luminance changes?
- Explain how the Anstis-Cavanagh method gives no (ambiguous) motion when red and green luminances are balanced.
- Present how measurements from the two methods compare.
- Present how isoluminant balances vary among observers.