

DATA VISUALIZATION

The Neurobiology of Color

4 | COLOR

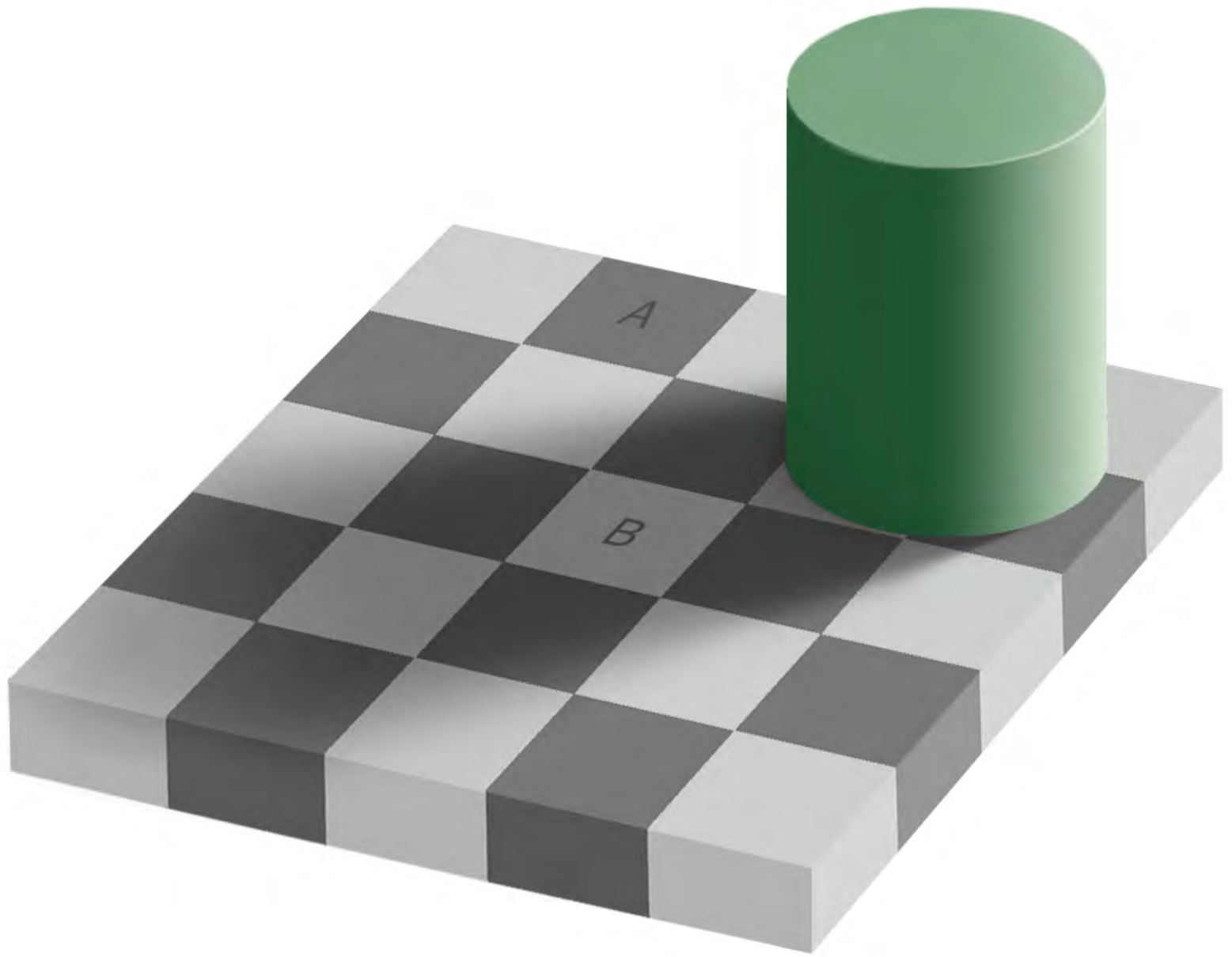


Image from Adelson, MIT

POP QUIZ, HOTSHOT

- 1) A IS LIGHTER THAN B
- 2) B IS LIGHTER THAN A
- 3) A AND B ARE THE SAME
- 4) JUST TELL ME, ALLRIGHT?

