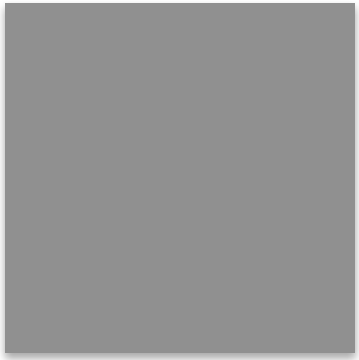
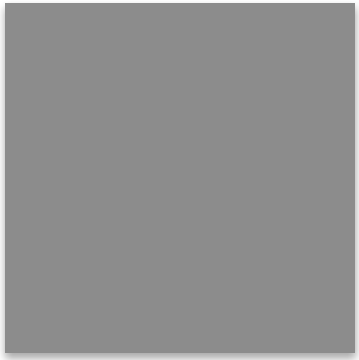
Perception of Contrast

Brightness: The *perceived* amount of light results in a nonlinear function.

Just Noticeable Difference



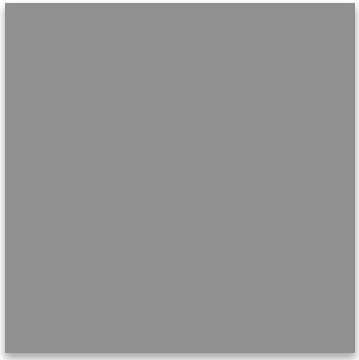
144, 144, 144



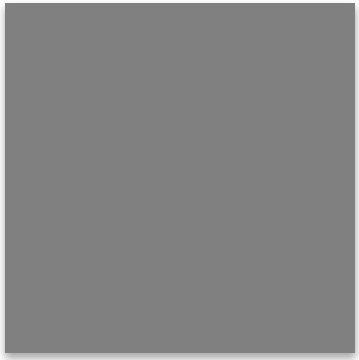
132, 132, 132

12 units different

Just Noticeable Difference



