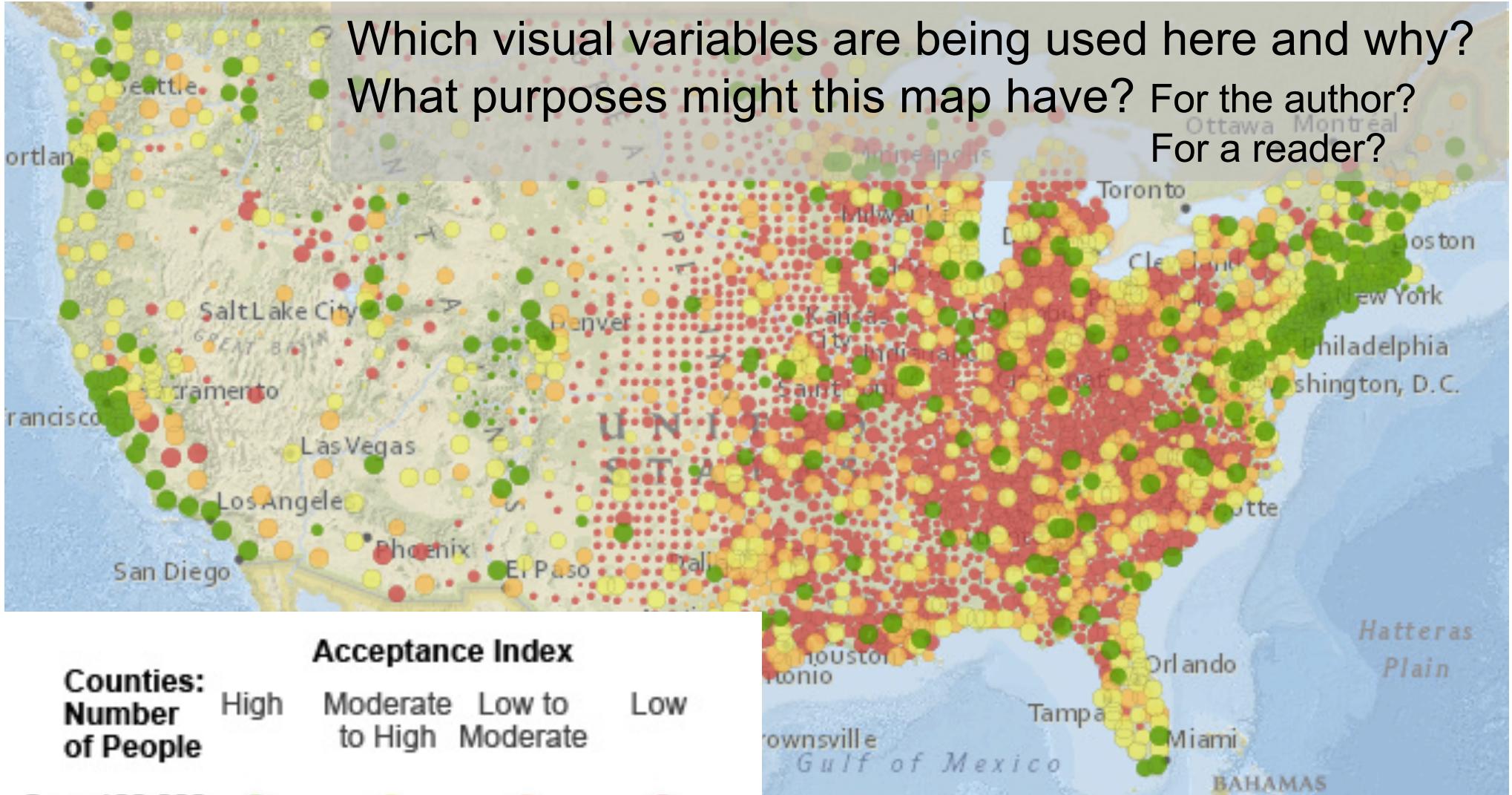
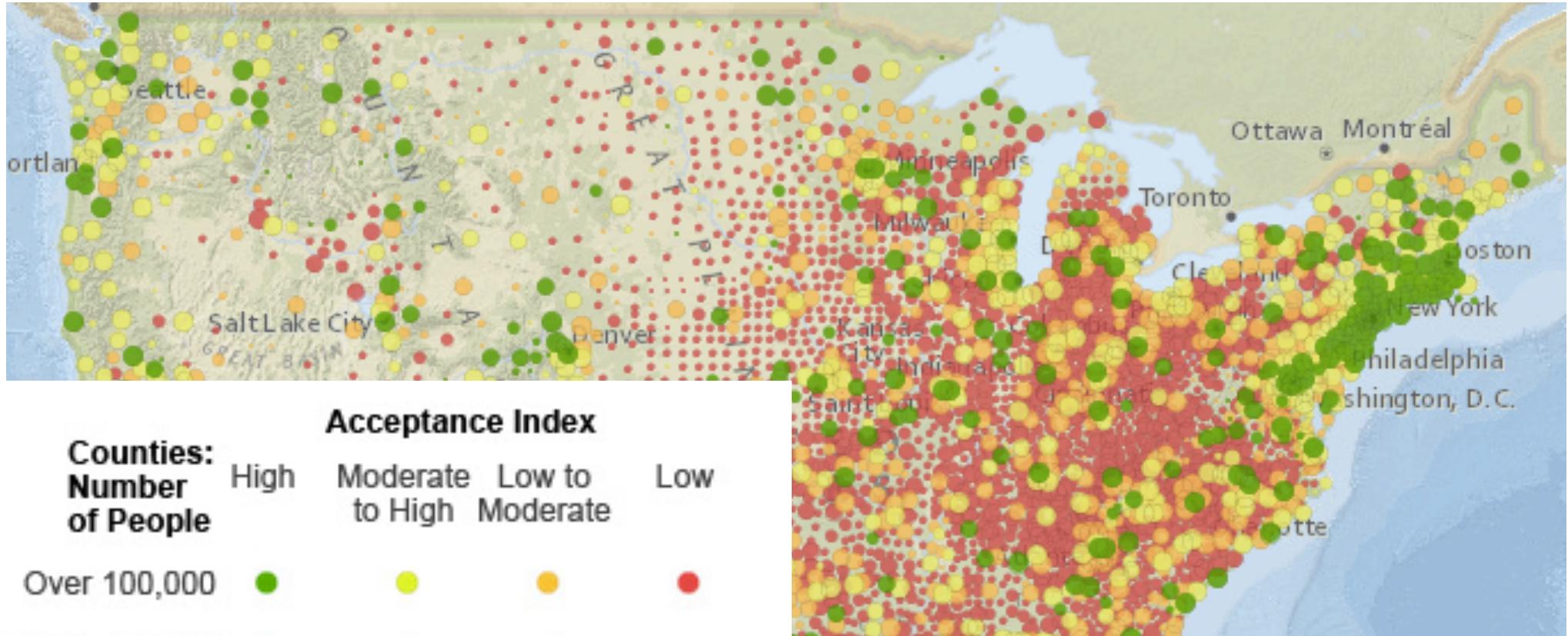


Which visual variables are being used here and why?
What purposes might this map have? For the author?
For a reader?