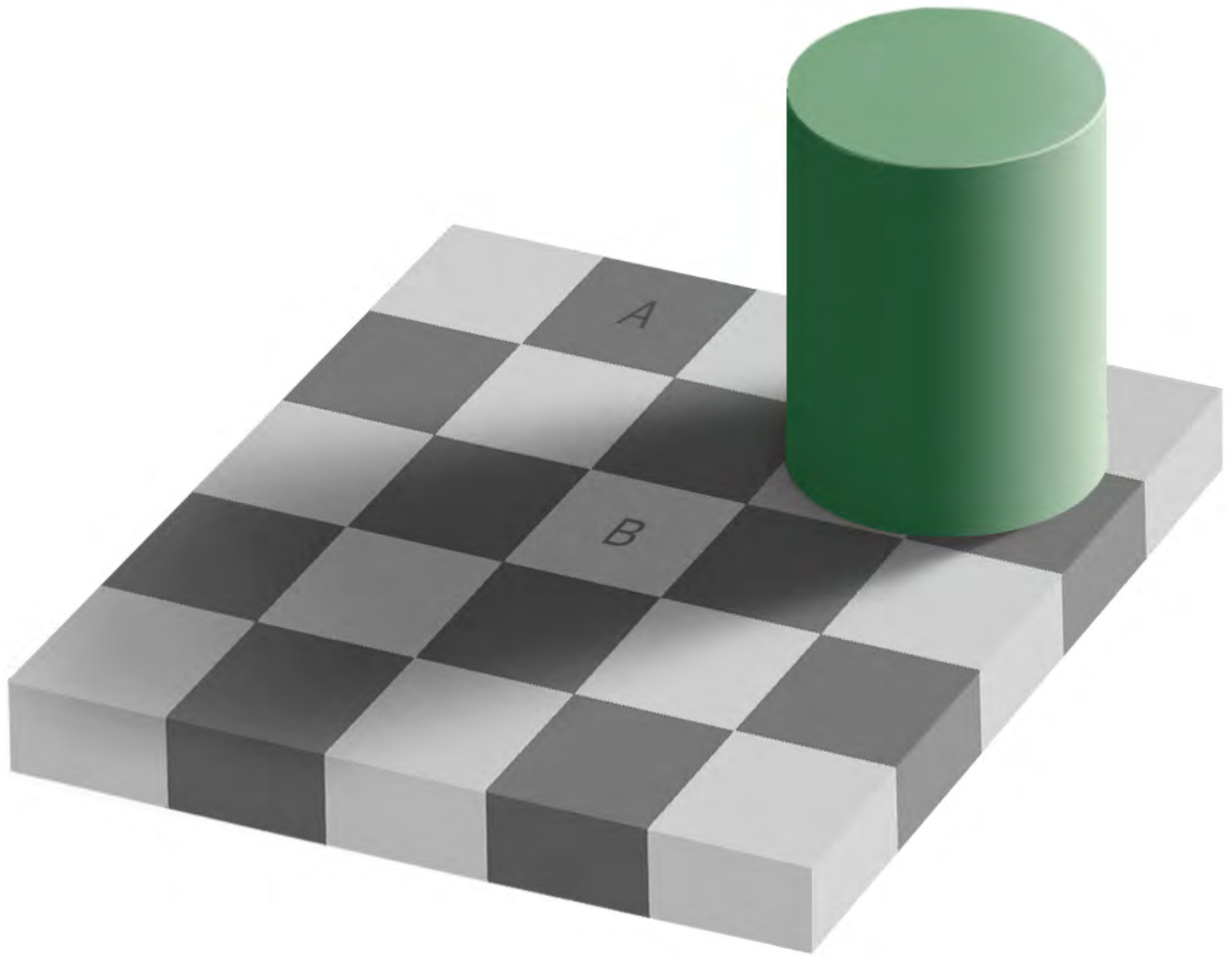
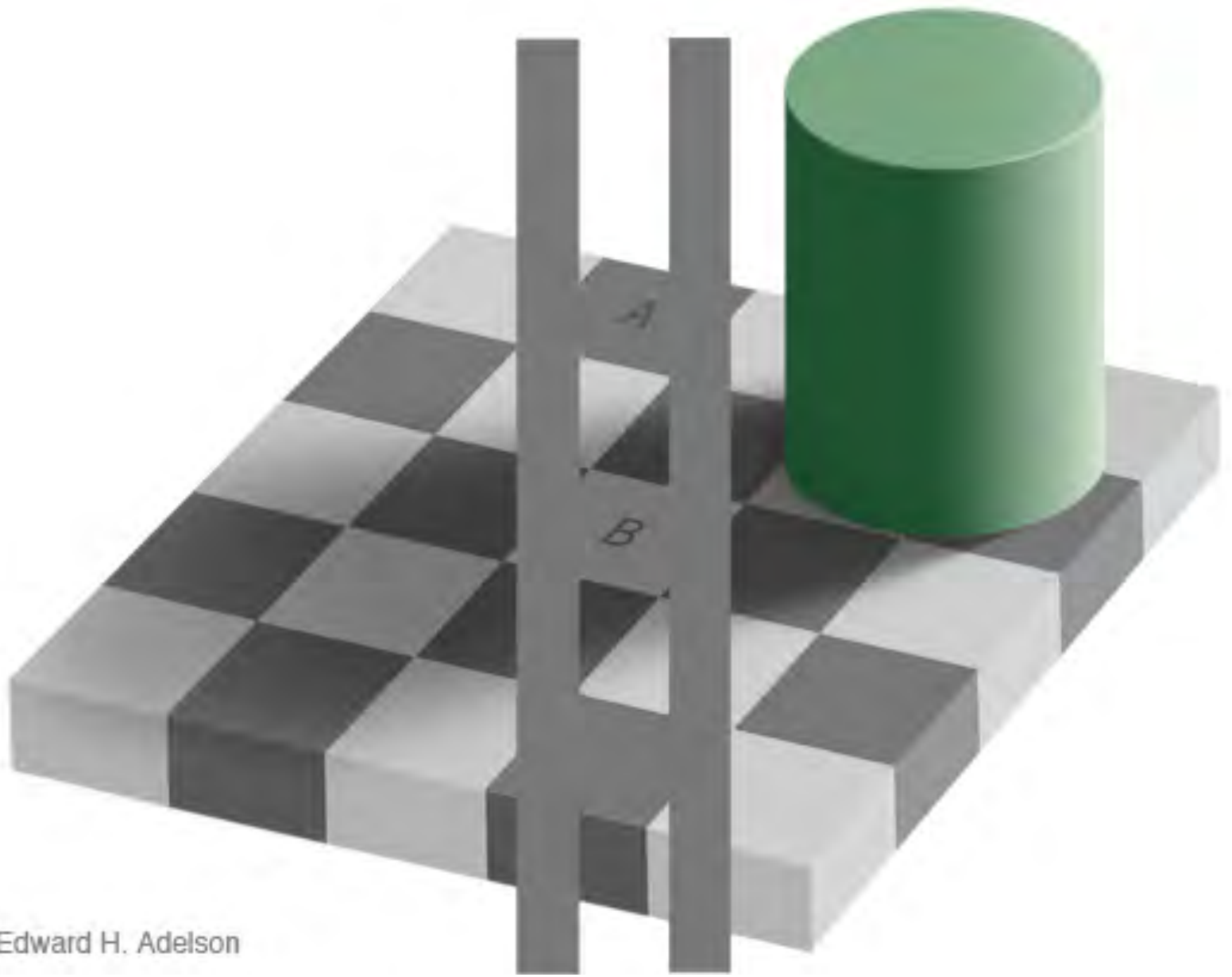












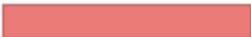







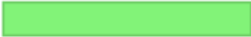





Image from Adelson, MIT



Edward H. Adelson

Image from Adelson, MIT

Color names if
you're a girl...

Maraschino		Red
Cayenne		
Maroon		Purple
Plum		
Eggplant		
Grape		
Orchid		Pink
Lavender		
Carnation		
Strawberry		
Bubblegum		
Magenta		
Salmon		Orange
Tangerine		
Cantaloupe		Yellow
Banana		
Lemon		
Honeydew		Green
Lime		
Spring		
Clover		
Fern		
Moss		
Flora		Blue
Sea Foam		
Spindrift		
Teal		
Sky		
Turquoise		

Color names if
you're a guy...

Doghouse Diaries
"We take no as an answer."

Actual color names
if you're a girl ...

Actual color names
if you're a guy ...



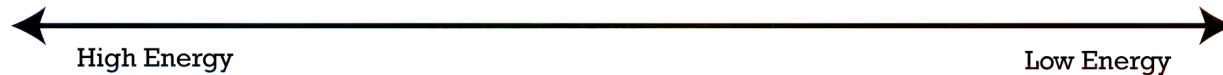
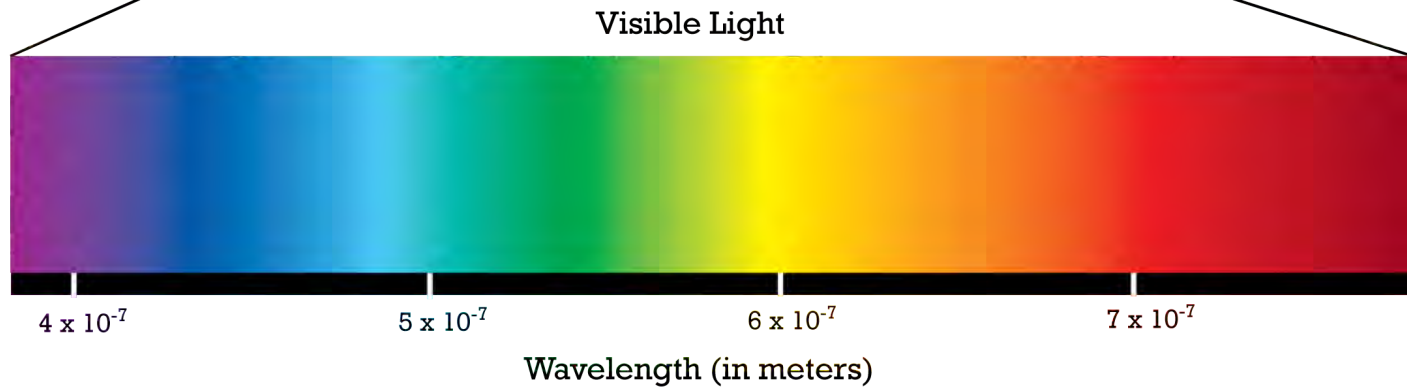
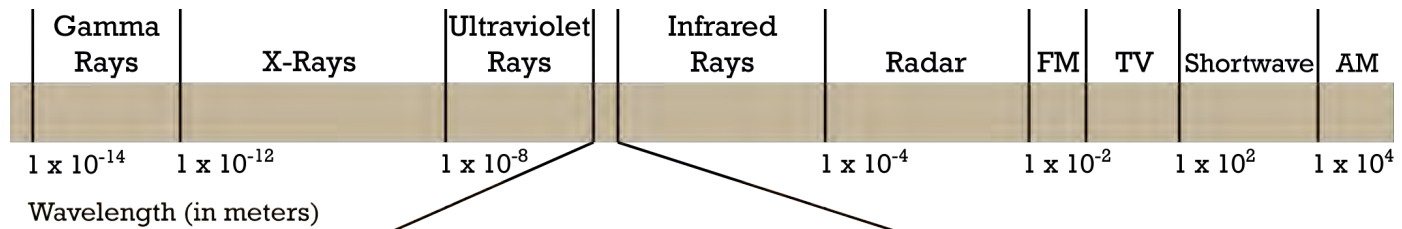
WHAT IS COLOR?

