
Calvin and Hobbes
by WATTERSON
WOW, HONEY, YOU'RE MISSING A BEAUTIFUL SUNSET OUT HERE!
I'LL COUNT TO 10, AND THEN... POW!
DAD, HOW COME OLD PHOTOGRAPHS ARE ALWAYS BLACK AND WHITE? DIDN'T THEY HAVE COLOR FILM BACK THEN?
SURE THEY DID. IN FACT, THOSE OLD PHOTOGRAPHS ARE IN COLOR. IT'S JUST THE WORLD WAS BLACK AND WHITE THEN.
REALLY?
YEP. THE WORLD DIDN'T TURN COLOR UNTIL SOMETIME IN THE 1930s, AND IT WAS PRETTY GRAINY COLOR FOR A WHILE, TOO.
THAT'S REALLY WEIRD.
WELL, TRUTH IS STRANGER THAN FICTION.
BUT THEN WHY ARE OLD PAINTINGS IN COLOR?! IF THE WORLD WAS BLACK AND WHITE, WOULDN'T ARTISTS HAVE PAINTED IT THAT WAY?
NOT NECESSARILY. A LOT OF GREAT ARTISTS WERE INSANE.
BUT... BUT HOW COULD THEY HAVE PAINTED IN COLOR ANYWAY? WOULDN'T THEIR PAINTS HAVE BEEN SHADES OF GRAY BACK THEN?
OF COURSE, BUT THEY TURNED COLORS LIKE EVERYTHING ELSE DID IN THE '30s.
SO WHY DIDN'T OLD BLACK AND WHITE PHOTOS TURN COLOR TOO?
BECAUSE THEY WERE COLOR PICTURES OF BLACK AND WHITE, REMEMBER?
THE WORLD IS A COMPLICATED PLACE, HOBBES.
WHENEVER IT SEEMS THAT WAY, I TAKE A NAP IN A TREE AND WAIT FOR DINNER.
10-29

cs6630 | September 11 2014

COLOR

Miriah Meyer

University of Utah

administrivia . . .

- data exploration assignment due on Tuesday last time . . .

MARK TYPES

marks as nodes (items)

points (0D)

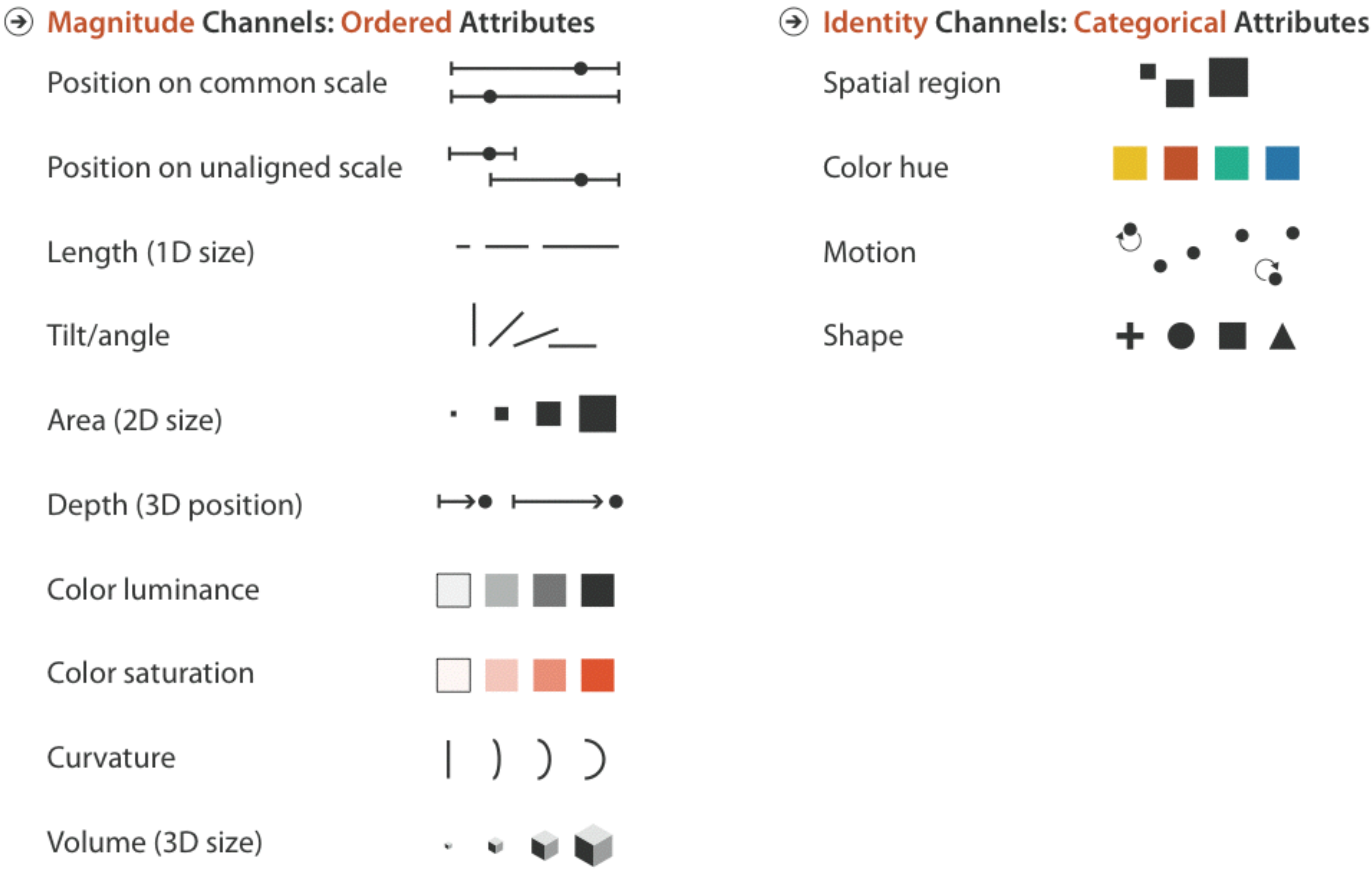
lines (1D)

areas (2D)

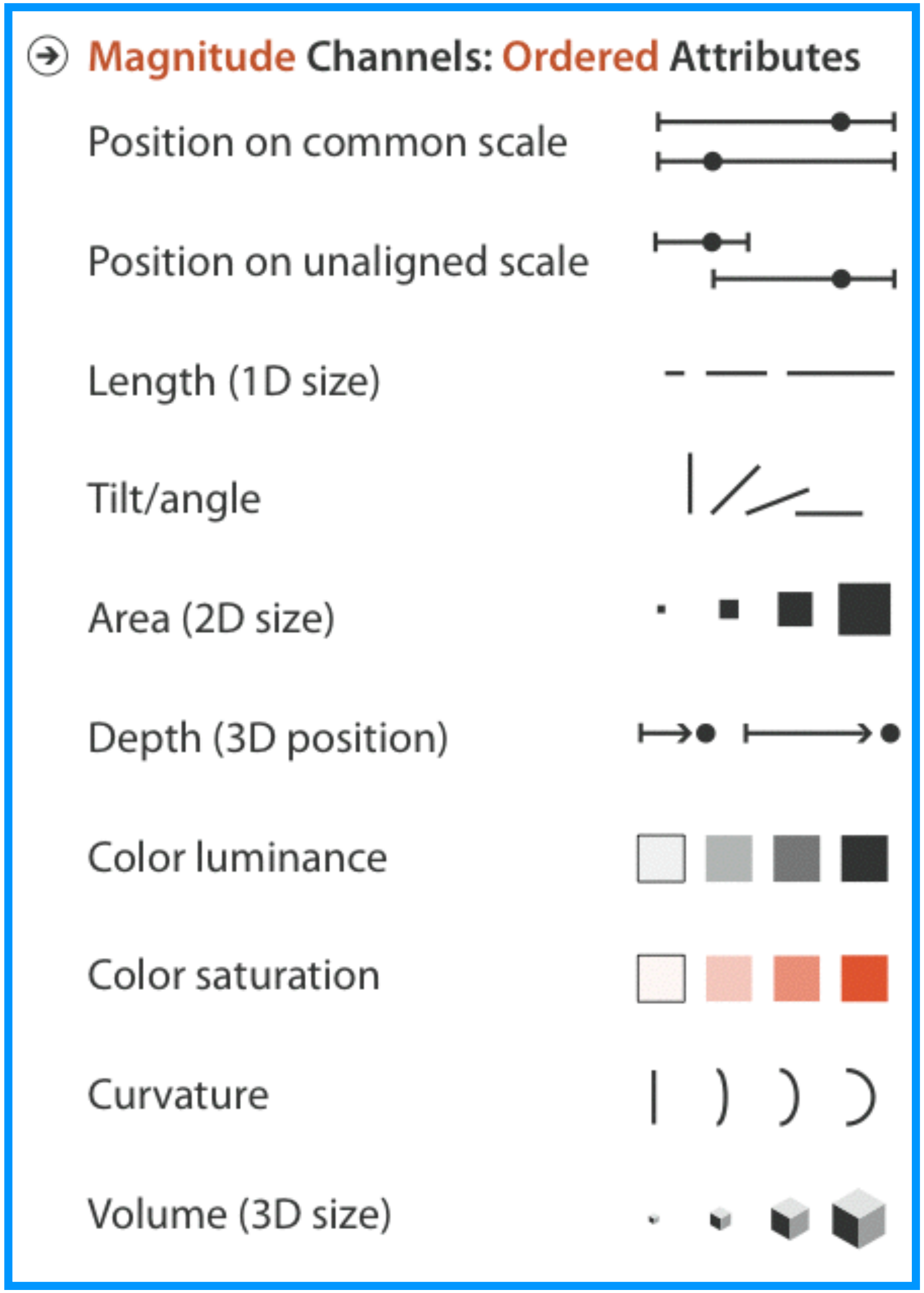
marks as links

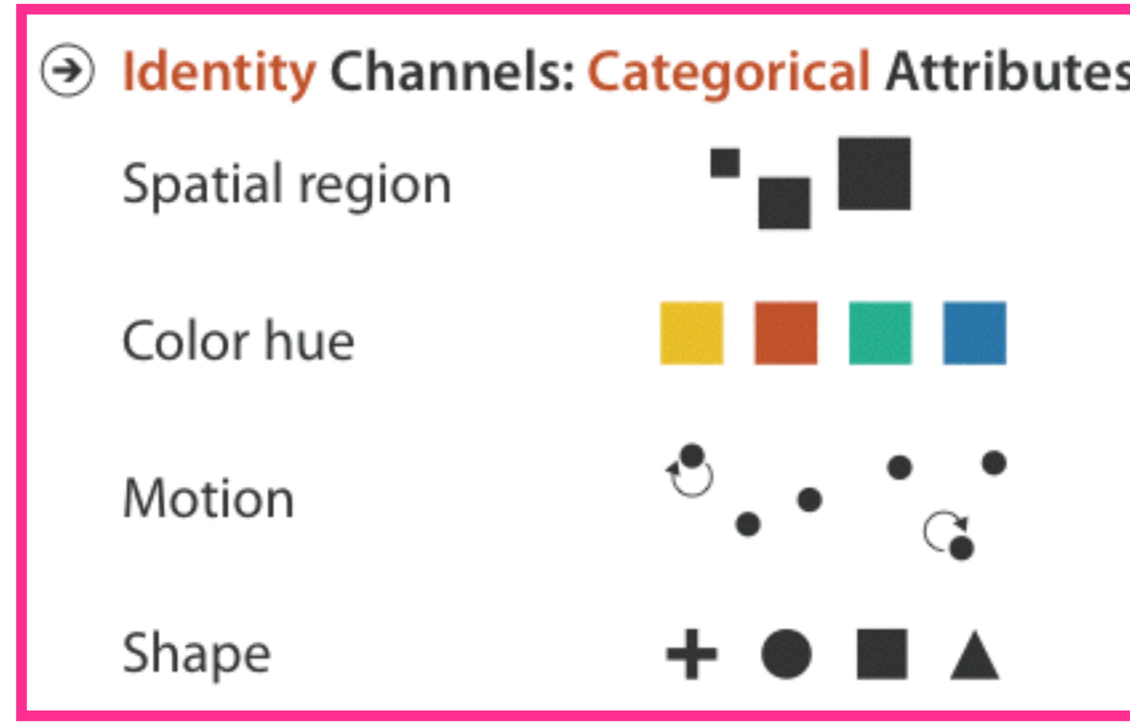
containment

connection



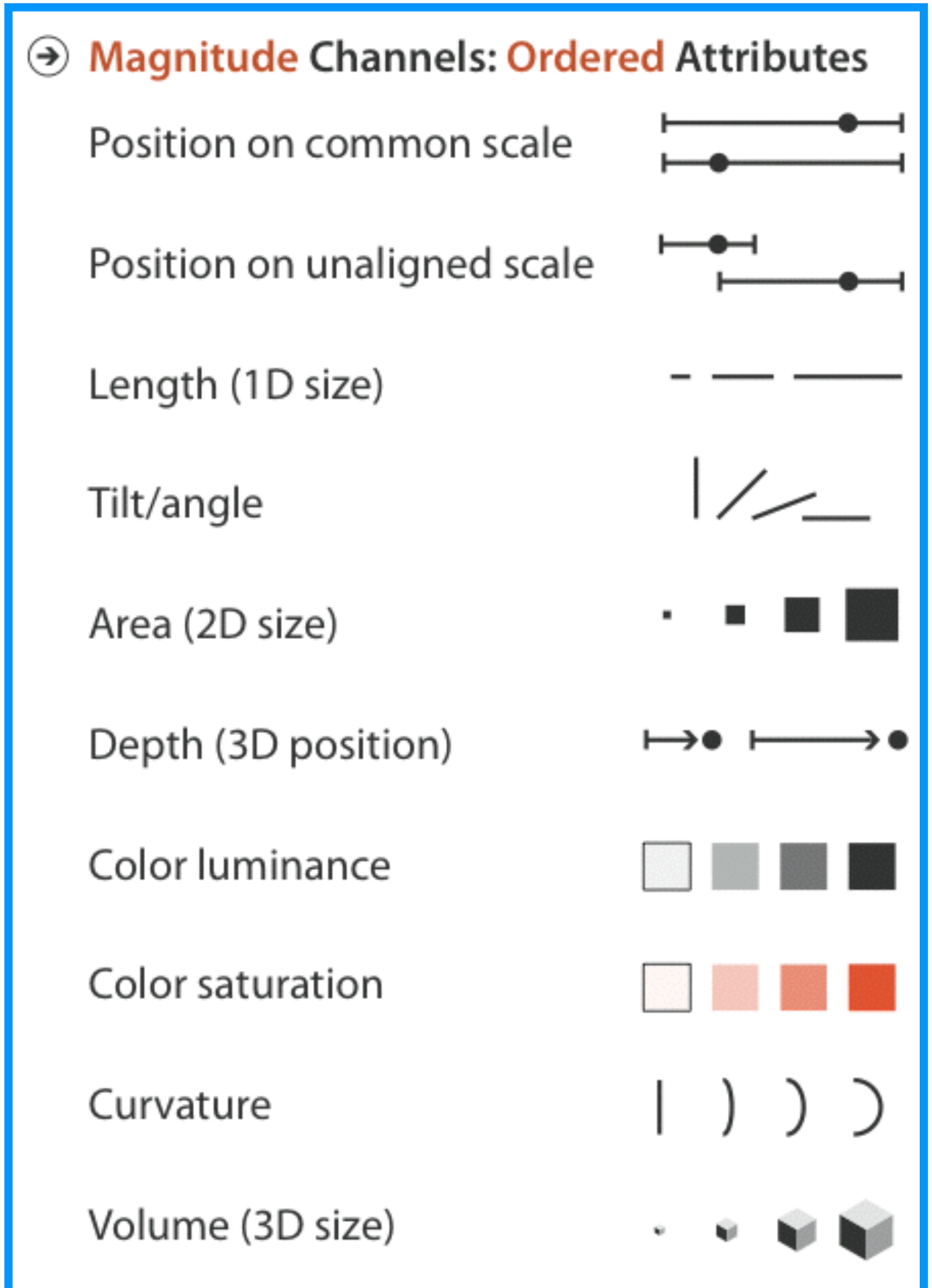
Magnitude Channels: Ordered Attributes
Position on common scale
Position on unaligned scale
Length (1D size)
Tilt/angle
Area (2D size)
Depth (3D position)
Color luminance
Color saturation
Curvature
Volume (3D size)
Identity Channels: Categorical Attributes
Spatial region
Color hue
Motion
Shape



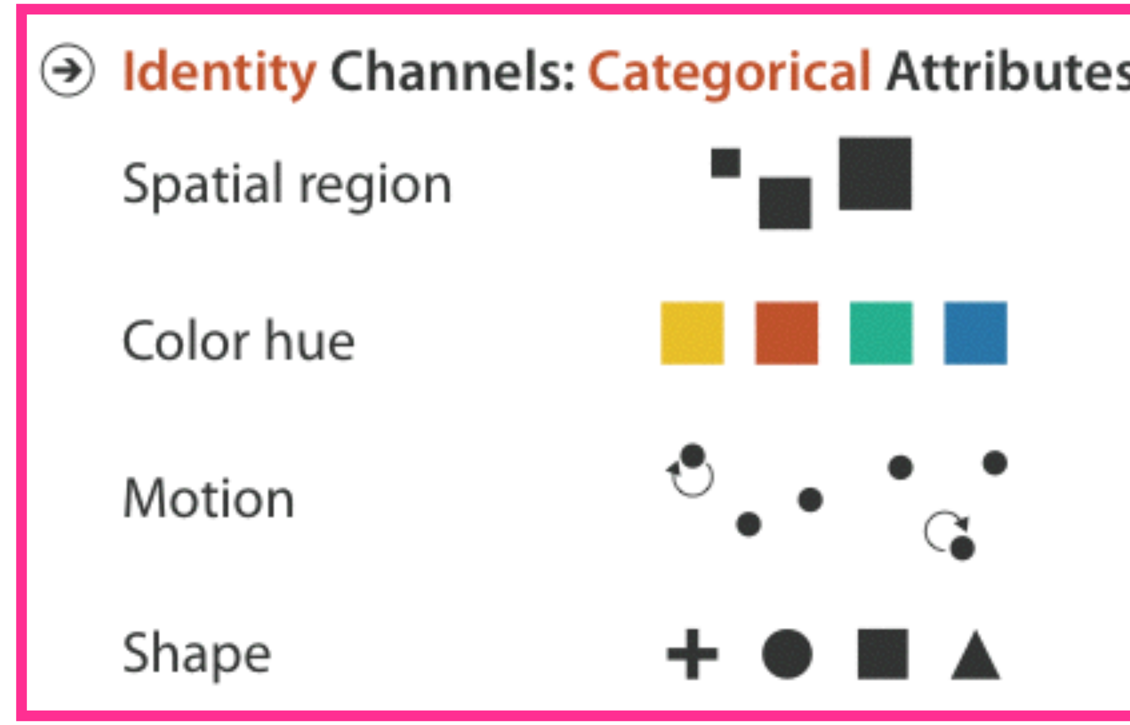


expressiveness

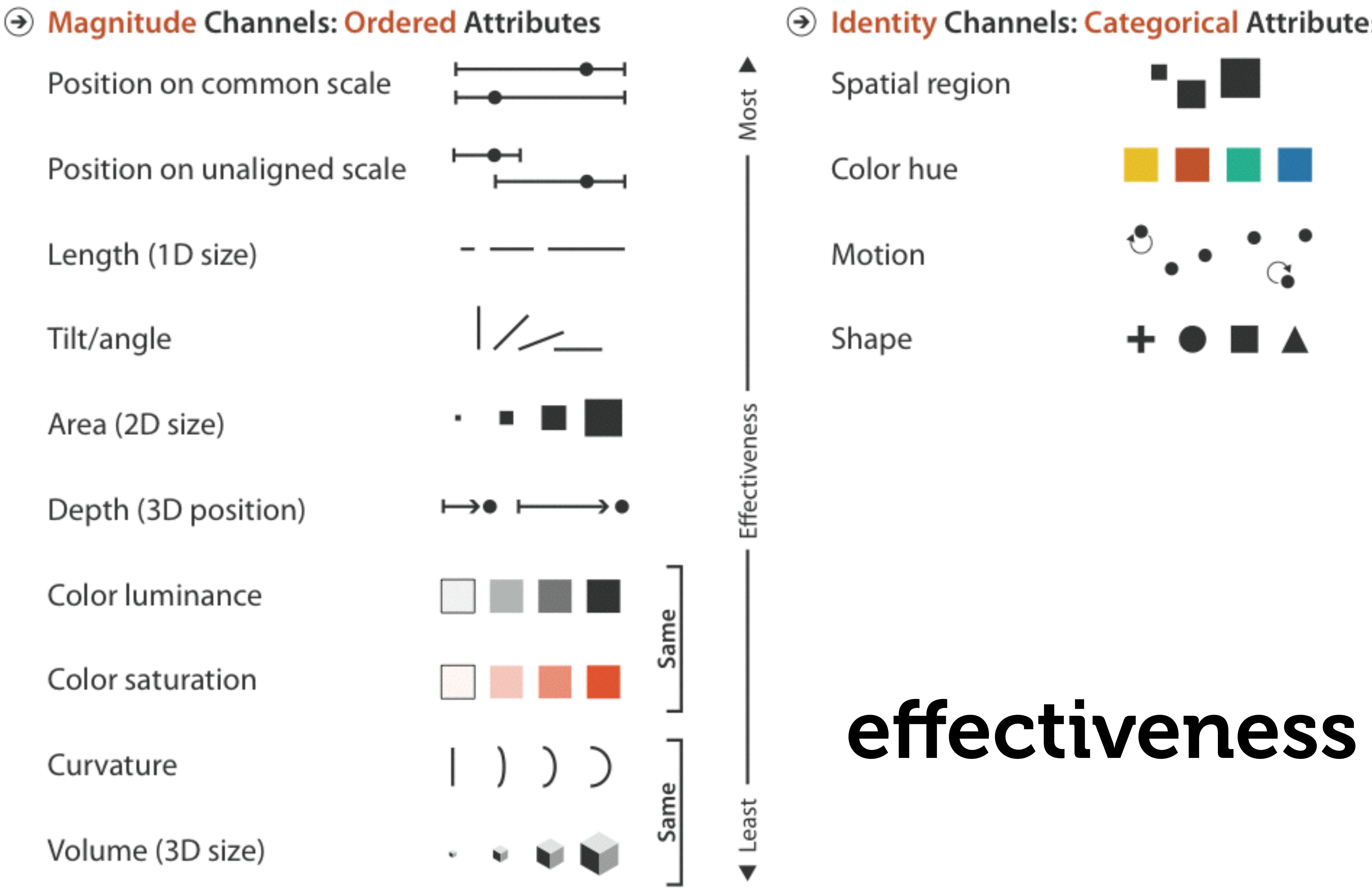
(how much)



(what or where)



expressiveness



effectiveness

WHAT'S SO SPECIAL ABOUT THE PLANE?

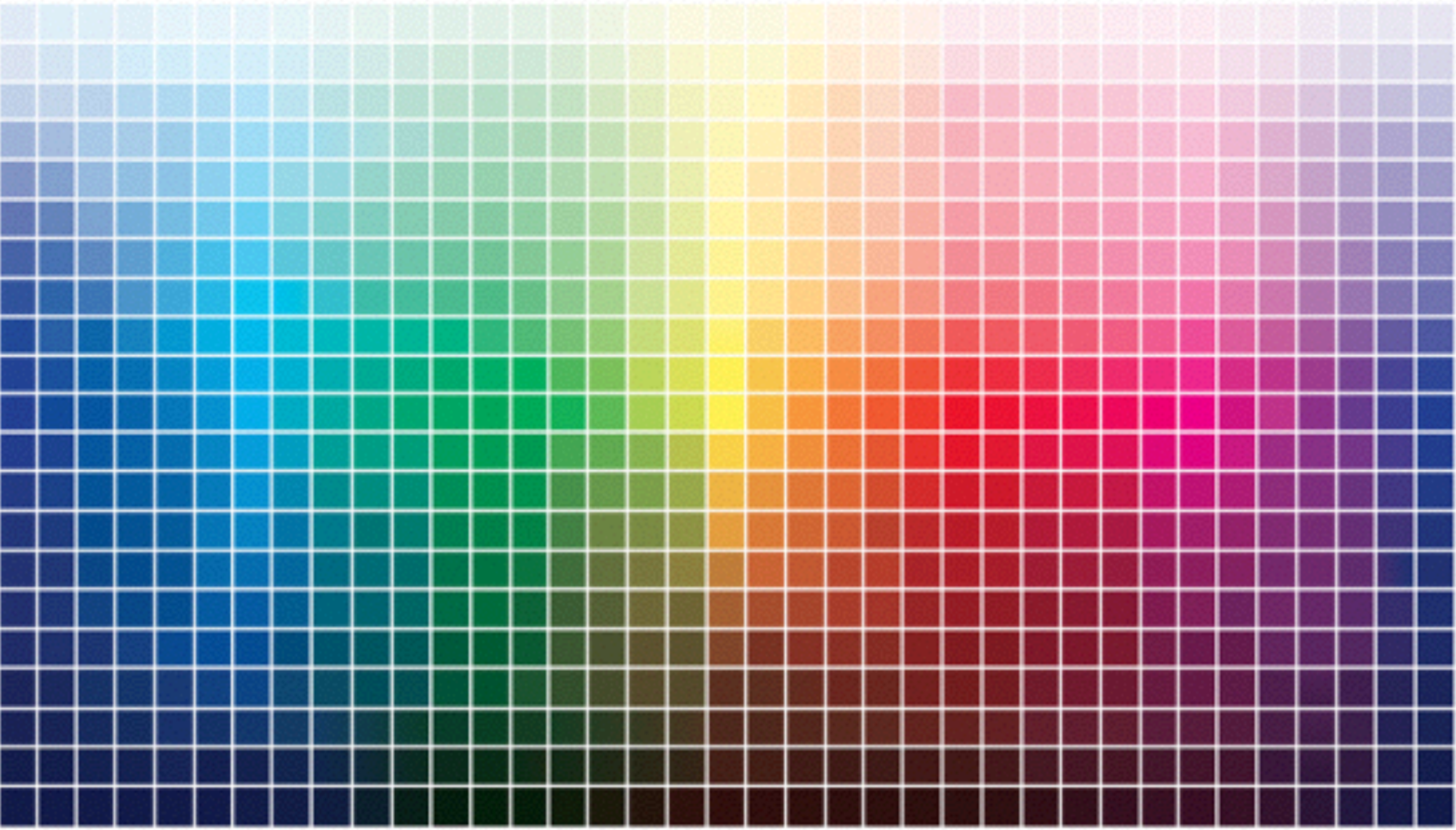
TIME AS ENCODING CHANNEL

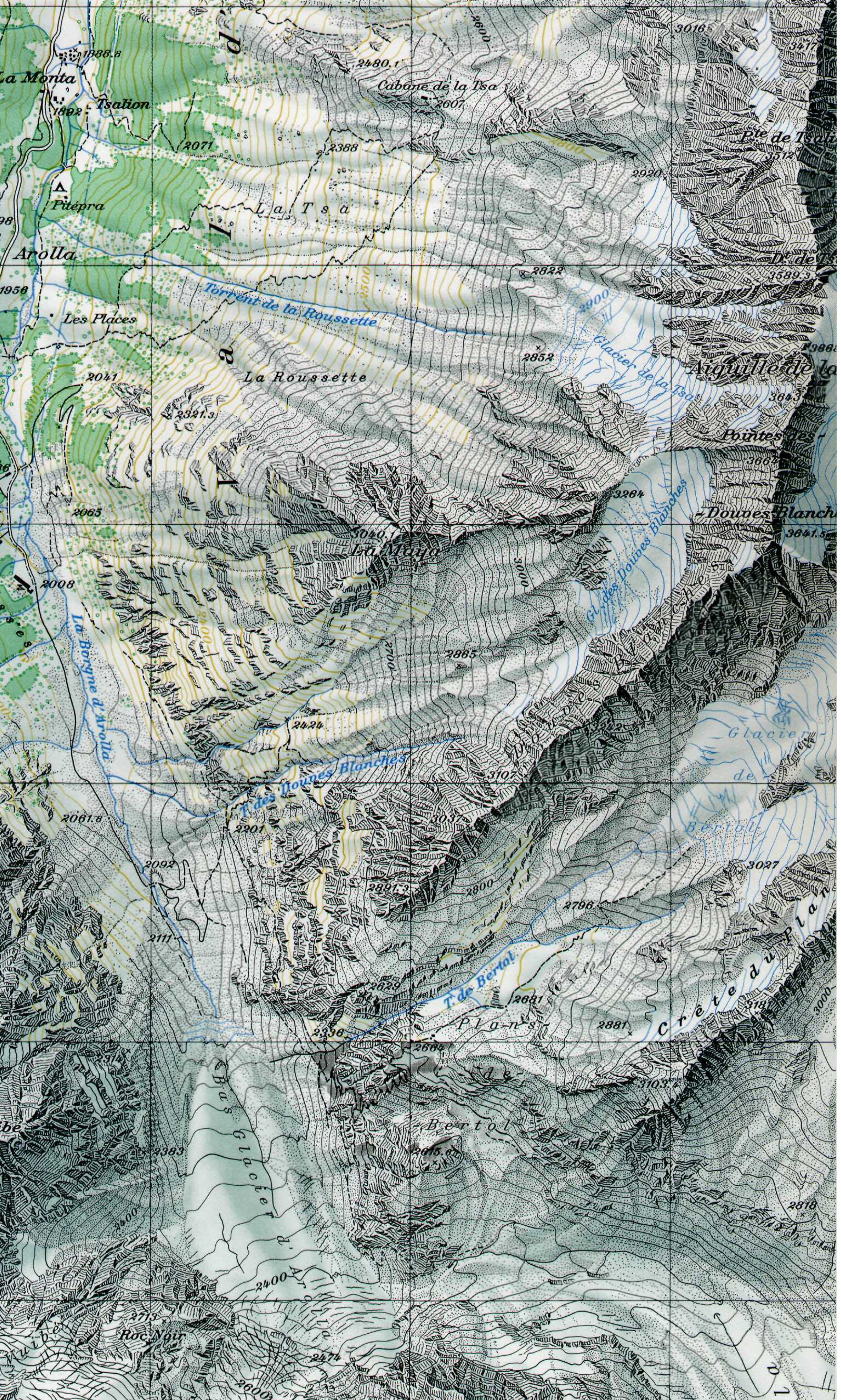
- **external versus internal memory**
  - *easy to compare views by moving eyes*
  - *hard to compare view to memory of what you saw*

Get it right in black and white.

Maureen Stone

today . . .