144, 144, 144



128, 128, 128

16 units different

Just Noticeable Difference

244, 244, 244

232, 232, 232

12 units different

Just Noticeable Difference

244, 244, 244

236, 236, 236

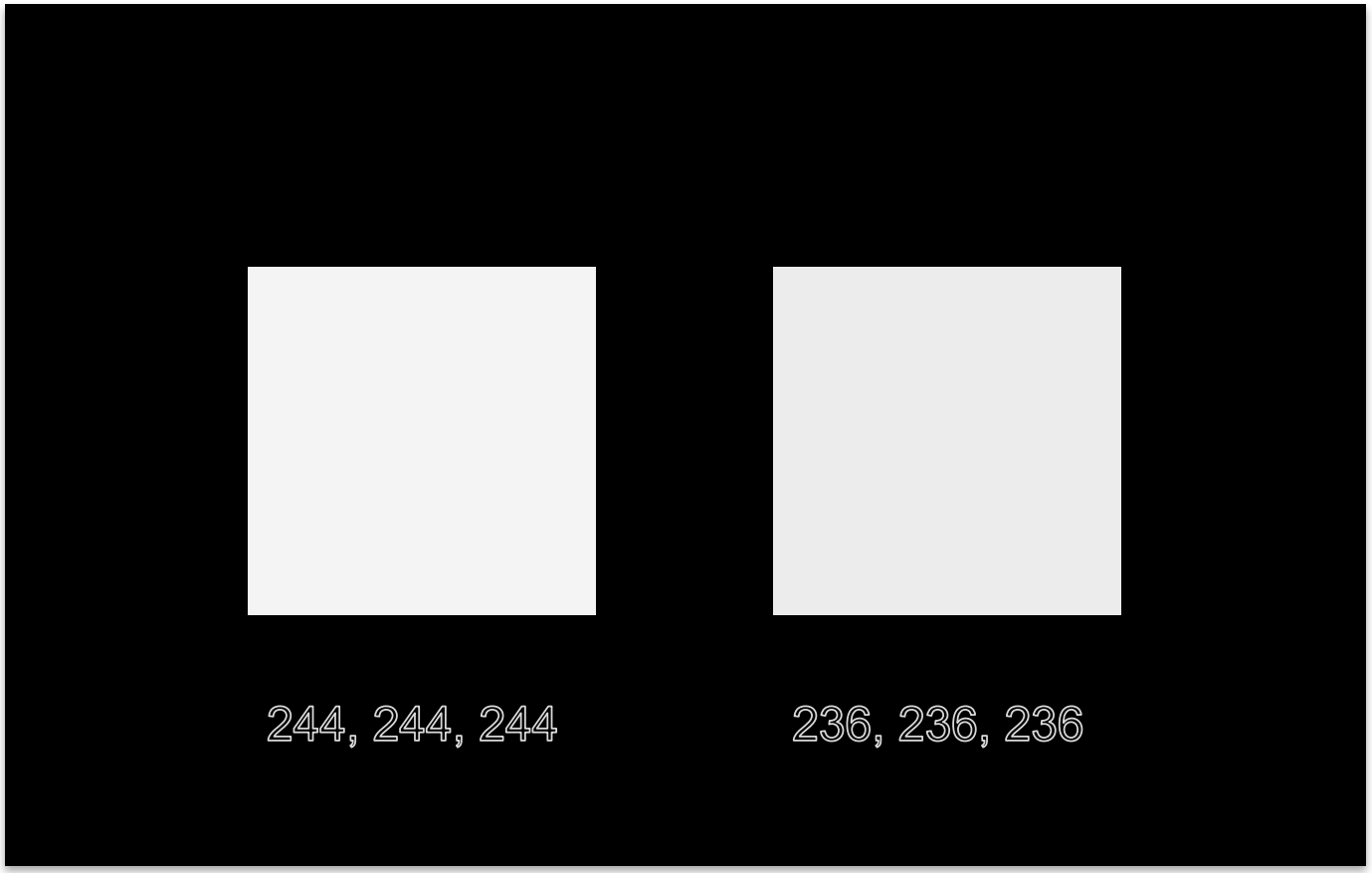
8 units different

Weber's Law

$$\Delta S/S = k$$

Ratio of change in stimulus to magnitude of stimulus is roughly constant