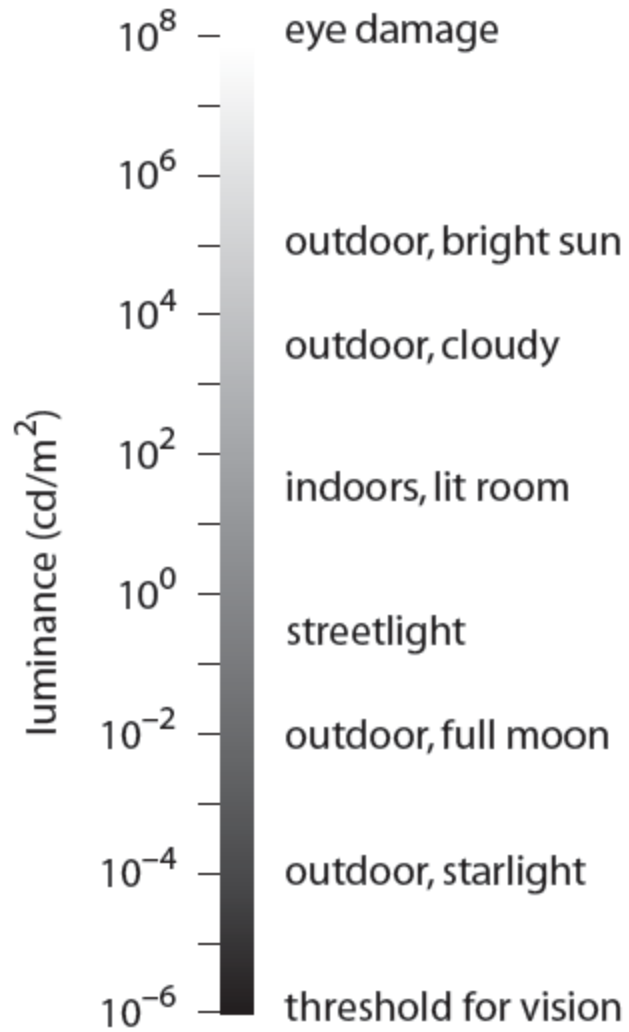
Physics	Biology	Visual System	Mental Models
Light Energy	Cone Response	Opponent Encoding	Perceptual Models
Wavelength	L, M, S	L, R-G, Y-B	Color perception