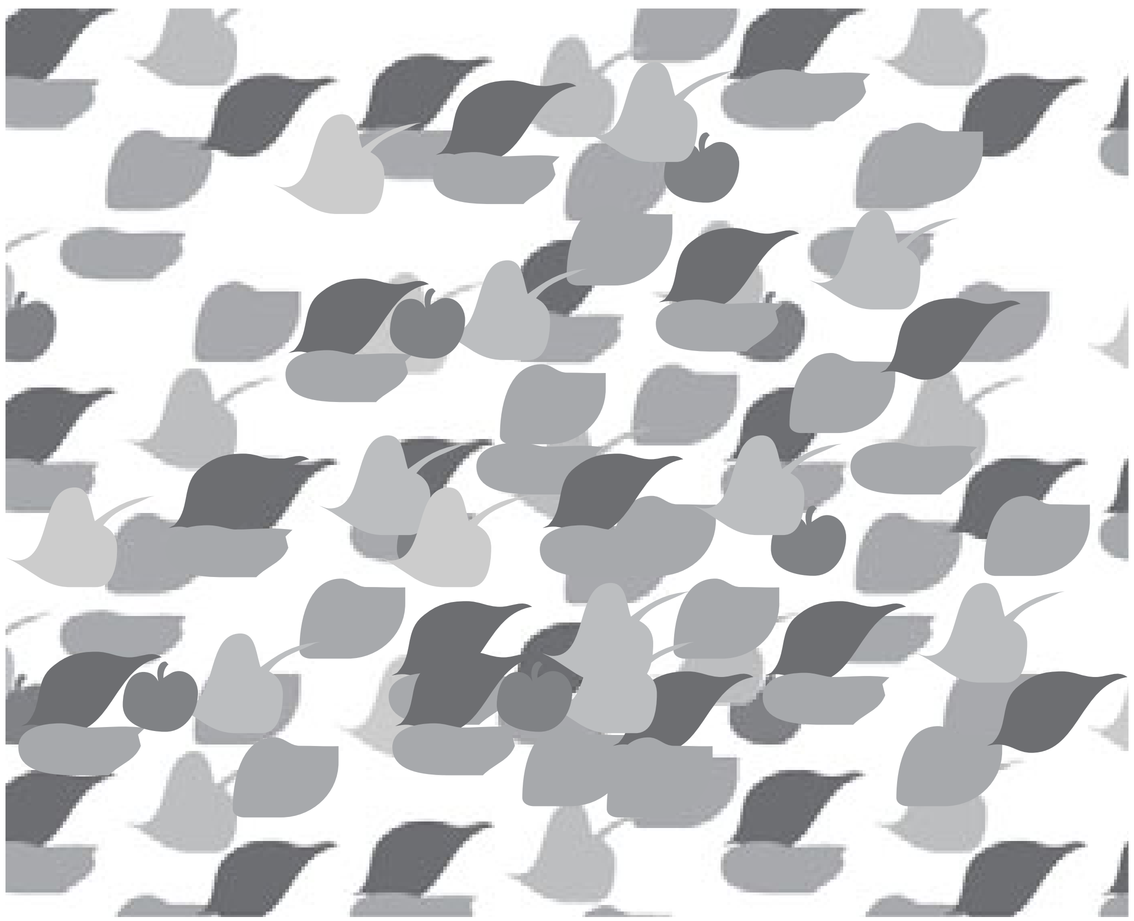
purpose of color

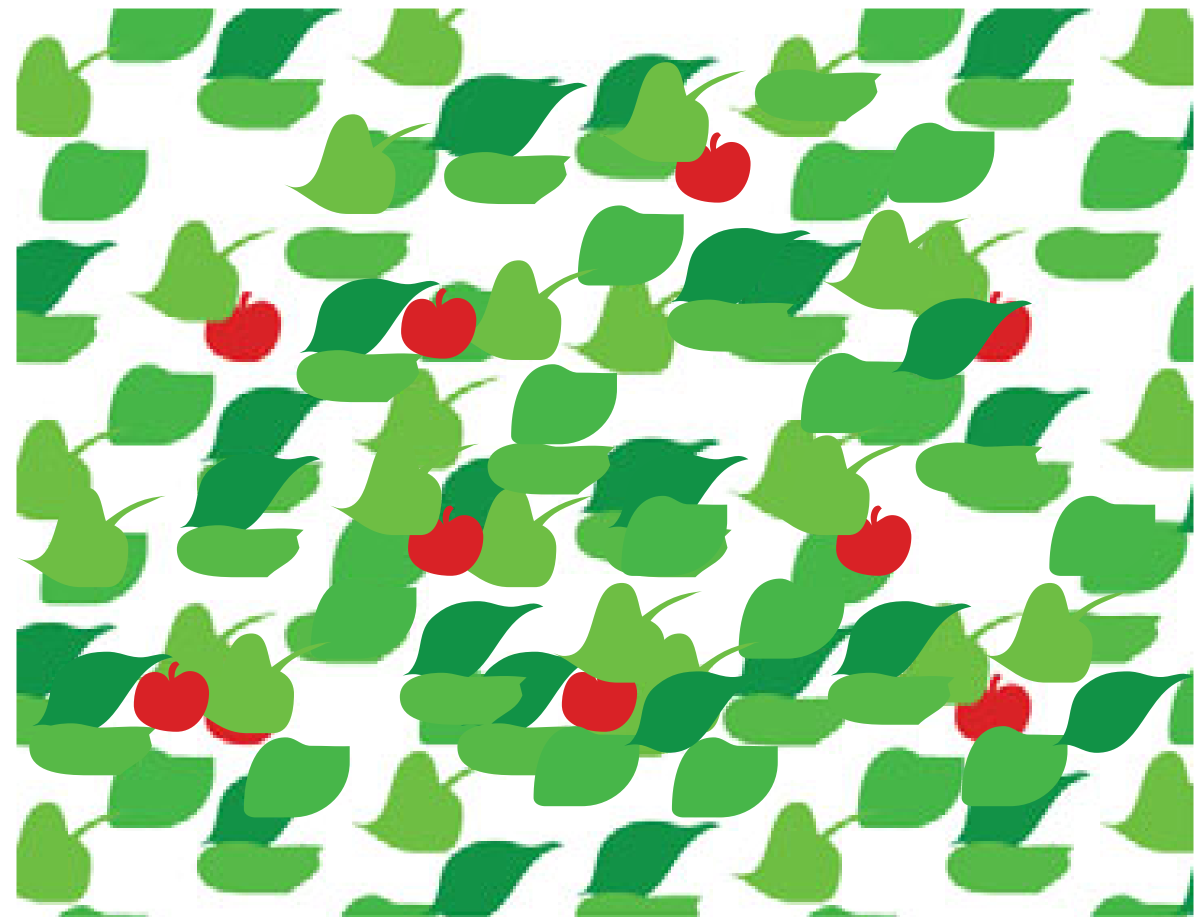
- to label (color as a noun)
- to measure (color as a quantity)
- to represent and imitate (color as a symbol)
- to enliven and decorate (color as beauty)

Matterhorn, Landeskarte der Schweiz (Wabern, 1983)

functions of color

identify, group, layer, highlight





Colin Ware, Information Visualization: Perception for Design

- **what is color?**
- **how do we see color?**
- **color deficiencies**
- **color spaces**
- **guidelines**
- **tools**

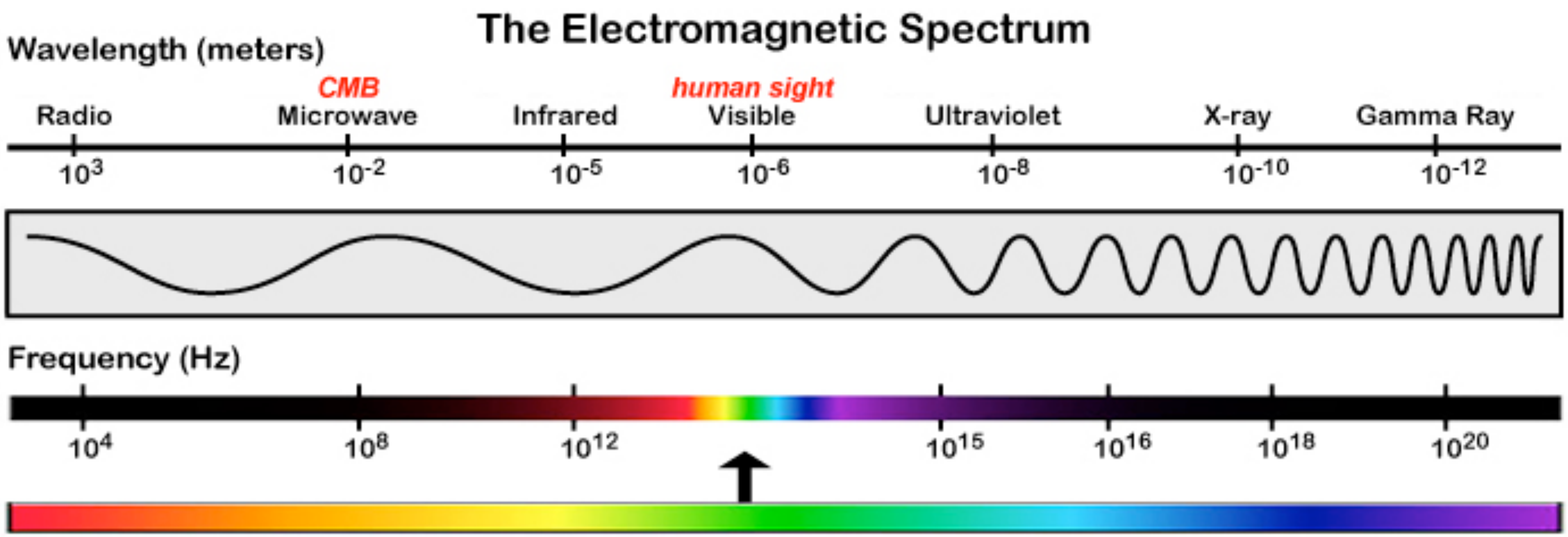
what is color?

COLOR

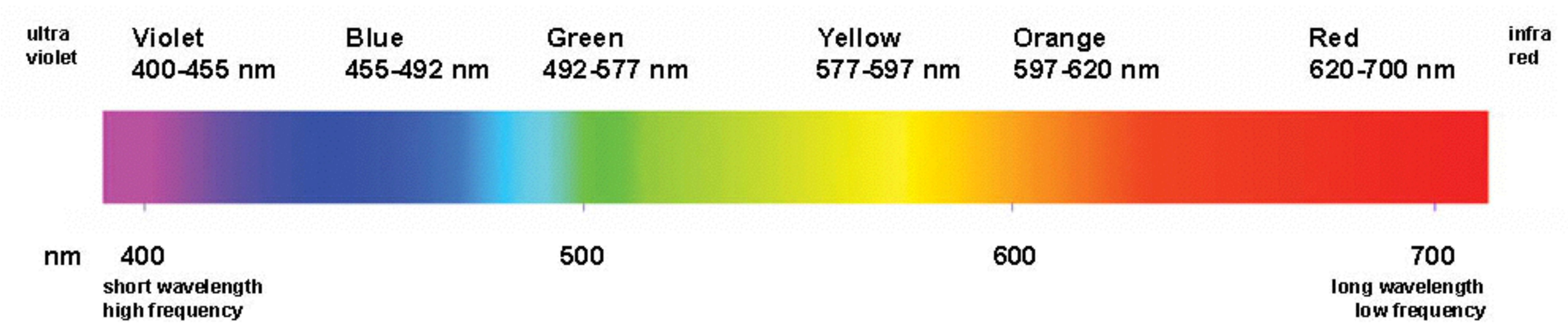
the property possessed by an object of producing different sensations on the eye as a result of the way it reflects or emits light

Oxford Dictionary

light

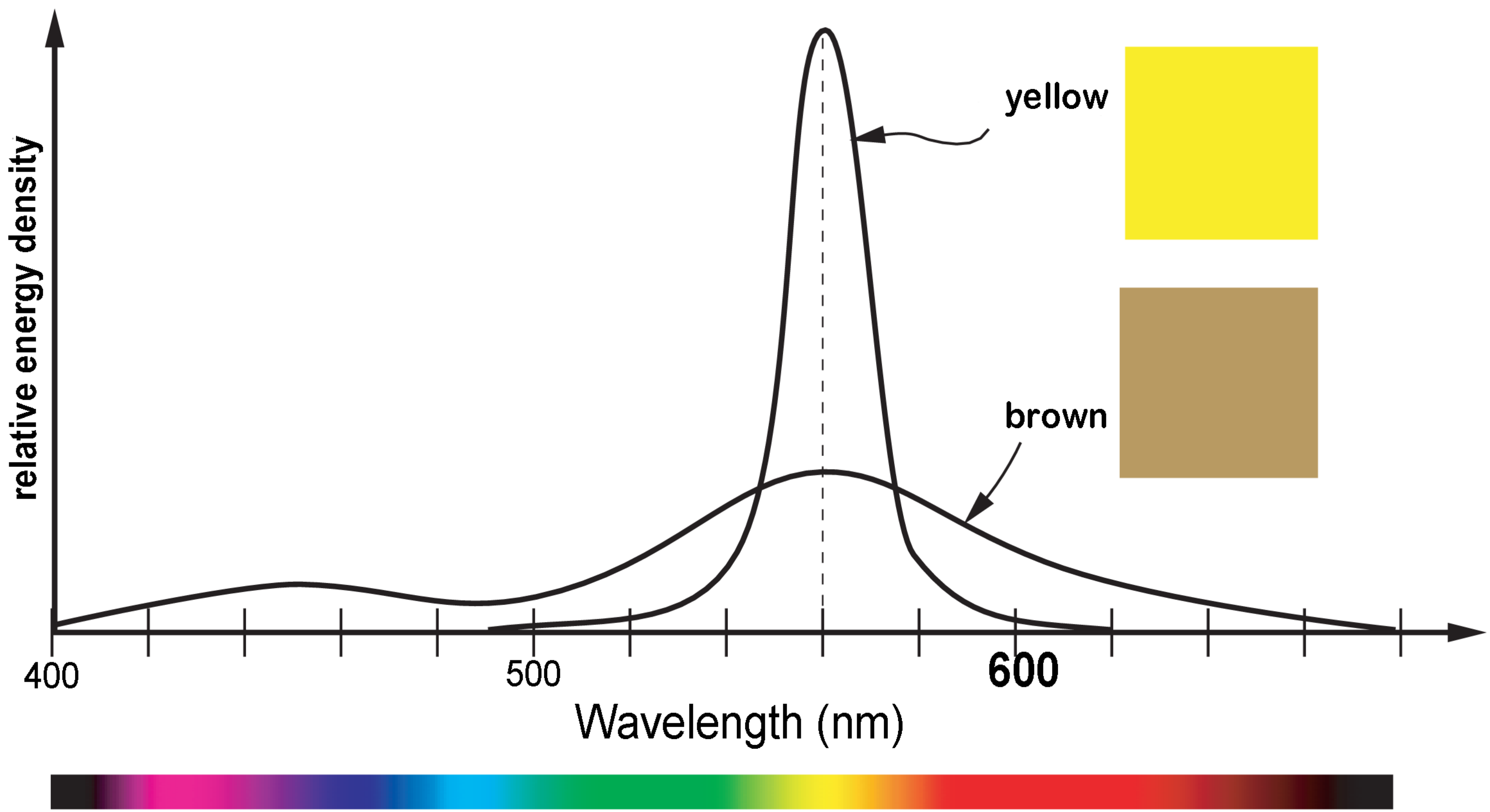

The Electromagnetic Spectrum
Wavelength (meters)
CMB
human sight
Radio
Microwave
Infrared
Visible
Ultraviolet
X-ray
Gamma Ray
10^{3}
10^{-2}
10^{-5}
10^{-6}
10^{-8}
10^{-10}
10^{-12}
Frequency (Hz)
10^{4}
10^{8}
10^{12}
10^{15}
10^{16}
10^{18}
10^{20}

(human) visible light

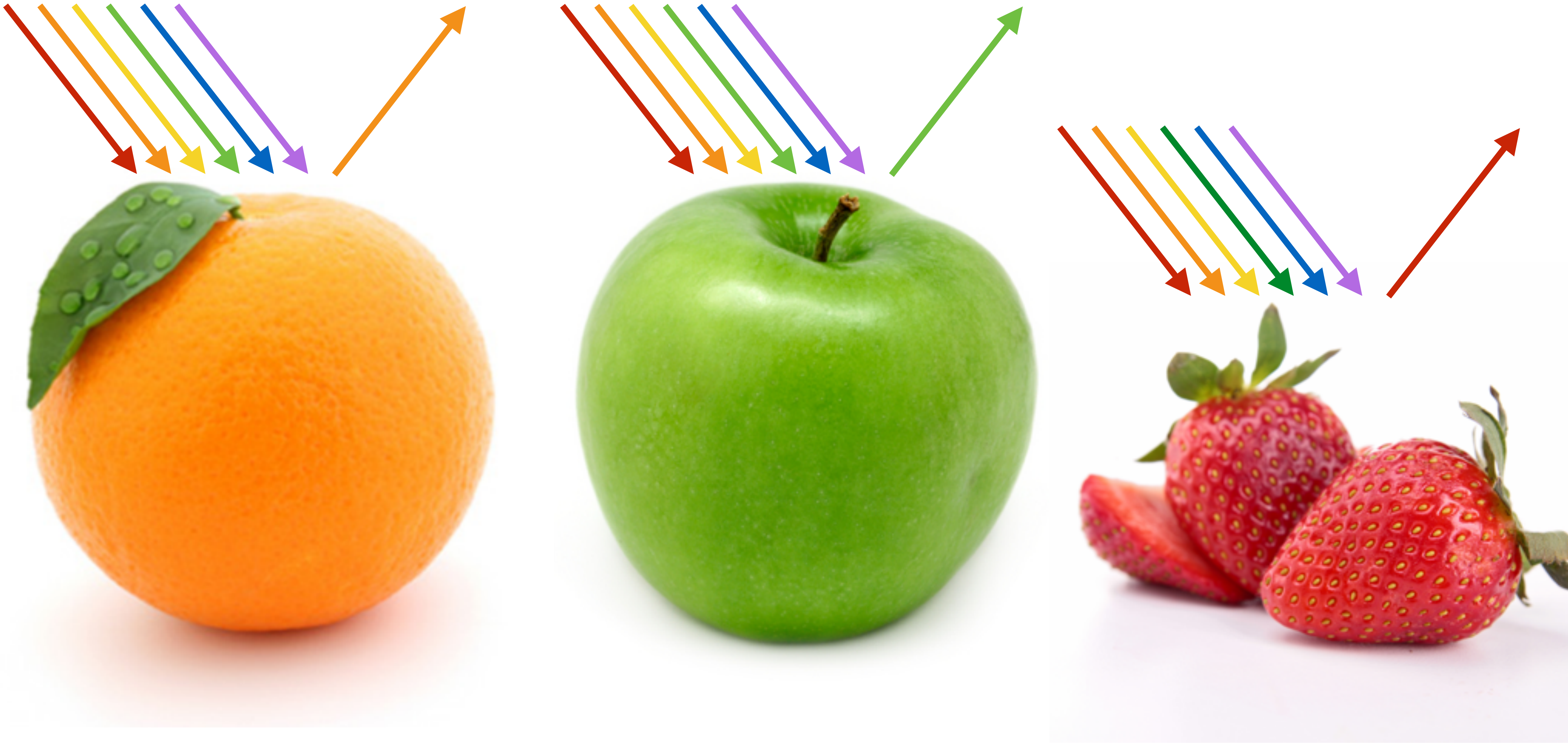


Color != Wavelength

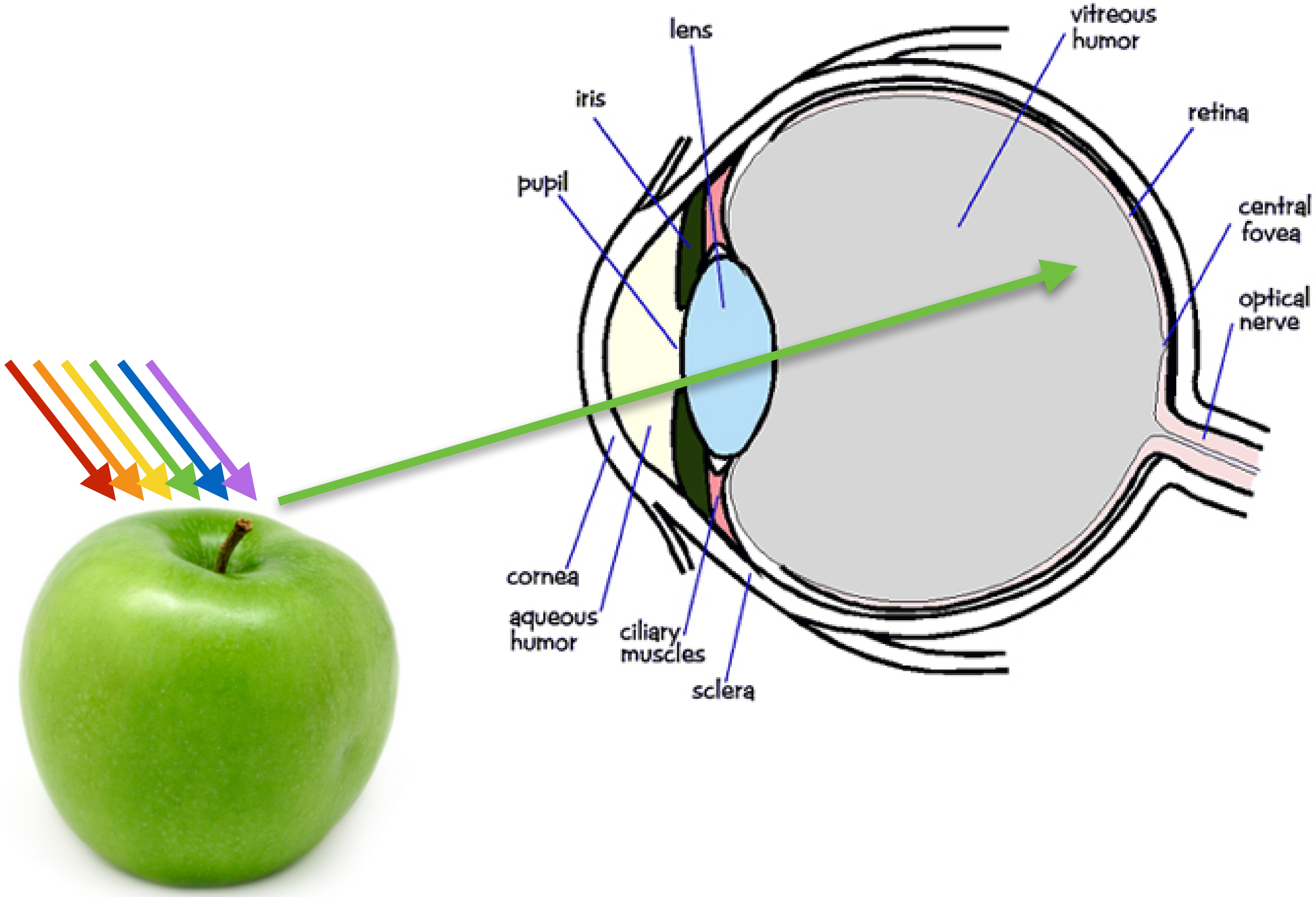
but rather, a combination of wavelengths and energy

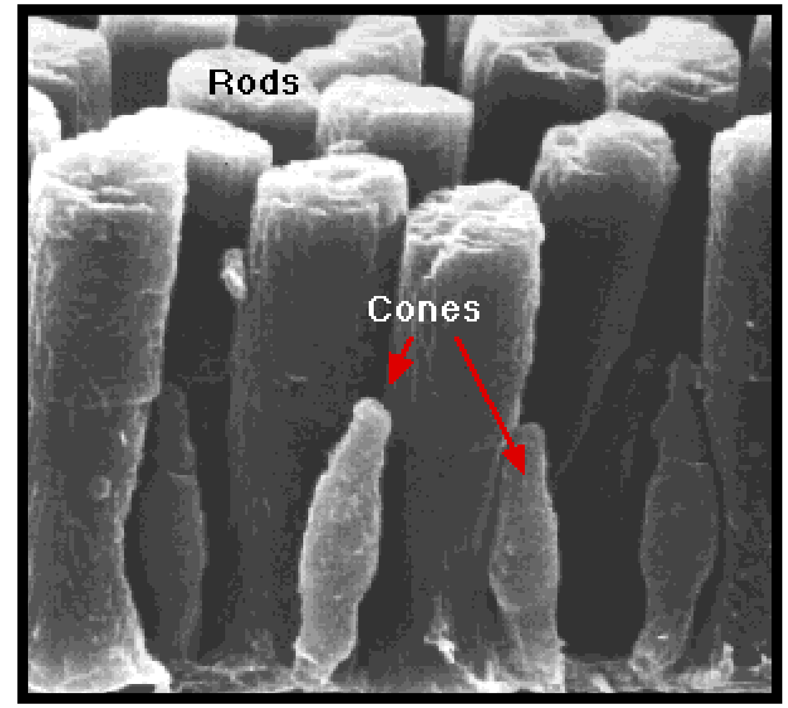


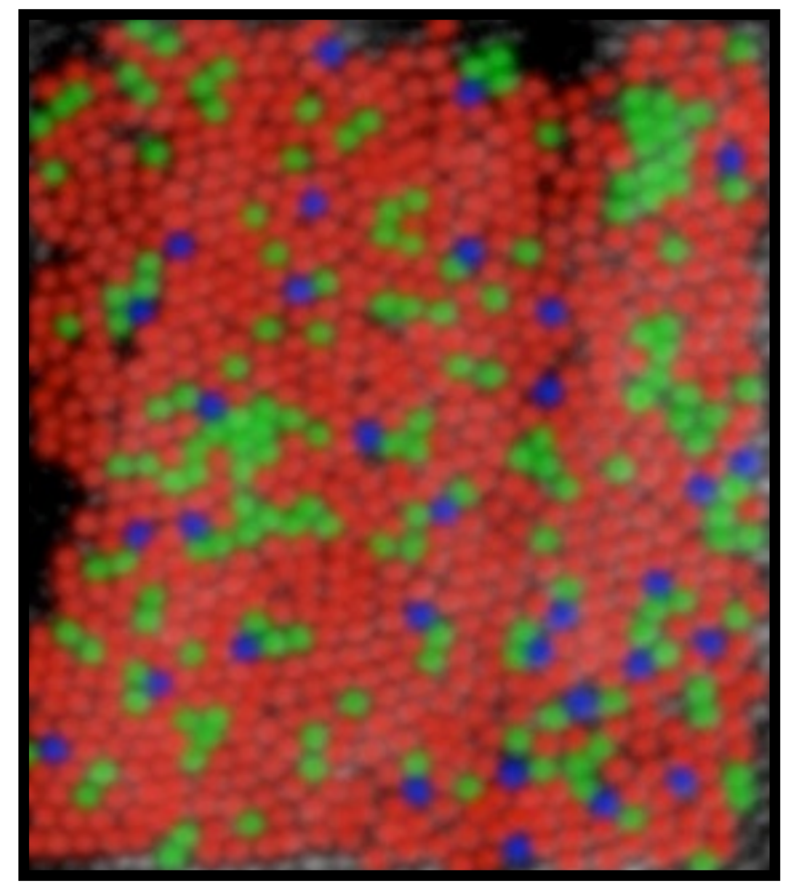
the role of objects



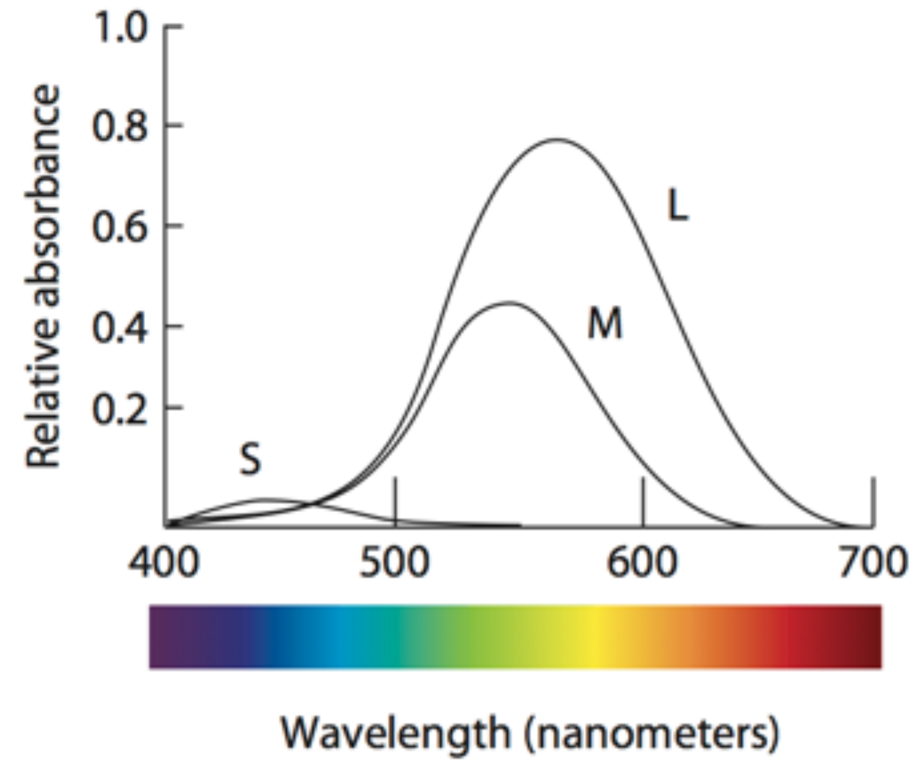
how do we see color?


lens
iris
pupil
vitreous humor
retina
central fovea
optical nerve
cornea
aqueous humor
ciliary muscles
sclera

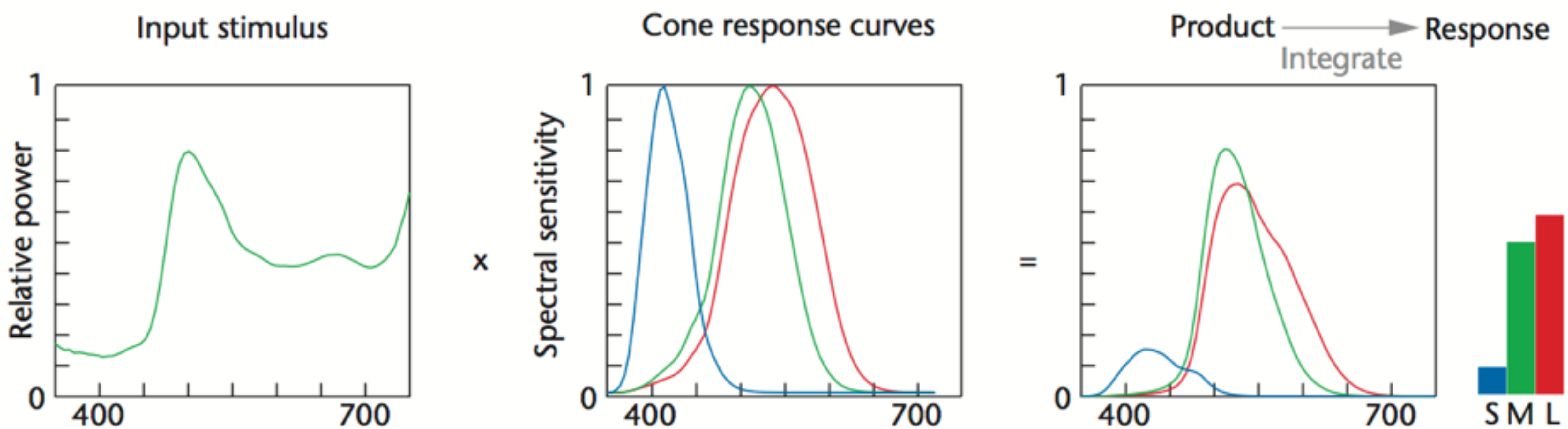

Rods
Cones



trichromacy

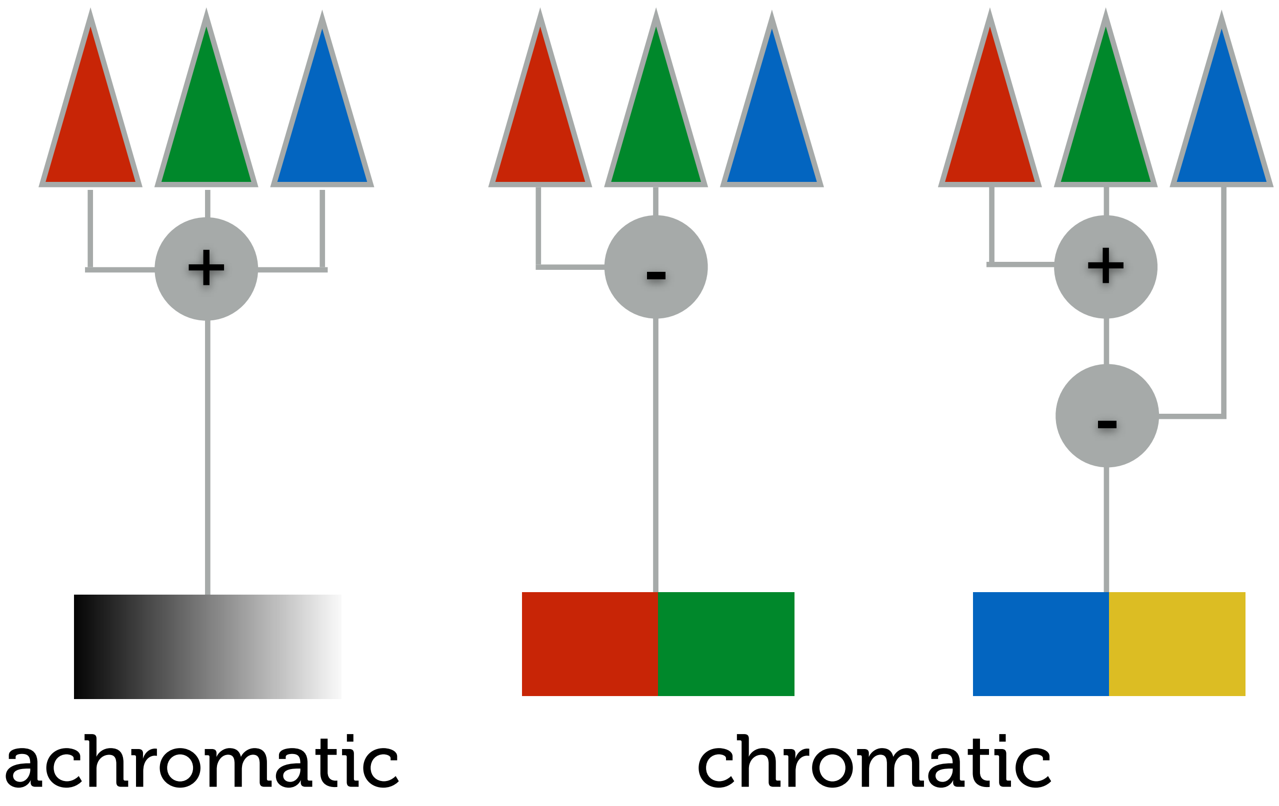


- possessing three independent channels for conveying color information
    - derived from three cone types
- each type of cone contains a specific photosensitive pigment
    - each pigment is especially sensitive to a certain wavelength of light
- likelihood of response is both *wavelength* and *intensity* based
    - thus brain could not distinguish color with input from only one type of cone
    - interaction between at least two types of cones is necessary to perceive color