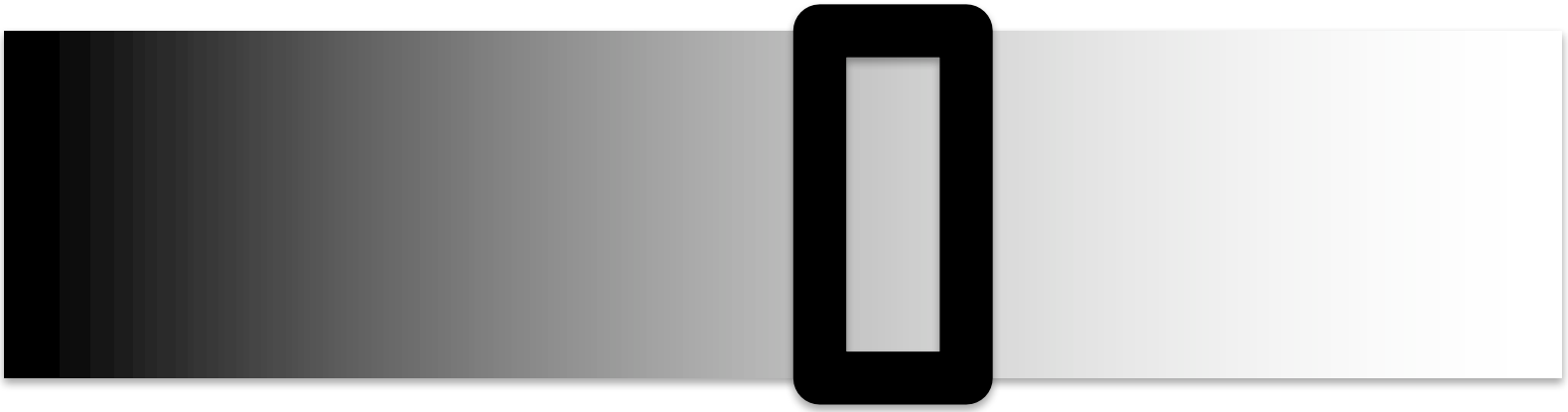
Just Noticeable Difference



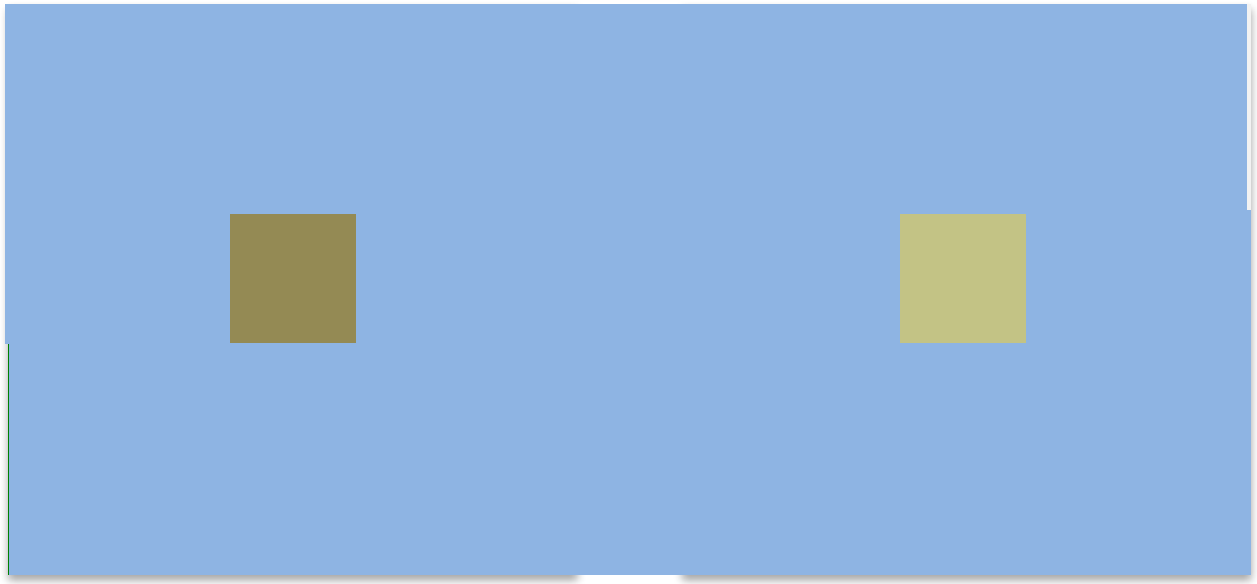
8 units different

Continuous Variation

Most continuous variations are perceived as discrete steps



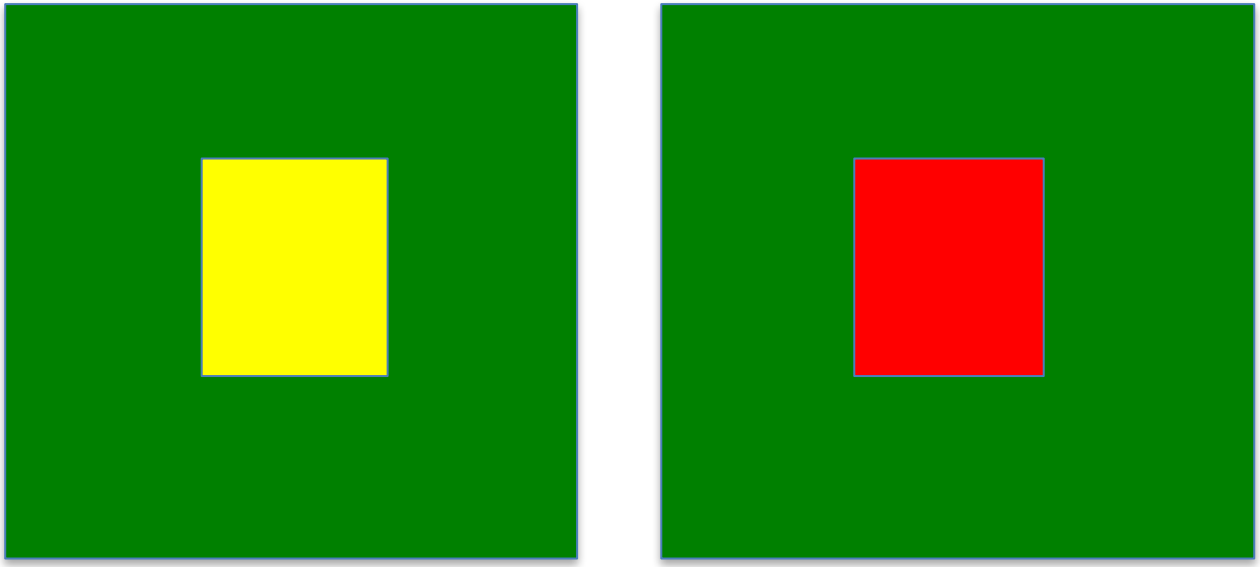
Color Contrast



After Josef Albers

Complementary Colors

Complements vibrate



Color Differentiation

Rapidly identify data elements using **color**