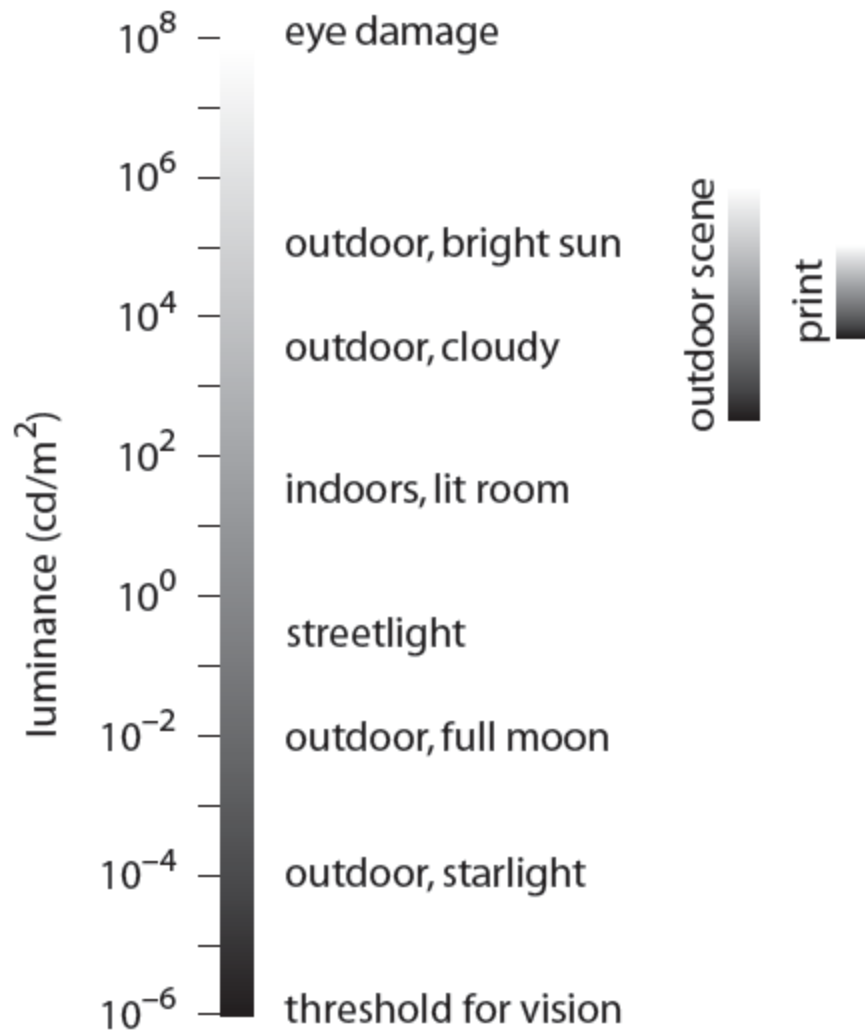
THE HUMAN EYE

SMALL FREQUENCY RANGE

HUGE LUMINANCE RANGE







A

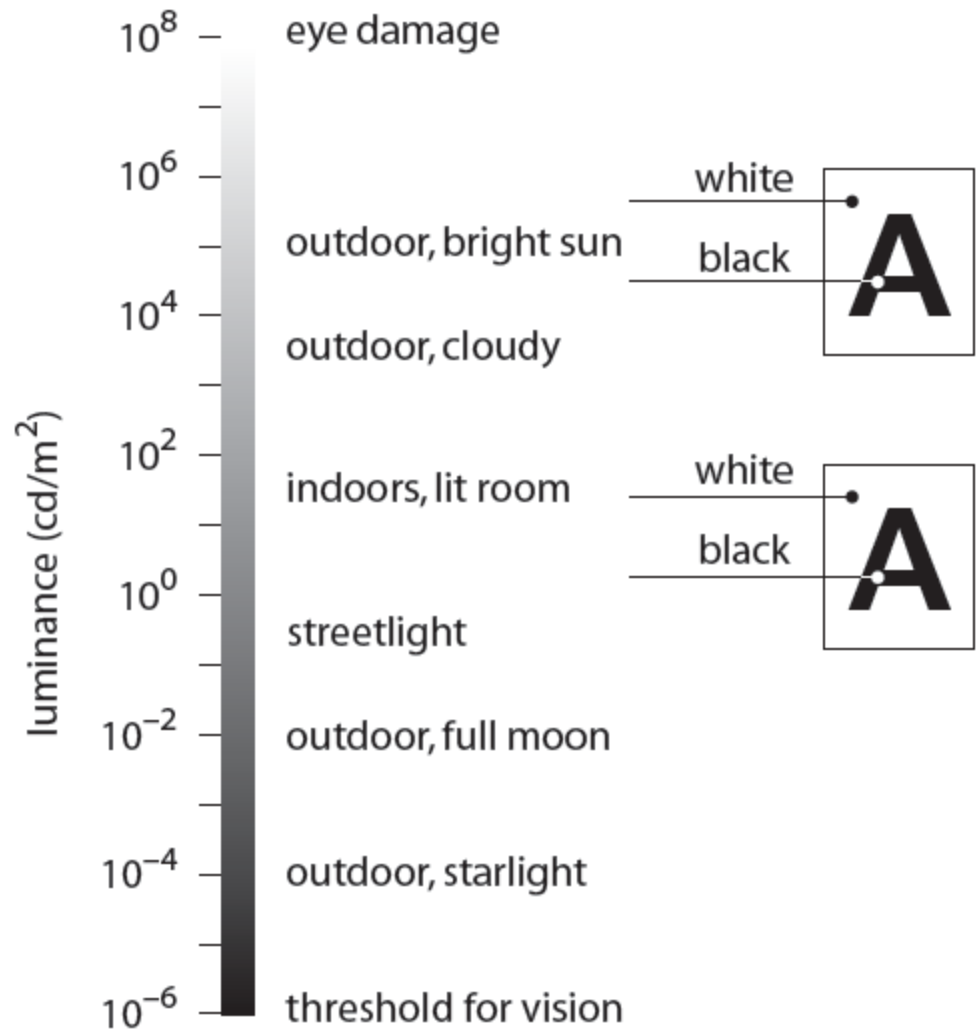
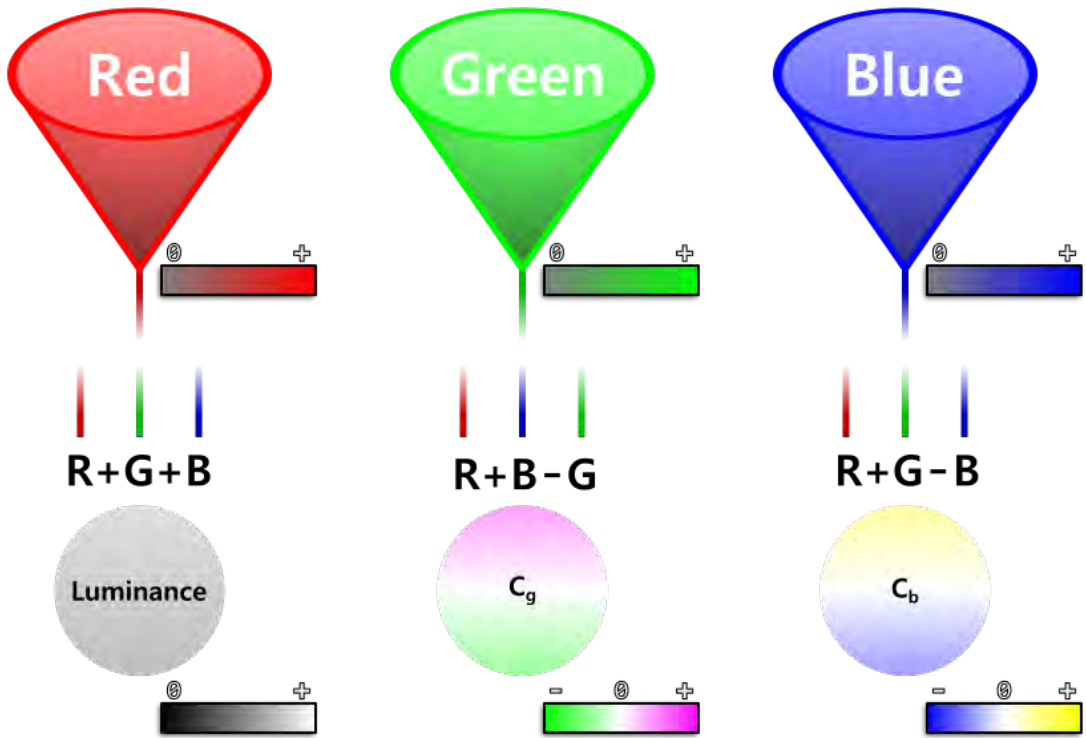




Image from <http://ideas.etublogs.usj.edu.lb/>



1. Trichromatic Stage

Trichromatic cone cells respond positively to one of three