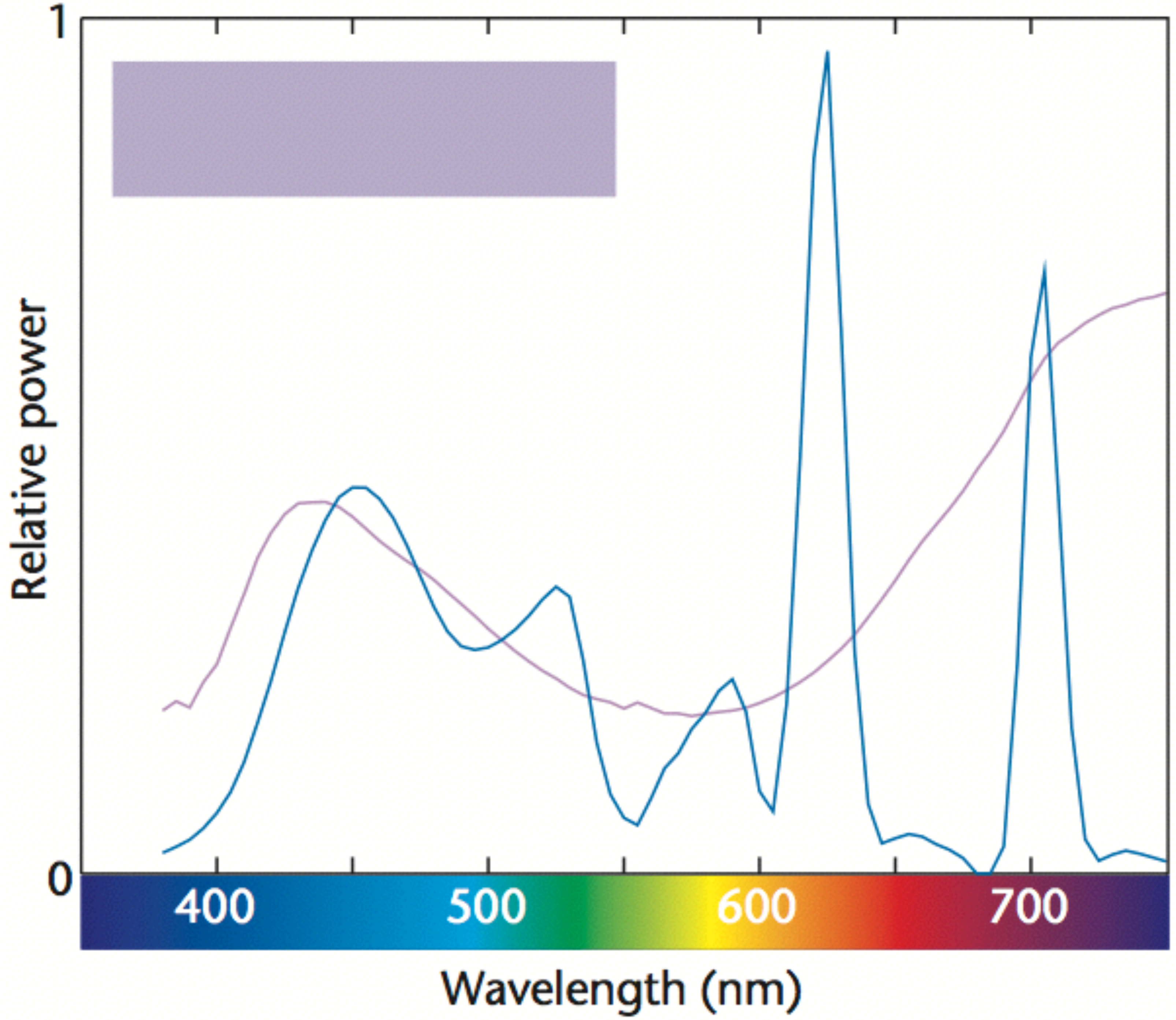

Input stimulus
Relative power
1
0
400
700
x
Cone response curves
Spectral sensitivity
1
0
400
700
=
Product
Integrate
Response
1
0
400
700
S M L

opponent-process model

- ***trichromatic theory*** explains how eye receives signals; ***opponent process theory*** explains how signals are processed
- visual system detects differences between the response of cones
- three opponent channels
    - red vs green
    - blue vs yellow
    - black vs white (luminance)
- opposite colors are never perceived together
    - no reddish green or bluish yellow



metamers



trichromacy

all spectra can be reduced to precisely three values without loss of information with respect to the visual system

metamerism

any spectra that create the same trichromatic response are indistinguishable

Rippin' the Rainbow a New One – Radiolab
www.radiolab.org/story/211178-rip-rainbow/
Reader
Device(Anonymous) camera http://192.168.2.1/ Google Scholar UT hiking poetry-vis Marriott Library
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SUPPORT
Rippin' the Rainbow a New One
« Back to Episode
08:25 / 18:58
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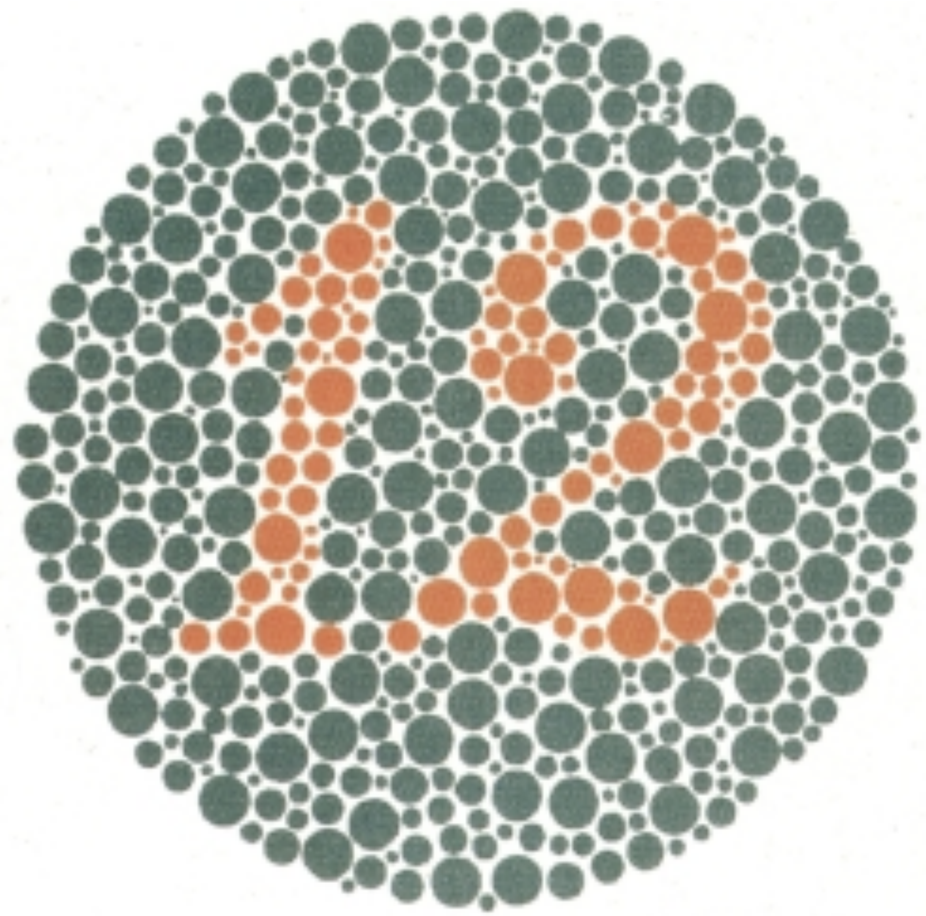
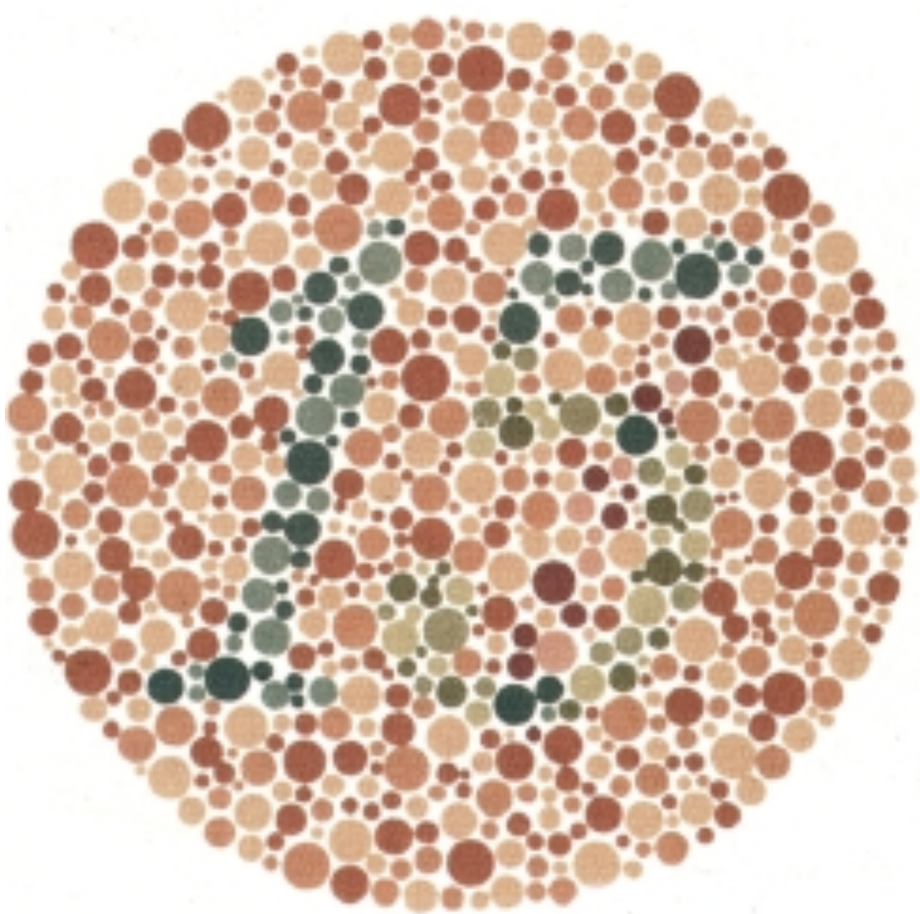
We tear into this show with a dark scene from 1665. A young Isaac Newton, hoping to ride out the plague by heading to the country to puzzle over the deep mysteries of the universe, finds himself wondering about light. And vision. He wants to get to the bottom of where color comes from--is it a physical property in the outside world, or something created back inside your eyeball somewhere? James Gleick explains how Newton unlocked the mystery of the rainbow. And, as Victoria Finlay tells us, sucked the poetry out of the heavens.
(jared/flickr/CC-BY-2.0)
Jonah Lehrer restores some of the lost magic by way of Goethe--who turned a simple observation into a deep thought: even though color starts in the physical world, it is finished in our minds.
SUPPORTED BY
DEATH SEX+ MONEY
with Anna Sale
>> Download the hit podcast.
The Most
Viewed | Listened | Commented
If You're Born In The Sky, What's Your Nationality? An Airplane Puzzler
Cities
Hello
Roadways You Can Install Like Throw Rugs
9-Volt Nirvana
Galapagos
Glenn Gould In Rapture

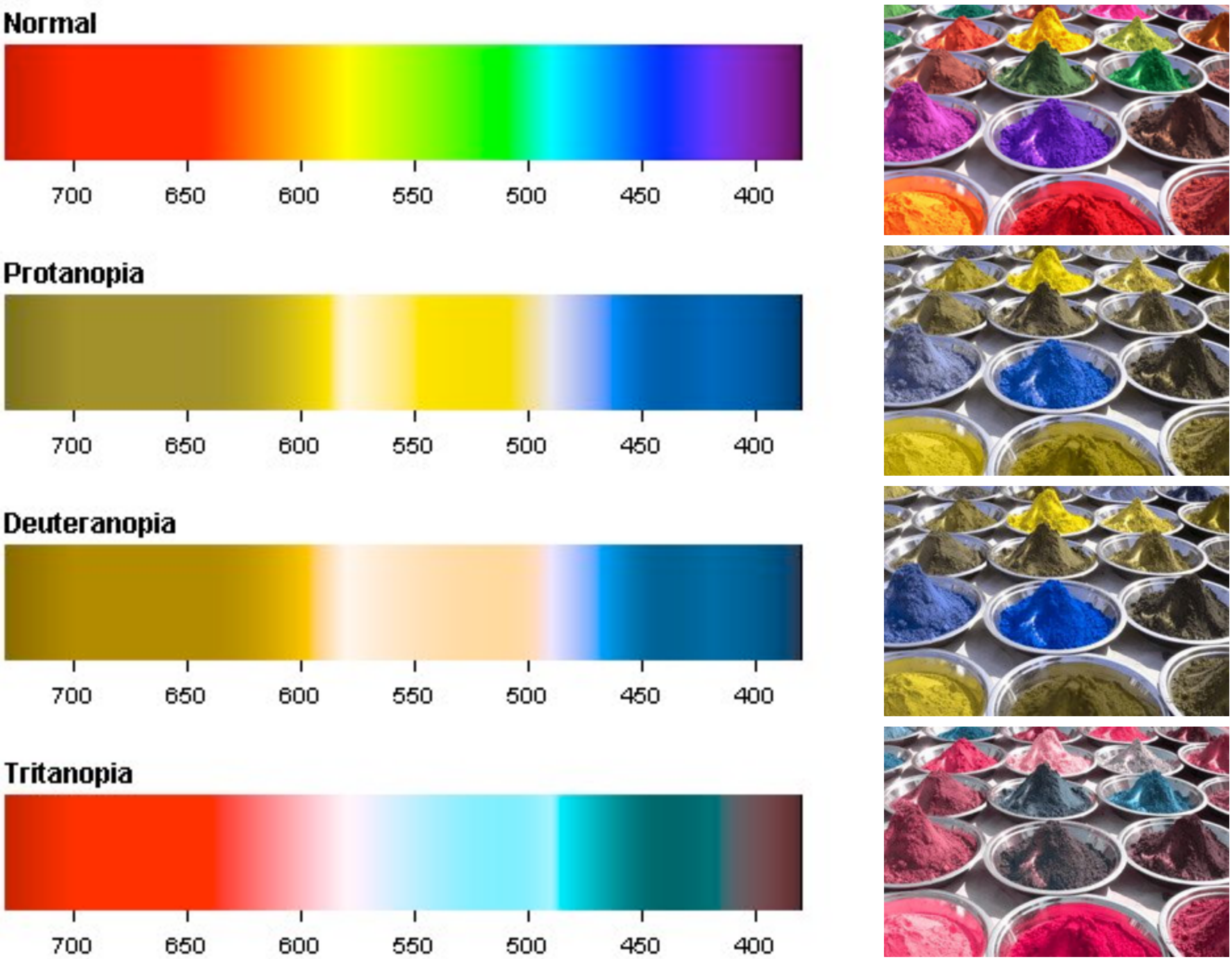
color deficiencies



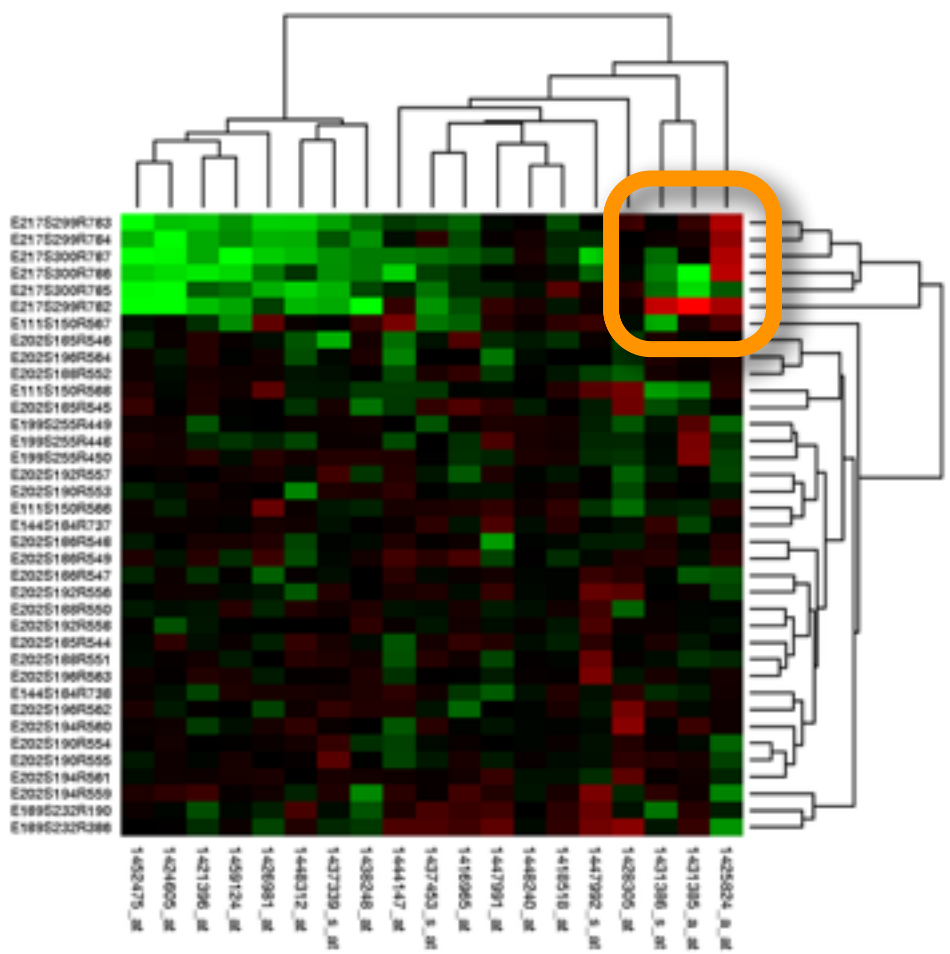


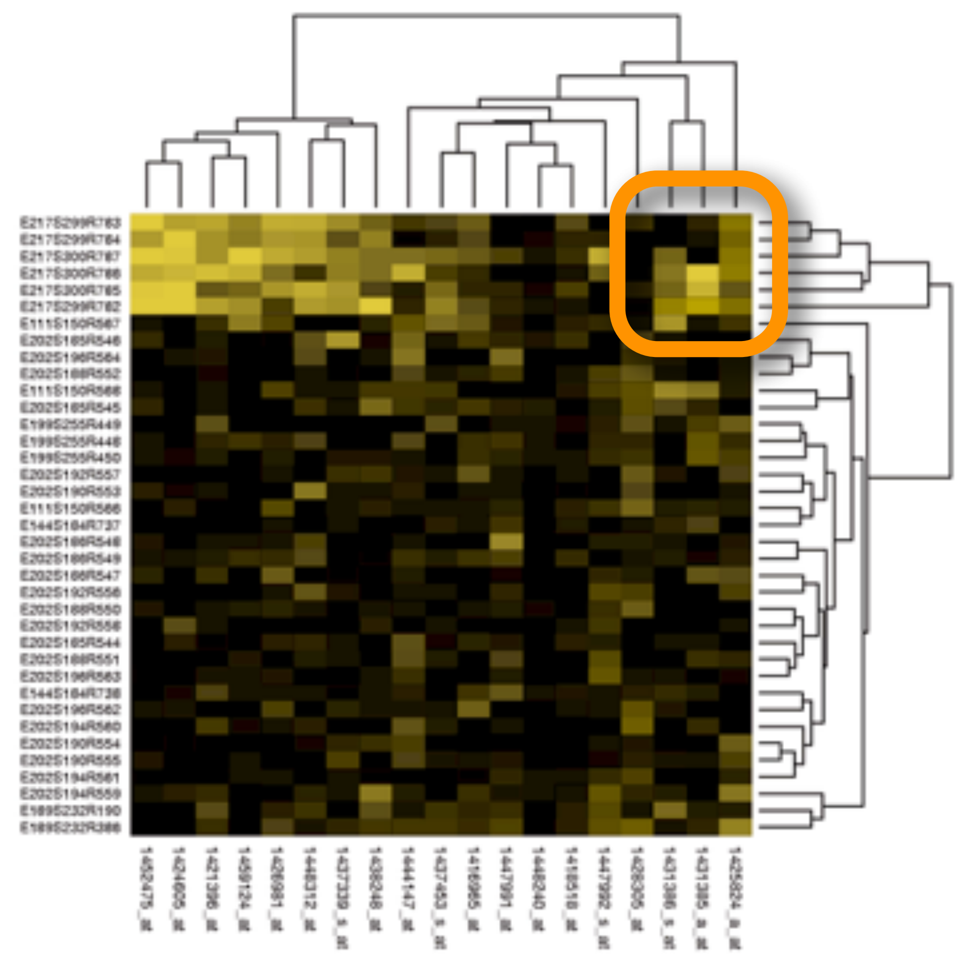
color deficiency

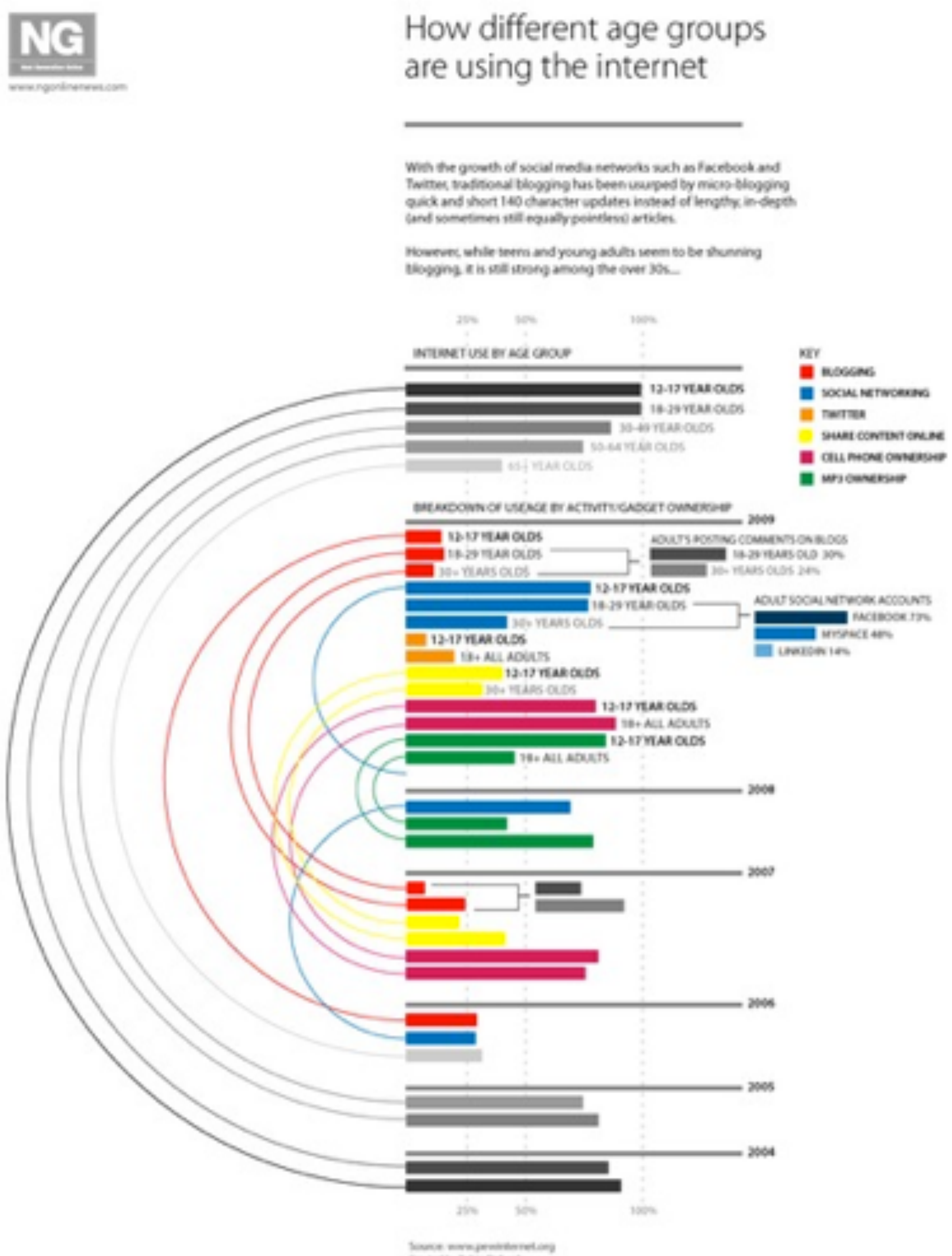
- sometimes caused by faulty cones, sometimes by faulty pathways
- red-green most common
    - 8% of (North American) males, 0.5% of females
- can be explained by opponent color theory

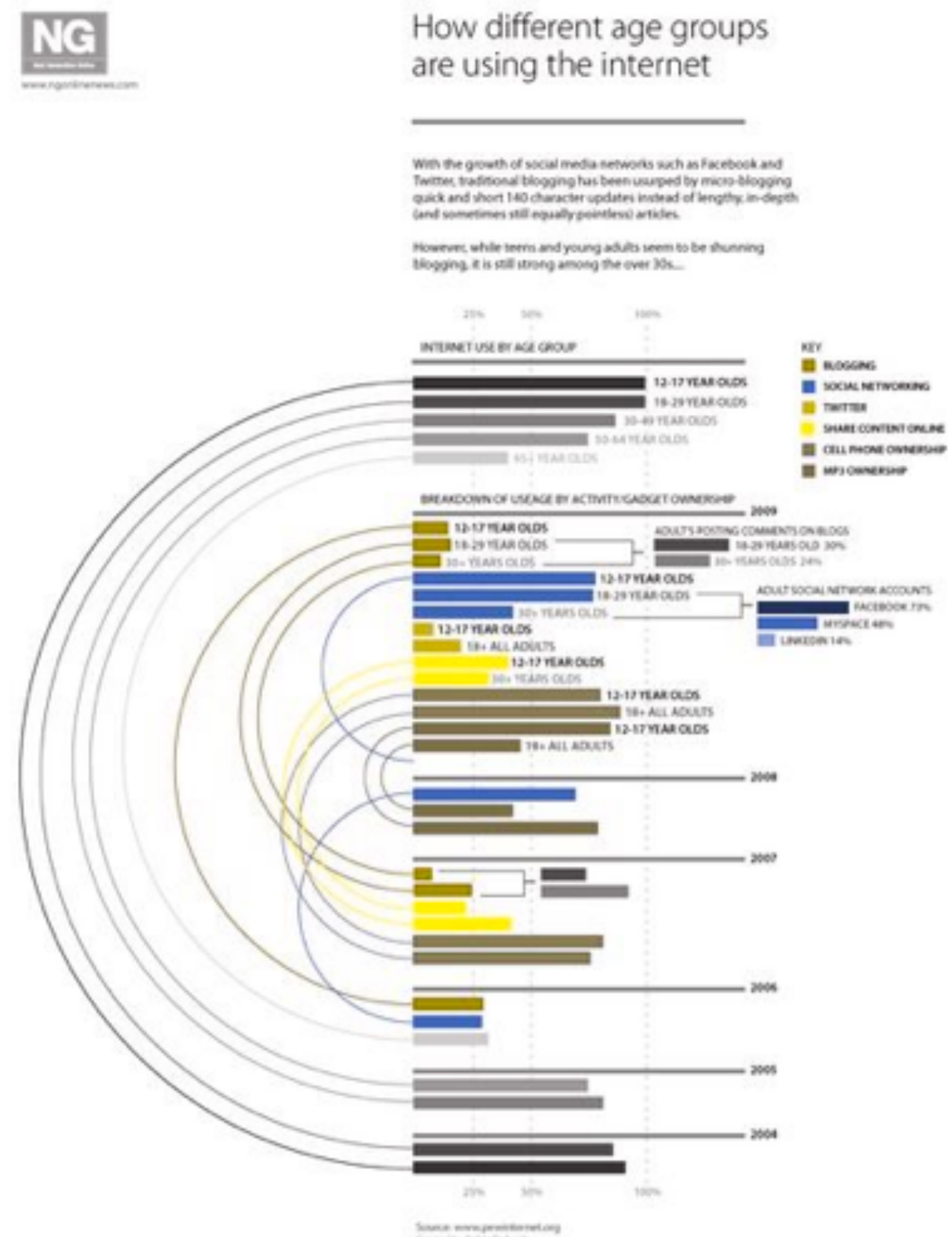


Normal
700 650 600 550 500 450 400
Protanopia
700 650 600 550 500 450 400
Deuteranopia
700 650 600 550 500 450 400
Tritanopia
700 650 600 550 500 450 400






NG
www.ngonlinenews.com
How different age groups are using the internet
With the growth of social media networks such as Facebook and Twitter, traditional blogging has been usurped by micro-blogging quick and short 140 character updates instead of lengthy, in-depth (and sometimes still equally pointless) articles.
However, while teens and young adults seem to be shunning blogging, it is still strong among the over 30s...
25%
50%
100%
INTERNET USE BY AGE GROUP
12-17 YEAR OLDS
18-29 YEAR OLDS
30-49 YEAR OLDS
50-64 YEAR OLDS
65+ YEAR OLDS
KEY
BLOGGING
SOCIAL NETWORKING
TWITTER
SHARE CONTENT ONLINE
CELL PHONE OWNERSHIP
MP3 OWNERSHIP
BREAKDOWN OF USEAGE BY ACTIVITY/GADGET OWNERSHIP
2009
12-17 YEAR OLDS
18-29 YEAR OLDS
30+ YEARS OLDS
ADULT'S POSTING COMMENTS ON BLOGS
18-29 YEARS OLD 30%
30+ YEARS OLDS 24%
12-17 YEAR OLDS
18-29 YEAR OLDS
30+ YEARS OLDS
ADULT SOCIAL NETWORK ACCOUNTS
FACEBOOK 73%
MYSPACE 48%
LINKEDIN 14%
12-17 YEAR OLDS
18+ ALL ADULTS
12-17 YEAR OLDS
30+ YEARS OLDS
12-17 YEAR OLDS
18+ ALL ADULTS
12-17 YEAR OLDS
18+ ALL ADULTS
2008
2007
2006
2005
2004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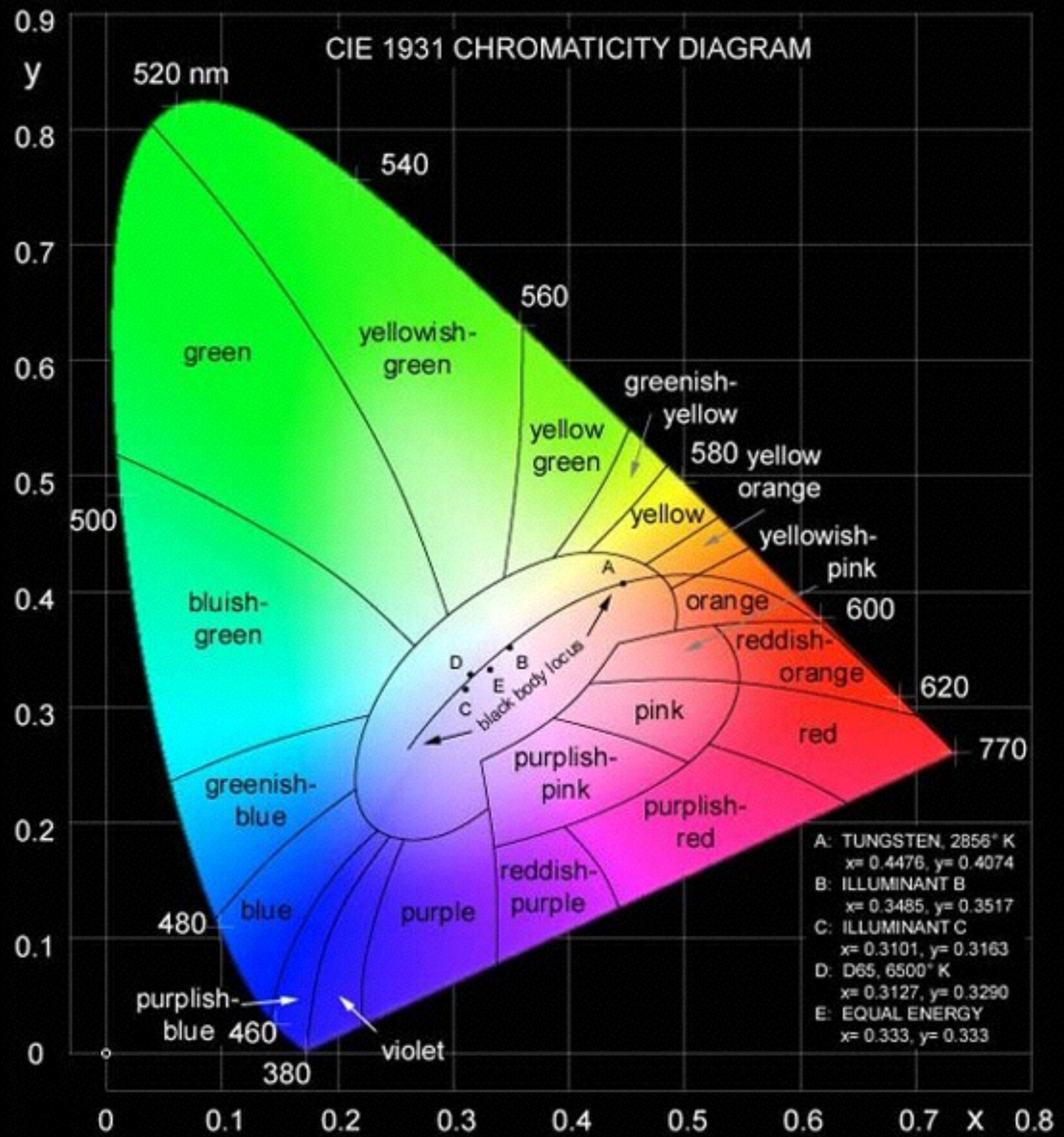
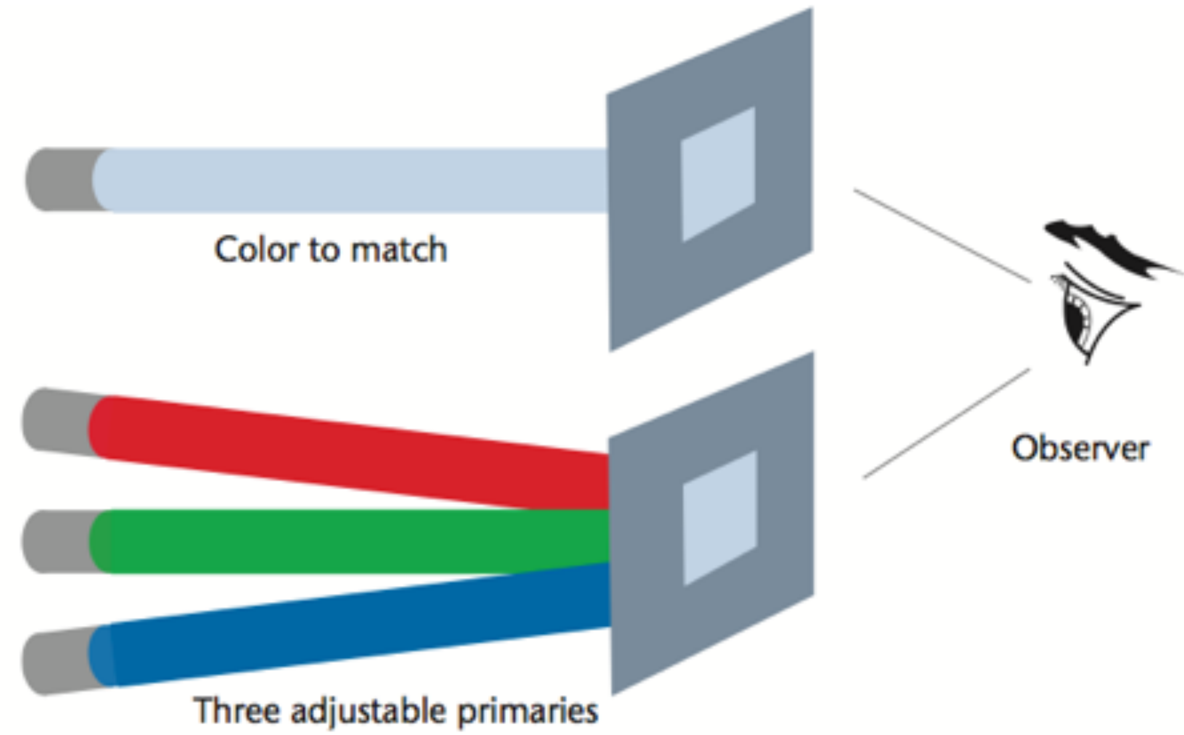
2009
ADULT'S POSTING COMMENTS ON BLOGS
ADULT SOCIAL NETWORK ACCOUNTS
2008
2007
2006
2005
2004

