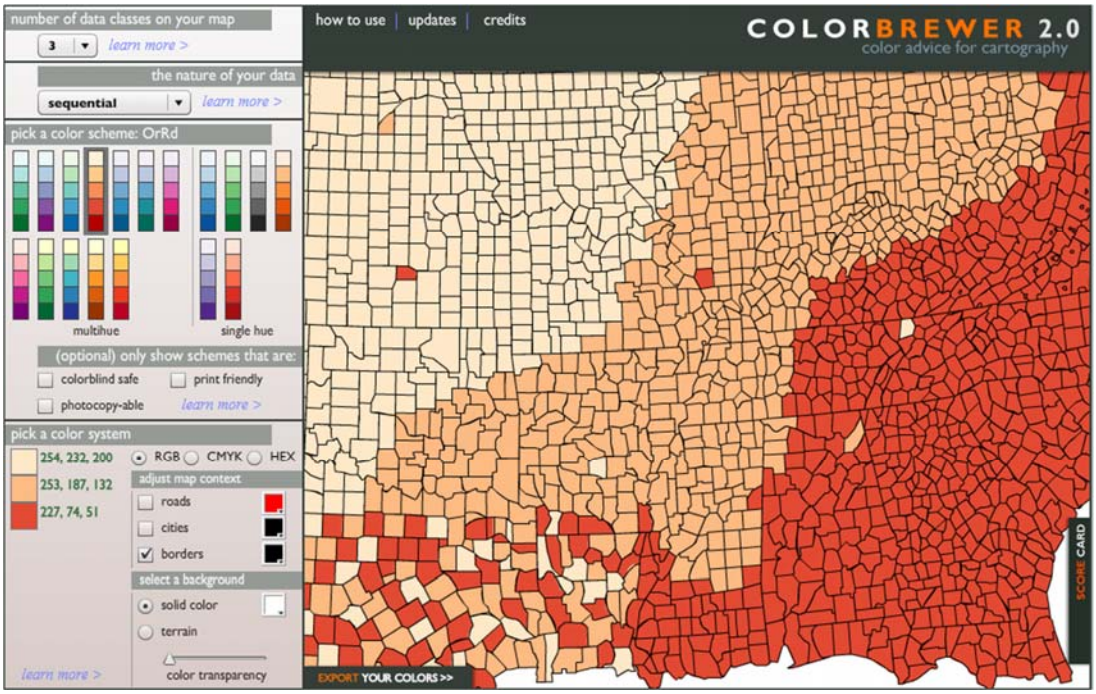
Color Brewer



http://colorbrewer2.org

Information Visualization MOOC

Unit 3 – "Where": Geospatial Data

Color

Relevant Research Disciplines:
Psychology, Design, Cartography, Information Visualization

Color

Use to

- convey importance or attract attention to specific symbols
- label, categorize, compare
- imitate reality (e.g., blue lakes in maps)
- generate emotions—orange and red are perceived as warm and active while blue, purple are cold and passive.

Do NOT use

- for displaying the layout of objects in space
- how they are moving, or
- what their shapes are.

Graphic Variable Types, see Workflow Design

Position: x, y; possibly z

Form:

- Size
- Shape
- Orientation/Rotation

Color:

- Value (Lightness)
- Hue (Tint)
- Saturation (Intensity)

Texture:

- Pattern, Rotation, Coarseness, Size, Density Gradient

Optics:

- Crispness, Transparency, Shading

Graphic Variable Types, see Workflow Design

Color

- **Value** 
  (Lightness, shade, tone, percent value, density, intensity, luminance, brightness) equals amount of light coming from a source or being reflected from an object. Ratio between the maximum and the minimum brightness values is also called contrast ratio.
- **Hue** 
  (Tint) related to the wavelength of the stimulus. Categorical and should never be used to encode magnitude. Need to select sequence carefully—e.g., yellow through orange to red.
- **Saturation** 
  (Intensity) is related to how much white content is in the stimulus. Monochromatic hues are very highly saturated. Higher saturated (purer) colors appear in the foreground while low saturation (dull) colors fade into background.

Graphic Variable Types, see Workflow Design

Color

- **Value**  **Quantitative**
  (Lightness, shade, tone, percent value, density, intensity, luminance, brightness) equals amount of light coming from a source or being reflected from an object. Ratio between the maximum and the minimum brightness values is also called contrast ratio.
- **Hue**  **Qualitative**
  (Tint) related to the wavelength of the stimulus. Categorical and should never be used to encode magnitude. Need to select sequence carefully, e.g., yellow through orange to red.
- **Saturation**  **Quantitative**
  (Intensity) is related to how much white content is in the stimulus. Monochromatic hues are very highly saturated. Higher saturated (purer) colors appear in the foreground while low saturation (dull) colors fade into background.