frequencies exhibited by photons arriving on their surface.

2. Opponent Process Stage

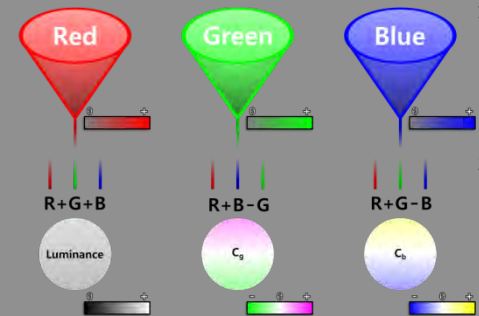
The three color channels are discovered by nearby opponent cells.

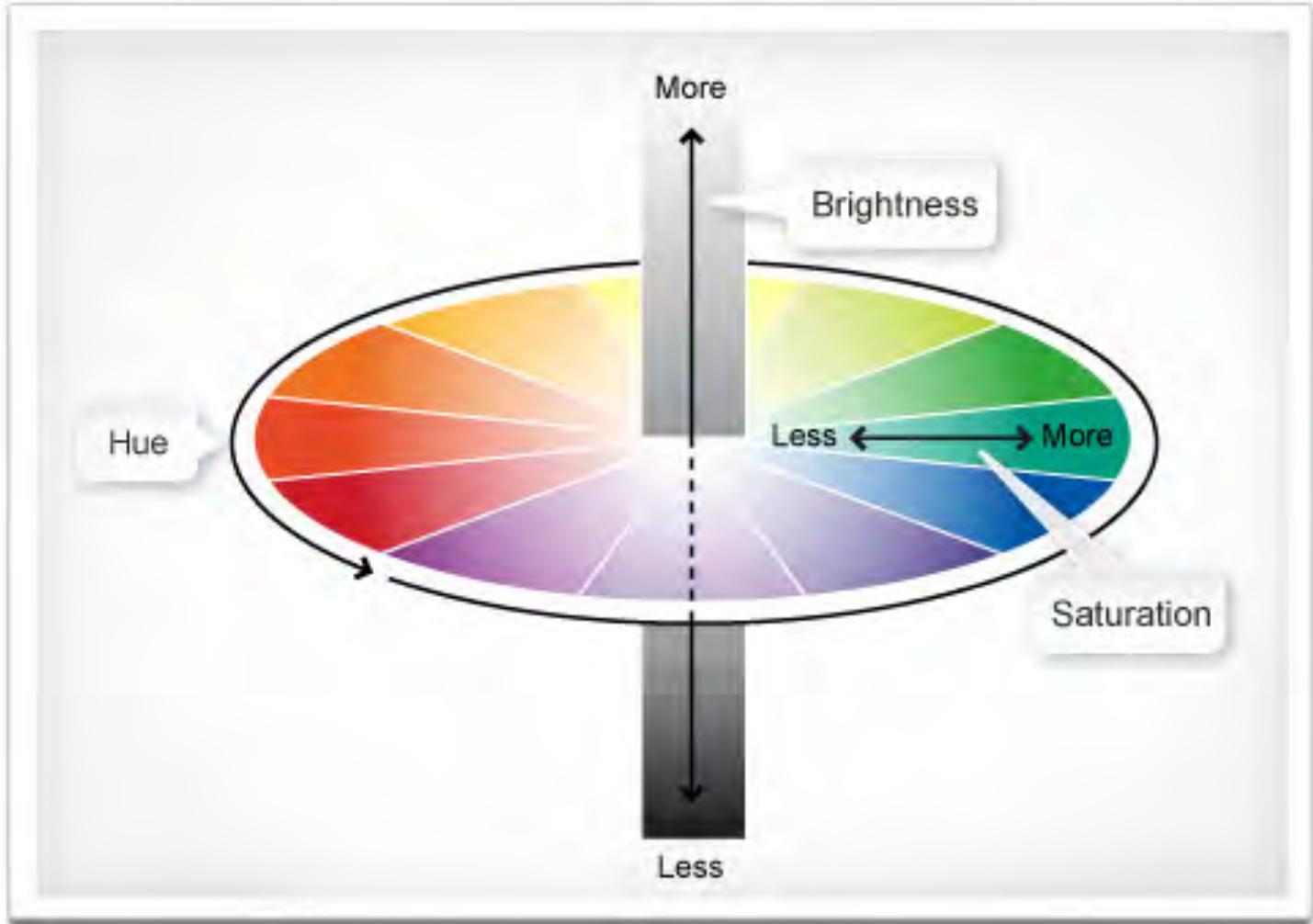
Opponent cells tuned to luminosity are excited by the red, green, and blue color signals.