color spaces

space of human color

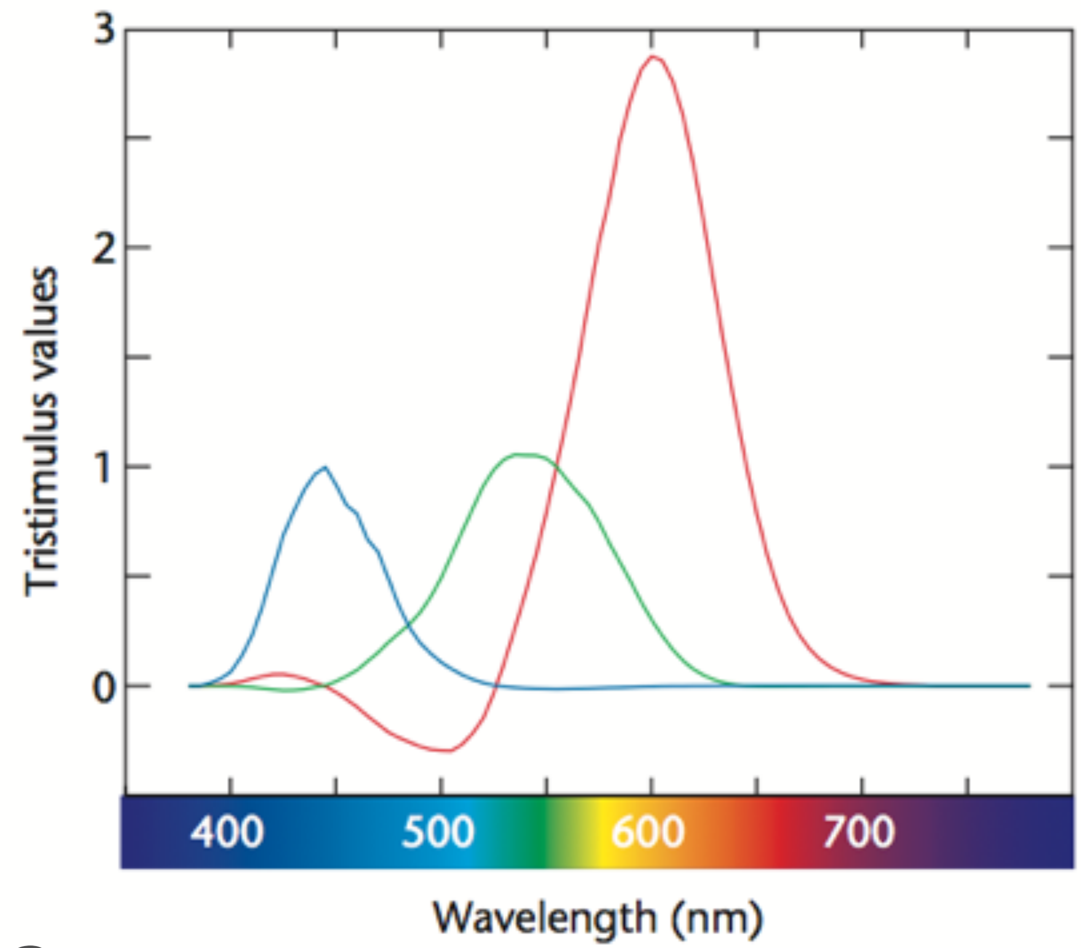


CIE color space



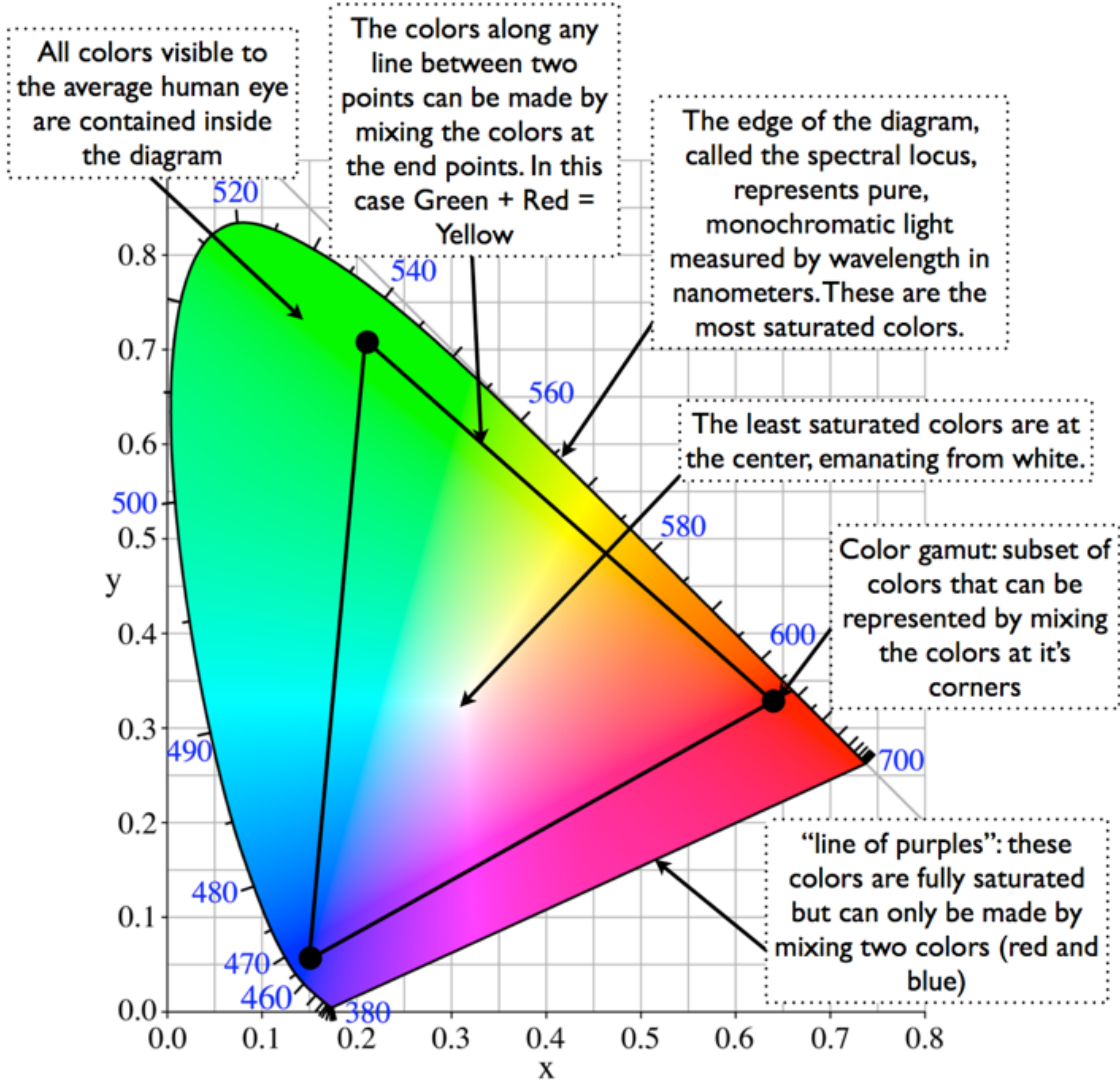
- experiments done in the 1920’s and 1930’s
- humans can mimic any pure (visible) light by addition and subtraction of three primary lights
- CIE (International Commission on Illumination)
    - *standardized a set of color-matching functions that form the basis for most color measurement instruments*

CIE color space



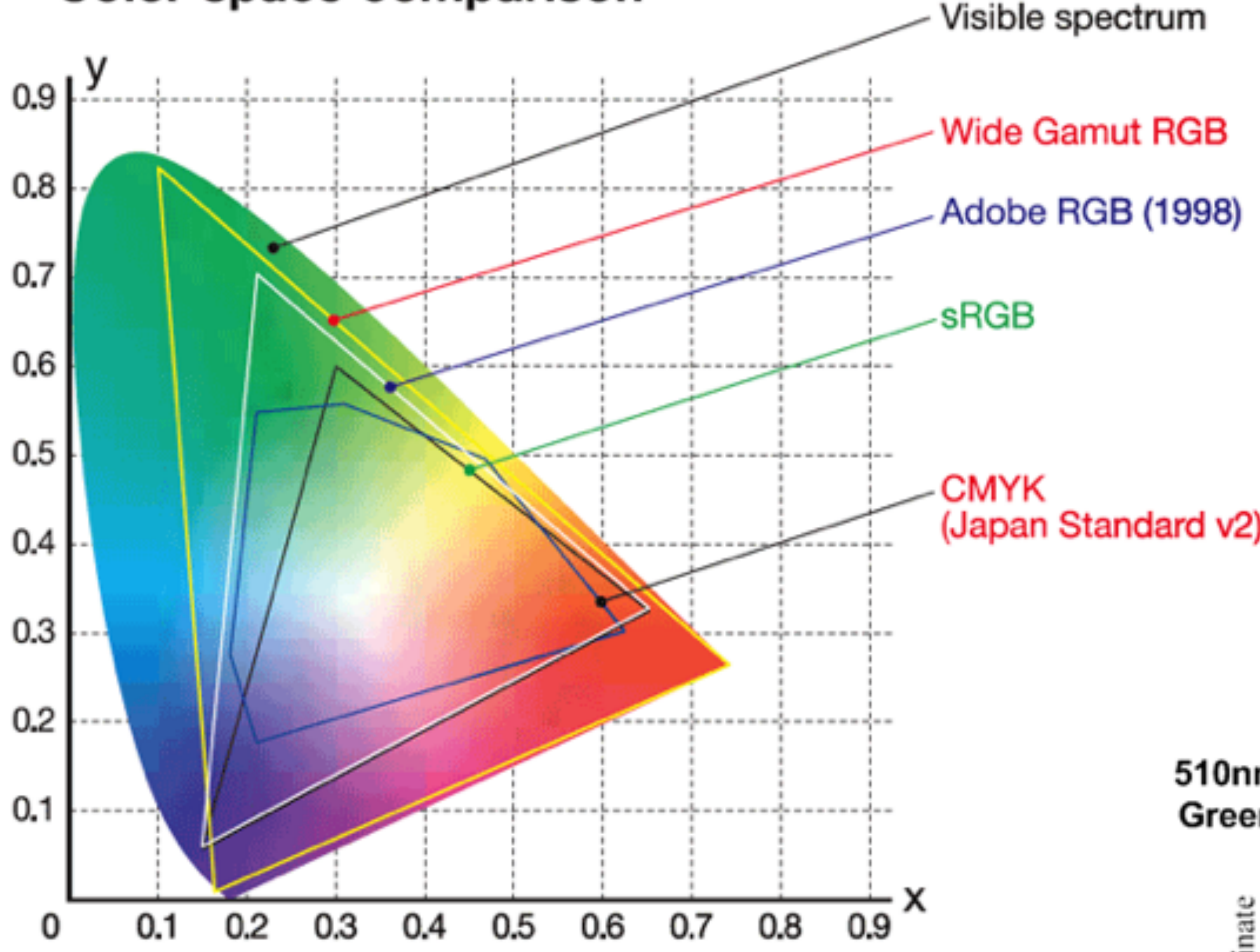
R: 645 nm, G: 526 nm, B: 444 nm

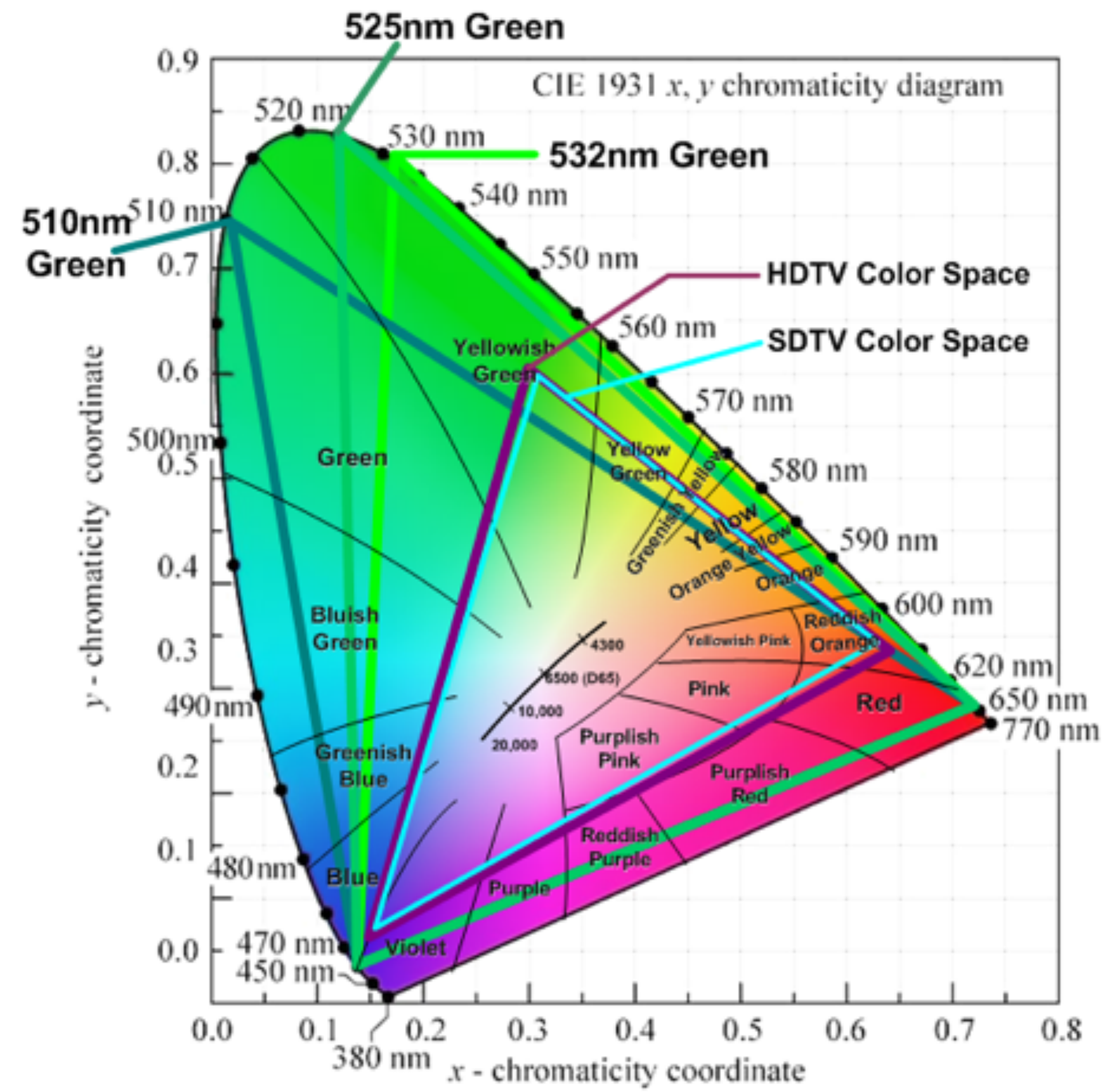
- with RGB, addition and subtraction were required to get all visible wavelengths
- in nature, light adds (but does not subtract)
- any three primaries (additive) can produce only a subset of all visible colors



Anatomy of a CIE Chromaticity Diagram

• **Color space comparison**





Representing Colors as Three Numbers

Editor: Frank Bliss

Maureen C. Stone
StoneSoup Consulting

How do three numbers, such as RGB or XYZ, represent color perception, and how are these representations related to each other and to physical color? When do they fail?

RGB in graphics is both a way of specifying color and a way of viewing color. Graphics algorithms manipulate RGB colors, and the images produced by graphics algorithms are encoded as RGB pixels and displayed on devices that render these pixels by emitting RGB light. Colored images are also used to specify color in graphics. These images may be captured by cameras or scanners, interactively drawn using tools such as Adobe PhotoShop, or algorithmically generated. But, what do all of these RGB values mean with respect to color perception? How does the RGB triple captured by a digital camera relate to the RGB pixels displayed on a monitor? How does the RGB triple selected with an interactive color tool relate to the RGB triple used to color an object in a 3D rendering?

Most computer graphics texts and tutorials provide a description of human color vision and measurement as defined by the CIE tristimulus values, XYZ. Often missing, however, is an in-depth discussion of the relationship between the different applications of RGB and XYZ, and any discussion of color models beyond trichromacy. The goal of this tutorial is to provide a complete, concise analysis of RGB color specification and its relationship to perceptual and physical specifications of color, and to introduce some models for color perception beyond tristimulus theory.

Representing color as three numbers

That color can be represented by three numbers—whether RGB or XYZ—is a direct result of the physiology of human vision. Electromagnetic radiation whose wavelength is in the visible range (370 to 730 nanometers) is converted by photopigments in the retinal cones into three signals, which correspond to the response of the three types of cones. This response is a function of wavelength and is described by the spectral sensitivity curves for the cones, as Figure 1 shows.

Colored light can be represented as a spectral distribution, which plots power as a function of wavelength. (Other fields, such as signal processing, plot spectra as a function of frequency, which is the inverse of wavelength.) The cones convert this to three cone response

what are the primary colors?

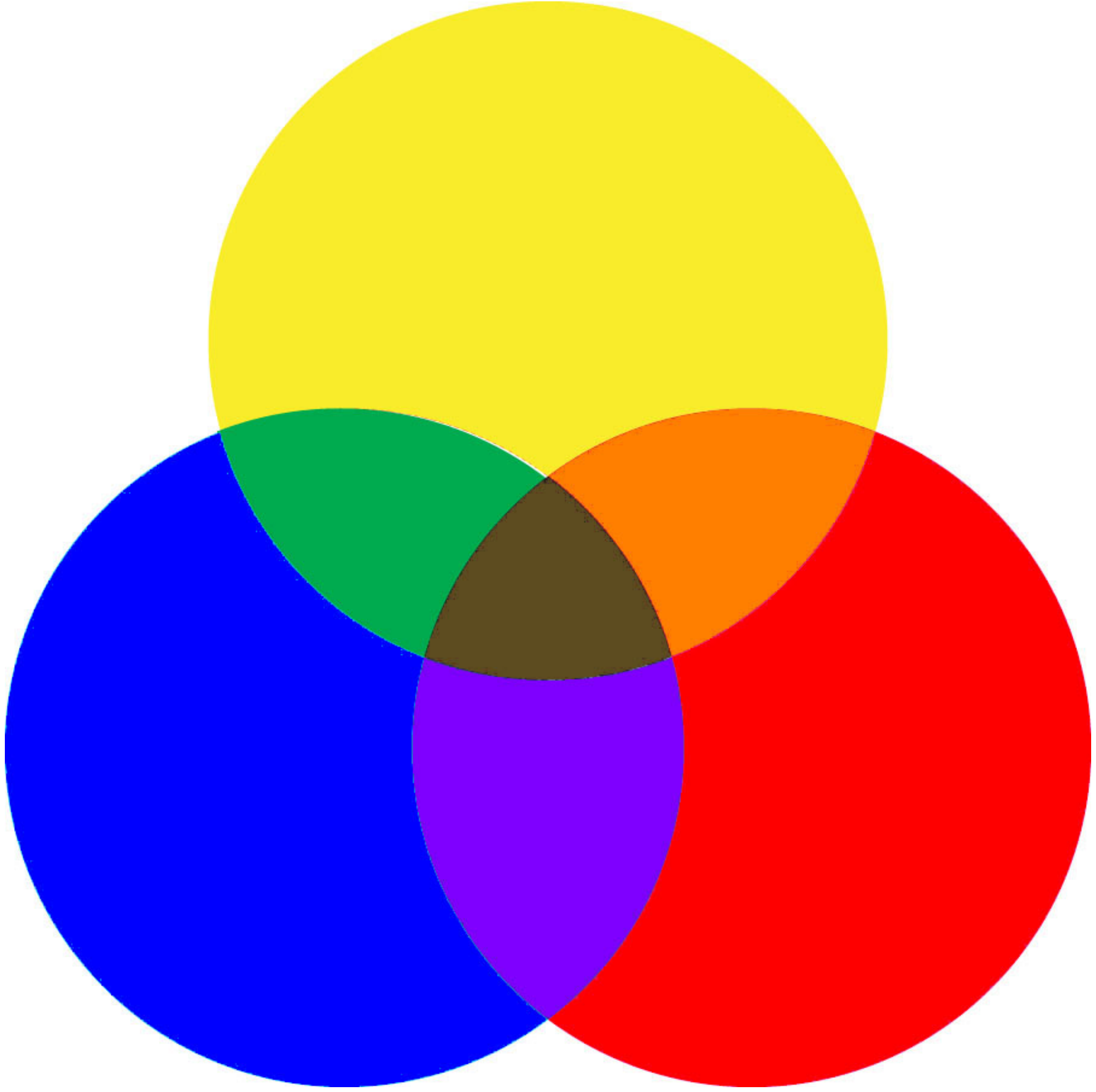
1. red, green, blue
2. red, yellow, blue
3. orange, green, violet
4. cyan, magenta, yellow

what are the primary colors?

1. red, green, blue
2. red, yellow, blue
3. orange, green, violet
4. cyan, magenta, yellow
5. all of the above

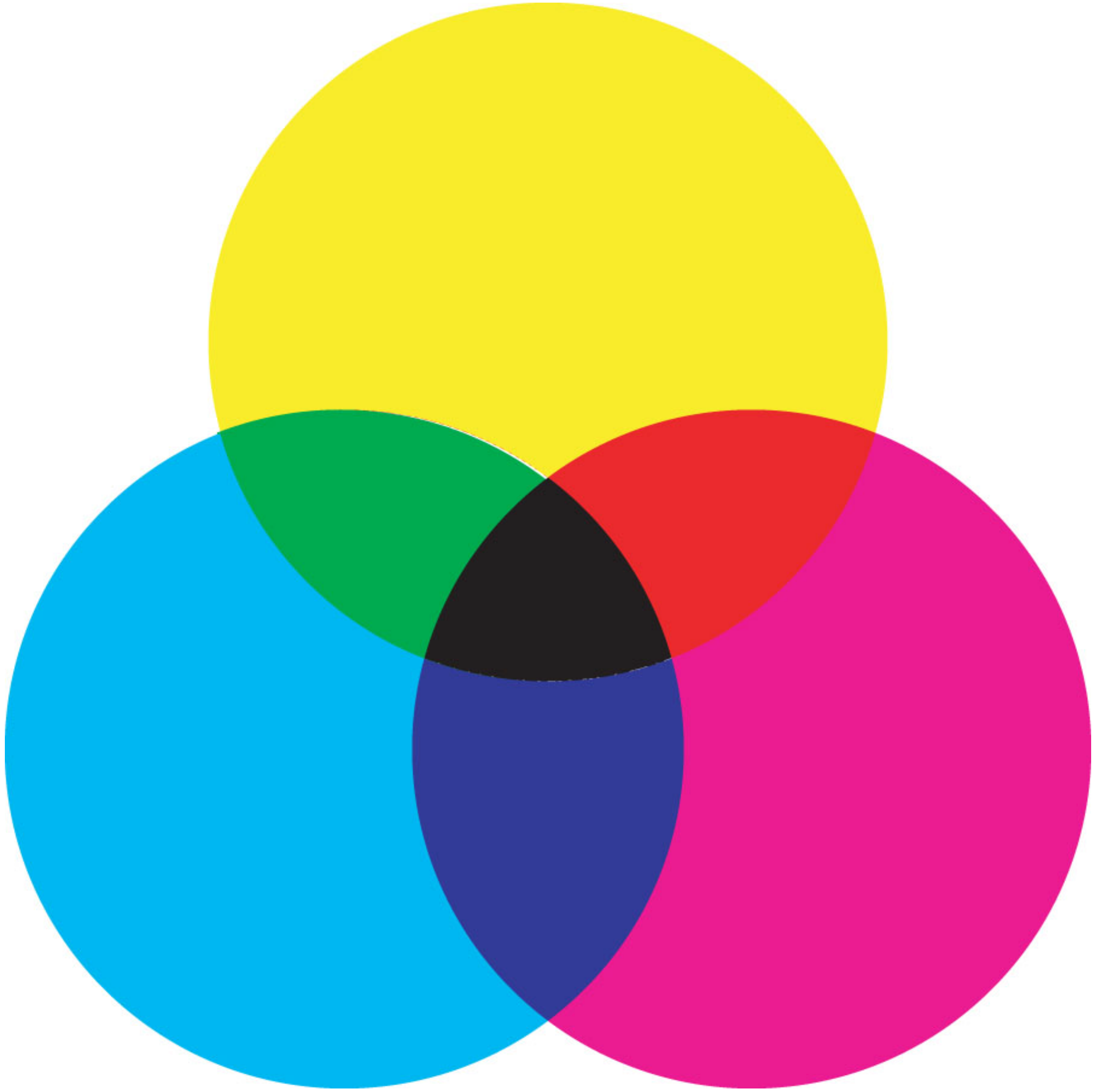
paint mixing

- physical mixing of opaque paints
- primary: RYB
- secondary: OGV
- subtractive



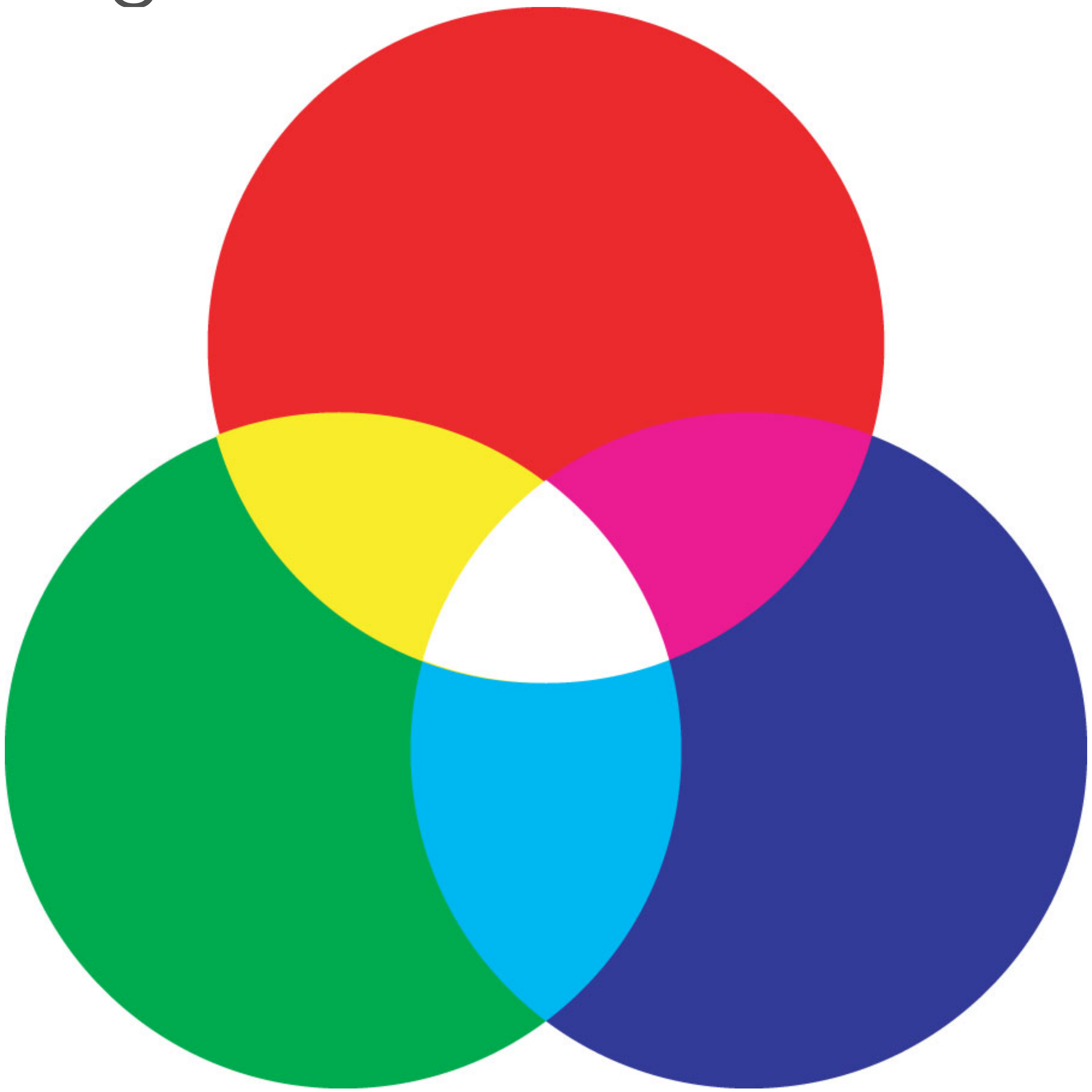
ink mixing

- subtractive mix of transparent inks
- primary: CMY
- secondary: RGB
- approx black = C+M+Y
  - *true black = C+M+Y+K*
- subtractive



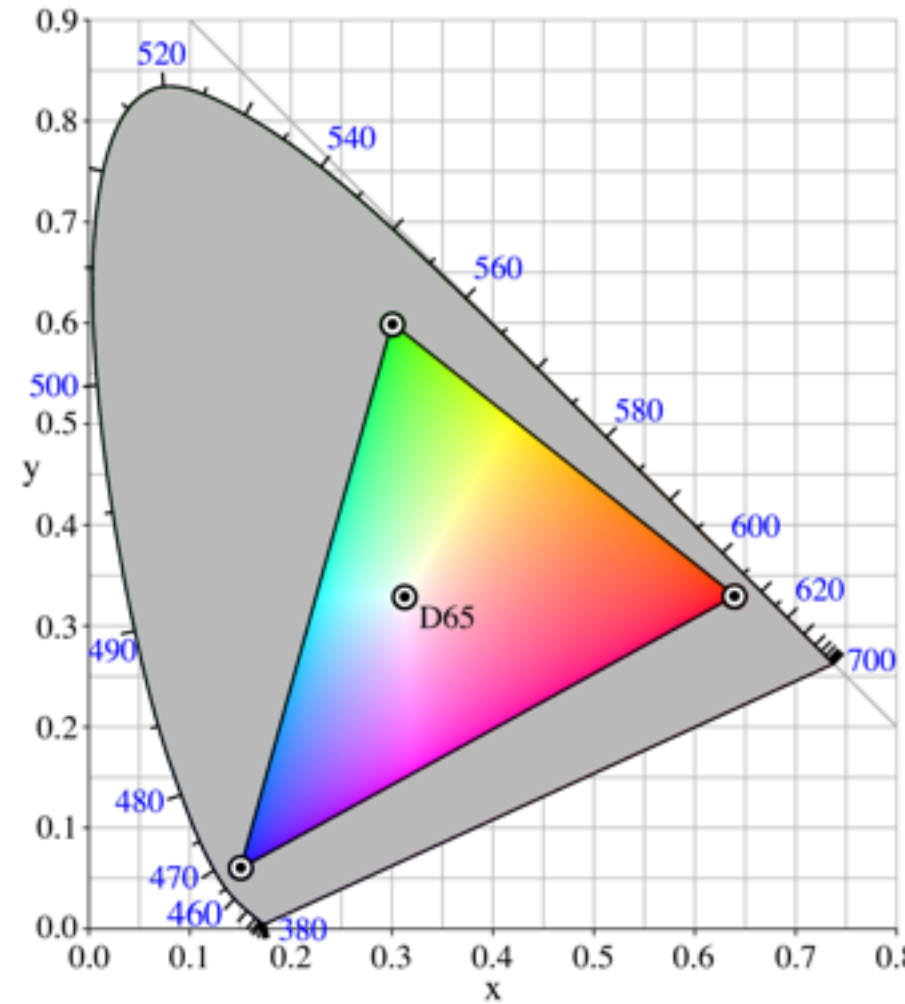
light mixing

- additive mix of colored lights
- primary: RGB
- secondary: CMY
- additive

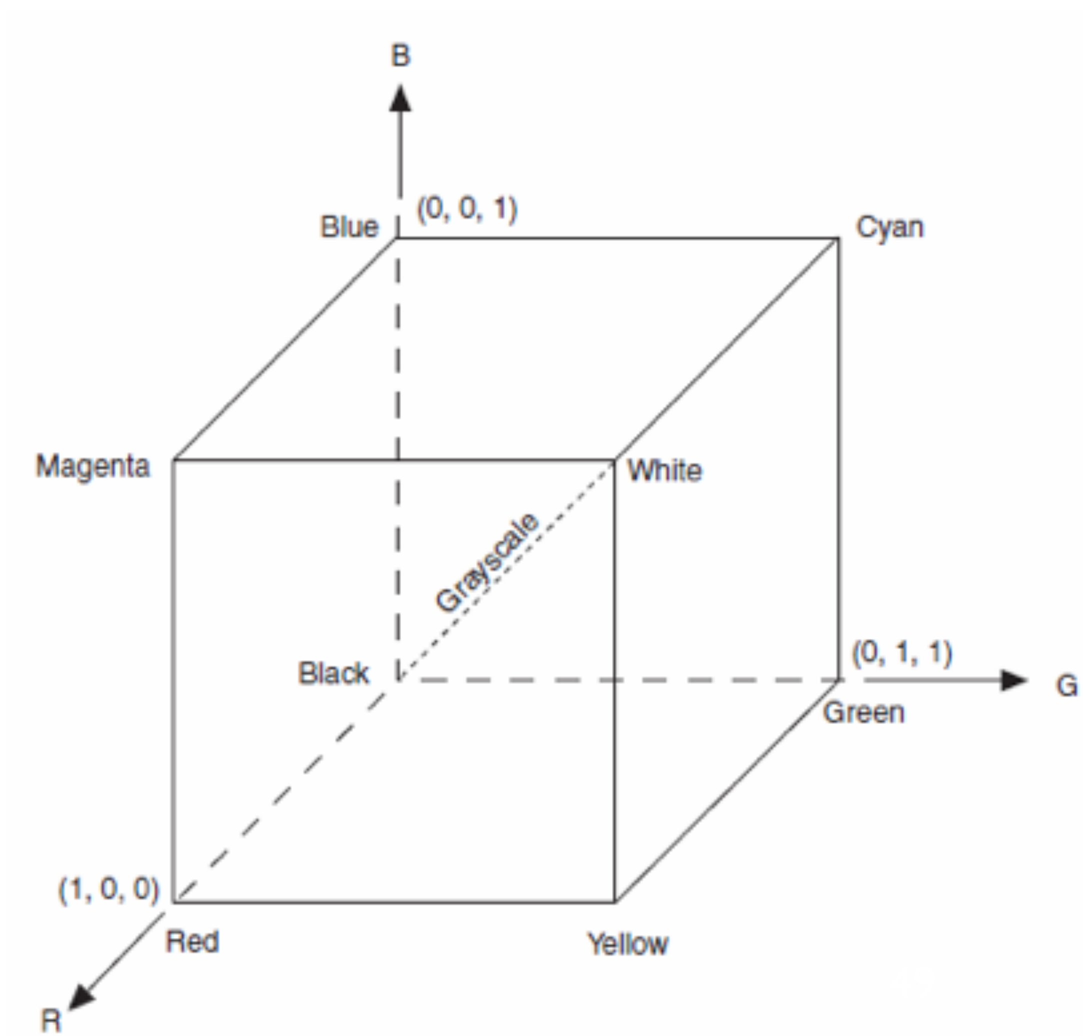


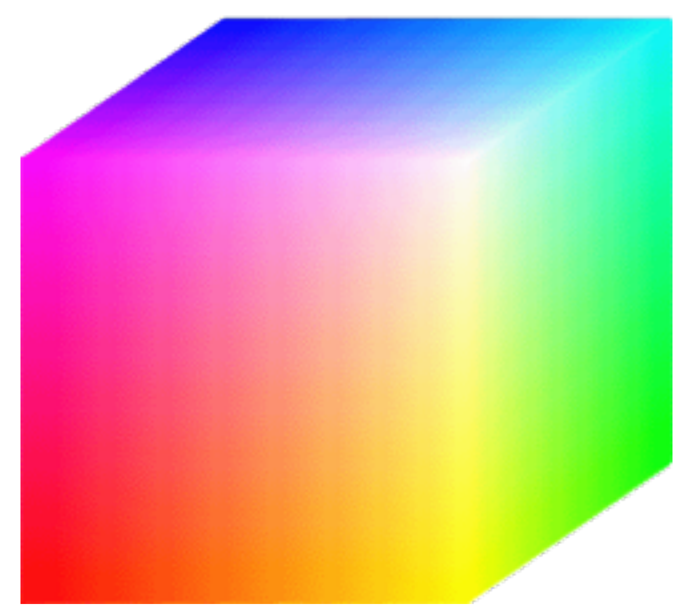
RGB color space

- very common color space
- additive, useful for monitors
- not perceptually uniform