“Same-Sex Marriage Acceptance Index”
(ESRI, 2012)



Excerpts from <http://storymaps.esri.com/stories/2012/marriage-equality/>

“While there has never been a comprehensive geographic survey on this subject, every community and neighborhood within the United States has been described using thousands of demographic variables. These variables can be combined and analyzed to determine spatial patterns and trends.

“Recently voters passed California’s Proposition 8 and North Carolina’s Amendment 1, which forbid same-sex marriage. Using the voting results of these two pieces of legislation, Esri analyzed the demographic and consumer data of these voters to identify the geographic views of same-sex marriage. The results were then summarized using Esri’s Tapestry market segmentation system to extrapolate an acceptance index across the country.[\[1\]](#)

[\[1\]](#) Note: religious affiliations are not currently incorporated in the model.”

For what map-reading purposes are these data potentially [un]reliable?
What purposes do you imagine ESRI had in making this map?

Geography 360
October 10, 2016

Interpreting data with color

1. *Announcements and questions!*
 - Hit 'Save' frequently.
 - Verify the URLs you turn in work.
 - If you have problems logging in, make sure you are using your UW-GEOG ArcGIS Online account, not the UW one.
 - More creative than the tutorial work:
A 'project' has been announced on mapping neighborhoods.
2. *Color (continued):* How we talk about it. How we use it.
How people perceive and understand it differently.
3. *Anonymous survey:* "What is helping you learn?"

Geography 360
October 10, 2016

Anonymous Survey

1. What is helping you learn in this class?
2. Is there anything that's not helping you learn?
What suggestions do you have?

Color functions in cartography...

- To assist with legibility, clarity, differentiation
- To elicit an emotional or psychological reaction
- For symbolization and classification

(And color can potentially do **the opposite** of any of these!)

Describing Color

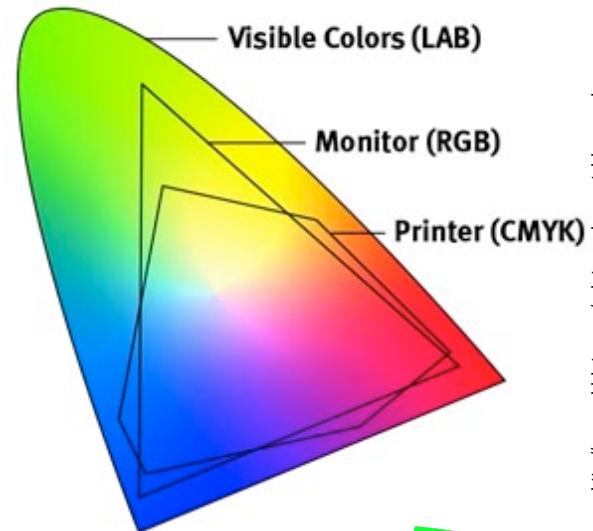
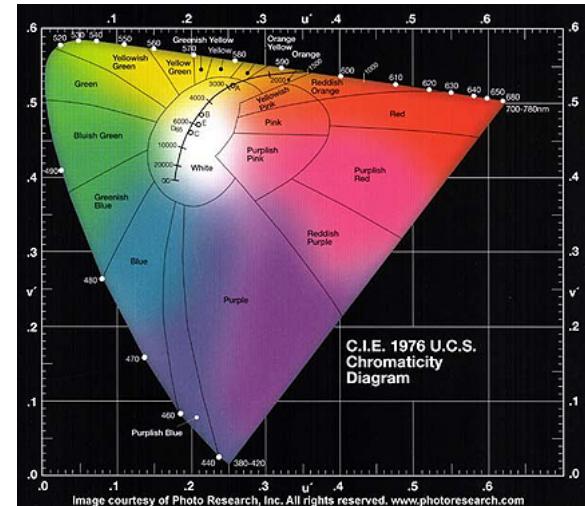
Color models:

- Are formalized ways of describing colors.
- They usually involve several numbers as 'coordinates'.
- Coordinate axes might include: Hue, Saturation, Red, Green, Value, L, a, b, etc.
- Models include RGB, Munsell, HSV, CIELAB ($L^*a^*b^*$)

Examples from the 'RGB' color model:

Colors are expressed as (red, green, blue) with each between 0-1, or sometimes 0-255. On the web, this can be written in 'hexadecimal'.