Cg cells are excited by red and blue and inhibited by green. Cb cells are excited by red and green and inhibited by blue.

THE RETINA & COLOR

- 1) SPATIAL COMPRESSION
- 2) ADJUST LUMINANCE RANGE TO NERVE S/N
- 3) EXTRACT REFLECTANCE (COLOR)





Who in the rainbow can draw the line where the violet tint ends and the orange tint begins? Distinctly we see the difference of the colors, but where exactly does the one first blendingly enter into the other? So with sanity and insanity.

—*Herman Melville, Billy Budd*

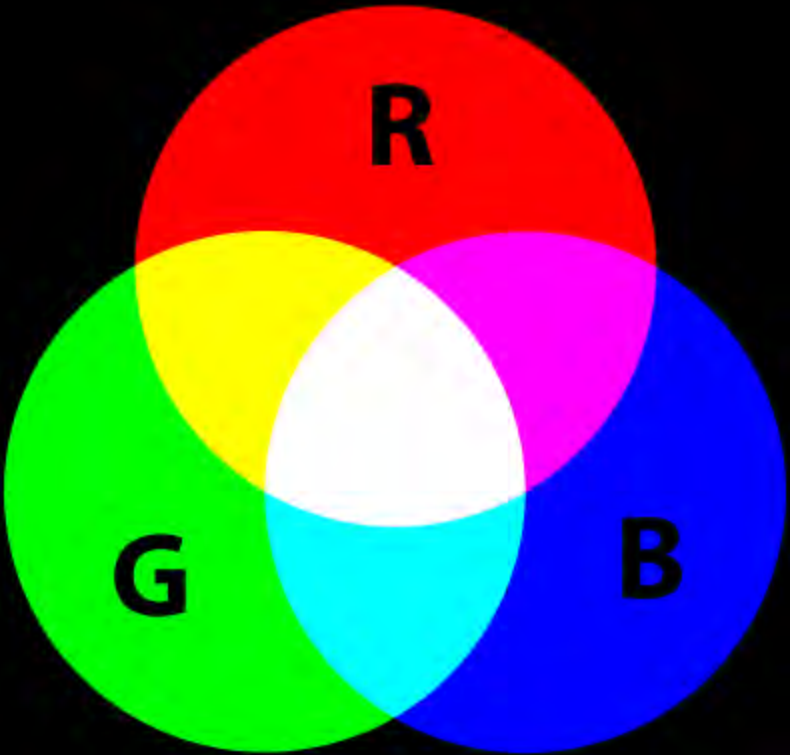


Image from Wikipedia

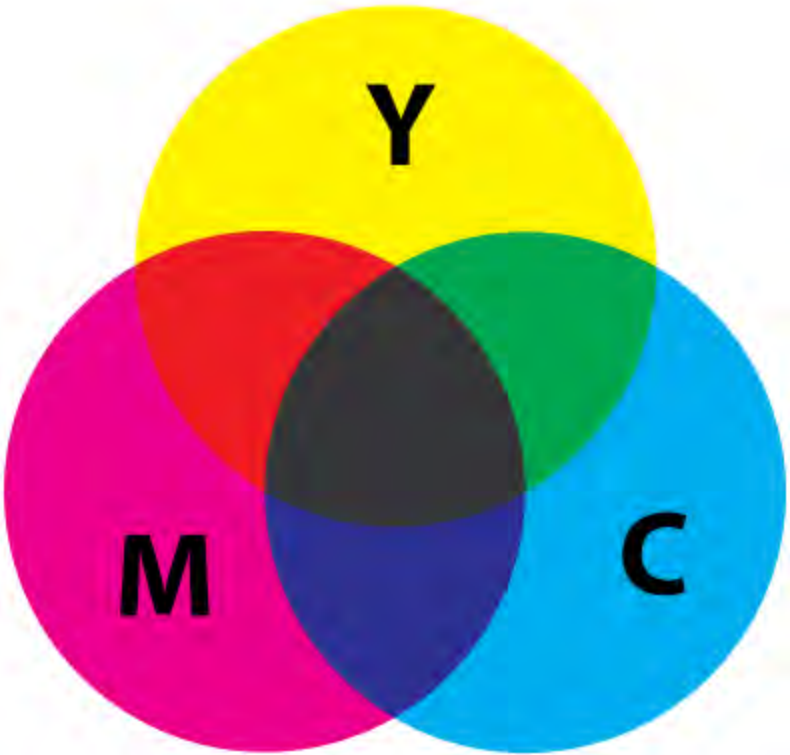
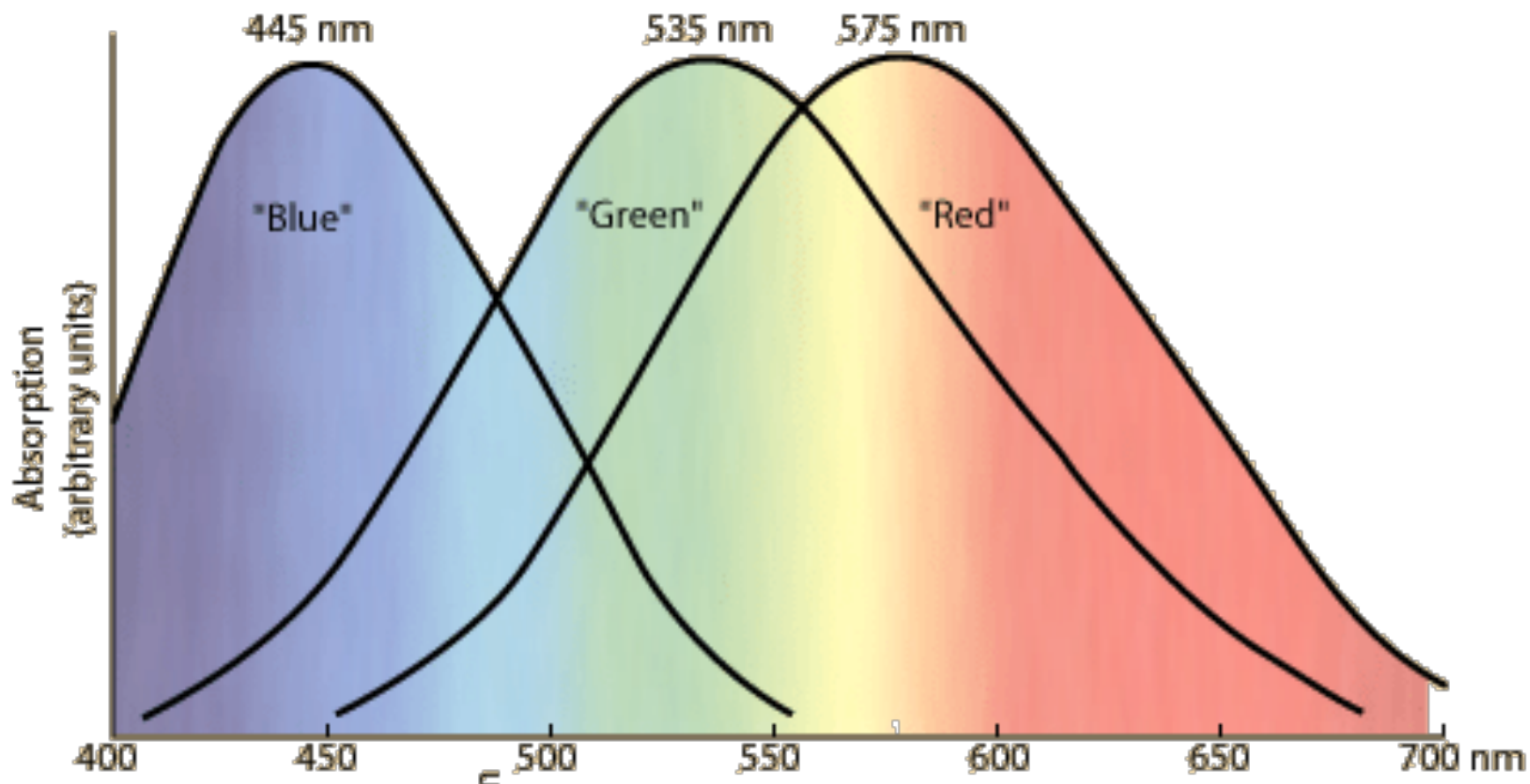
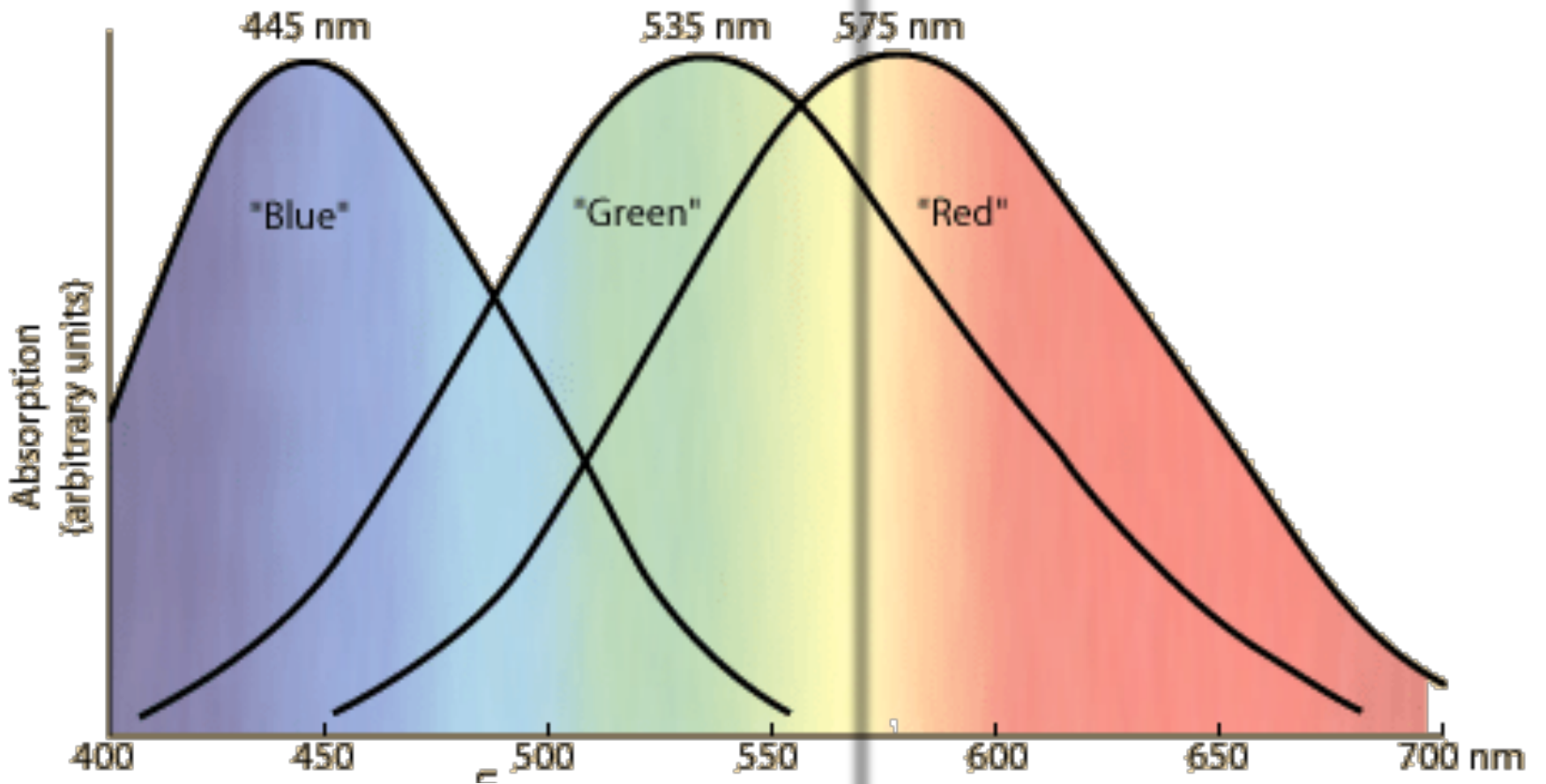


Image from Wikipedia

GOOGLE THIS IS NOT YELLOW





WHAT IS YELLOW?

REAL WORLD: 570 NM

SCREEN: ADDITIVE (R+G)