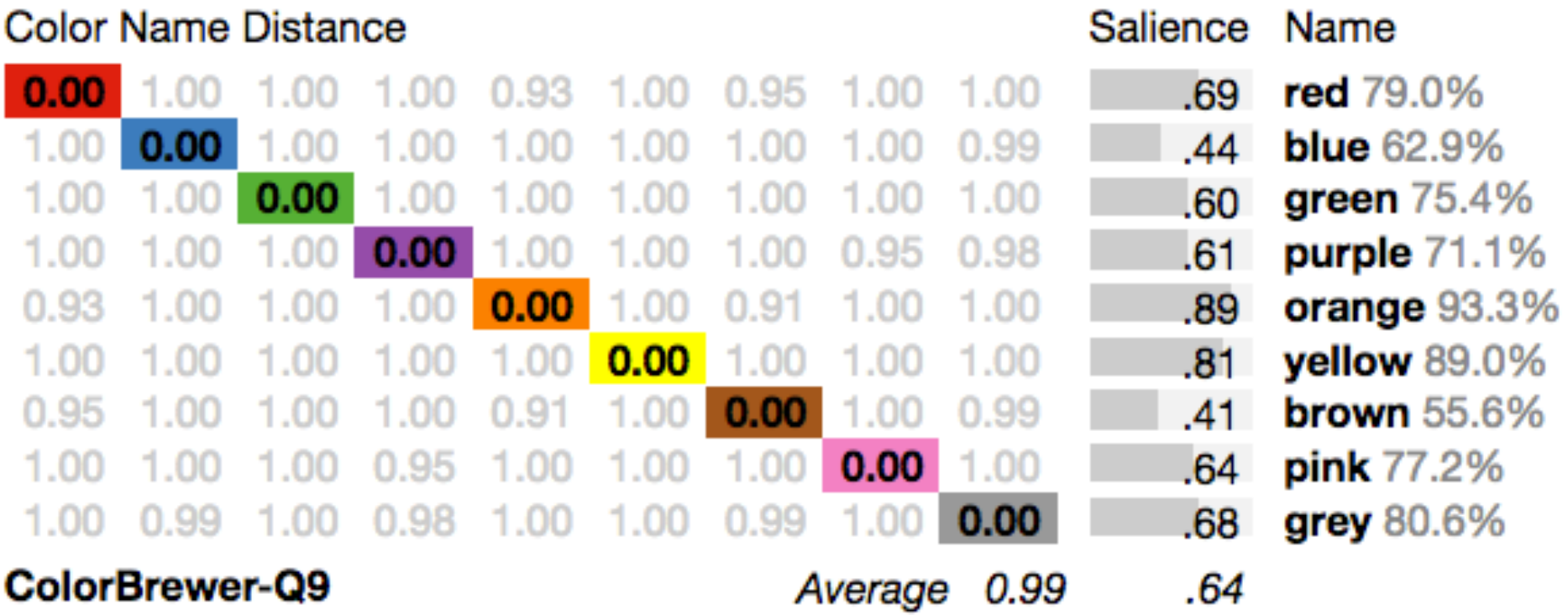
Color Differentiation

Color distance: the Euclidian distance between colors in the model

Linear separation: ability to separate targets from nontargets when one can or cannot draw a straight line between the target and nontargets

Color category: named color regions occupied by both target and nontarget elements