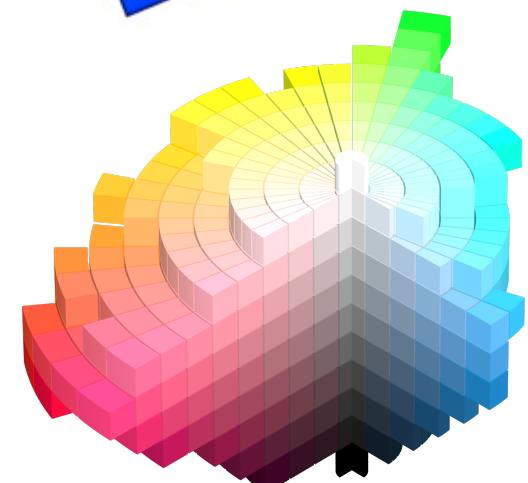
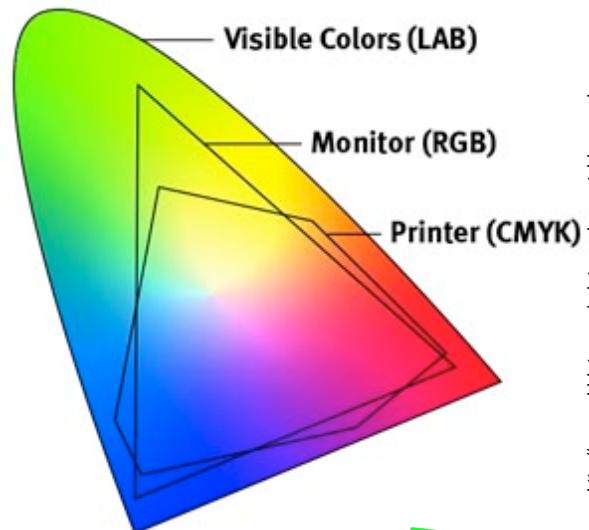
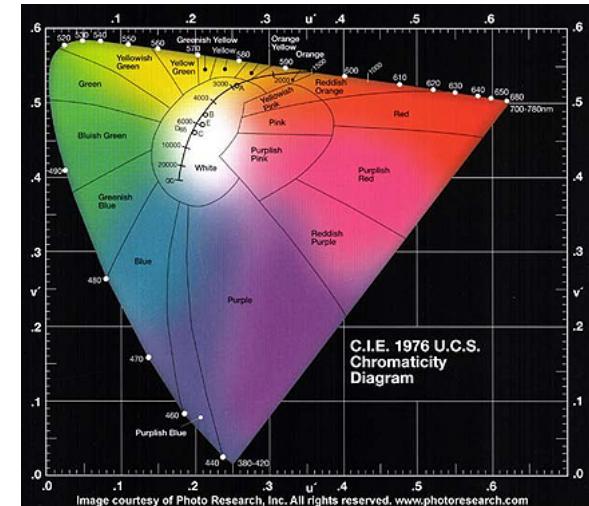
- (1, 1, 1) is white (or in hexadecimal: #FFFFFF)
- (0, 0, 0) is black (or in hexadecimal: #000000)
- (1, 0, 0) is red (or in hexadecimal: #FF0000)
- (1, 0.5, 0) is orange (or in hexadecimal: #FF8000)
- etc...



Describing Color

Color models:

- With their coordinates, models generate abstract ‘color spaces’.
 - These differ in what colors they can describe.
 - They also differ in how they portray relationships between colors.
- You have a **perceptually uniform color space** when different ‘distances’ in the color space are proportional to what people perceive is the amount of difference between colors.
 - Example: CIELAB (or $L^*a^*b^*$ or Lab)
 - When is using a perceptually uniform color space useful for mapping?
 - When you want to visually express quantitative relationships between numbers.
(Think: ‘interval’ data and above)
 - RGB is not perceptually uniform.



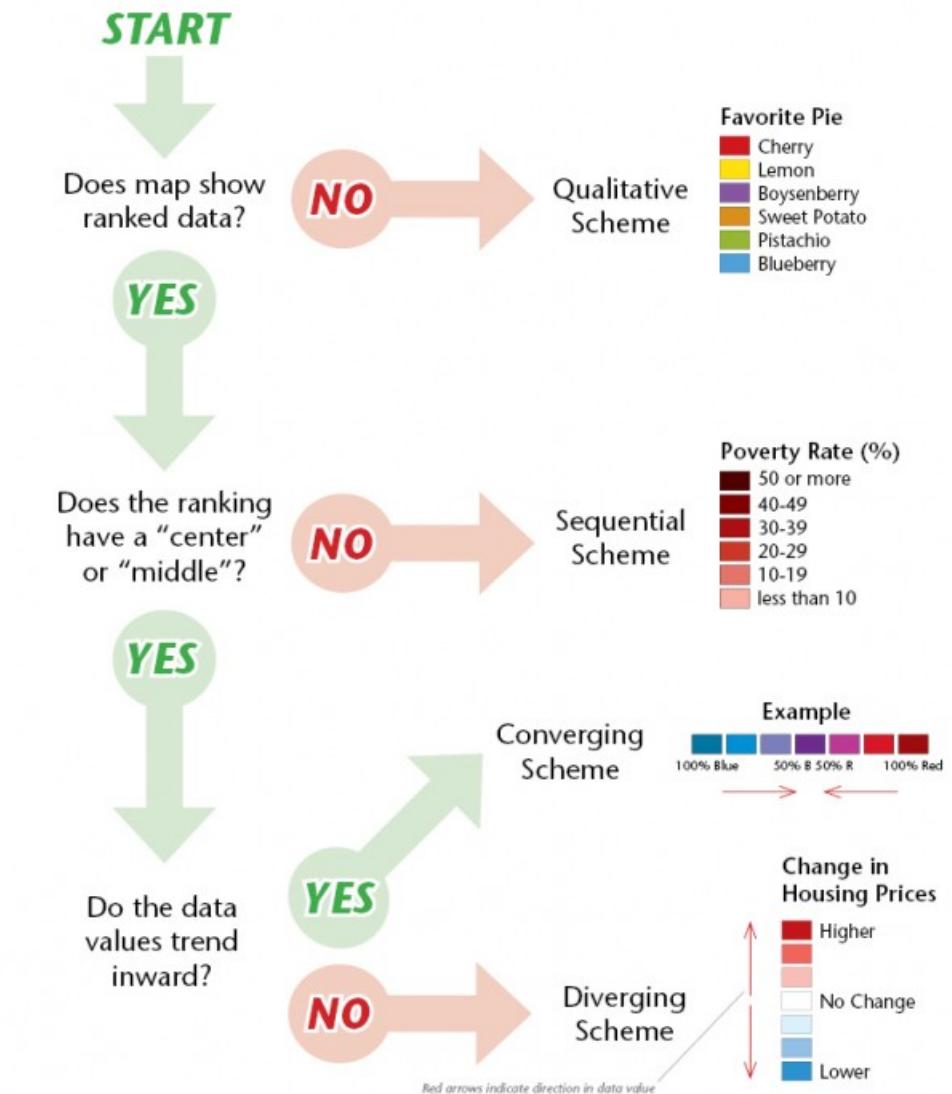
Using Color in Maps

A starting point for thinking about color in choropleth maps when you are mapping.