PRINT: SUBTRACTIVE





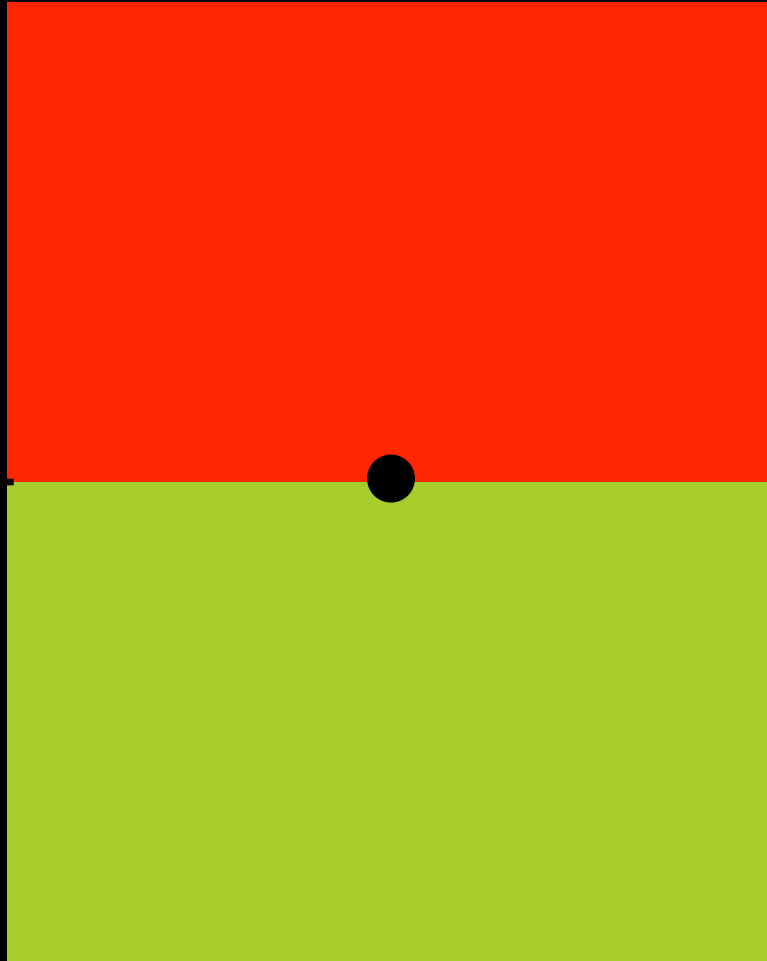
Tritanope

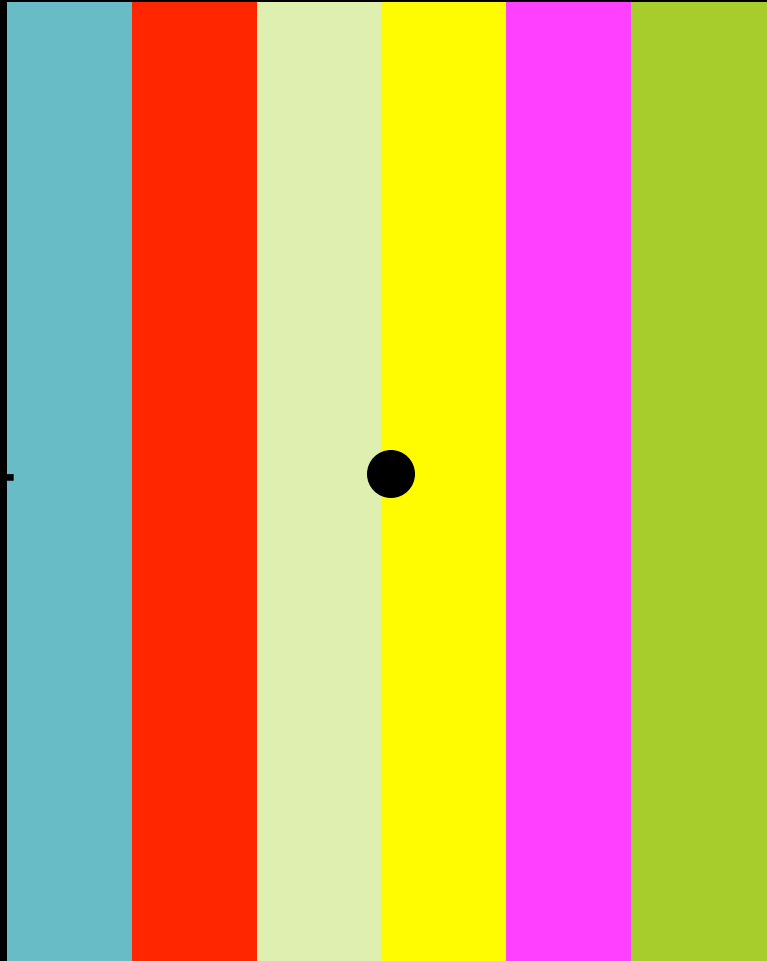


Normal



Deuteranope





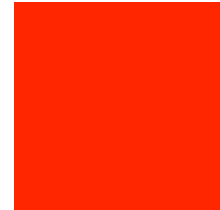
RULE OF THUMB

**COLOR: FORM & FUNCTION
QUALITATIVE**

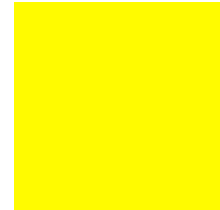
**LUMINESCENCE: DEPTH
SLIGHTLY QUANTITATIVE**

USING COLOR

NOMINAL



ORDINAL

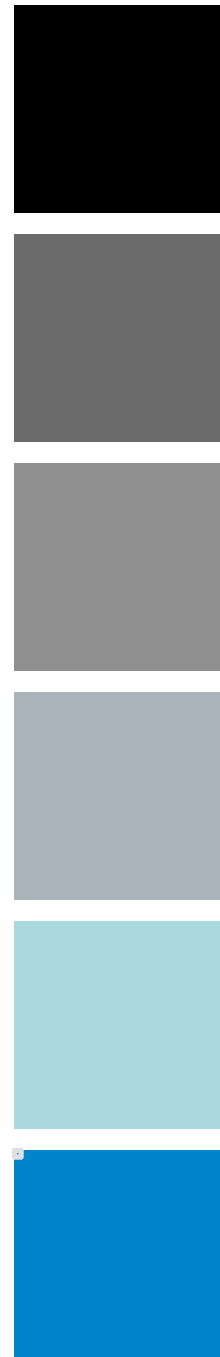


ORDINAL / SEQUENTIAL



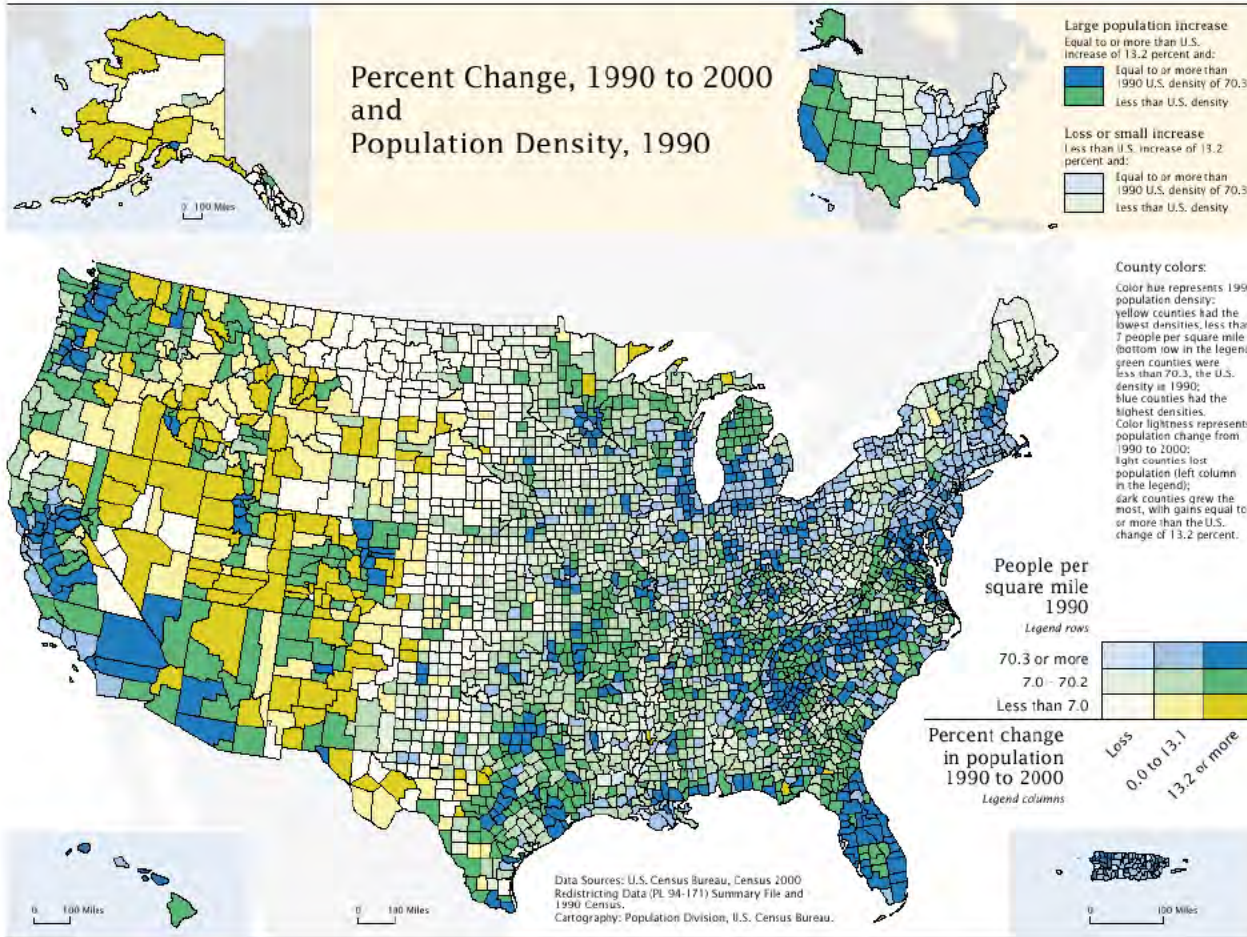
■

DIVERGENT



SEQUENTIAL







SCREEN

PRINT



SCREEN

PRINT



SCREEN

PRINT

DON'T DO THIS!