Graphic Variable Types, see Workflow Design

Color

- **Value**  **Quantitative**
  Use value to create depth, light, or patterns, to lead the eye, or to emphasize. Poor contrast occurs when two colors have similar perceived brightness.
- **Hue**  **Qualitative**
  Only 6-12 color codes can be used reliably. (But, "Language Communities in Twitter" uses 30+ colors that are carefully selected to be distinct per geolocation.) Always have a significant luminance difference in addition to color difference.
- **Saturation**  **Quantitative**
  Higher saturated (purer) colors appear in the foreground while low saturation (dull) colors fade into background.

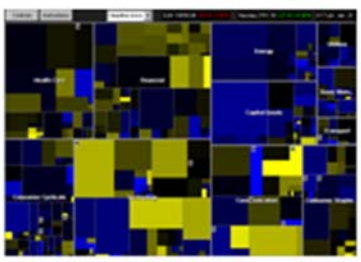
Simultaneous contrast with surrounding or background colors can dramatically alter color appearance, making one color look like another or two similar colors look very different.

Color Schemes

Binary schemes
(Two colors) use color opponents such as

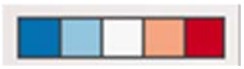
- black/white
- red/green
- yellow/blue

They are often applied as bi-polar, diverging schemes:



Color Schemes

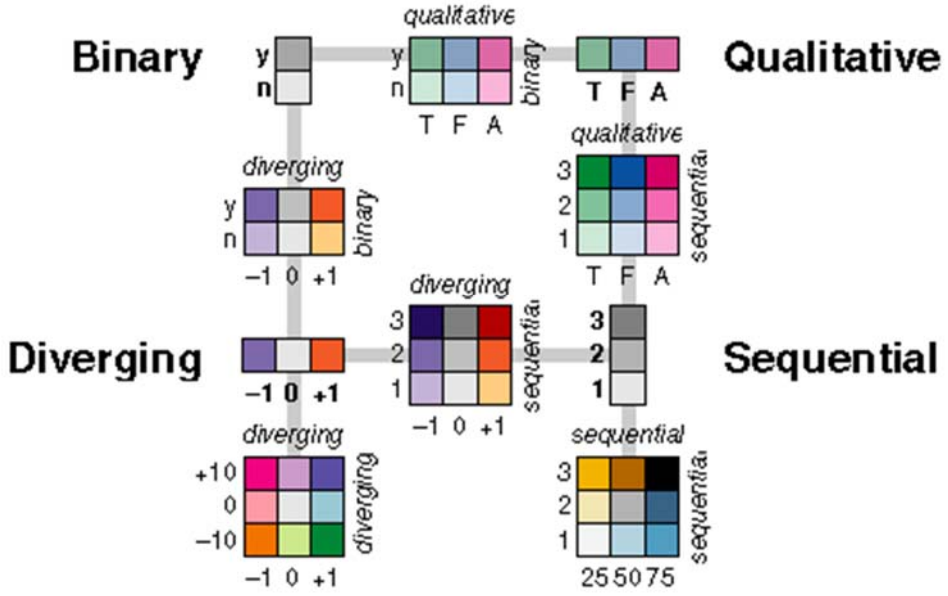
- **Sequential schemes** **Quantitative**
  (Single hue) best for ordered data that progress from low to high. Use light colors for low data values to dark colors for high data values. Example: heat maps or isomaps.
- **Diverging schemes** **Quantitative**
  (Bi-polar) put equal emphasis on mid-range critical values and extremes at both ends of the data range. The critical class or break in the middle of the legend is emphasized with light colors and low and high extremes are emphasized with dark colors that have contrasting hues.



- **Qualitative schemes** **Qualitative**
  (Full spectral) do not imply magnitude differences between legend classes, and hues are used to create the primary visual differences between classes. Qualitative schemes are best suited to representing nominal or categorical data.