1 Plan on Purpose

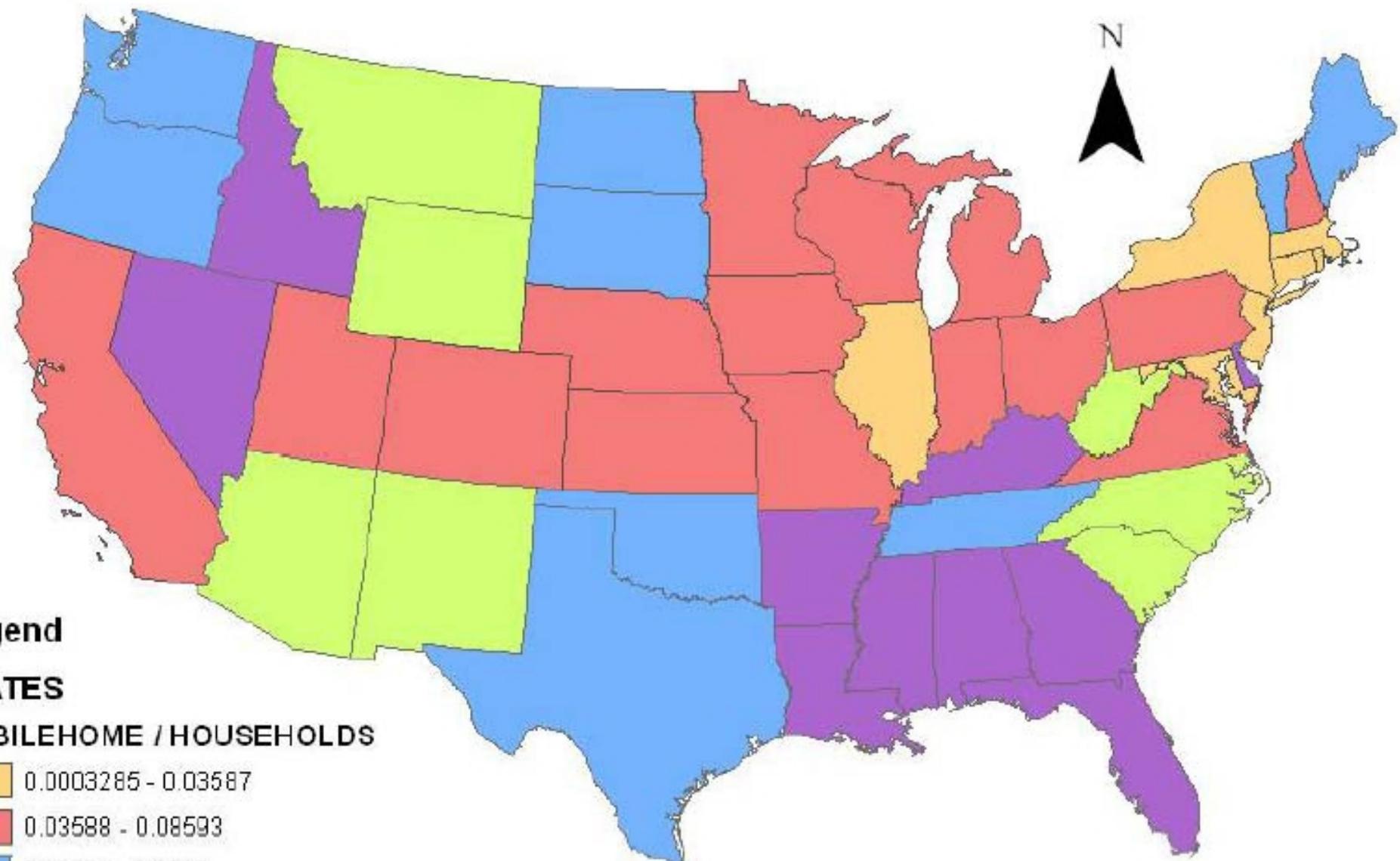
Before you select colors for your map, it is important to understand who will be reading it, and how it will be used. In the following steps, you will choose an appropriate color scheme and then a color palette to best communicate the information you are trying to convey to the reader from the data included in your map. Particular color dimensions suggest particular characteristics of your data. Color hue suggests qualitative differences, color value ordered, quantitative differences. These guidelines apply to point, line, and area map symbols (Krygier 2011). Special consideration for color blindness should be noted when choosing to use color. The following examples are primarily for color on choropleth maps.

2 Choose A Color Scheme



What not to do!

Mobilehome per households by State



Source: ESRI ArcData (2000)