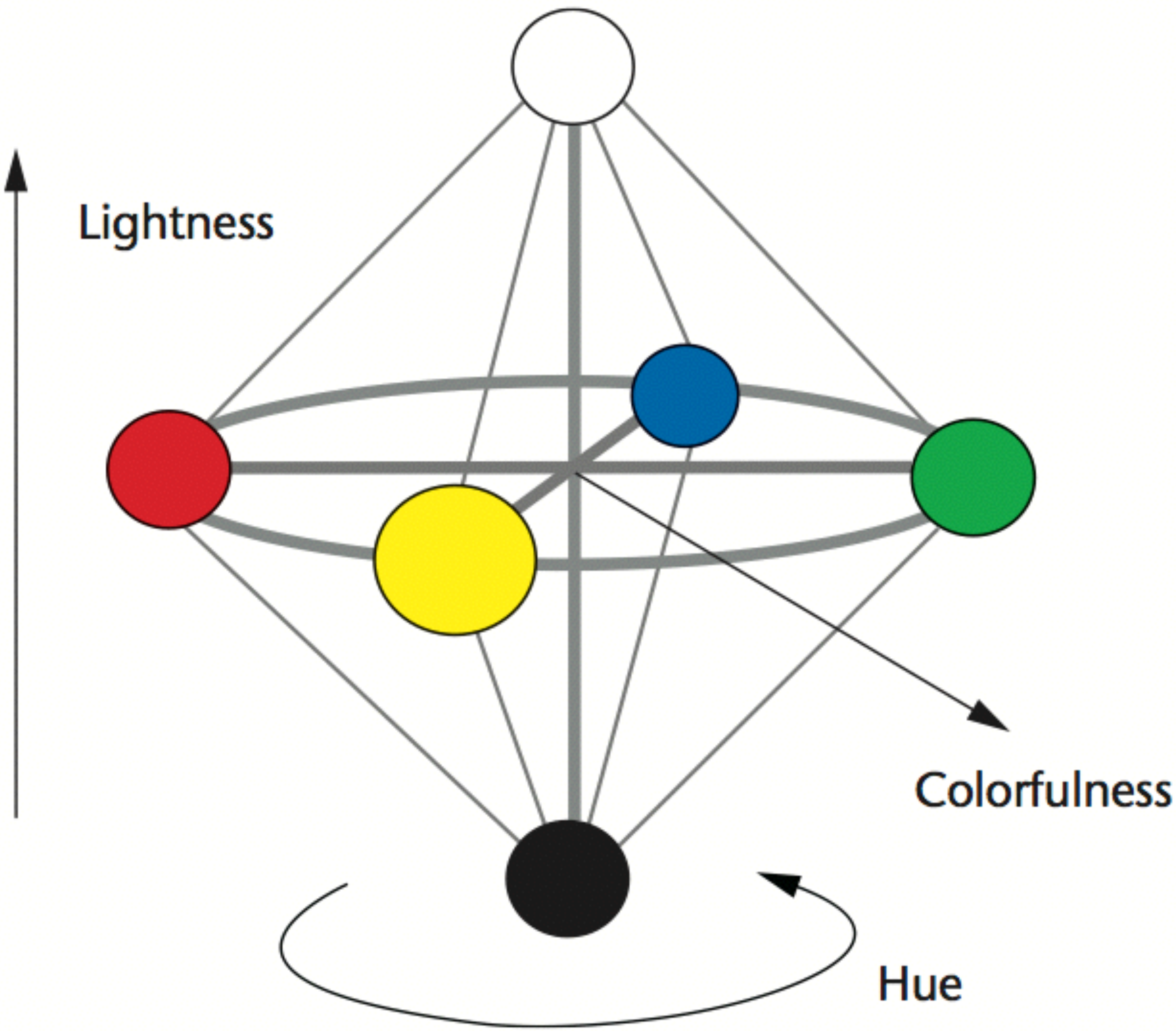
D65: midday sun in Western Europe



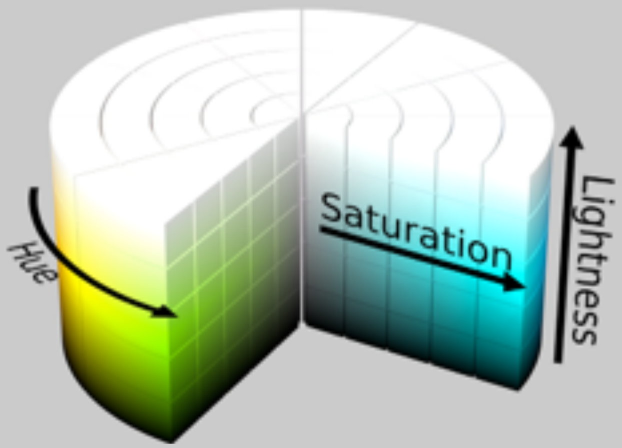


perceptual color spaces

change in amount of a color value should produce an equivalent visual change



HS L|V|B color spaces

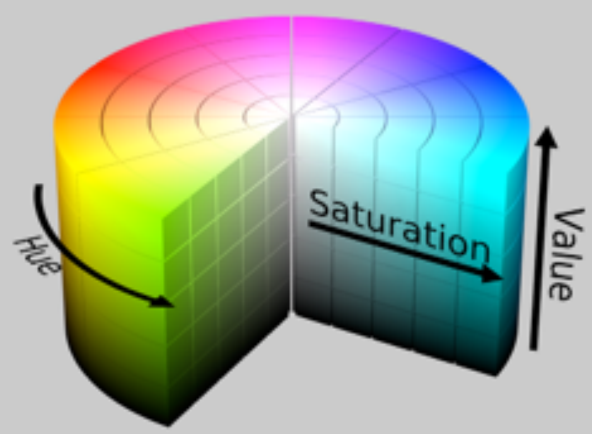


- common cylindrical-coordinate representations of points in RGB space
  - *rearrange geometry of RGB in attempt to be more intuitive and perceptually relevant*

- **hue:** what people think of as color

- **saturation:** amount of white mixed in

- **luminance:** amount of black mixed in
  - ***lightness*** *vs* ***value*** *(or brightness)*
  - ***intensity****, in computer vision applications*



- chroma vs saturation
  - *chroma is colorfulness relative to the brightness of another color that appears white under similar viewing conditions*
  - *saturation is colorfulness of a color relative to its own brightness*

HS L|V|B color spaces

- common cylindrical-coordinate representations of points in RGB space
  - *rearrange geometry of RGB in attempt to be more intuitive and perceptually relevant*
- **hue:** what people think of as color
- **saturation:** amount of white mixed in
- **luminance:** amount of black mixed in
  - ***lightness*** *vs* ***value*** *(or brightness)*
  - ***intensity****, in computer vision applications*
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  - *chroma is colorfulness relative to the brightness of another color that appears white under similar viewing conditions*
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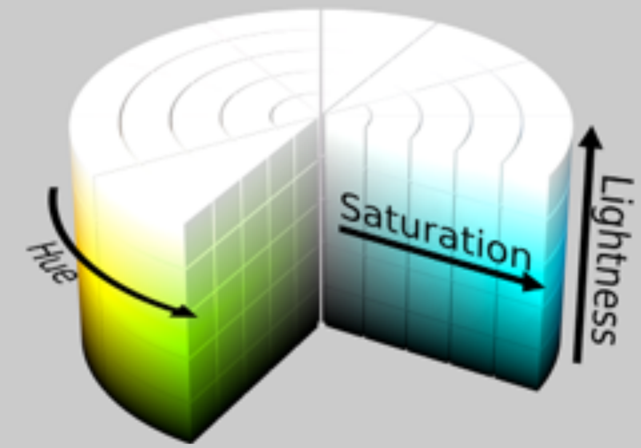
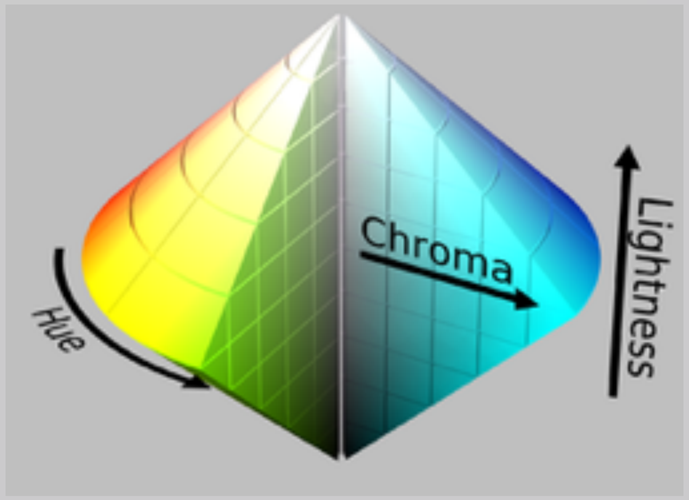
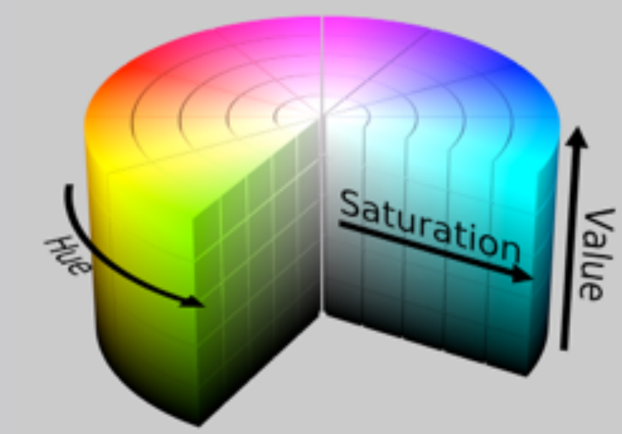
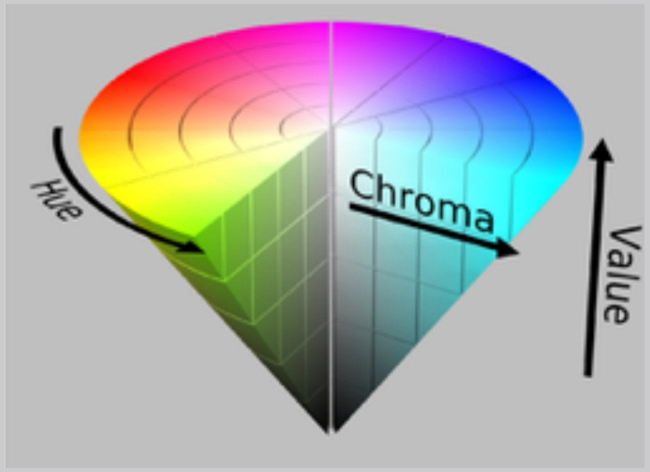


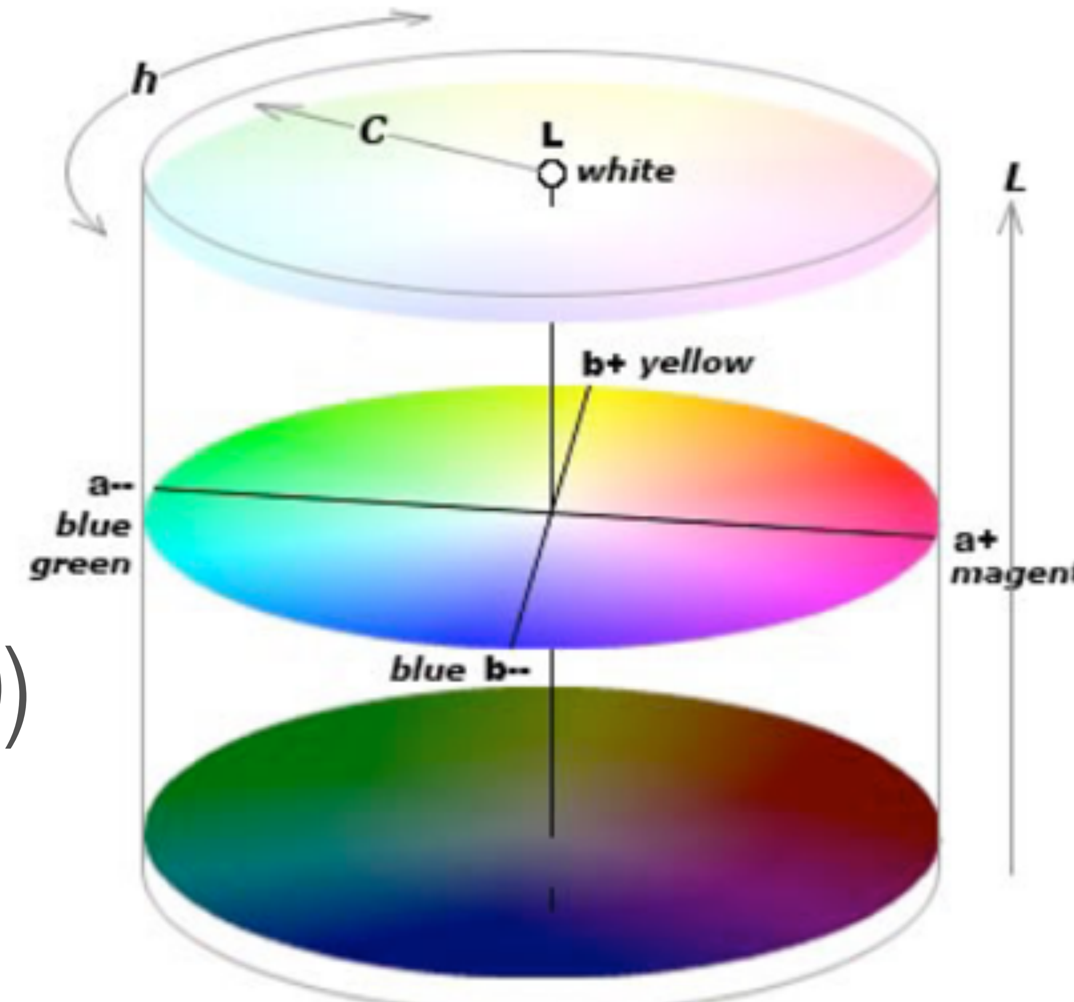




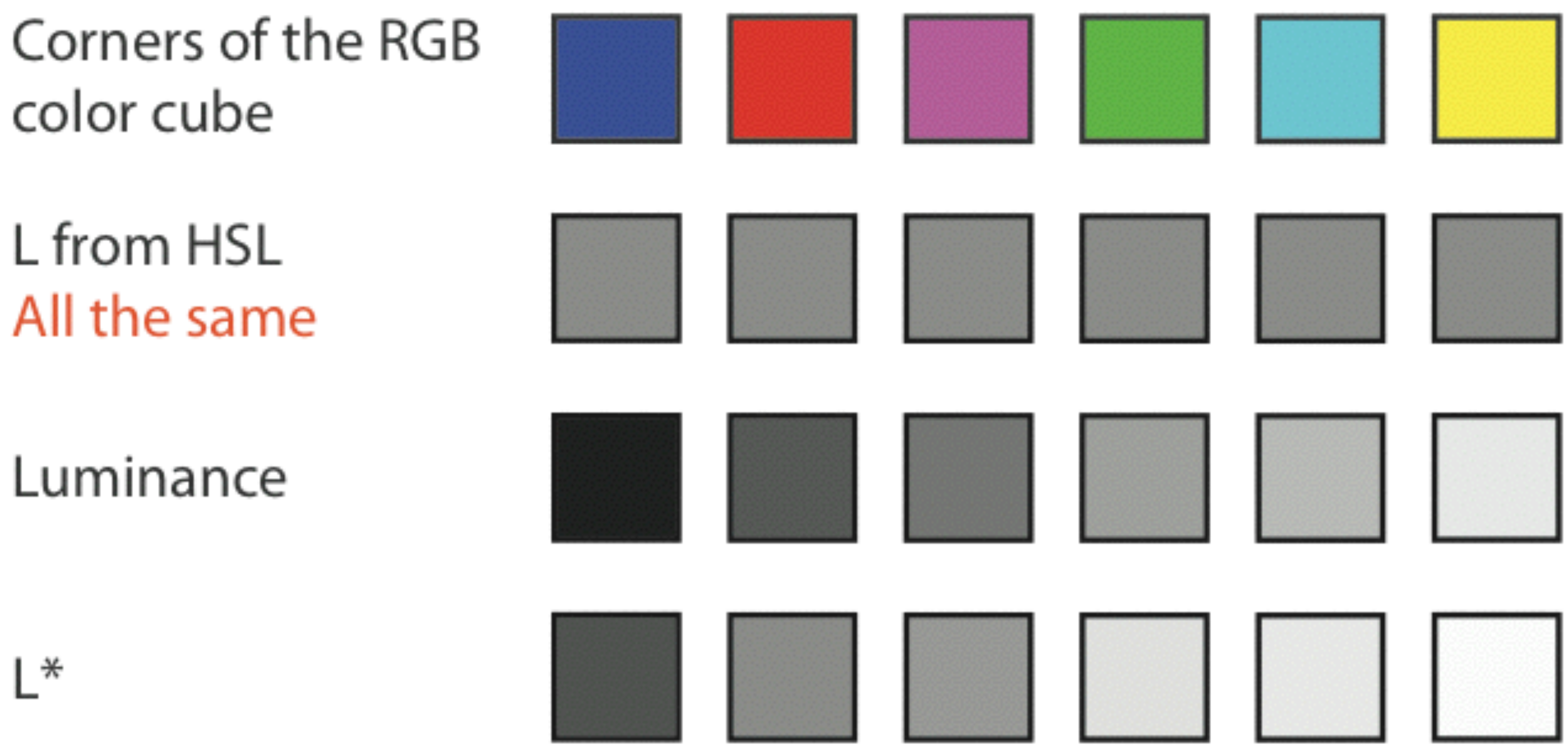


CIE L*a*b* color space

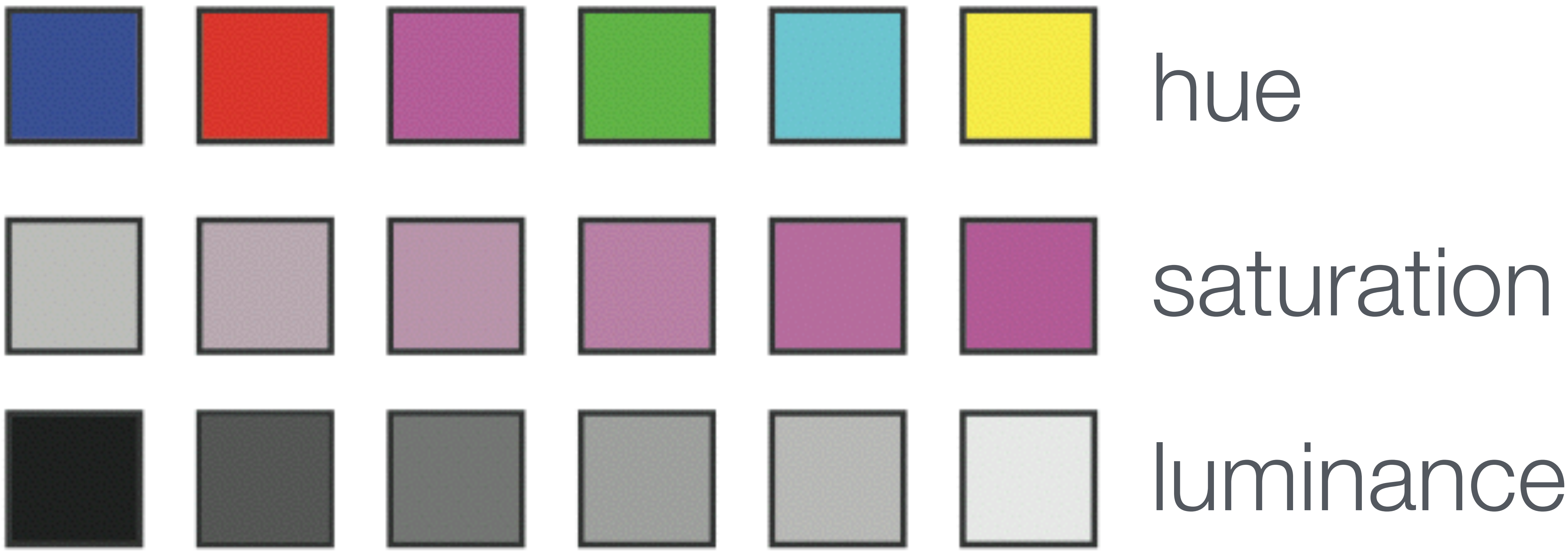
- designed to approximate human vision
- describes all colors visible to human eye
  - *uses positive and negative values*
- **L*:** lightness
- **a*:** red/magenta to green
- **b*:** yellow to blue
- relative to a point of white (D50)
- supersedes RGB and CMYK



luminance is tricky



in this class…



guidelines

what is a colormap?

- specifies a mapping between color and values
  - sometimes called a transfer function

- categorical vs ordered
- sequential vs diverging
- segmented vs continuous
- univariate vs bivariate

- **expressiveness**: match colormap to attribute type characteristics!

what is a colormap?

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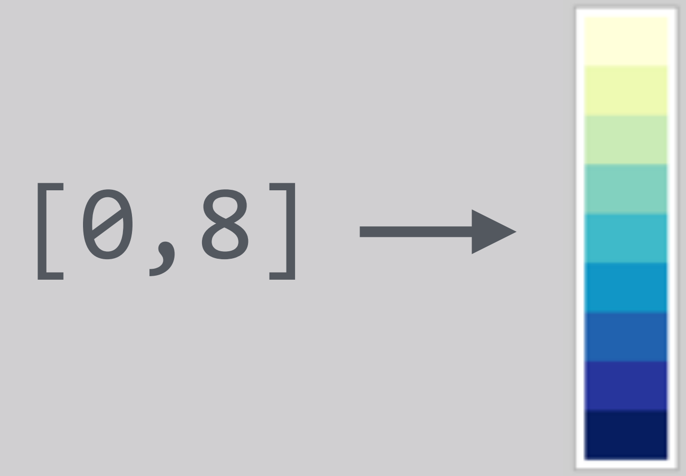

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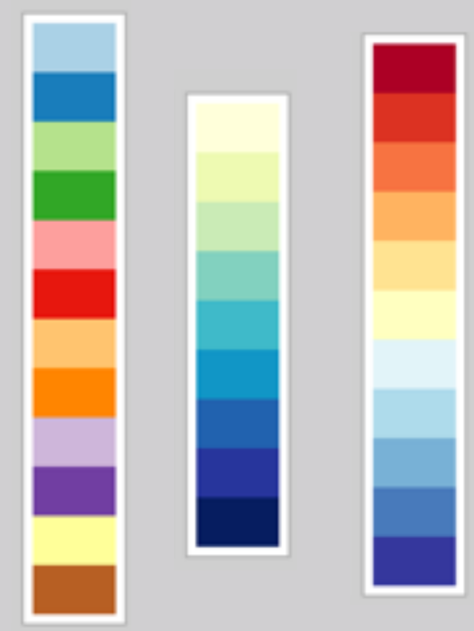

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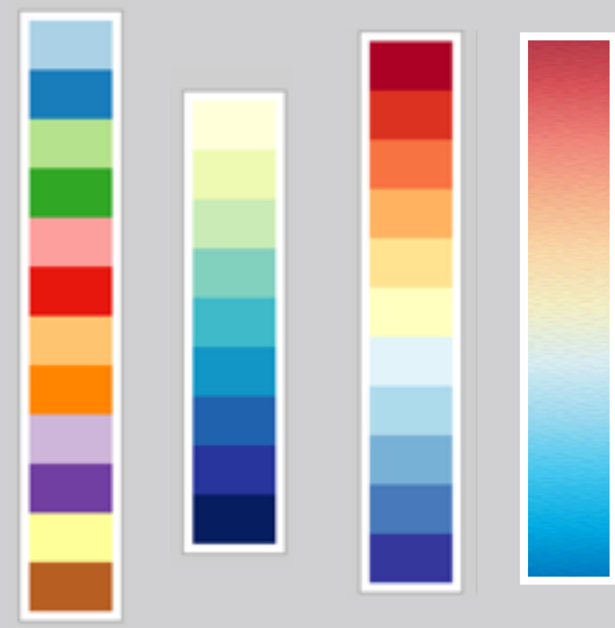
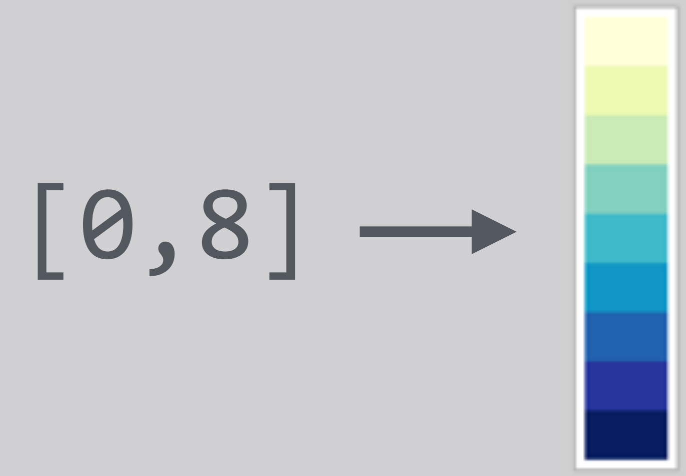


- **expressiveness**: match colormap to attribute type characteristics!

what is a colormap?



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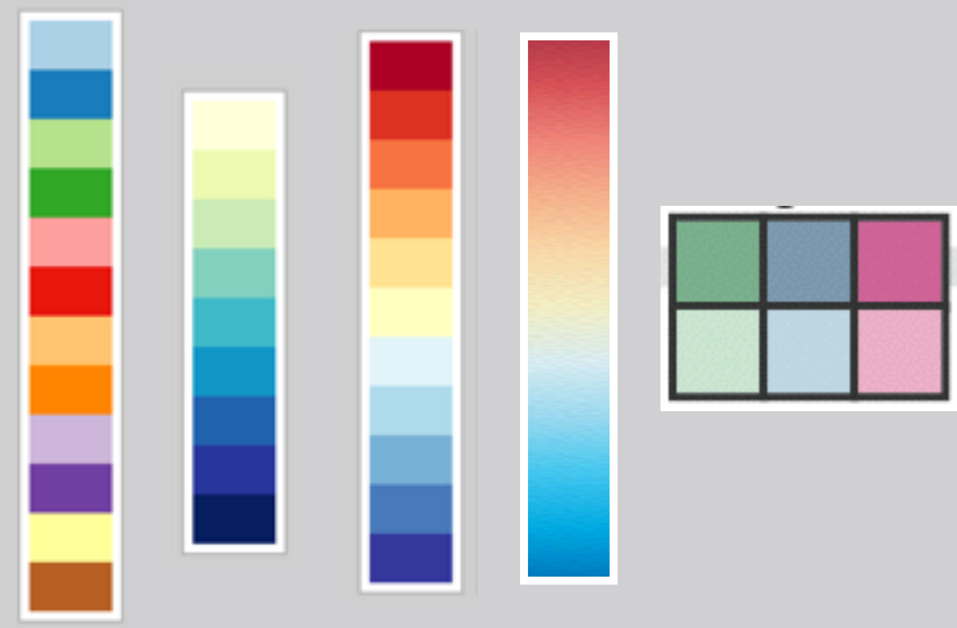


- **expressiveness**: match colormap to attribute type characteristics!

guidelines

- ordered colormaps should vary along saturation or luminance

- bivariate colormaps are difficult to interpret if at least one variable is not binary

- categorical colors are easier to remember if they are nameable

- number of hues, and distribution on the colormap, should be related to which, and how many structures in the data to emphasize
    - min or max, ends or middle, etc…

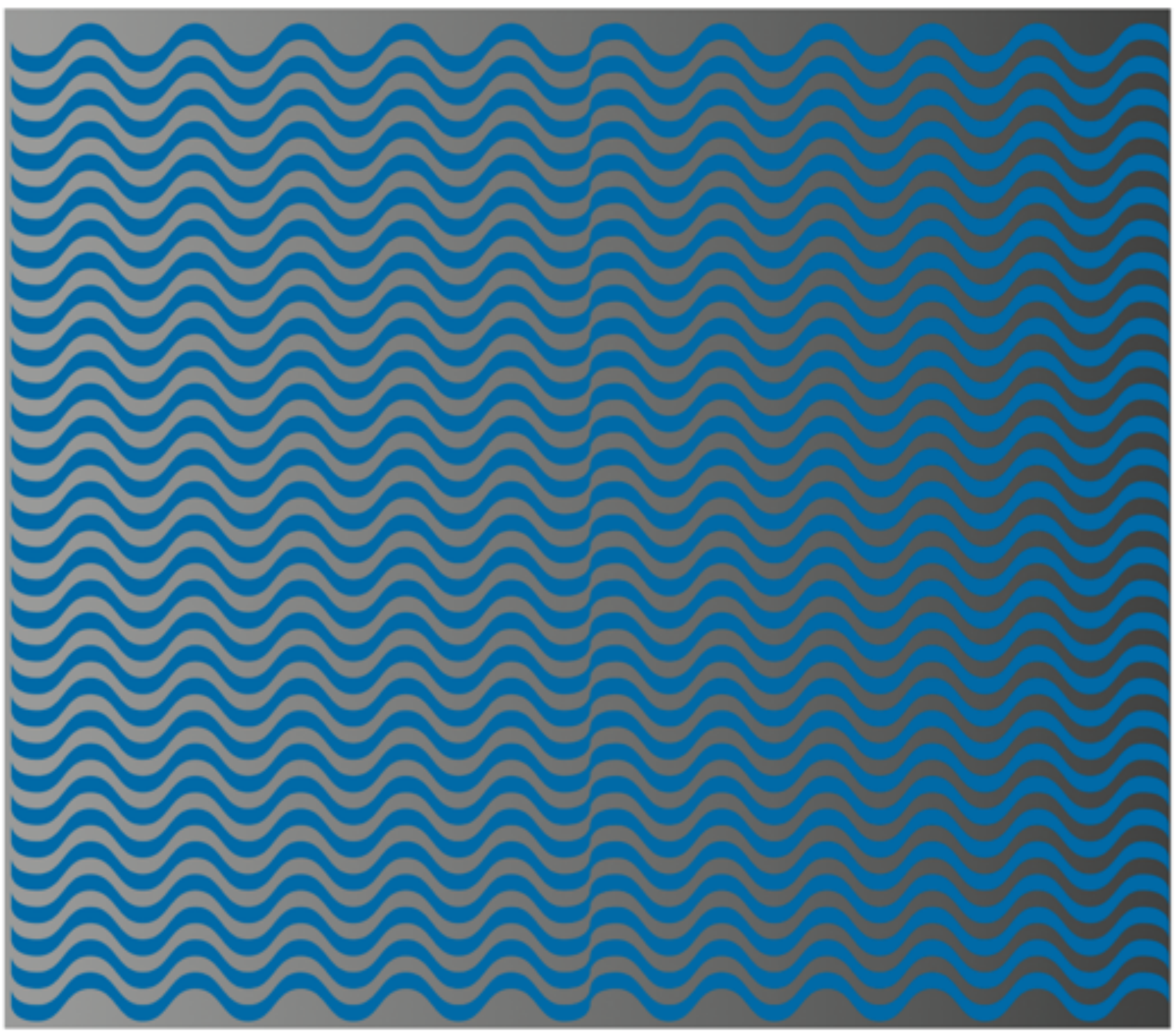
size & color

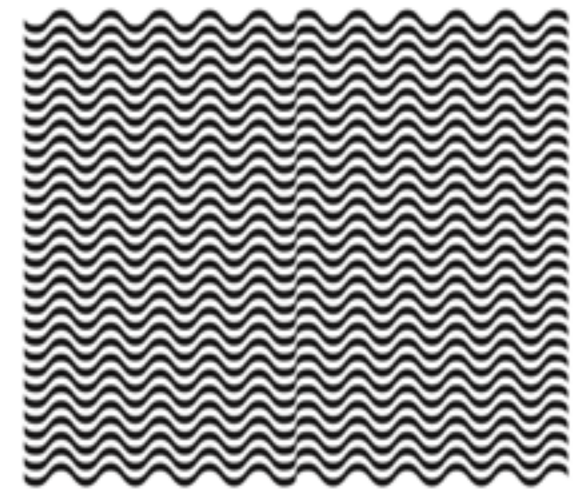
size & color

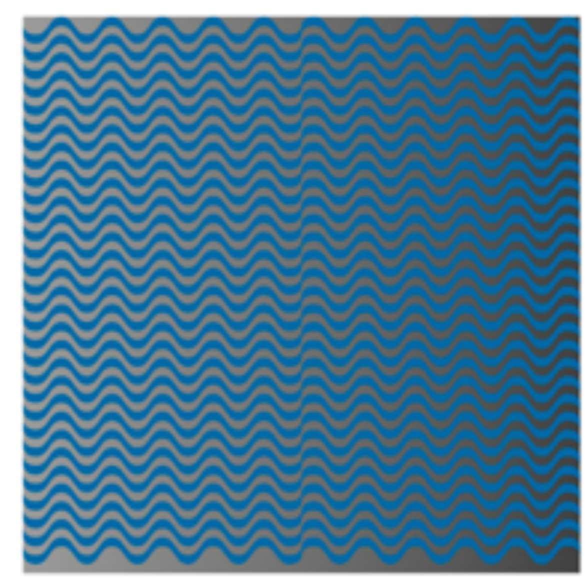
"the smaller the mark, the less distinguishable are the colors"

-Jacques Bertin

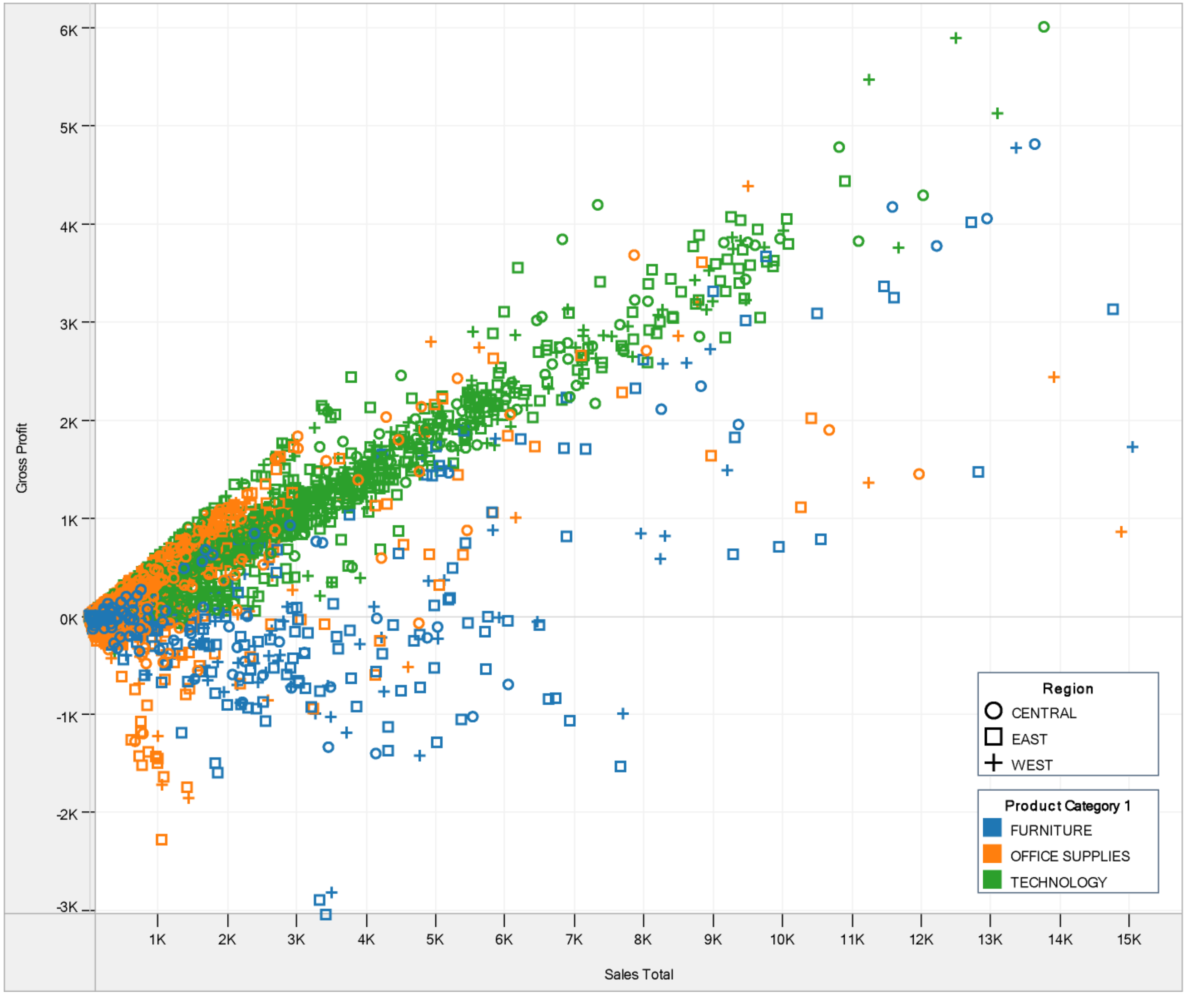
size & color







small areas



Gross Profit
6K
5K
4K
3K
2K
1K
0K
-1K
-2K
-3K
1K
2K
3K
4K
5K
6K
7K
8K
9K
10K
11K
12K
13K
14K
15K
Sales Total
Region
CENTRAL
EAST
WEST
Product Category 1
FURNITURE
OFFICE SUPPLIES
TECHNOLOGY

which area is bigger, red or green?