Distinct Nameable Colors

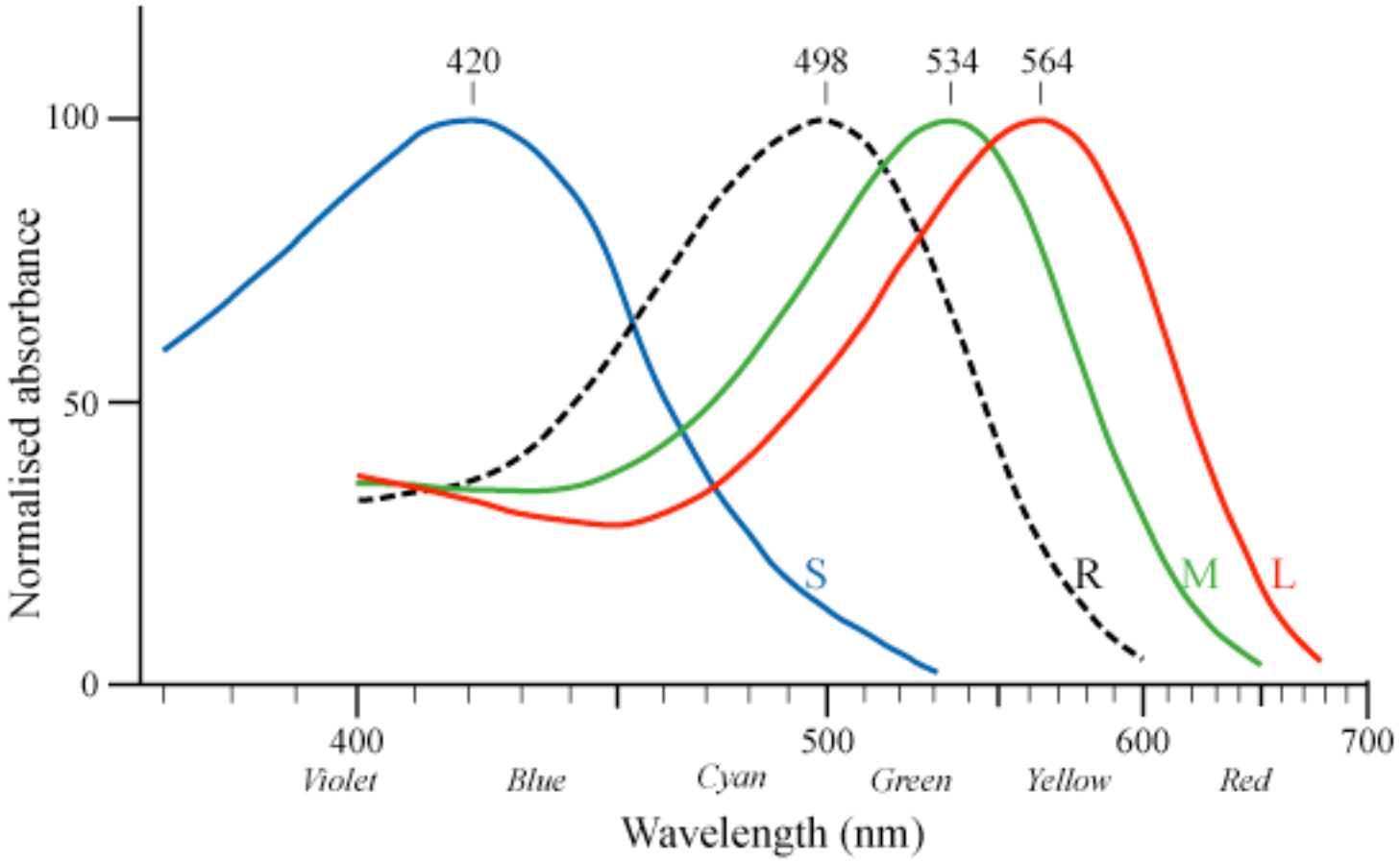


Source: http://vis.stanford.edu/color-names/analyzer/

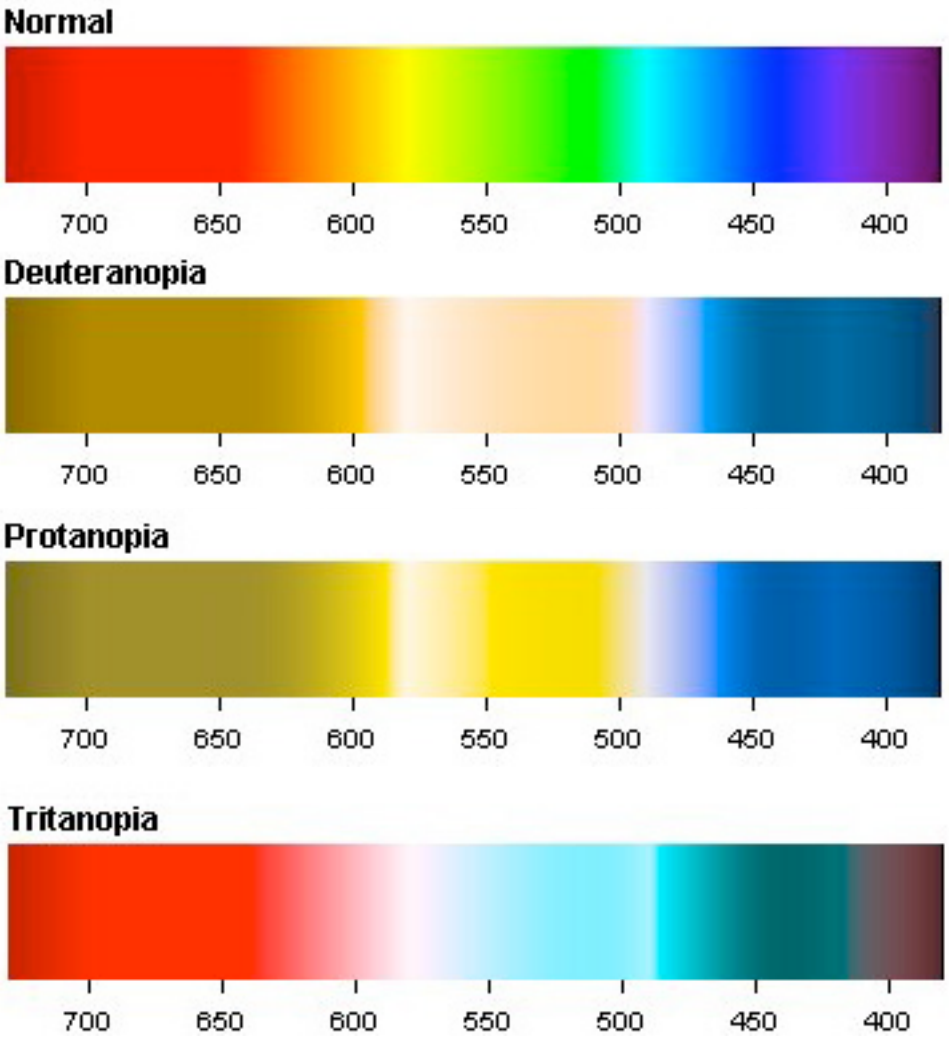
Saturation and Size

Source: Ware, C. *Information