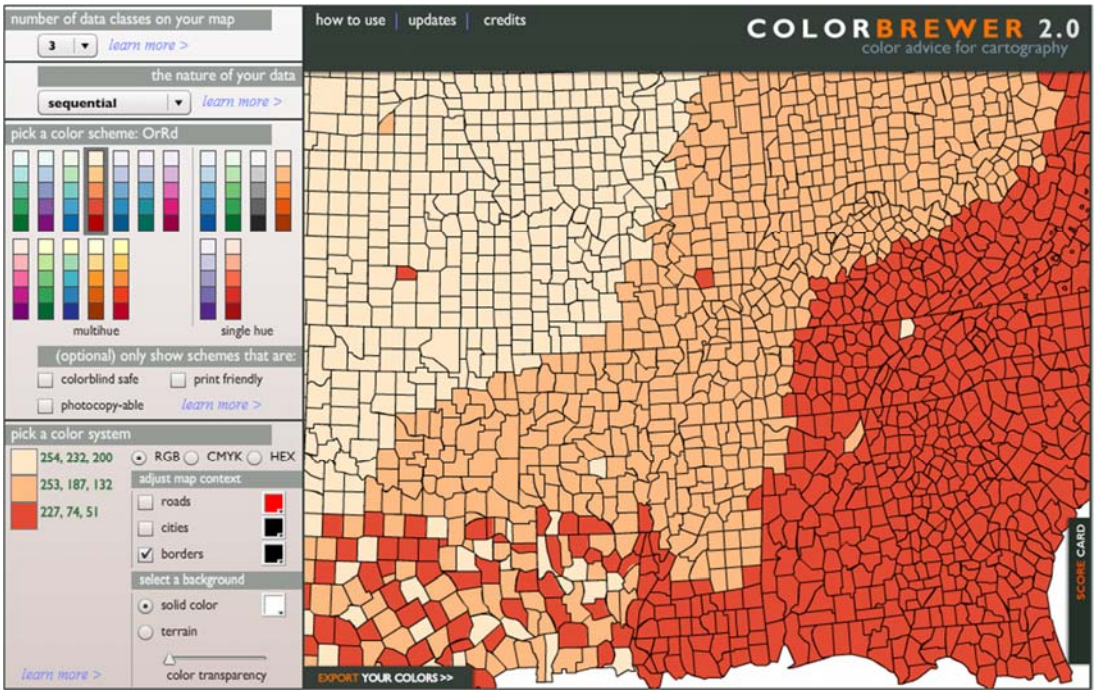
From http://colorbrewer2.org

Color Schemes

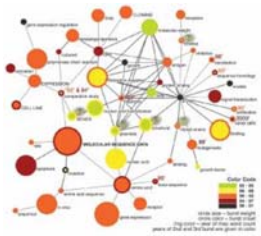


See Color Use Guidelines for Mapping and Visualization by Cynthia Brewer

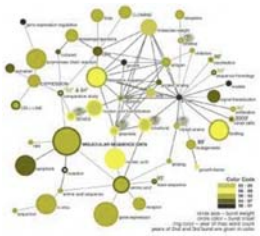
Color Brewer



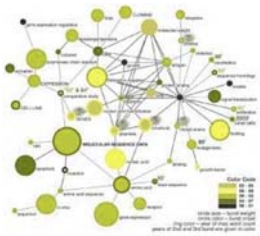
http://colorbrewer2.org



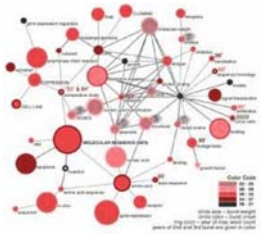
Normal Color Vision



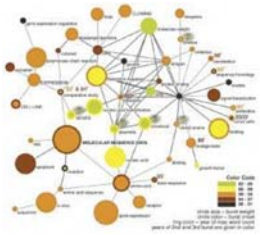
Red-Blind/Protanopia



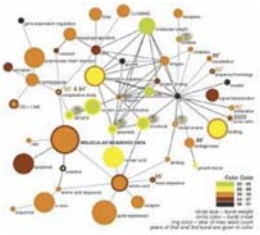
Green-Blind/Deuteranopia



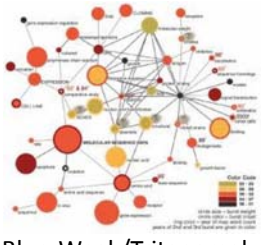
Blue-Blind/Tritanopia



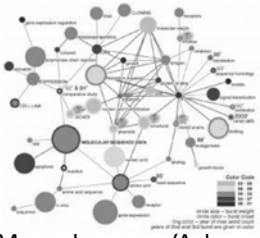
Red-Weak/Protanomaly



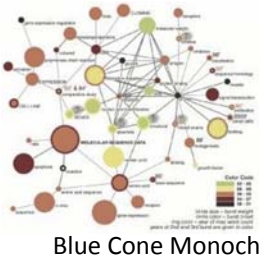
Green-Weak/Deuteranomaly



Blue-Weak/Tritanomaly



Monochromacy/Achromatopsia



Blue Cone Monochromacy

Color Blind ness Simulator: http://www.colblindor.com/coblis-color-blindness-simulator/

Acknowledgments

The U.S. maps shown in these slides were generated using http://d3js.org.

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Many visualizations used in the course come from the *Places & Spaces: Mapping Science* exhibit, online at http://scimaps.org, and from the *Atlas of Science: Visualizing What We Know*, MIT Press (2010).