

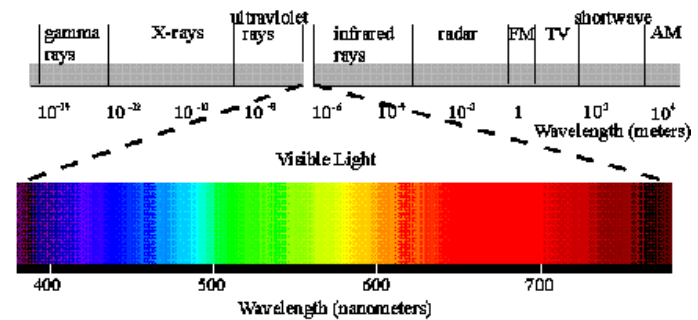
CMPSCI 370HH: Introduction to Computer Vision

Color naming

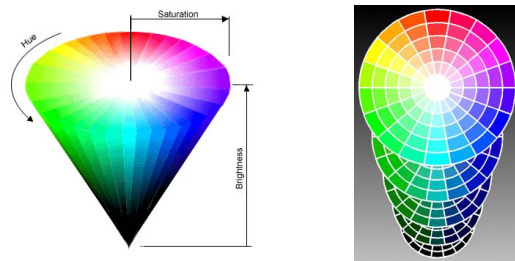
University of Massachusetts, Amherst
February 09, 2016

Instructor: Subhansu Maji

Electromagnetic Spectrum

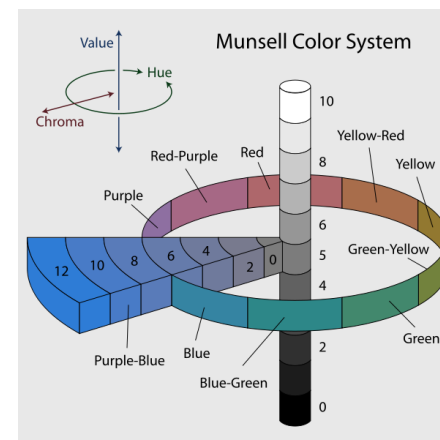


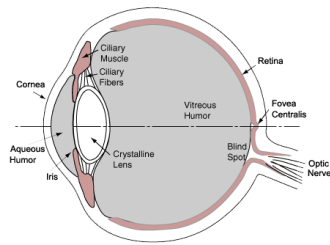
Hue, Saturation, Brightness



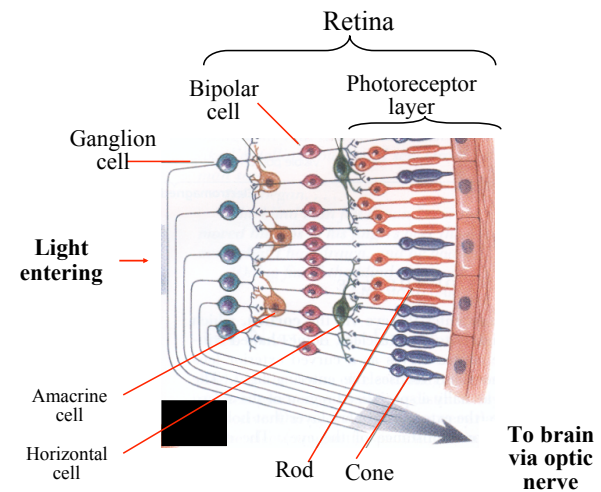
How many color gradations can the human eye distinguish?

1. about 200 hues
 2. about 500 levels of brightness
 3. About 20 levels of saturation
- $200 \times 500 \times 20 = 2,000,000$ color gradations



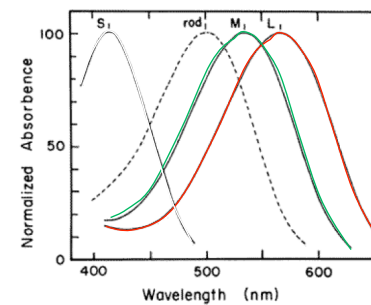


<http://web.mit.edu/bcs/schillerlab/research.html>



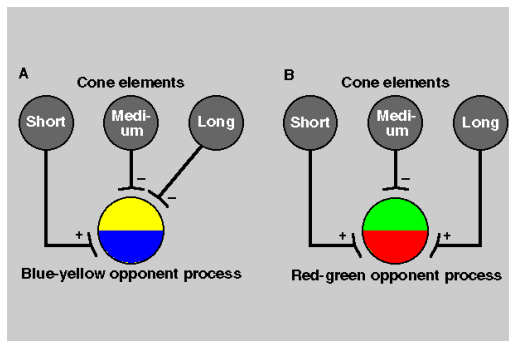
Trichromatic – Cones

- Trichromatic Theory
red-, green-, blue-sensitive cones
- Opponent-process Theory
red-green, blue-yellow, black-white opponent pairs