visualization, perception for design*, 2013

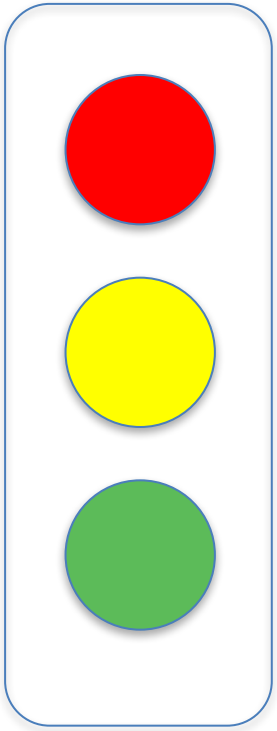
Color Blindness: Cones



Color Blindness: Types

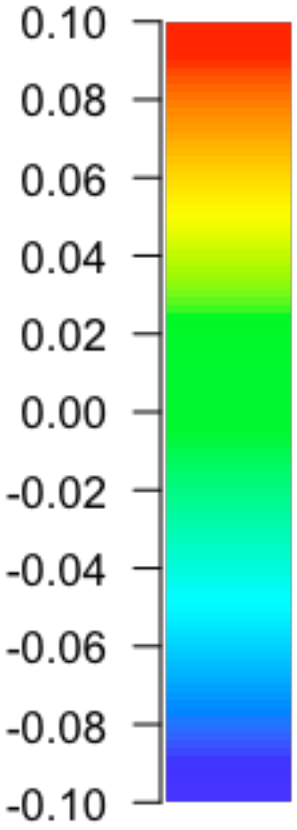


"Traffic Light" Indicators