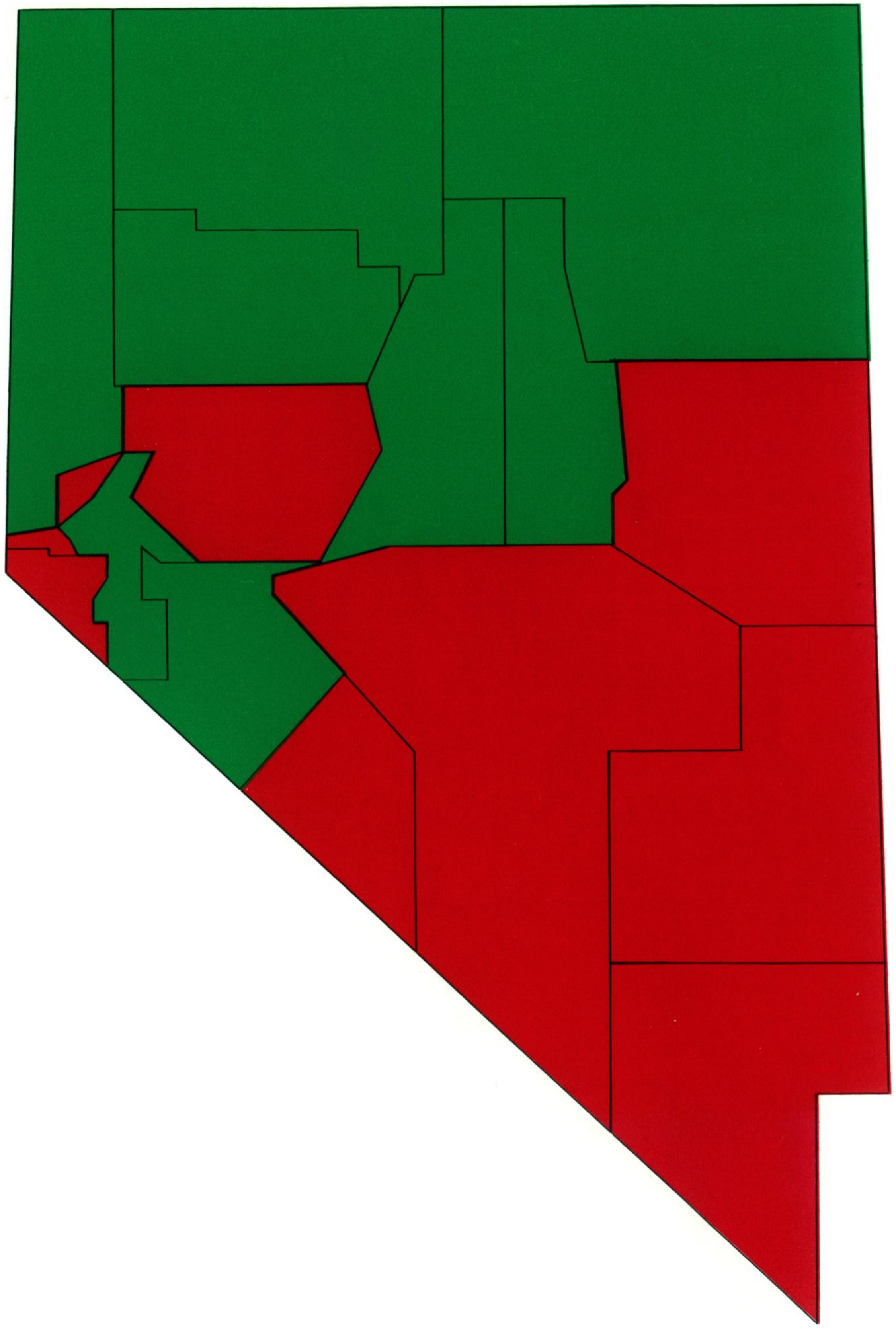


Figure 1. Stimulus From the High-Saturation Group

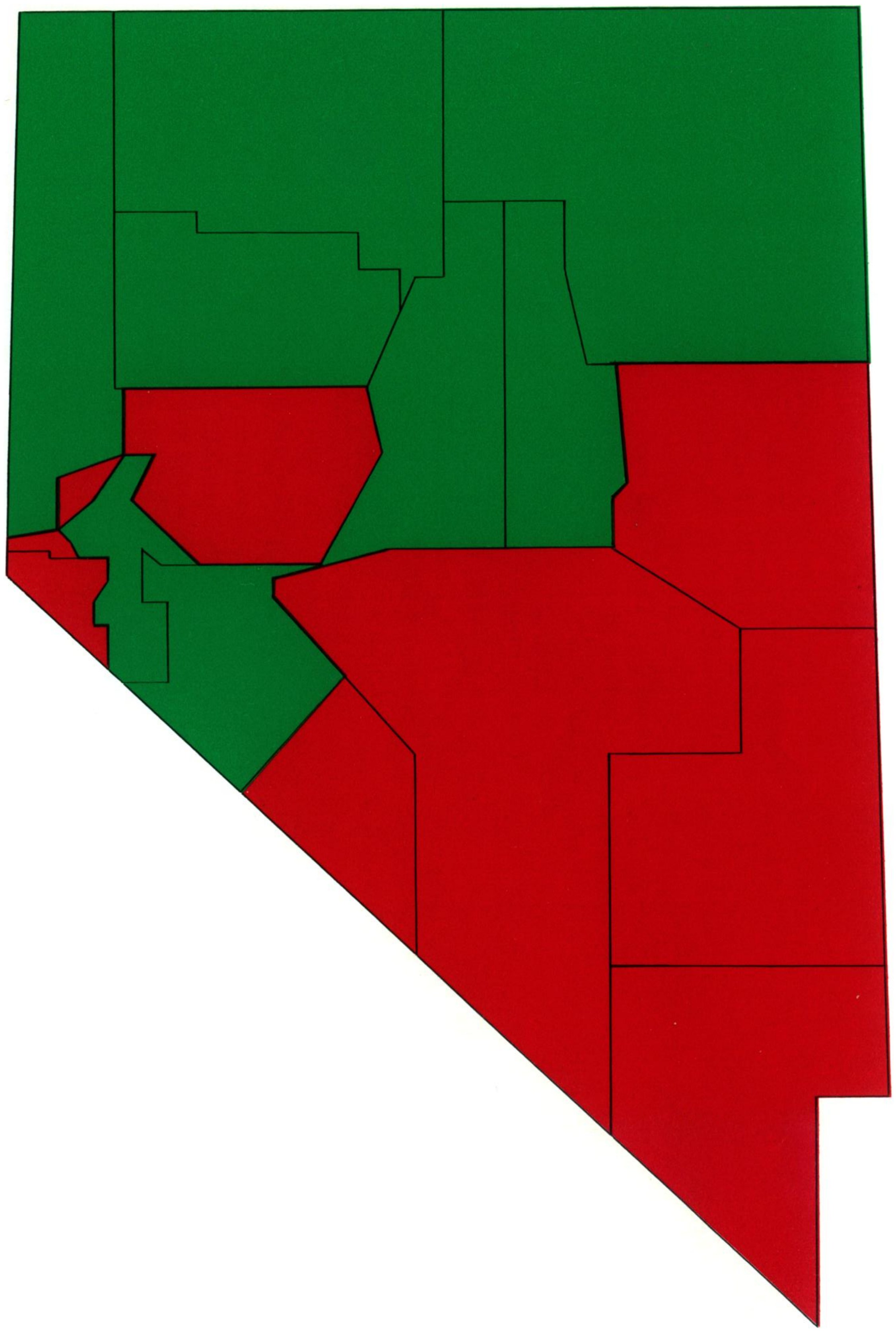


Figure 1. Stimulus From the High-Saturation Group

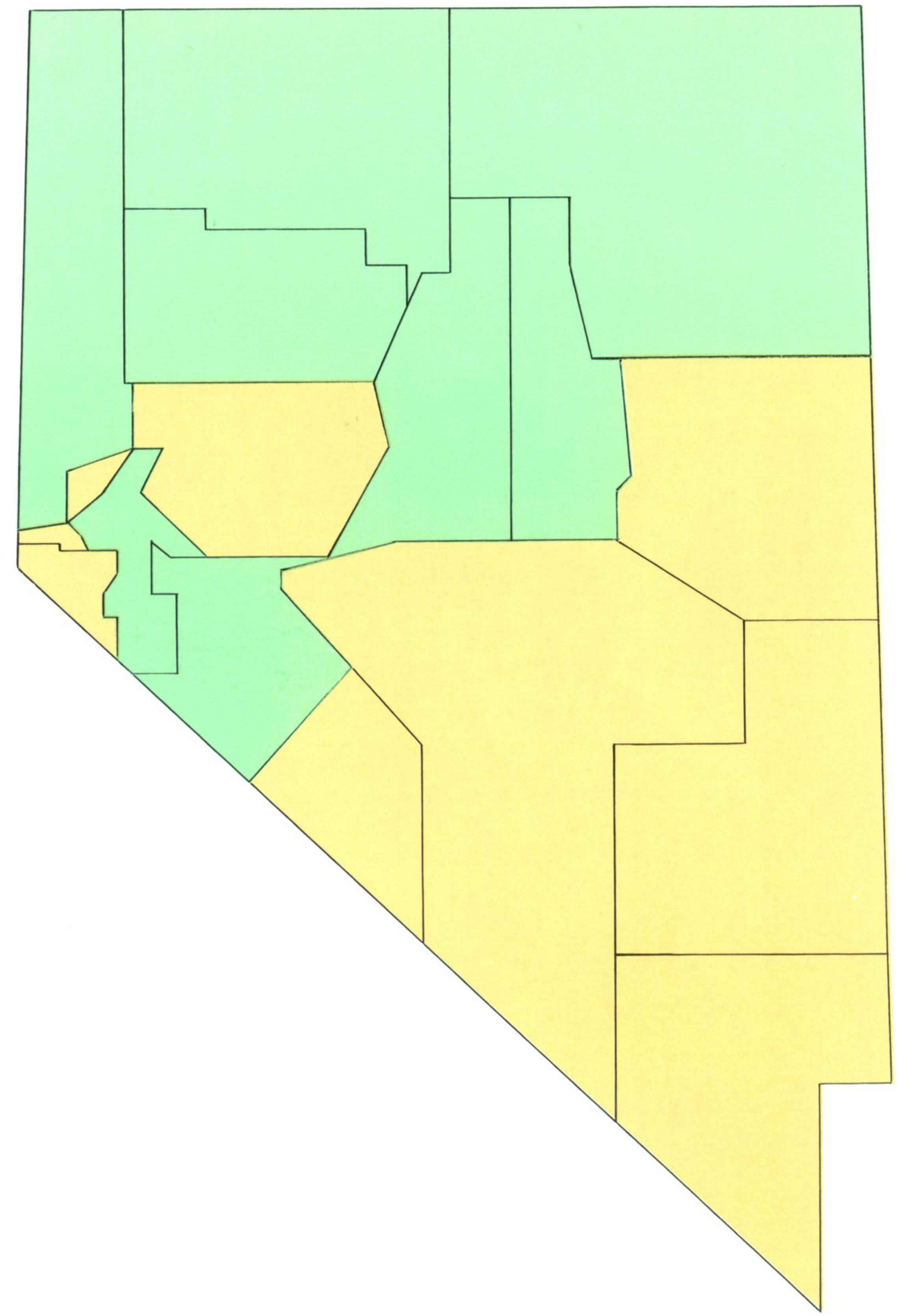
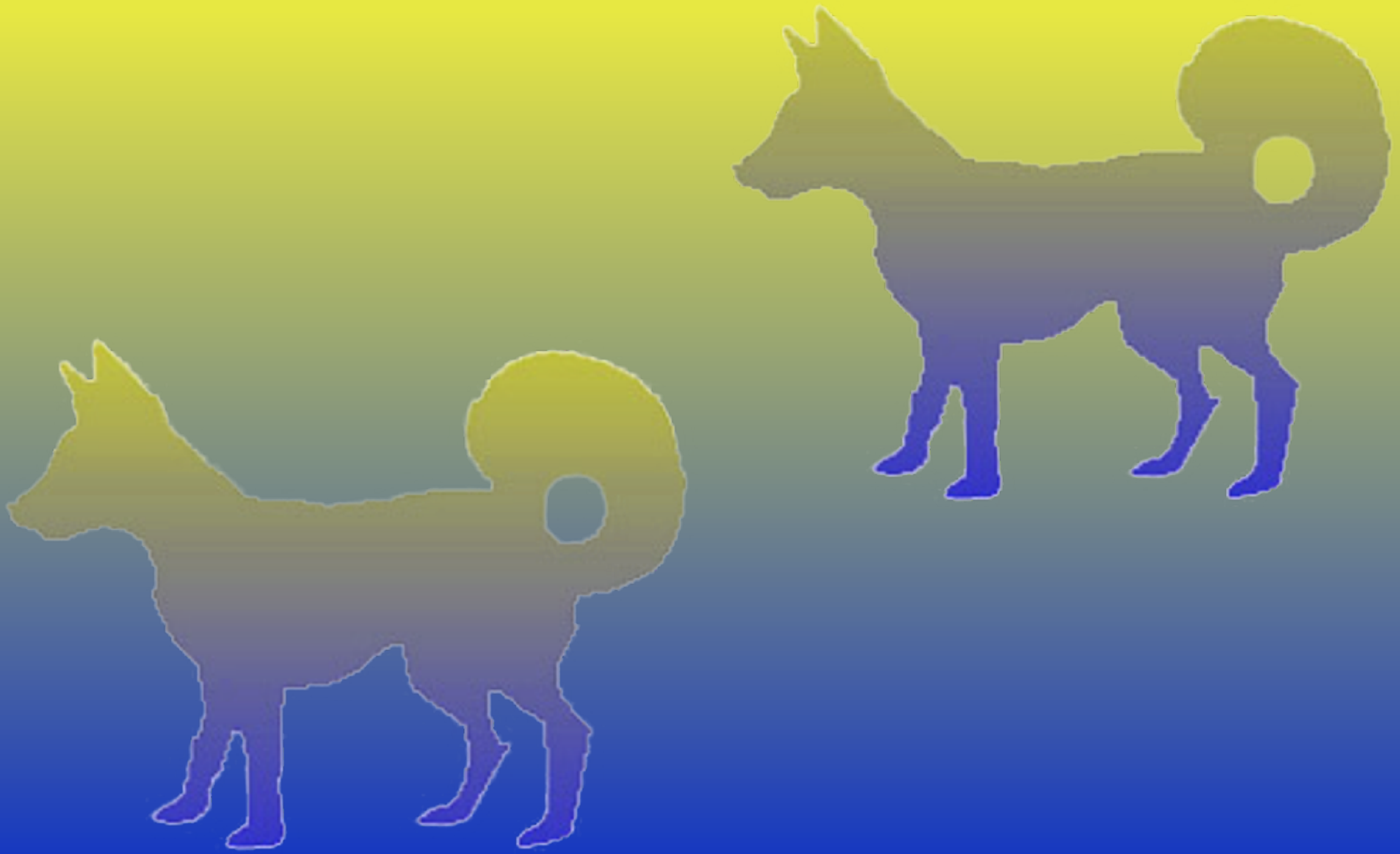


Figure 2. Stimulus From the Low-Saturation Group

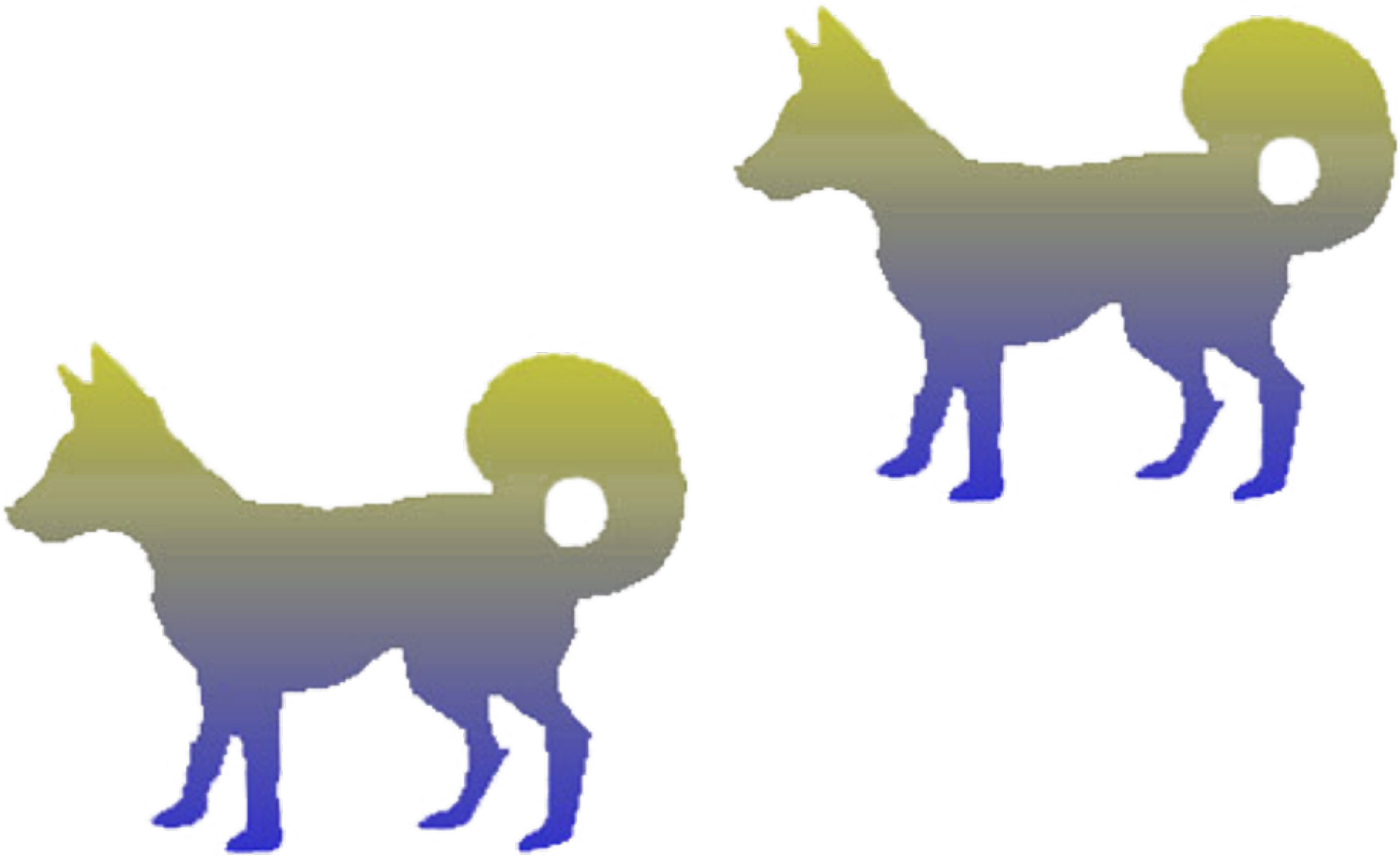
guidelines

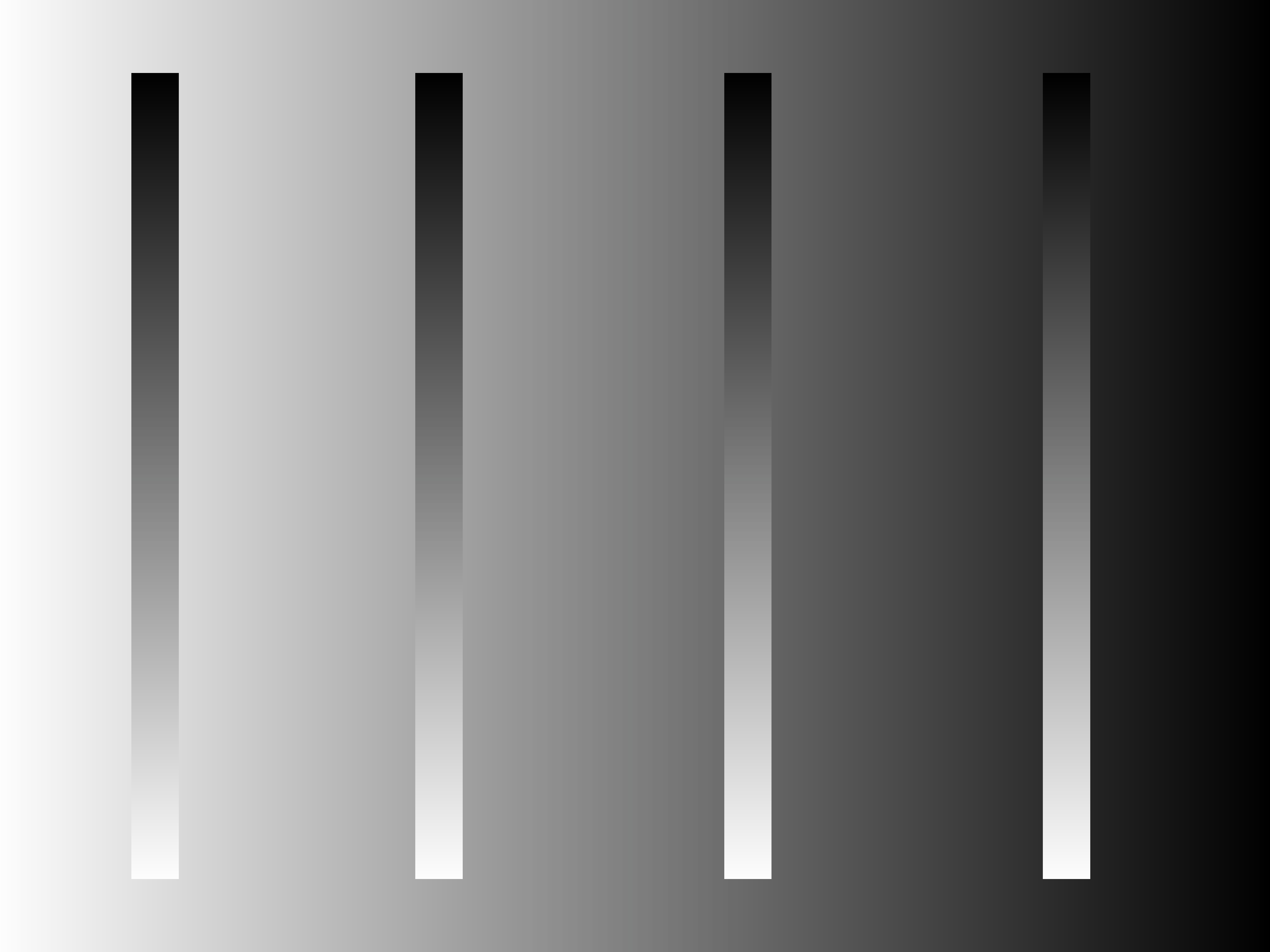
- saturation and hue are not separable in small regions
  - in small regions use bright, highly saturated colors
- saturation interacts strongly with size
  - more difficult to perceive in small regions
  - for points and lines use just two saturation levels
- higher saturation makes large areas look bigger
  - use low saturation pastel colors for large regions and backgrounds

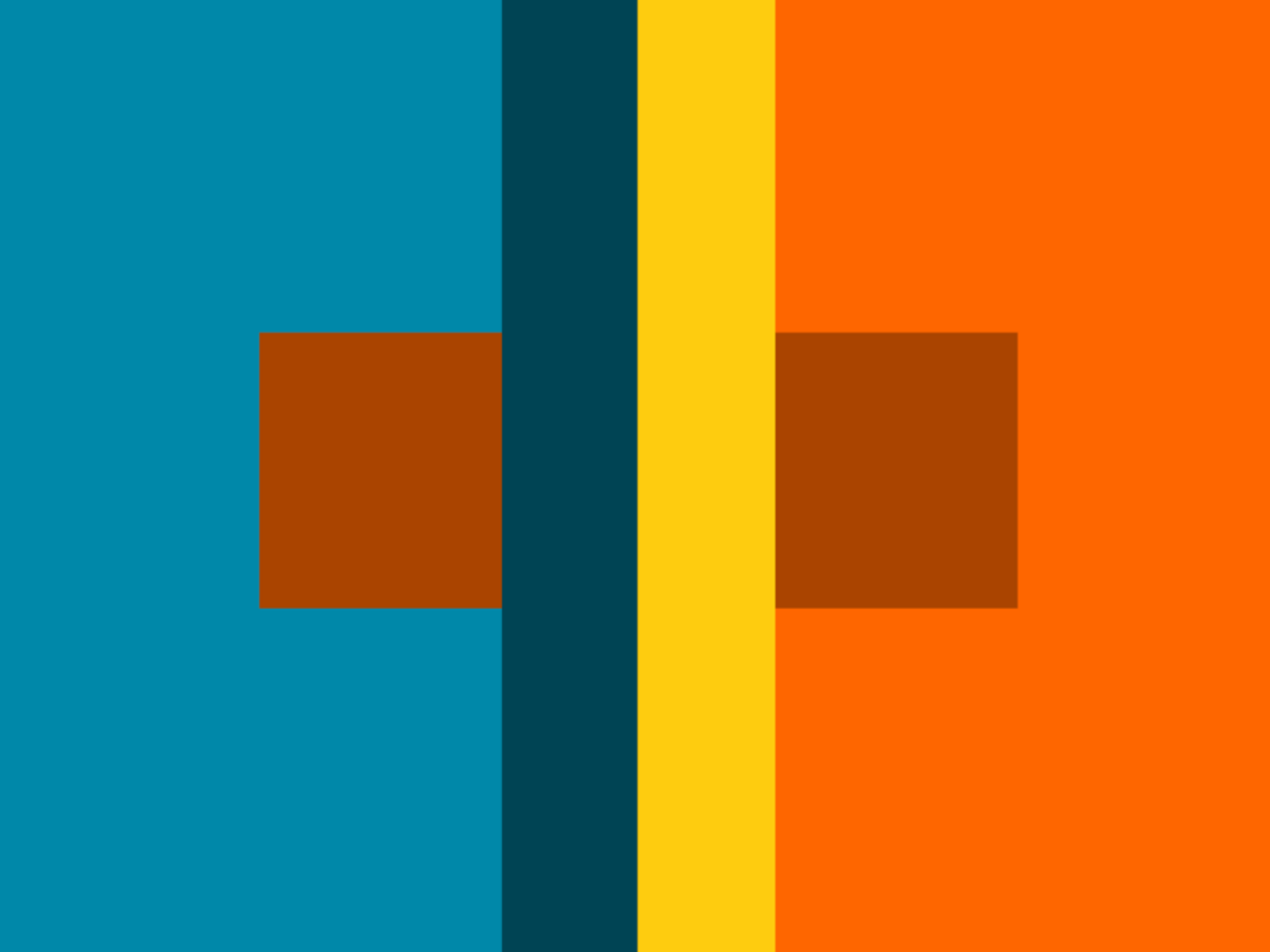
simultaneous contrast



simultaneous contrast







luminance contrast

Showing small blue text on a black background is a bad idea.
There is insufficient luminance contrast.

Showing small blue text on a black background is a bad idea.
There is insufficient luminance contrast.

Showing small yellow text on a white background is a bad idea.
There is insufficient luminance contrast.

Showing small yellow text on a white background is a bad idea.
There is insufficient luminance contrast.