- Avoid loud, garish colors...dark text on light background or vice versa is best.
- Avoid text colors that fade into background, i.e. blue and black
- Avoid color-blind combinations:
 - Red and green
 - Blue and yellow

CHECK LUMINANCE & COLOR IN GRAYSCALE

Number of data classes: 3

how to use | updates | downloads | credits

COLORBREWER 2.0

color advice for cartography

Nature of your data:

sequential diverging qualitative

Pick a color scheme:

Multi-hue:



Single hue:



Only show:

- colorblind safe
- print friendly
- photocopy safe

Context:

- roads
- cities
- borders

Background:

- solid color
- terrain

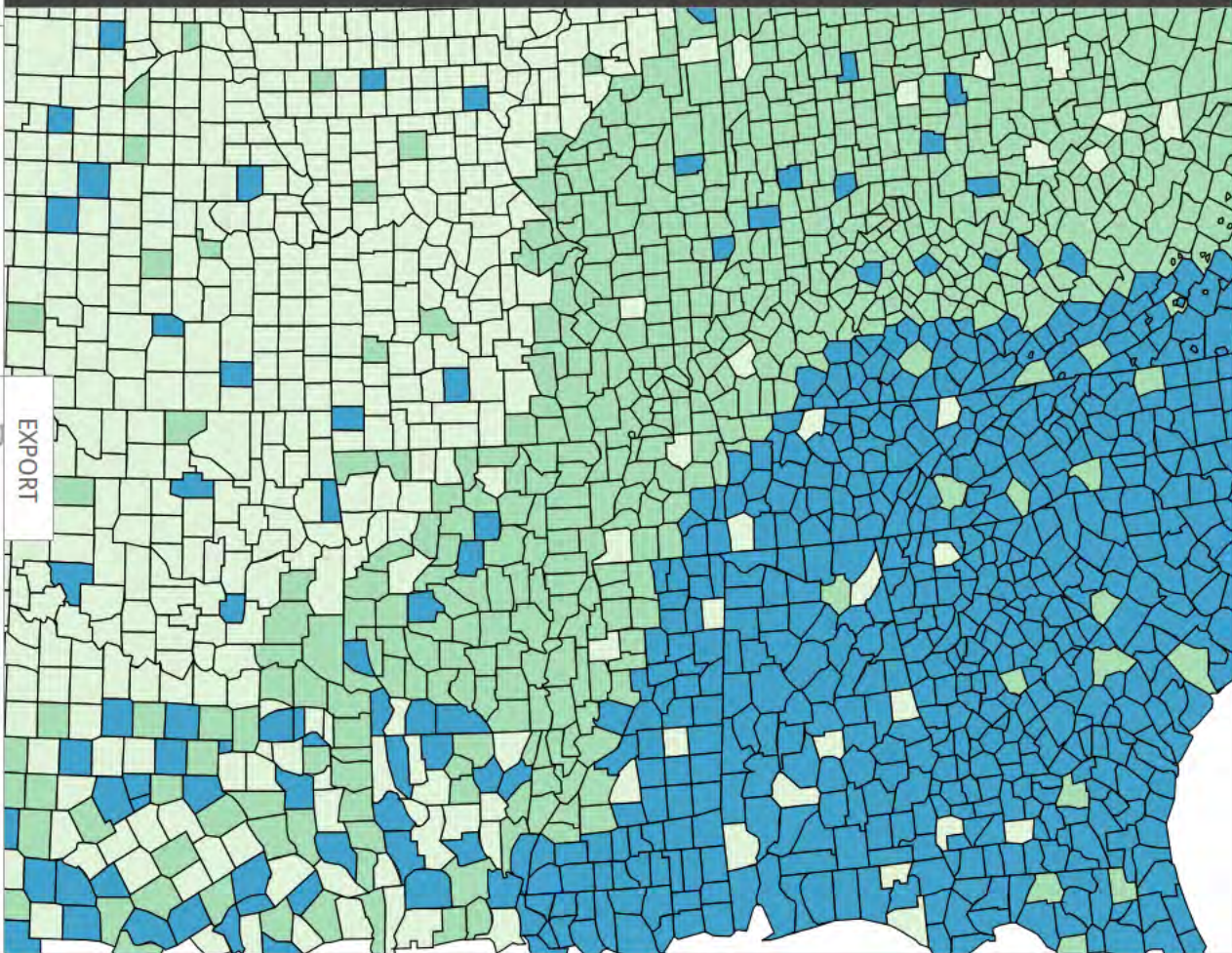
color transparency

3-class GnBu



HEX

- #e0f3db
- #a8ddb5
- #43a2ca



Adobe Color CC Create Explore My Themes SIGN IN Adobe

Save My Color Theme

Color Rule

Analogous

Color palette showing four selected colors with their RGB and HEX values:

Color	RGB	HEX
Orange	255 83 13	FF530D
Red-Orange	232 44 12	E82C0C
Red	255 0 0	FF0000
Magenta	232 12 122	E80C7A
Light Magenta	255 13 255	FF00FF

View

All Themes

Most Popular

Week | Month | All

Most Used

Random



sandy stone beach o... 9K+ 9K+ 326



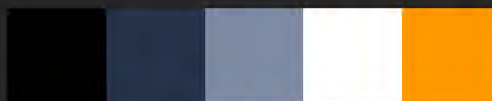
Firenze 9K+ 7K+ 185



Neutral Blue 9K+ 5K+ 50



Cherry Cheesecake 9K+ 4K+ 105



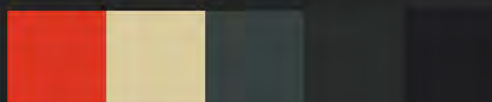
1944mustang 8K+ 3K+ 44



Honey Pot 6K+ 3K+ 40



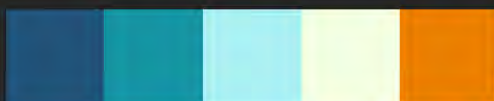
Watermelon 9K+ 3K+ 151



Sea Wolf 5K+ 3K+ 38



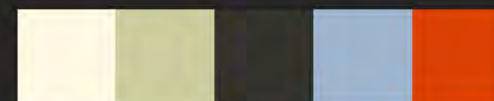
Phaedra 4K+ 3K+ 14



Aspirin C 6K+ 3K+ 27



Vitamin C 5K+ 3K+ 37



Orange on gray 8K+ 3K+ 46

[HTTP://WWW.COLOR-BLINDNESS.COM](http://www.color-blindness.com)

[HTTP://WWW.VISCHECK.COM/](http://www.vischeck.com/)

[HTTP://COLOR.ADOBE.COM](http://color.adobe.com)

(4) | COLOR

2 3 4 5 6 7 8 9 1 2 3 4 5

1
10⁻³