- Cones
- Short (Blue)
 - Medium (Green)
 - Long (Red)

Opponent-Process



Qs to ask about role of language on color perception

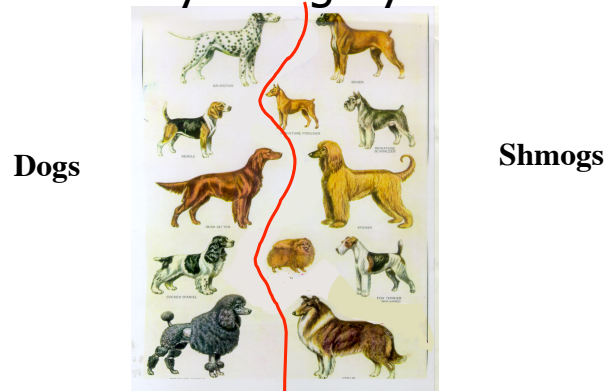
Two Positions

- Universalists
 - perceptual categories are “hardwired” into the visual system, and language categories reflect these discontinuities in perceptual color space
- Relativists
 - perceptual categories are constructed through language

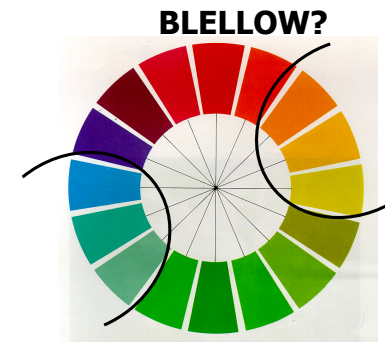
Berlin & Kay (1969)

- Is color naming across languages largely a matter of arbitrary linguistic convention?
 - If YES: support relativist position
 - If NO: support universalist position

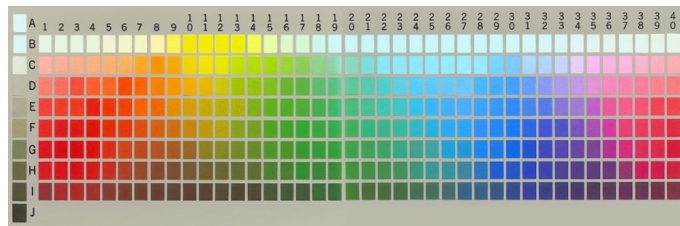
Can languages pick out
any category?



Dividing the spectrum



Name that color.



Languages

Table 2. Languages studied by BK (1)

Index	Language	Where spoken
1	Arabic (Lebanese colloquial)	Lebanon
2	Bahasa Indonesia	Indonesia
3	Bulgarian	Bulgaria
4	Cantonese	China
5	Catalan	Spain
6	(American) English	United States
7	Hebrew	Israel
8	Hungarian	Hungary
9	Ibibio	Nigeria
10	Japanese	Japan
11	Korean	Korea
12	Mandarin	China
13	(Mexican) Spanish	Mexico
14	Pomo	United States
15	Swahili	Tanzania
16	Tagalog	Philippines
17	Thai	Thailand
18	Tzeltal	Mexico
19	Urdu	Pakistan
20	Vietnamese	Vietnam

Data reported from one subject per language.

Eleven possible basic color terms

- White, black, red, green, yellow, blue, brown, purple, pink, orange, gray.
- All languages contain term for white and black.
- Has 3 terms, contains a term for red.
- Has 4 terms, contains green or yellow.
- Has 5 terms, contains both green and yellow.
- Has 6 terms, contains blue.
- Has 7 terms, contains brown.
- Has 8 or more terms, chosen from {purple, pink, orange, gray}

Color hierarchy

- White, black
- Red
- Green, yellow
- Blue
- Brown
- Purple, pink, orange, gray
- Even assuming these 11 basic color terms, there should be 2048 possible sets—but only 22 (1%) are attested.

Color terms

- BW Jalé (New Guinea) 'brilliant' vs. 'dull'
- BW^R Tiv (Nigeria), Australian aboriginals in Seven Rivers District, Queensland.
- BW^RGB Ibibo (Nigeria), Hanunóo (Philippines)
- BW^RY Ibo (Nigeria), Fitzroy River people (Queensland)
- BW^RY^G Tzeltal (Mexico), Daza (eastern Nigeria)
- BW^RY^GU Plains Tamil (South India), Nupe (Nigeria), Mandarin?
- BW^RY^GU^O Nez Perce (Washington), Malayalam (southern India)

Color terms

- Interesting questions abound, including *why* this order, *why* these eleven—and there are potential reasons for it that can be drawn from the perception of color spaces which we will not attempt here.
- The point is: This is a fact about Language: If you have a basic color term for blue, you also have basic color terms for black, white, red, green, and yellow.