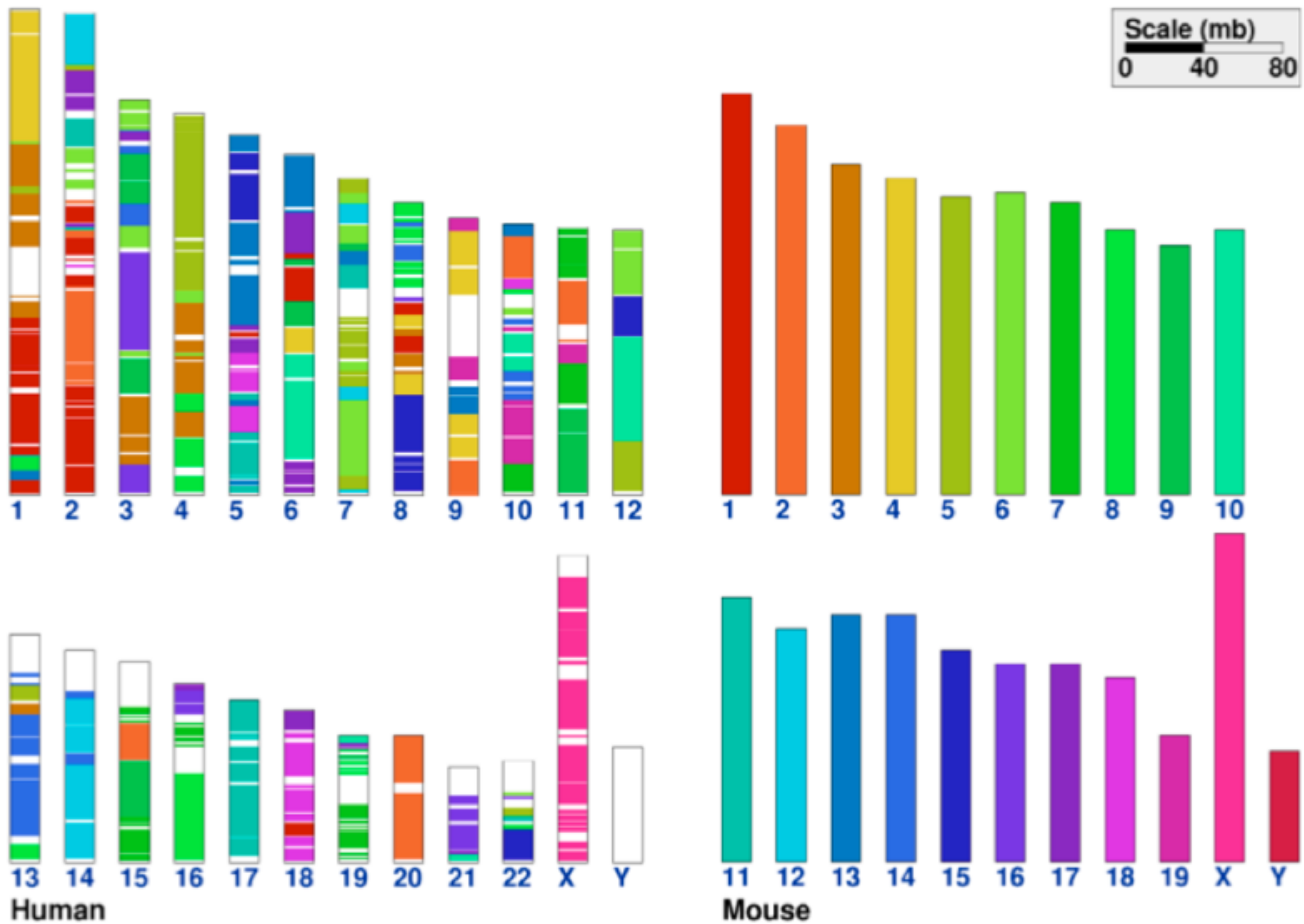
guidelines

- color is a relative medium
  - if encoding ordinal data with color, place marks on solid, neutral background
- because of contrast effects, it is difficult to perceive absolute luminance of noncontiguous regions
  - use only 2-4 bins when background is nonuniform
  - for text, ideally use 10:1 ratio, 3:1 minimum

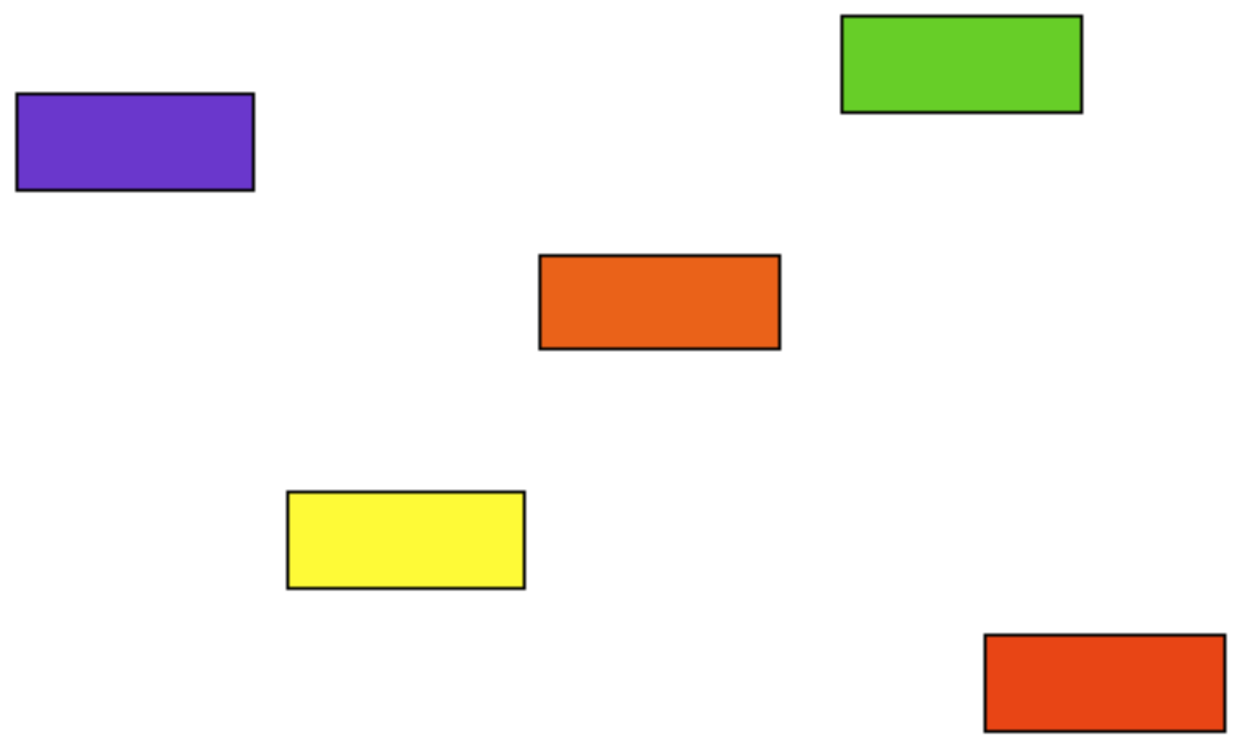
hues for categories

distinguishability

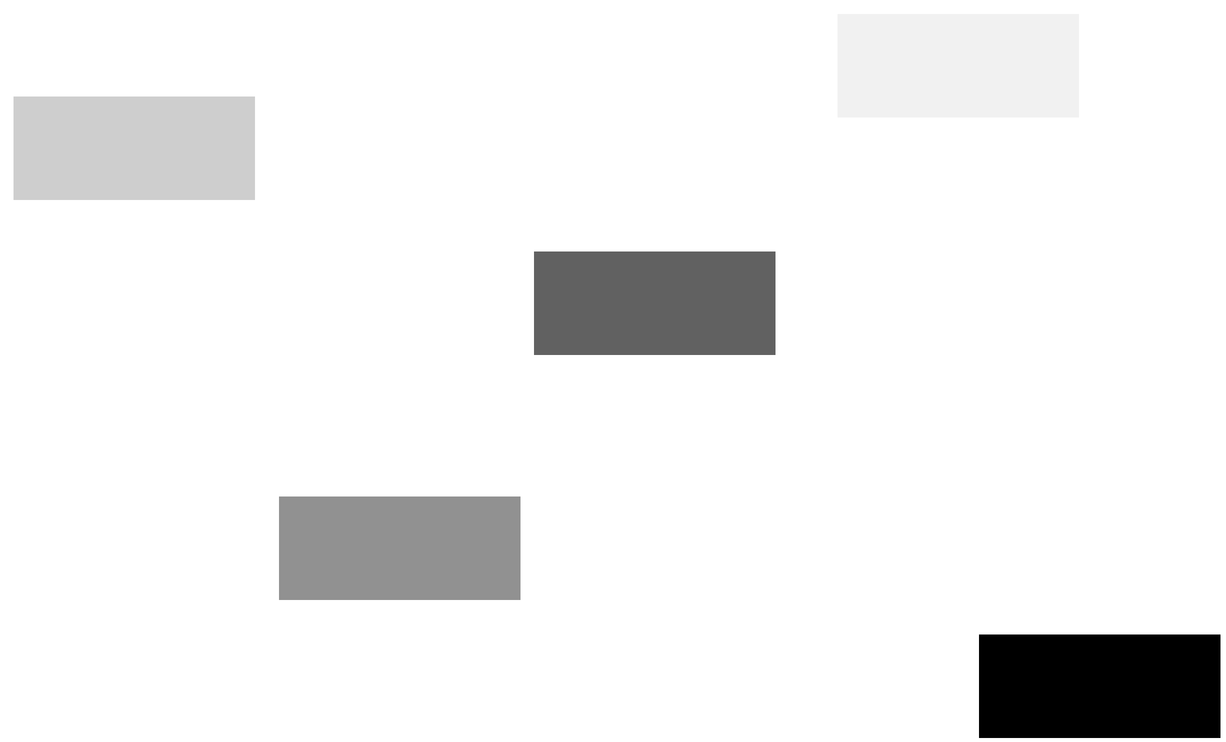
only good at distinguishing 6-12 simultaneous colors



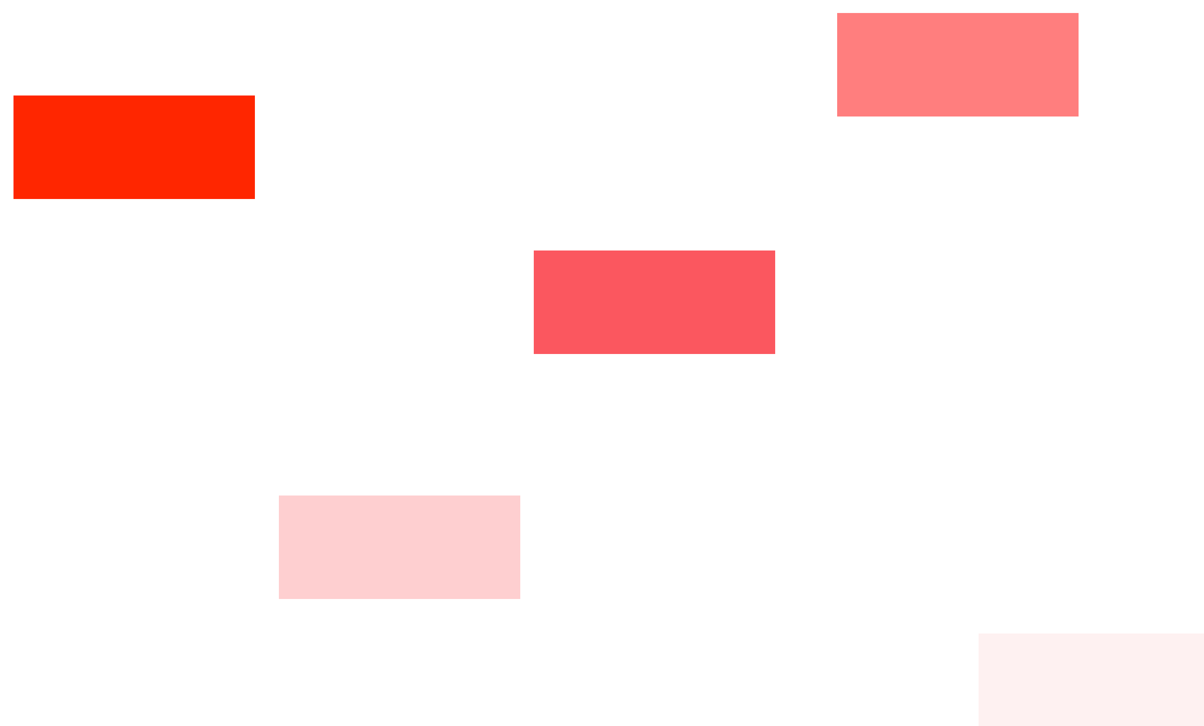
order these colors…



order these colors…



order these colors…



guidelines

- luminance and saturation are most effective for ordinal data because they have an inherent ordering
- hue is great for categorical data because there is no inherent ordering
  - but limit number of hues to 6-12 for distinguishability

rainbow colormaps: challenges

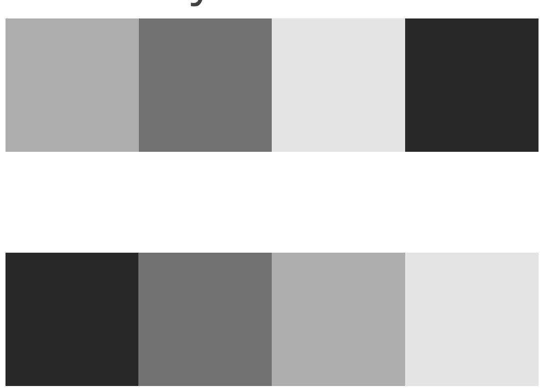
no implicit order

Borland 2007

rainbow colormaps: challenges

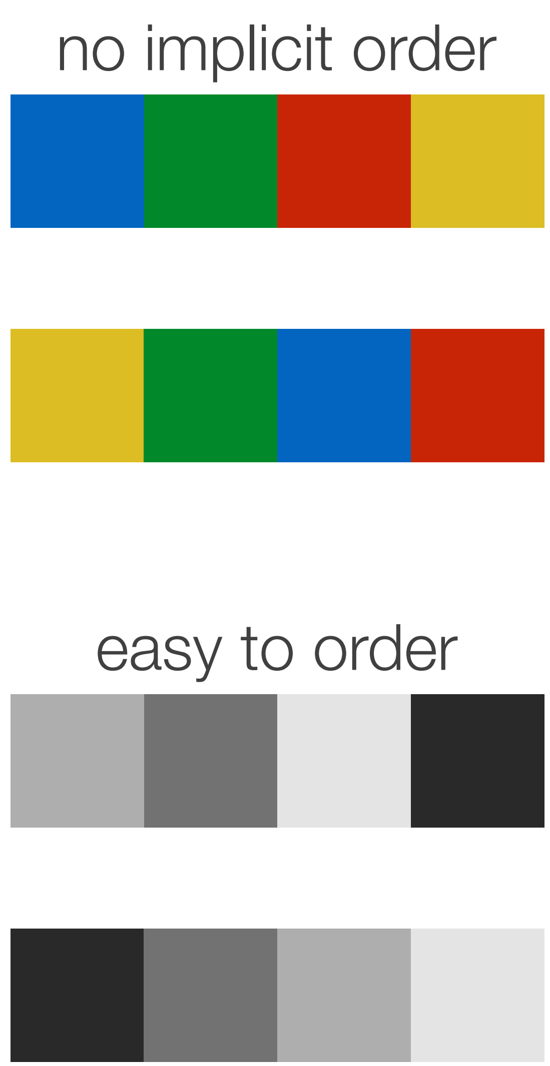
no implicit order

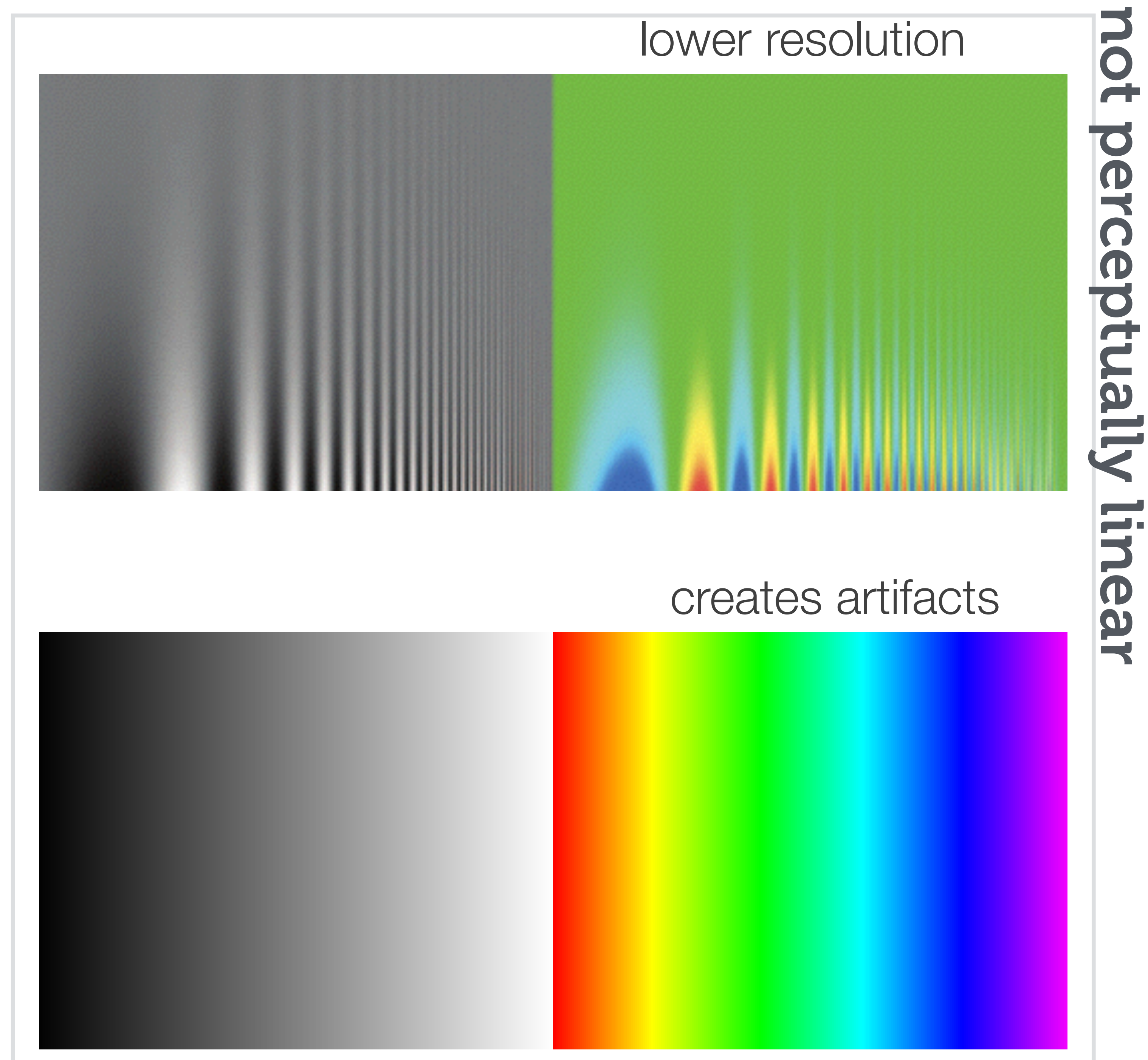
easy to order



Borland 2007

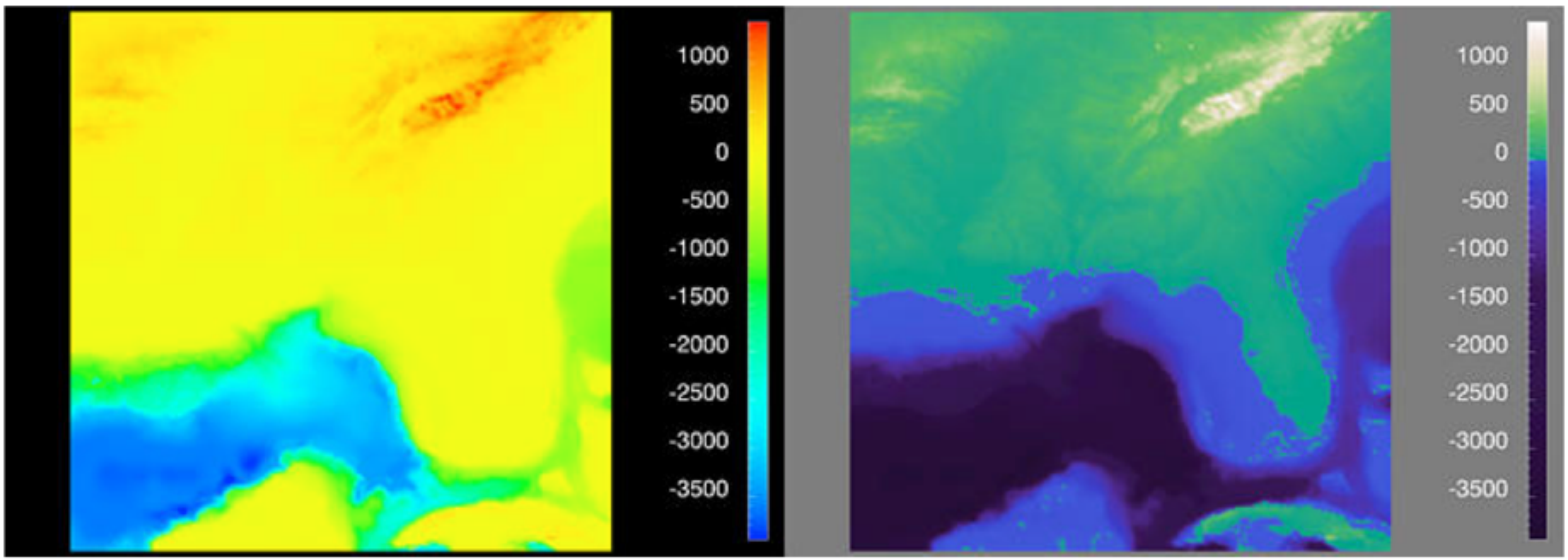
rainbow colormaps: challenges





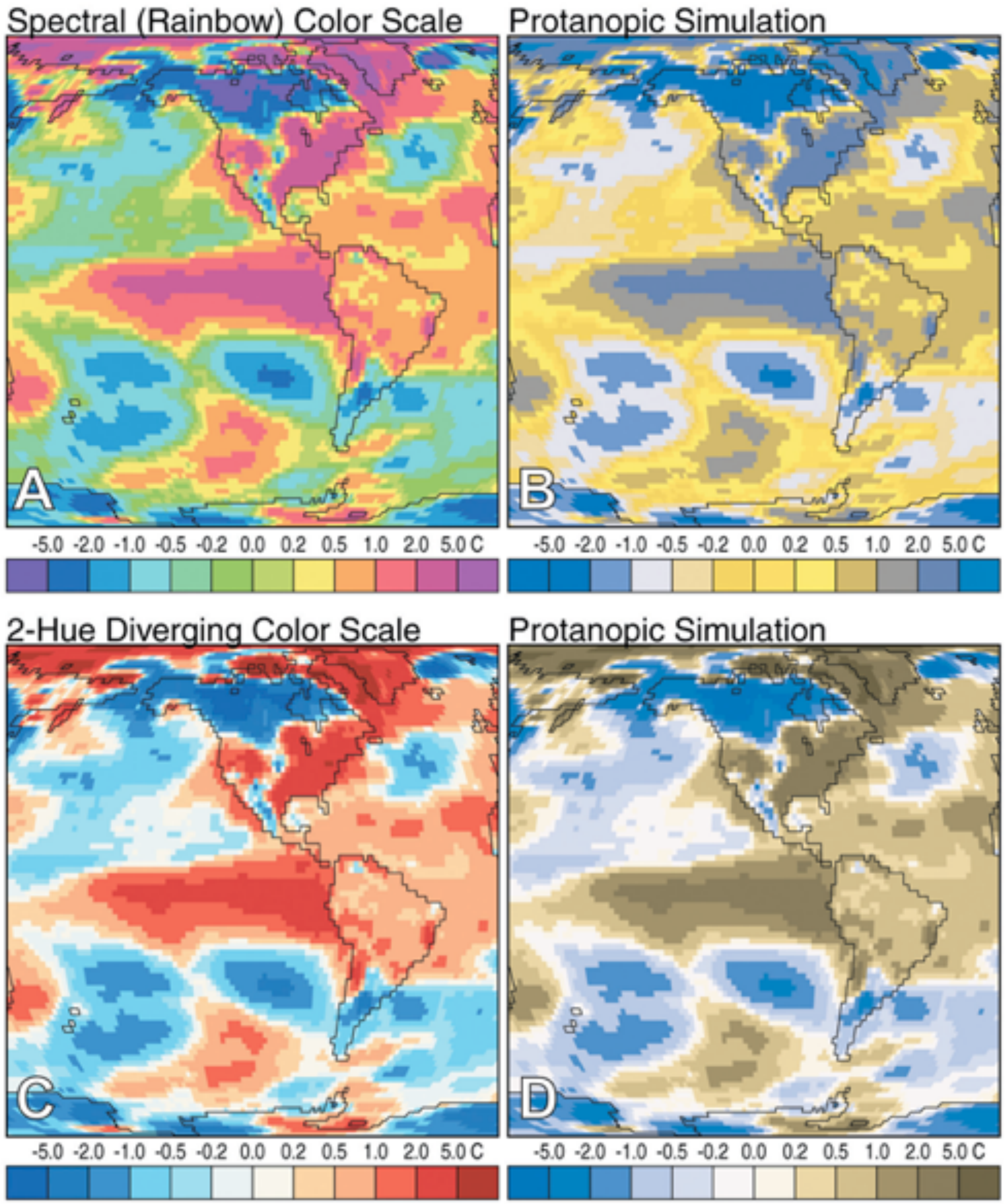
Borland 2007

rainbow colormaps: challenges



zero crossing not explicit

rainbow colormaps: challenges



Visualization Viewpoints

Editor: Theresa-Marie Rhyne

Rainbow Color Map (Still) Considered Harmful

David Borland and Russell M. Taylor II
University of North Carolina at Chapel Hill

Research has shown that the rainbow color map is rarely the optimal choice when displaying data with a pseudocolor map. The rainbow color map confuses viewers through its lack of perceptual ordering, obscures data through its uncontrolled luminance variation, and actively misleads interpretation through the introduction of non-data-dependent gradients.

Despite much published research on its deficiencies, the rainbow color map is prevalent in the visualization community. We present survey results showing that the rainbow color map continues to appear in more than half of the relevant papers in IEEE Visualization Conference proceedings; for example, it appeared on 61 pag[illegible]2005. [illegible] as the default color map used in most visualization toolkits that we inspected. The visualization community must do better.

RECOMMENDED READING

In this article, we reiterate the characteristics that make the rainbow color map a poor choice, provide examples that clearly illustrate these deficiencies even on simple data sets, and recommend better color maps for several categories of display.

The goal is to make the rainbow color map as rare in commercials, weather forecasts, and even the IEEE Visualization Conference 2006 call for papers, just to name a few. The problem with this wide use of the rainbow color map is that research shows that it is rarely, if ever, the optimal color map for a given visualization.[1-6] Here we will discuss the rainbow color map's characteristics of confusing the viewer, obscuring data, and actively misleading interpretation.

Confusing

For all tasks that involve comparing relative values, the color map used should exhibit perceptual ordering. A simple example of a perceptually ordered color map is t[illegible]creasing luminance from black to white is a strong perceptual cue that indicates values mapped to darker shades of gray are lower in value than values mapped to lighter shades of gray. This mapping is natural and intuitive.

The rainbow color map is certainly ordered—from a shorter to longer wavelength of light (or vice versa)—but it's not perceptually ordered. If people are given a series of gray paint chips and asked to put them in order, they will consistently place them in either a dark-to-light

How NOT to Lie with Visualization

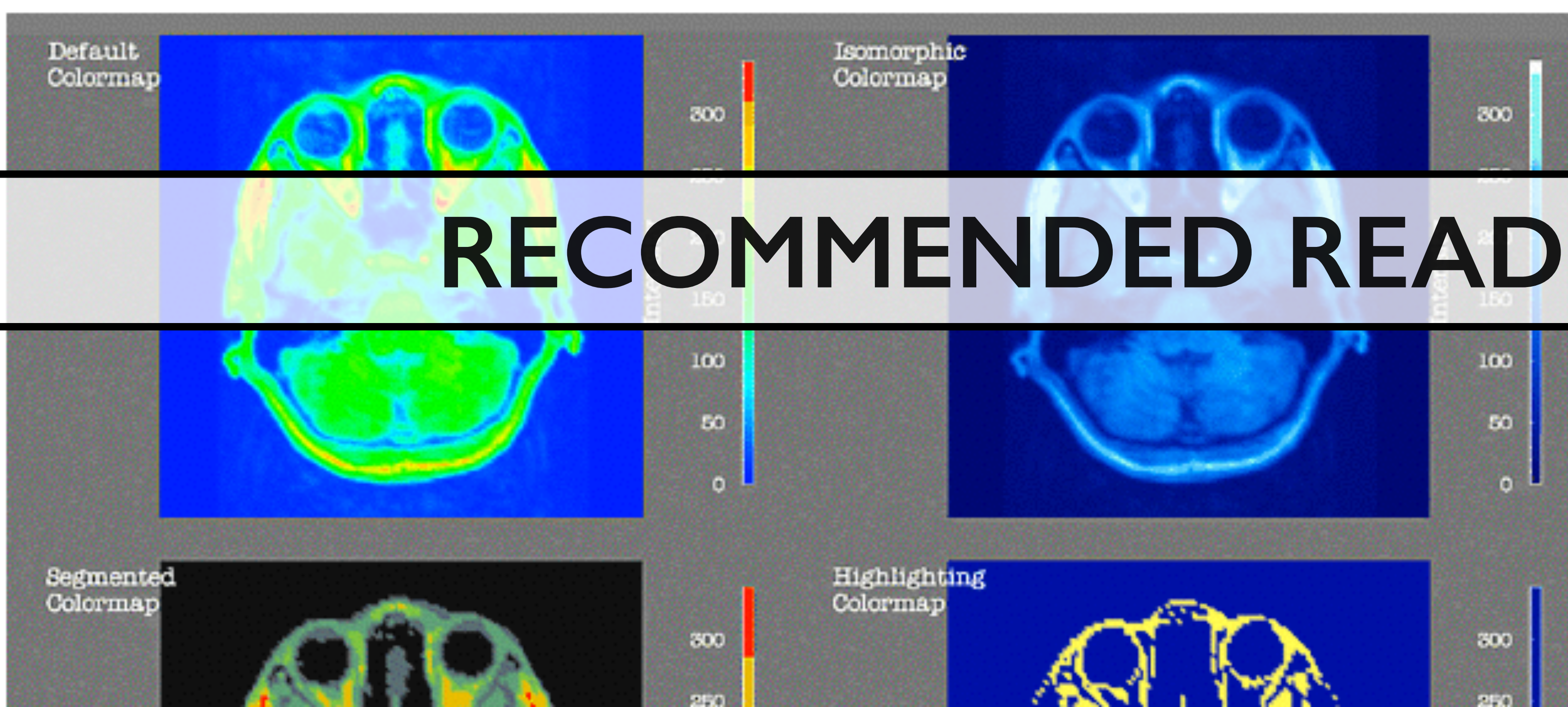
Bernice E. Rogowitz
rogowtz@watson.ibm.com

Lloyd A. Treinish
lloydt@watson.ibm.com

IBM Thomas J. Watson Research Center
Yorktown Heights, NY

Introduction

How data are represented visually has a powerful effect on how the structure in those data is perceived. For example, in Figure 1, four representations of an MRI scan of a human head are shown. The only difference between these images is the mapping of color to data values, yet, the four representations look very different. Furthermore, the inferences an analyst would draw from these representations would vary considerably. That is, variations in the method of representing the data can significantly influence the user's perception and interpretation of the data.

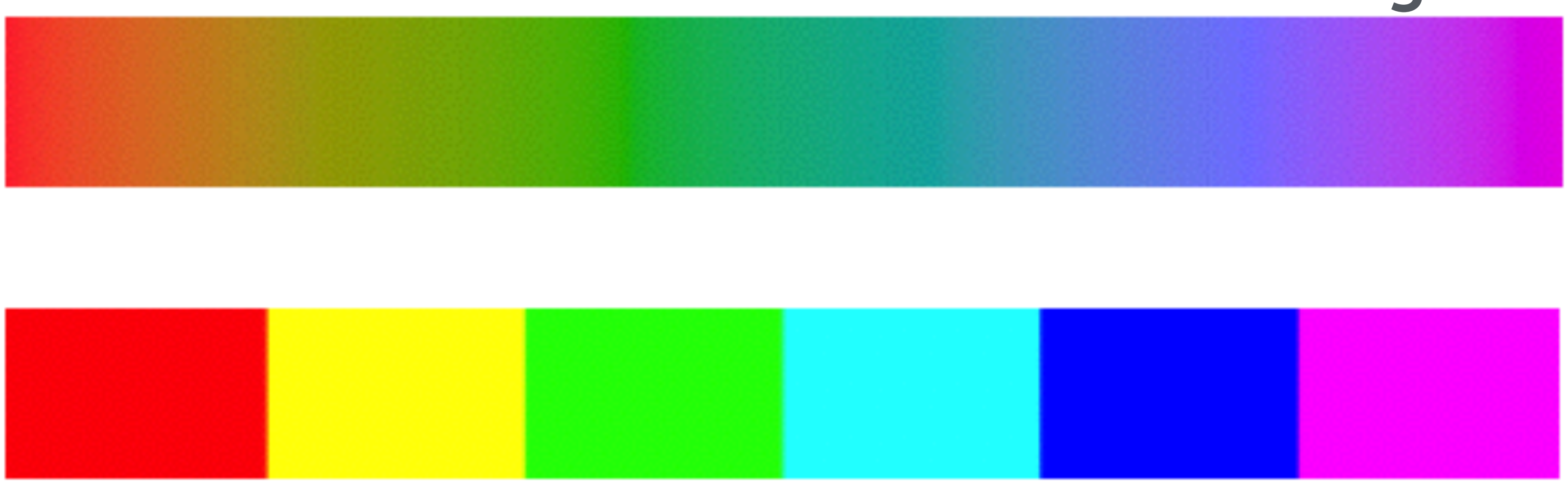


RECOMMENDED READING

guidelines

poor

good



Face-based Luminance Matching for Perceptual Colormap Generation

Gordon Kindlmann*
School of Computing
University of Utah

Erik Reinhard
School of Electrical Engineering and Computer Science
University of Central Florida

Sarah Creem
Dept. of Psychology
University of Utah

ABSTRACT

Most systems used for creating and displaying colormap-based visualizations are not photometrically calibrated. That is, the relationship between RGB input levels and perceived luminance is usually not known, due to variations in the monitor, hardware configuration, and the viewing environment. However, the luminance component of perceptually based colormaps should be controlled, due to the central role that luminance plays in our visual processing. We address this problem with a simple and effective method for performing luminance matching on an uncalibrated monitor. The method is akin to the minimally distinct border technique (a previous method of luminance matching used for measuring luminous efficiency), but our method relies on the brain's highly developed ability to distinguish human faces. We present a user study showing that our method produces equivalent results to the minimally distinct border technique, but with significantly improved precision. We demonstrate how results from our luminance matching method can be directly applied to create new univariate colormaps.

CR Categories: I.3.3 [Computing Methodologies]: Computer Graphics—Picture/Image Generation I.3.4 [Computing Methodologies]: Computer Graphics—Graphics Utilities I.4.10 [Computing Methodologies]: Image Processing and Computer Vision—Image Representation

surface shape could come from luminance variations in the univariate colormap itself.