0 240,000 480,000 960,000 1,440,000 1,920,000 Meters

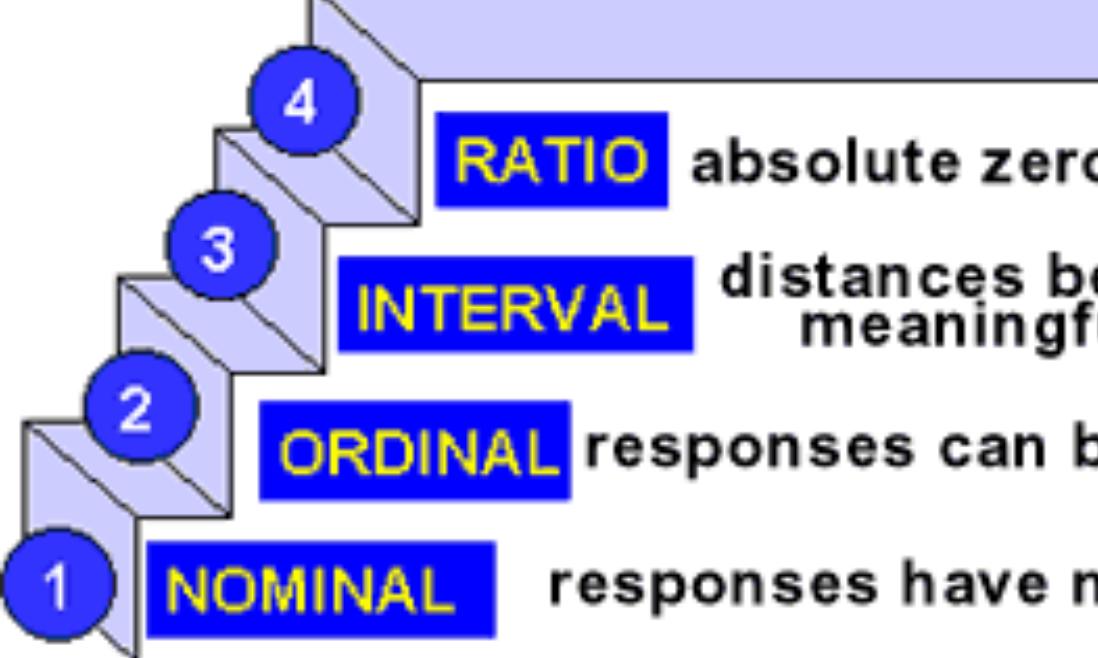
Color in GIS as of 2016

- ArcGIS Online is trying to have ‘smart mapping’: guessing some settings for you, but this is also just a starting point.
- Built-in choices are getting better.
 - Some are based on ‘*ColorBrewer*’, or you can go to its website and get advice and colors there:
<http://colorbrewer2.org>

The screenshot shows the ArcGIS Online color palette interface. At the top, it says "Number of data classes: 3". Below that, "Nature of your data:" has "sequential" selected. Under "Pick a color scheme:", there are two sections: "Multi-hue:" and "Single hue:". The "Multi-hue:" section displays a grid of 12 color swatches, each composed of four vertical bars representing different color components. The "Single hue:" section shows a grid of 8 color swatches, each composed of four vertical bars. On the right side of the interface, there is a map of the United States where states are colored according to a 3-class BuGn scheme. A callout box highlights the first class with the following details:
BuGn class 1
RGB: 229,245,24
CMYK: 10,0,0,0
HEX: #e5f5f9

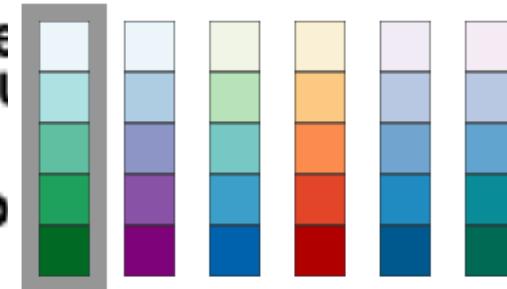
Nature of your data:

- sequential diverging qualitative

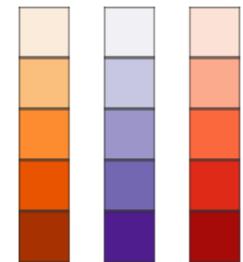
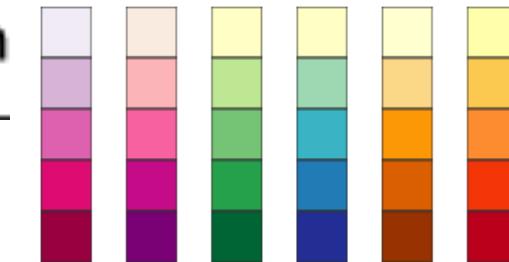
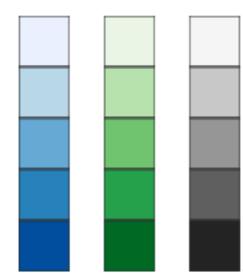


Pick a color scheme:

Multi-hue:



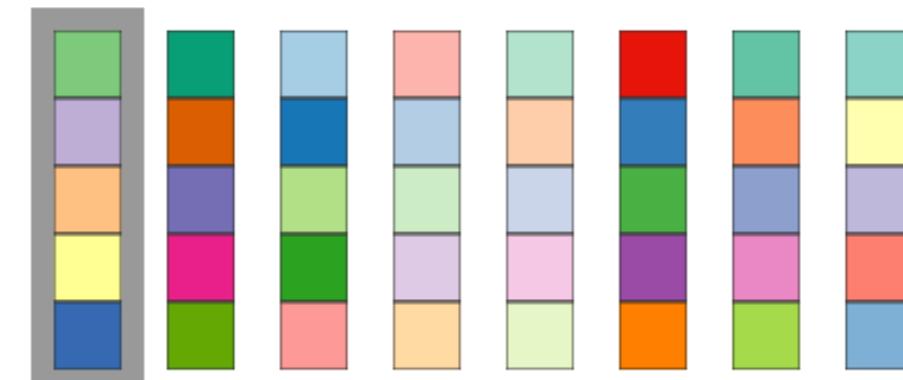
Single hue:



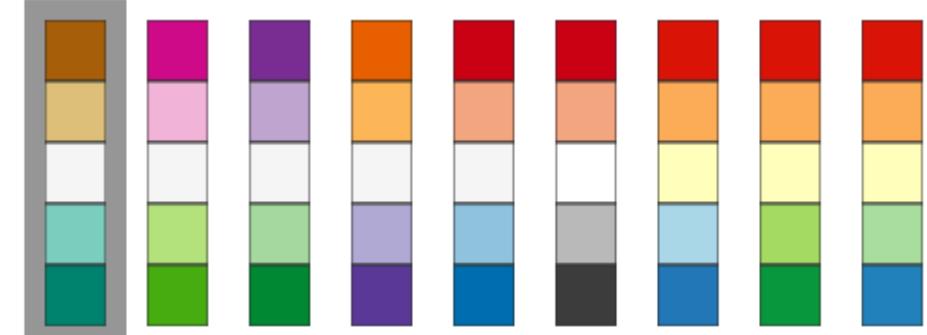
Nature of your data:

- sequential diverging qualitative sequential diverging qualitative

Pick a color scheme:



Pick a color scheme:



Other relationships to express with color: Thresholds and transitions

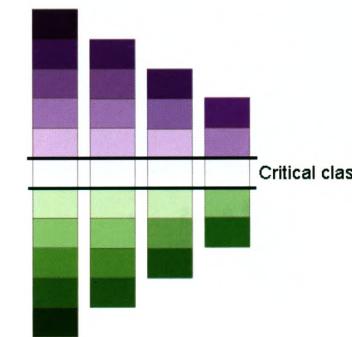
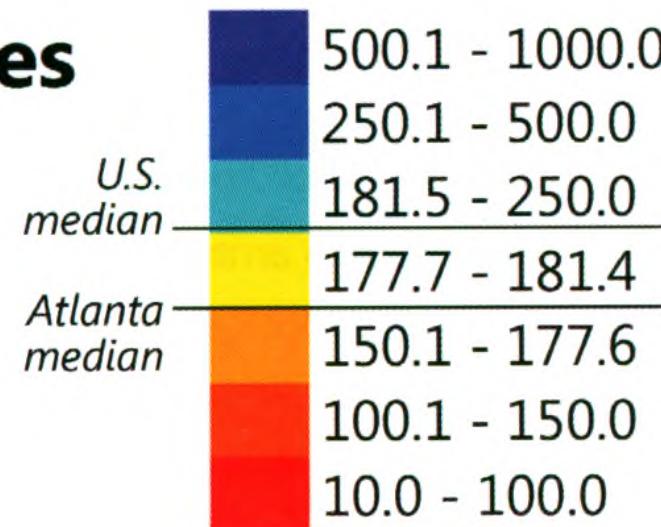
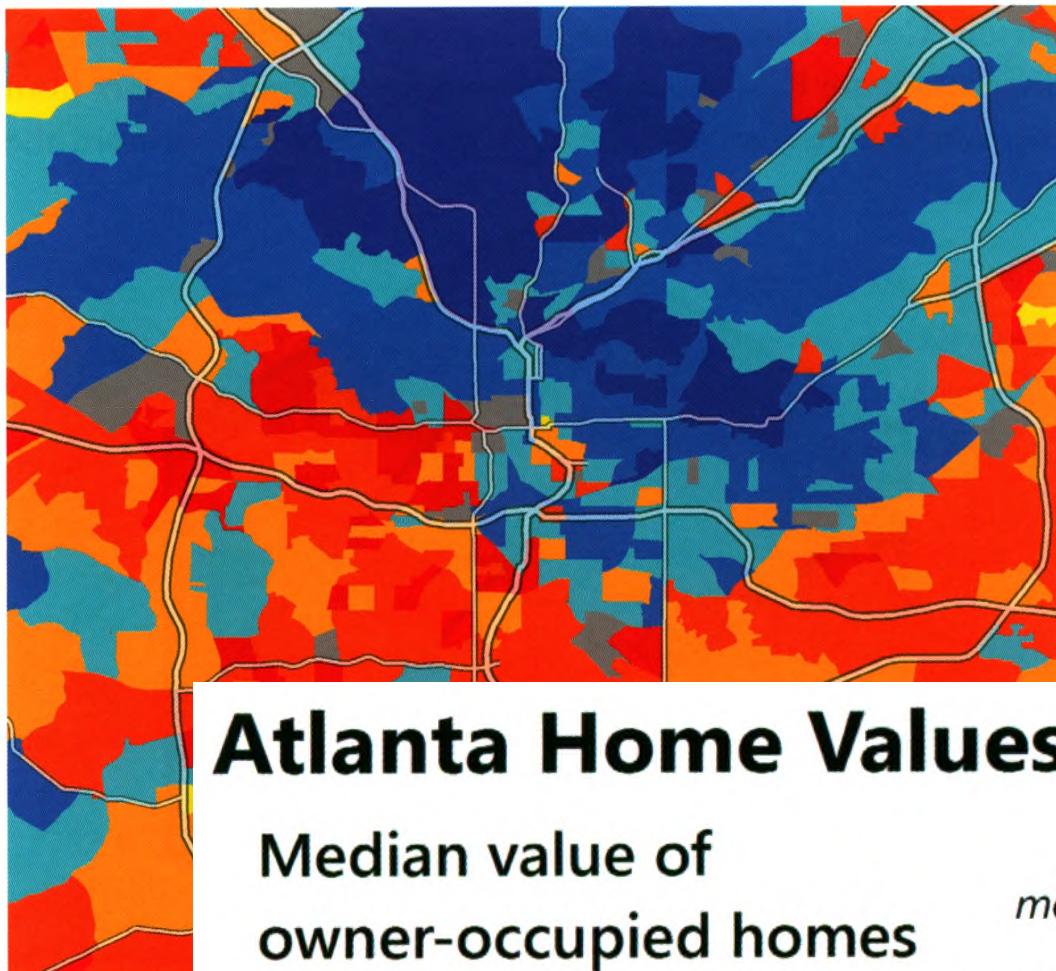


Figure 8.7 Diverging purple-green color schemes with odd numbers of classes. Each scheme is symmetrically organized around a middle light class that corresponds to a critical range in mapped data.

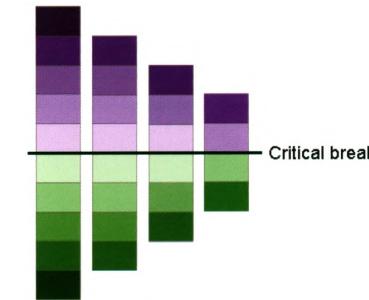
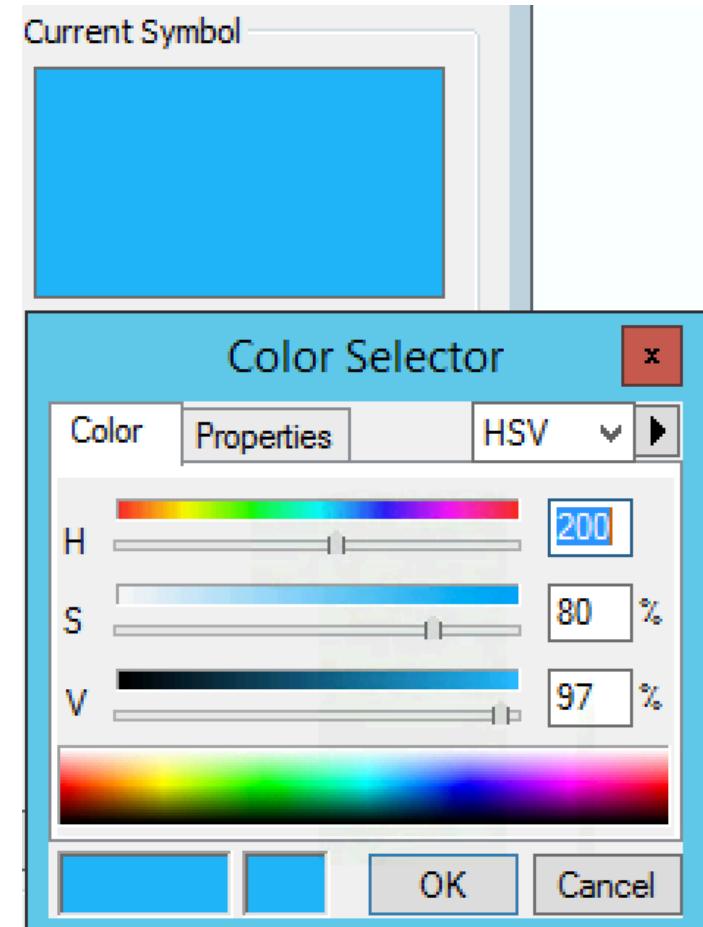
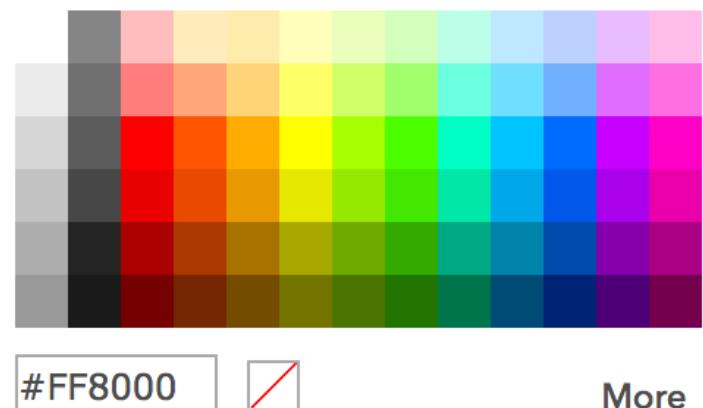