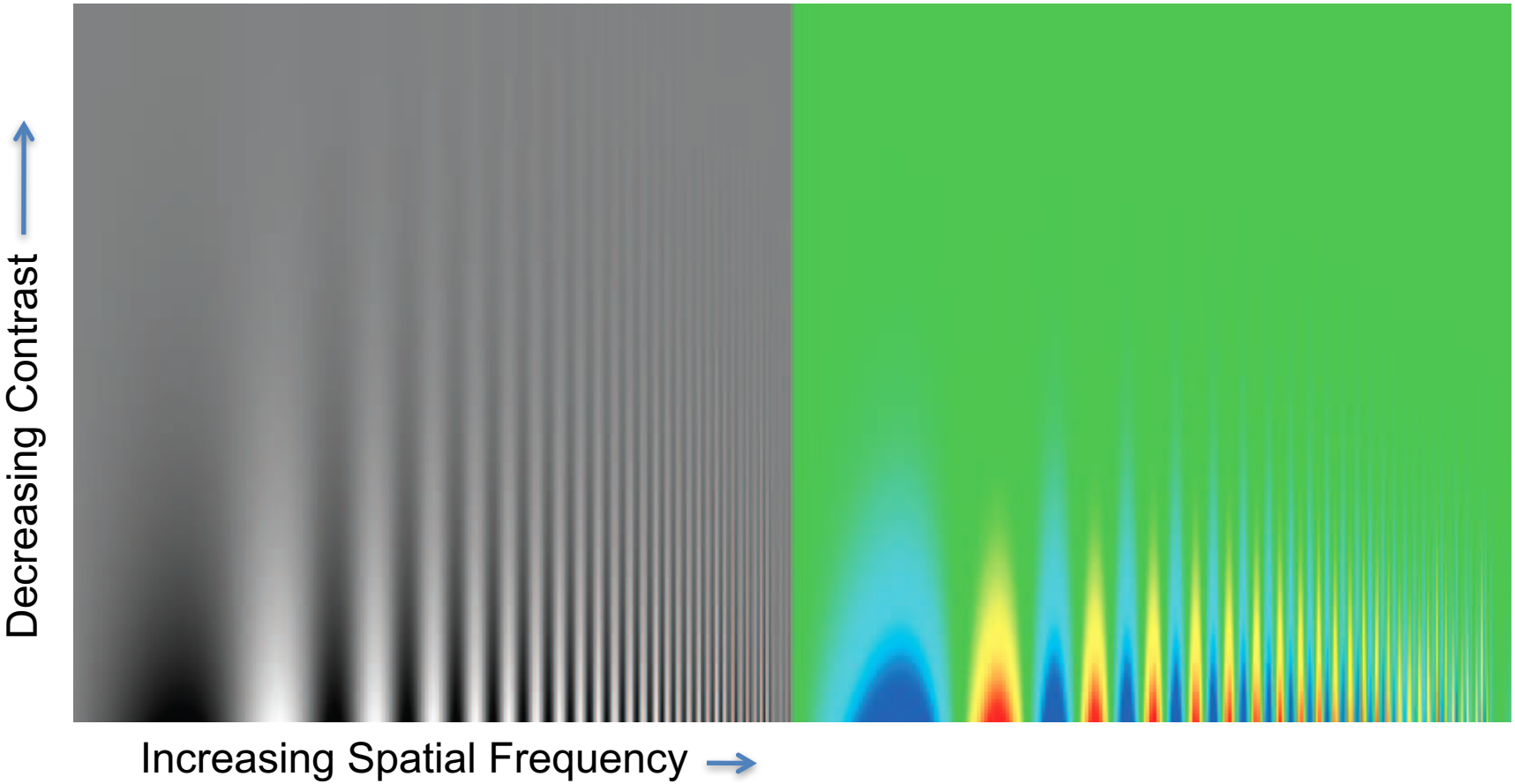


Color Scales

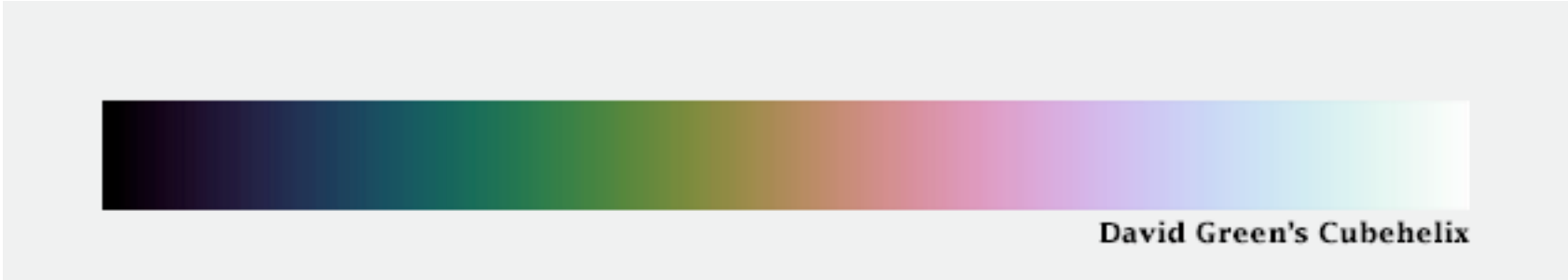
Typical Rainbow Color Scale



Contrast Sensitivity Function



Alternatives



d3.cubehelix()

divergent scales

Design Tips

- First ask: Is color necessary?
- Use colors that are separable and nameable when possible
- Scale appropriately
- Beware of poor contrast effects
- Design for color blindness

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