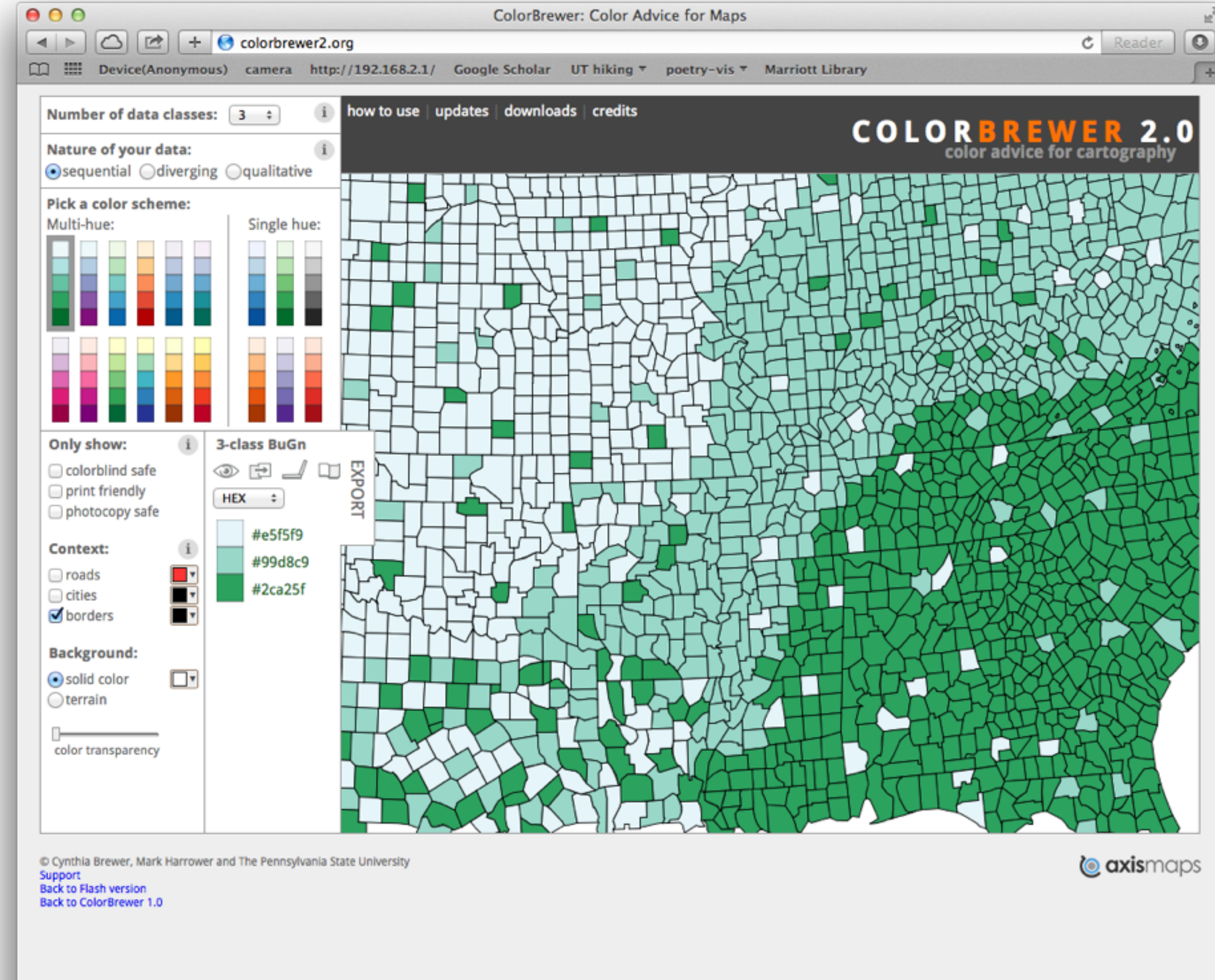
Exerting control of luminance in colormap-based visualizations is an interesting problem, due to at least three confounding issues. Most importantly, the display device tends to be uncalibrated (proper calibration would require an external measurement device [7]). The chromaticities, intensities, and response functions of the primary colors are often not known, and can vary significantly between display devices [13]. Also, the lighting conditions and configuration of the room are often unknown (or uncontrolled), contributing to factors such as light reflecting off the display device surface, and differences in brightness and color perception caused by variations between foveal and peripheral luminous sensitivity [26]. Finally, yellow pigments in the ocular media such as the lens and the macular area of the retina, can cause non-trivial differences between individuals in spectral sensitivity [26]. Our experience has been that there is so much variation between monitors that it is not sensible to simply assume a "standard" monitor and then work in a CIE colorimetric space such as XYZ, or the approximately perceptually uniform spaces CIELAB and CIELUV.

We address the general problem of colormap luminance control by proposing a novel technique for luminance matching. Given a fixed reference color, and a test color with lightness varied by a user interface, our technique facilitates matching the luminance of the two colors. The technique is based on the brain's special capac-

Get it right in black and white.

Maureen Stone

tools for color


ColorBrewer: Color Advice for Maps
colorbrewer2.org
Reader
Device(Anonymous)
camera
http://192.168.2.1/
Google Scholar
UT hiking
poetry-vis
Marriott Library
Number of data classes:
3
Nature of your data:
sequential
diverging
qualitative
Pick a color scheme:
Multi-hue:
Single hue:
how to use | updates | downloads | credits
COLORBREWER 2.0
color advice for cartography
Only show:
colorblind safe
print friendly
photocopy safe
Context:
roads
cities
borders
Background:
solid color
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HEX
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#99d8c9
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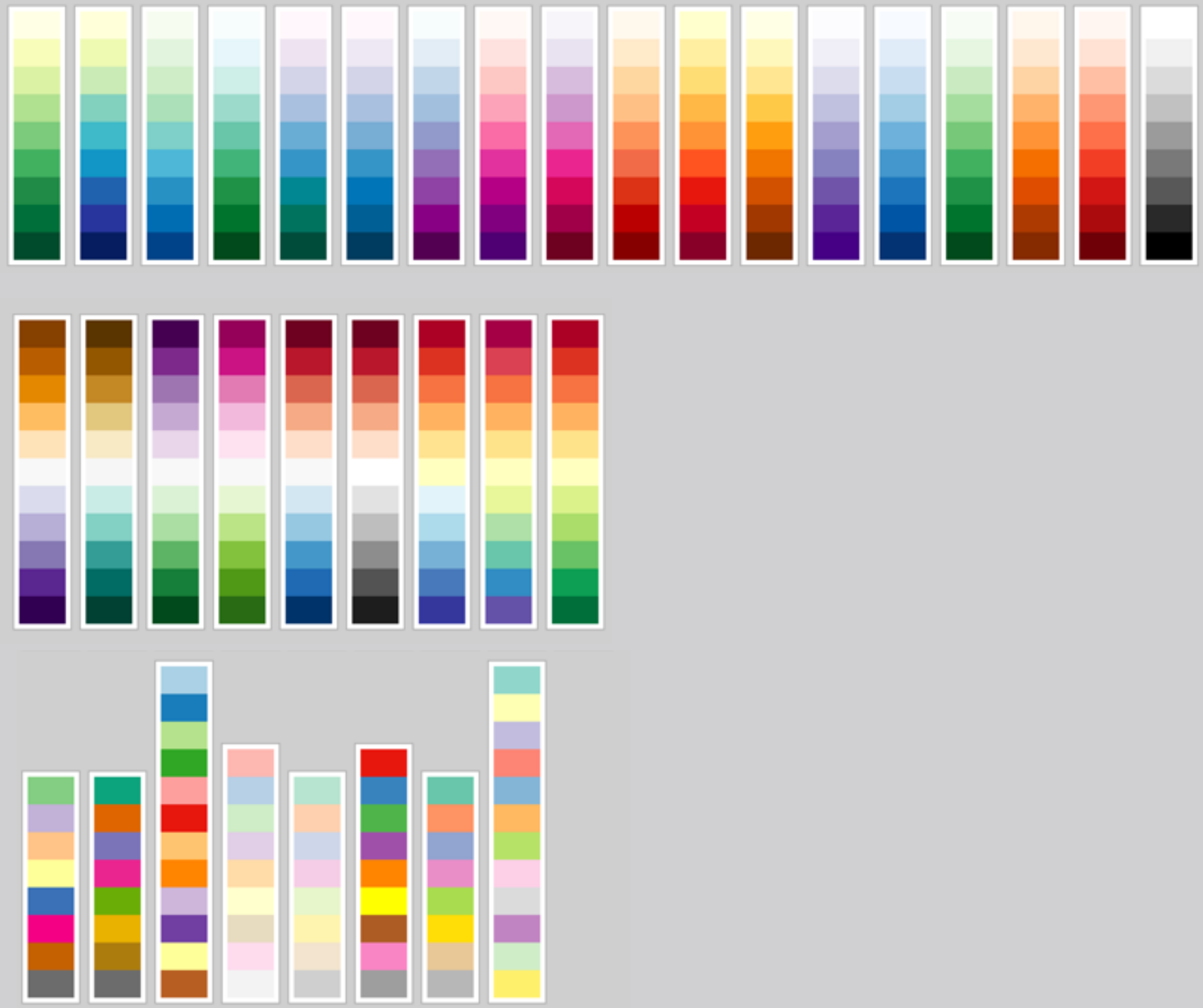
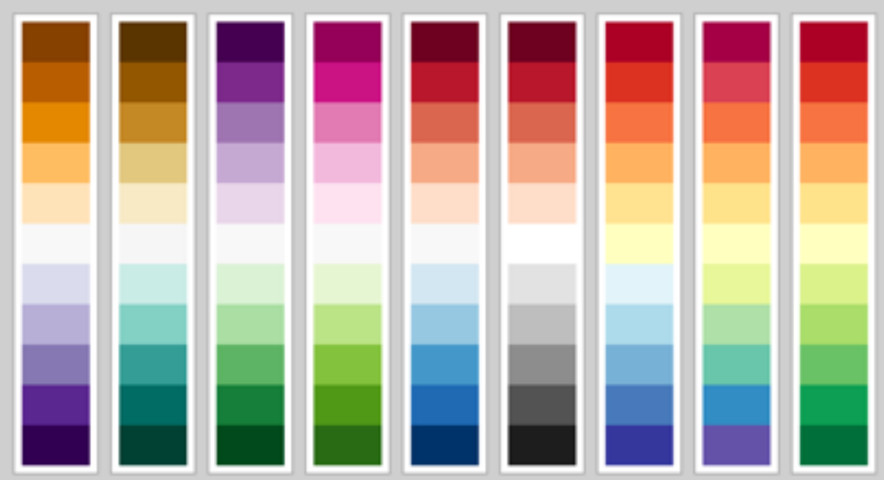
© Cynthia Brewer, Mark Harrower and The Pennsylvania State University
Support
Back to Flash version
Back to ColorBrewer 1.0
axismaps

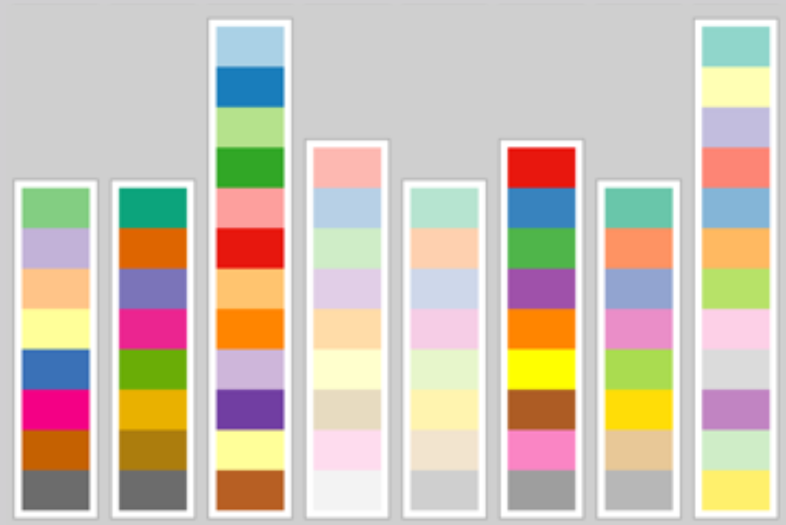
ColorBrewer palates



ColorBrewer palates

sequential

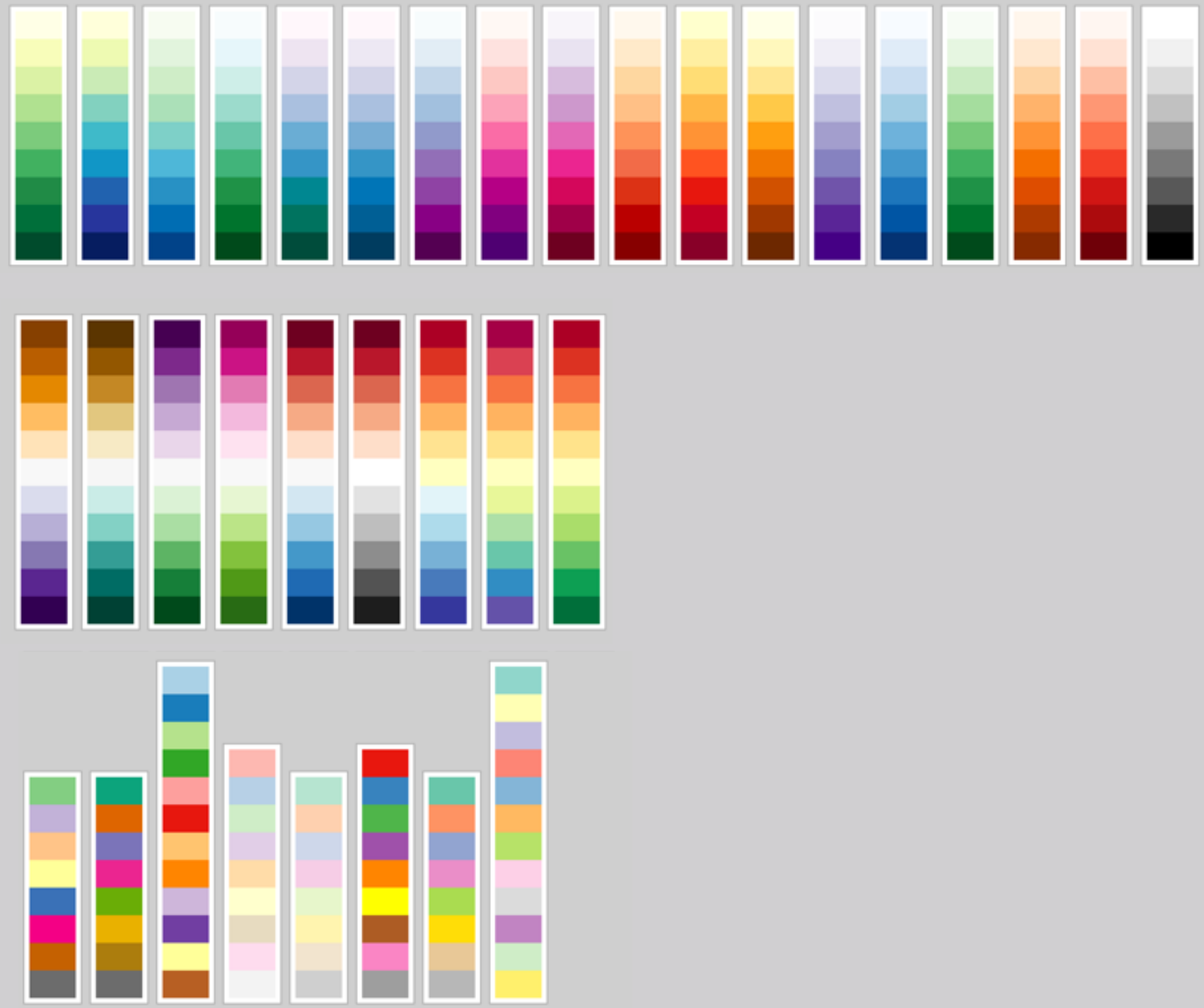




ColorBrewer palates

sequential

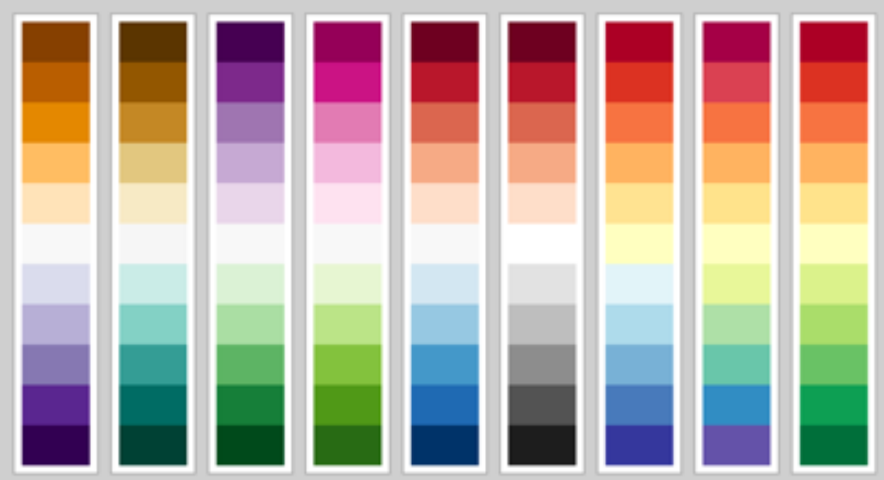
diverging



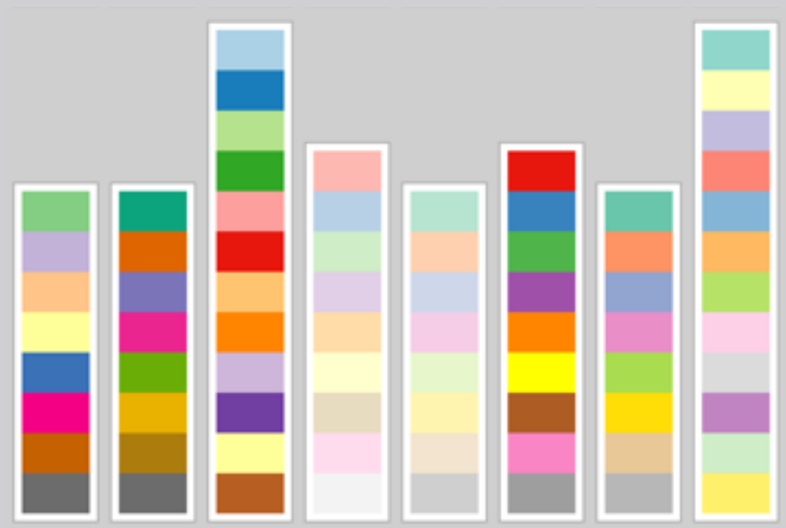
ColorBrewer palates

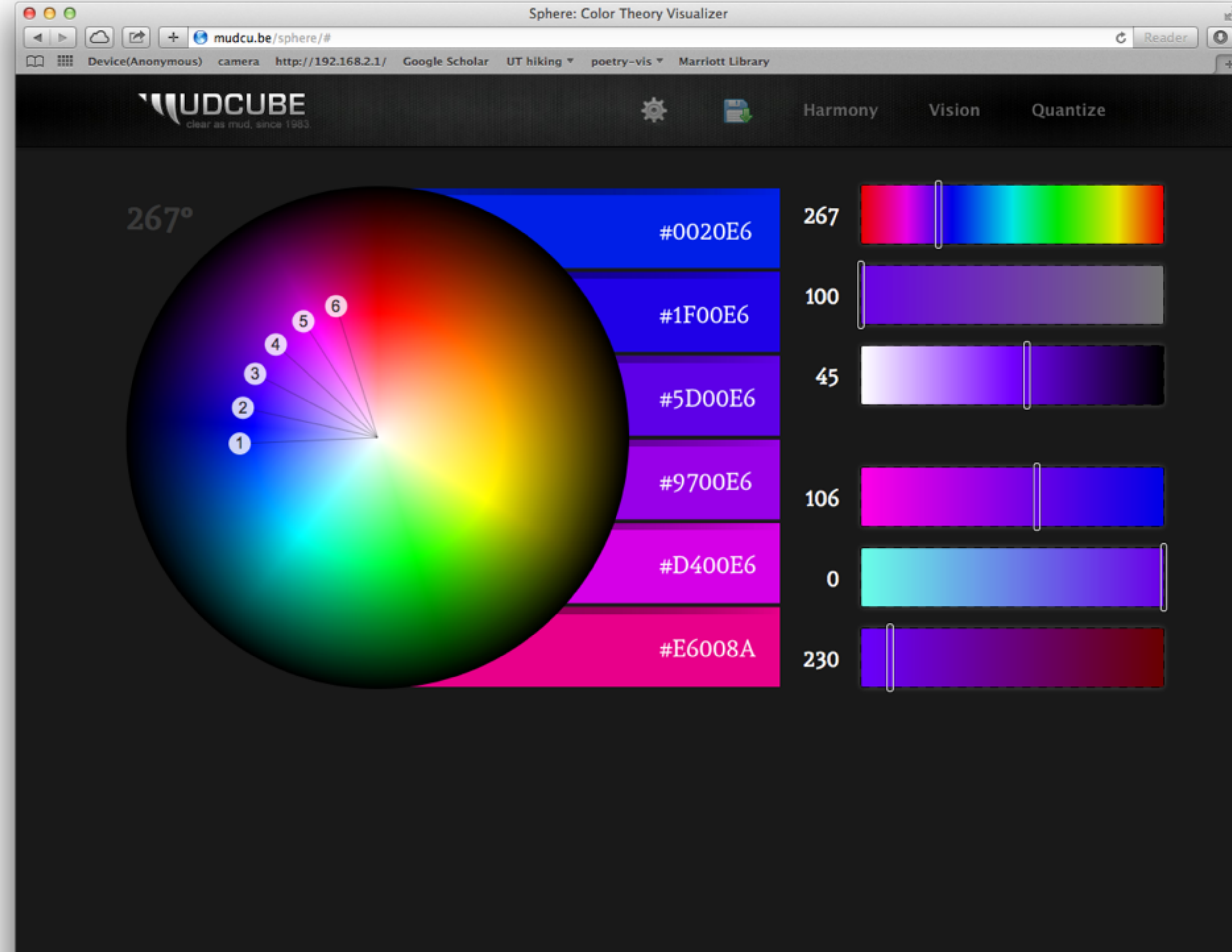
sequential

diverging



categorical




Sphere: Color Theory Visualizer
mudcu.be/sphere/#
Reader
Device(Anonymous)
camera
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UDCUBE
clear as mud, since 1983
Harmony
Vision
Quantize
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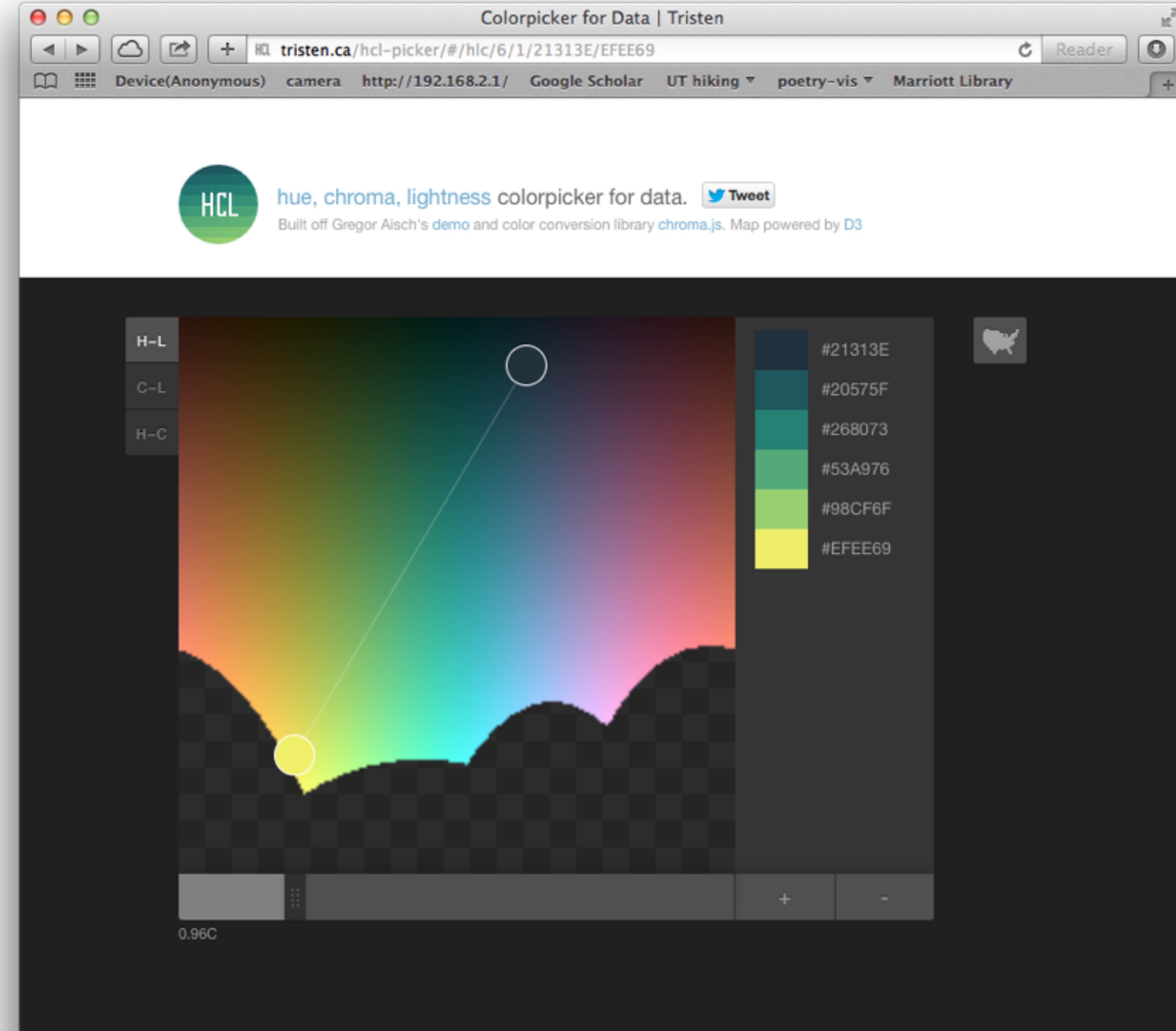
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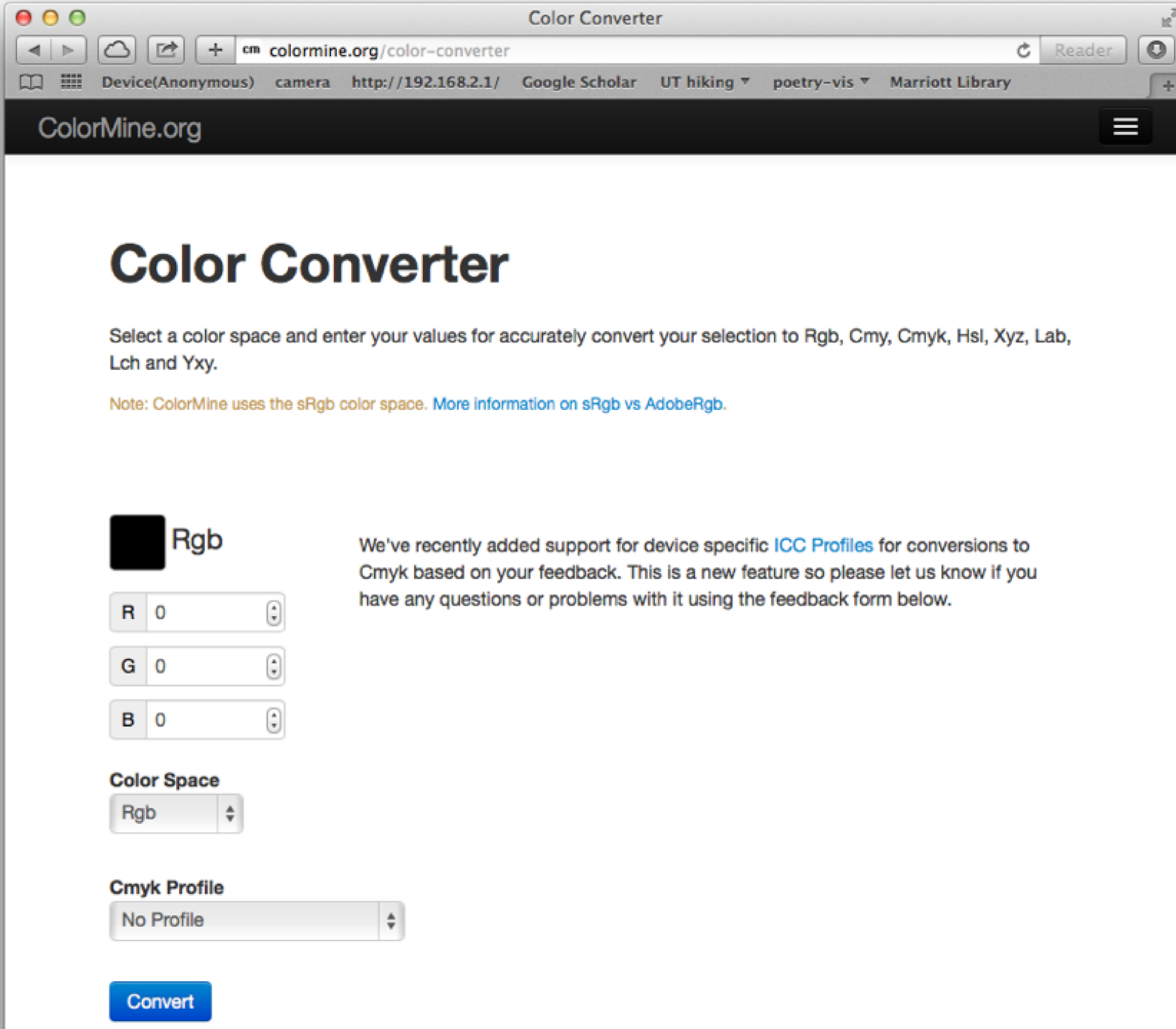
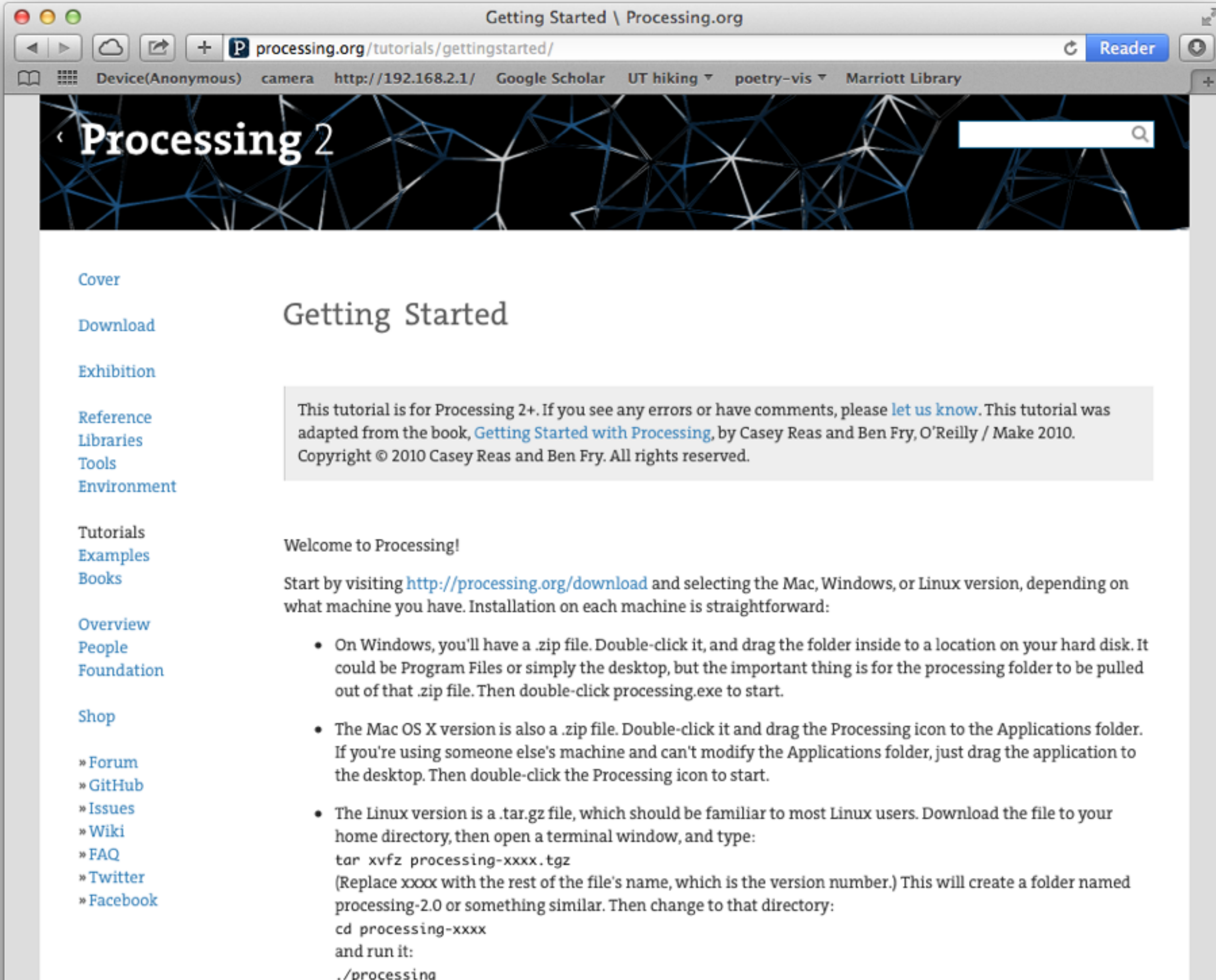
Google Scholar
UT hiking
poetry-vis
Marriott Library
HCL
hue, chroma, lightness colorpicker for data.
Tweet
Built off Gregor Aisch's demo and color conversion library chroma.js. Map powered by D3
H-L
C-L
H-C
#21313E
#20575F
#268073
#53A976
#98CF6F
#EFEE69
+
-
0.96C


Color Converter
colormine.org/color-converter
Reader
Device(Anonymous)
camera
http://192.168.2.1/
Google Scholar
UT hiking
poetry-vis
Marriott Library
ColorMine.org
Color Converter
Select a color space and enter your values for accurately convert your selection to Rgb, Cmy, Cmyk, Hsl, Xyz, Lab, Lch and Yxy.
Note: ColorMine uses the sRgb color space. More information on sRgb vs AdobeRgb.
Rgb
R 0
G 0
B 0
We've recently added support for device specific ICC Profiles for conversions to Cmyk based on your feedback. This is a new feature so please let us know if you have any questions or problems with it using the feedback form below.
Color Space
Rgb
Cmyk Profile
No Profile
Convert

L7. Intro to Processing

REQUIRED READING



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» Twitter
» Facebook

Getting Started

This tutorial is for Processing 2+. If you see any errors or have comments, please let us know. This tutorial was adapted from the book, Getting Started with Processing, by Casey Reas and Ben Fry, O'Reilly / Make 2010. Copyright © 2010 Casey Reas and Ben Fry. All rights reserved.

Welcome to Processing!

Start by visiting http://processing.org/download and selecting the Mac, Windows, or Linux version, depending on what machine you have. Installation on each machine is straightforward:

- On Windows, you'll have a .zip file. Double-click it, and drag the folder inside to a location on your hard disk. It could be Program Files or simply the desktop, but the important thing is for the processing folder to be pulled out of that .zip file. Then double-click processing.exe to start.
- The Mac OS X version is also a .zip file. Double-click it and drag the Processing icon to the Applications folder. If you're using someone else's machine and can't modify the Applications folder, just drag the application to the desktop. Then double-click the Processing icon to start.
- The Linux version is a .tar.gz file, which should be familiar to most Linux users. Download the file to your home directory, then open a terminal window, and type:
  `tar xvfz processing-xxxx.tgz`
  (Replace xxxx with the rest of the file's name, which is the version number.) This will create a folder named processing-2.0 or something similar. Then change to that directory:
  `cd processing-xxxx`
  and run it:
  `./processing`