Color

Not as hard as it seems.
High School Graduates  College Graduates  Median Household Income

http://awesome.good.is/transparency/web/1101/census-data/flat.html
Addendum to Last Week
Integral vs separable
All Colors Are Equal
Our eyes

Increasing Frequency ($\nu$)

$\nu$ (Hz)

$\lambda$ (m)

$10^{24}$ $10^{22}$ $10^{20}$ $10^{18}$ $10^{16}$ $10^{14}$ $10^{12}$ $10^{10}$ $10^{8}$ $10^{6}$ $10^{4}$ $10^{2}$ $10^{0}$

$10^{-16}$ $10^{-14}$ $10^{-12}$ $10^{-10}$ $10^{-8}$ $10^{-6}$ $10^{-4}$ $10^{-2}$ $10^{0}$ $10^{2}$ $10^{4}$ $10^{6}$ $10^{8}$

$\gamma$ rays  X rays  UV  IR  Microwave  FM  AM  Long radio waves

Increasing Wavelength ($\lambda$) →

Visible spectrum

Increasing Wavelength ($\lambda$) in nm →
From Light to Color
Interpretations and Interpolations
3 Types of Cones

![Normalized cone response (linear energy)](image)

- **S** (Short-wavelength): Peak response at approximately 430 nm
- **M** (Middle-wavelength): Peak response at approximately 530 nm
- **L** (Long-wavelength): Peak response at approximately 580 nm

Wavelength (nm)
Perceptual Color Space

Lightness

Hue
Opponent Color

Contrast is essential
Opponent Color
Watch out – Color Blindness

Deuteranope
Protanope
Tritanope

Red-Green
Blue-Yellow
Van Gogh for Colorblind People

http://asada0.tumblr.com/post/11517603099/the-day-i-saw-van-goghs-genius-in-a-new-light
Van Gogh for Colorblind People

http://asada0.tumblr.com/post/11517603099/the-day-i-saw-van-goghs-genius-in-a-new-light
Color Blindness

Consequences
Color Blindness

Consequences
All Colors Are Equal
... but they’re not perceived the same

6 corners of the RGB color cube
All Colors Are Equal

... but they're not perceived the same

6 corners of the RGB color cube

Luminance Value
All Colors Are Equal
... but they’re not perceived the same

6 corners of the RGB color cube

Luminance Value

Perceived Lightness
Luminance and 3D

Contrast is not enough
When to use color
To Label
Product Categories

Categorical Data
To Measure

Data to Color; different scales

Lightness Scale

Lightness scale with hue and chroma variation

Hue scale with lightness variation
To Measure

Data to Color: Hue scale with three colors

Sequential Color Scales
Ordinal and Continuous Data

- RGB
- Lab
- HSL
- HCL
Sequential Color Scales

Ordinal and Continuous Data

RGB
Lab
HSL
HCL
Diverging Color Scales

Ordinal and Continuous Data, focus on center and extremes

- RGB
- Lab
- HSL
- HCL
Diverging Color Scales

Ordinal and Continuous Data, focus on center and extremes

RGB

Lab

HSL

HCL
Diverging Color Scales

Ordinal and Continuous Data, focus on center and extremes
Qualitative Color Scales
Categorical/Nominal Data
Tools

Color Palettes and Scales
Good Color Scales

Color Brewer (by Synthia Brewer): Focus on legibility

http://colorbrewer2.org
Good Color Scales
Adobe Kuler: Focus on aesthetics

http://kuler.adobe.com
Good Color Scales
I Want Hue: Focus on maximizing distinction, good for categorical data

Good Color Scales

D3 color palettes: Cookie cutter solution

```javascript
d3.scale.category10()
```
Examples

Good or bad?
“Deep Purple”
Australia Bureau of Meteorology
“Deep Purple”
Australia Bureau of Meteorology
Topography of The Moon

NASA
Create Your Better Life Index

What is your recipe for a better life — a good education, clean air, nice home, money? See how your country measures up on the topics important to you.

Start with all topics rated equally or set your own preferences here.
Standard Pie Chart
Excel for Mac 2011

- Construction
- Manufacturing
- Wholesale Trade
- Information
- Finance and Insurance
Lab Thursday

D3.js
Next Lecture

Interaction