Figure 8.8 Diverging purple-green color schemes with even numbers of classes. Each scheme is symmetrically organized around a middle class break that corresponds to a critical data value.

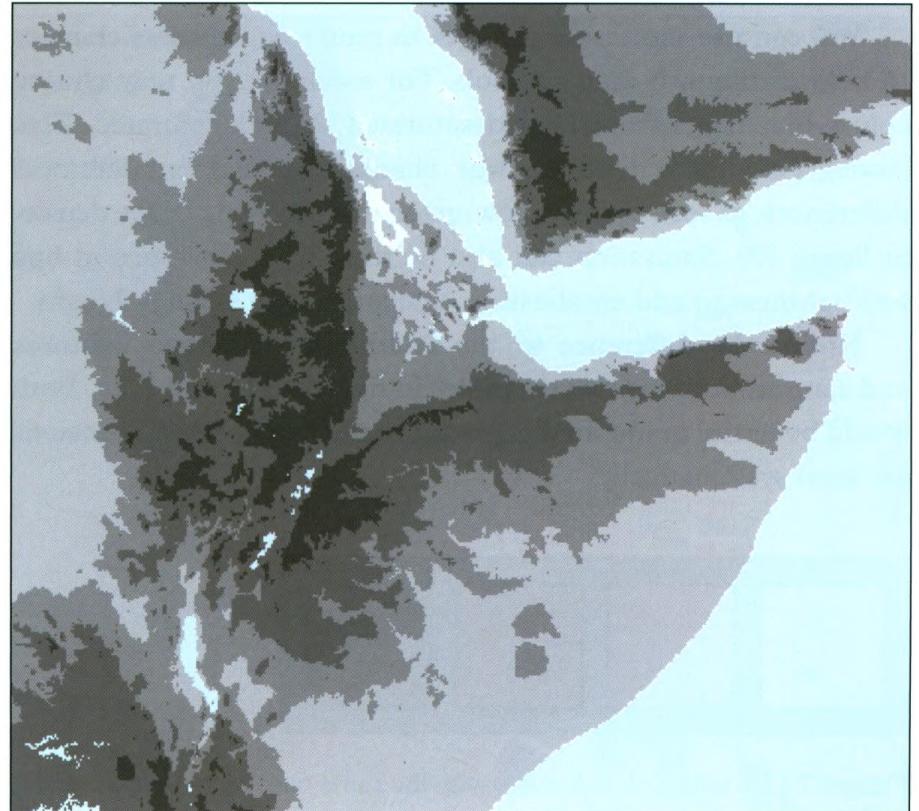
Color in GIS as of 2016

- Custom choices (such as those from ColorBrewer) can be inputted using RGB (ArcGIS Online) or using HSV at best (ArcMap)...

...but there are websites you can use to convert colors you've chosen using other color models to RGB (including the hexadecimal form) or HSV : <http://colorizer.org/>



Saturation vs. Lightness



Saturation can work better
when combined with lightness:

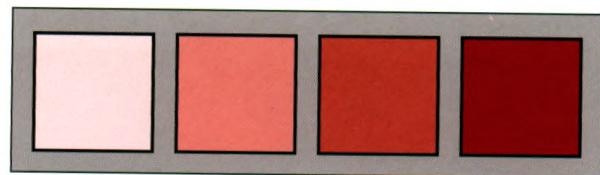
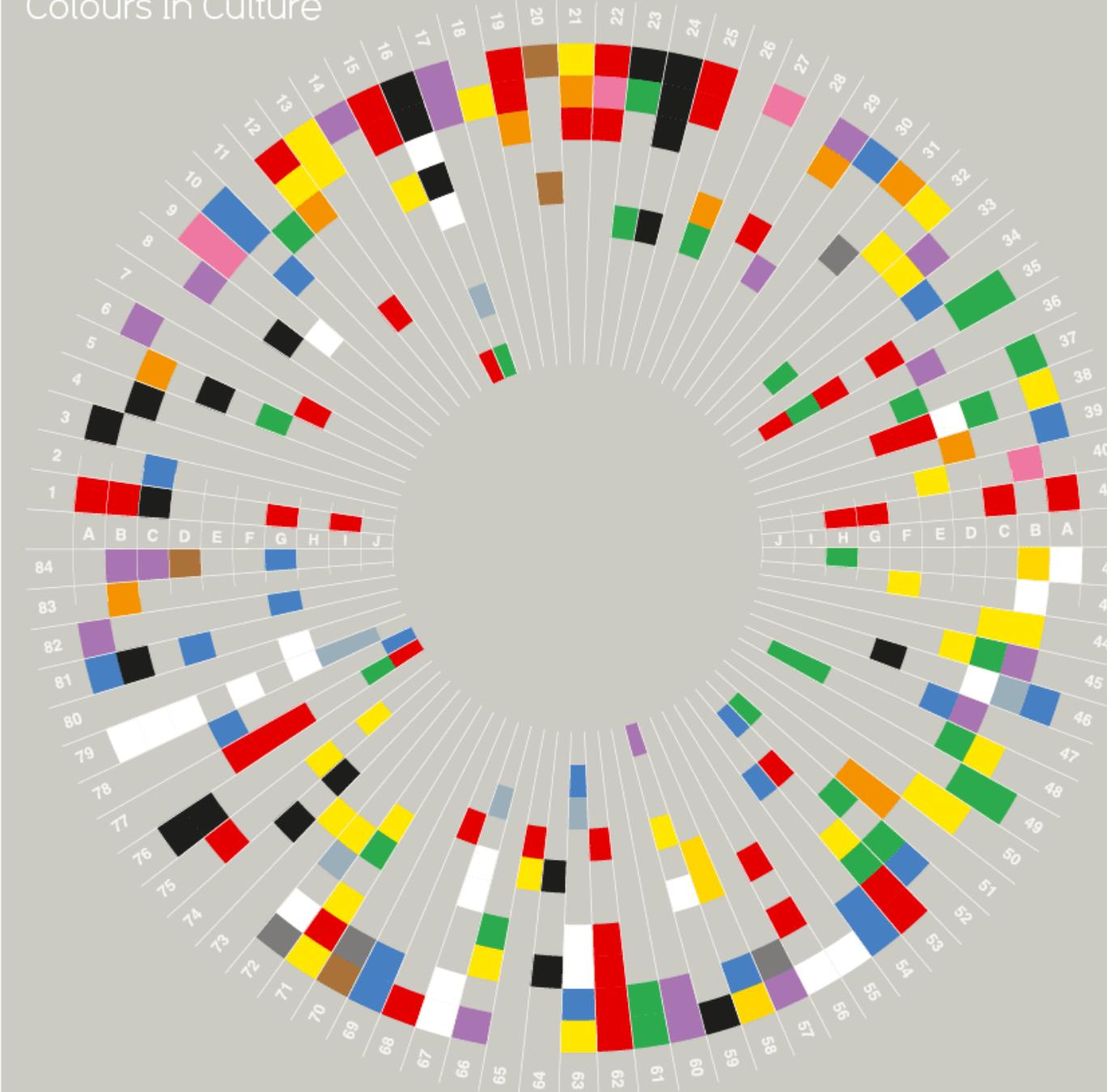


Figure 7.17 A series of four colors with the same hue, decreasing in lightness and increasing in saturation toward the right. They range from light-desaturated red to dark-saturated red.

If you are not careful, your colors may not be read the way you intend...

Colours In Culture



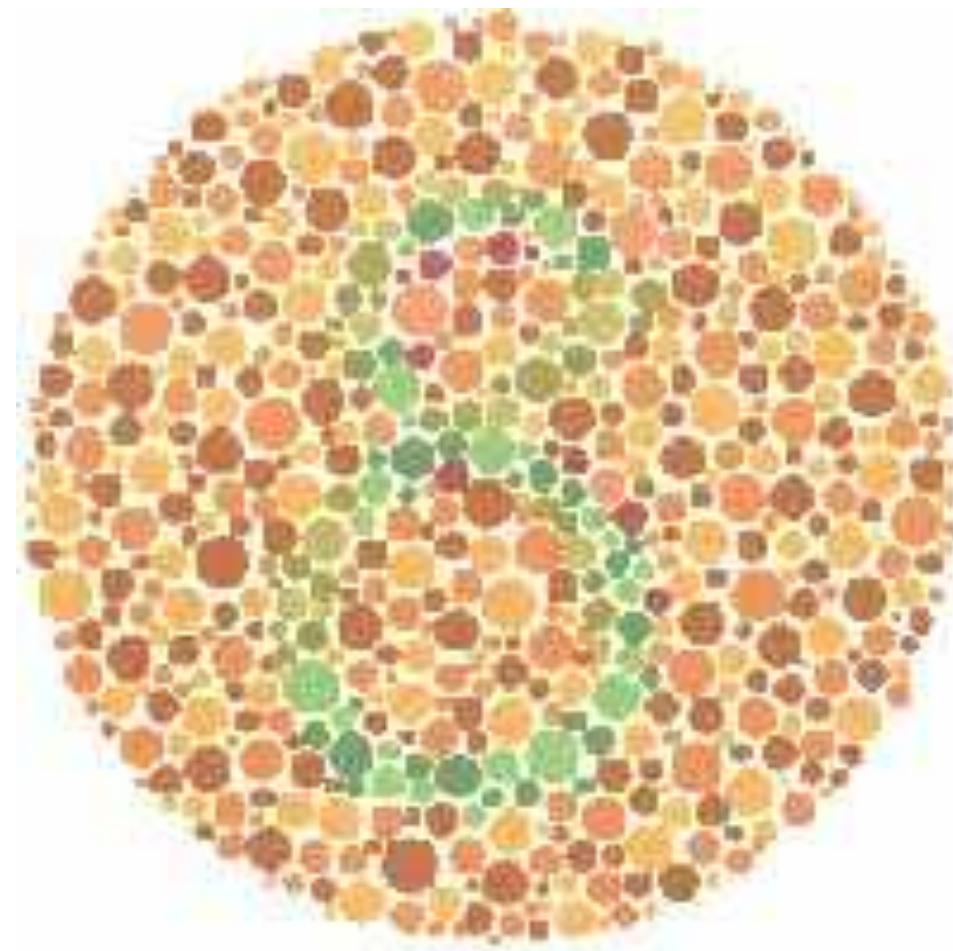
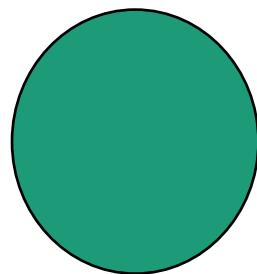
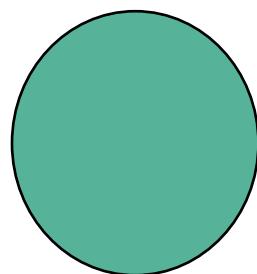
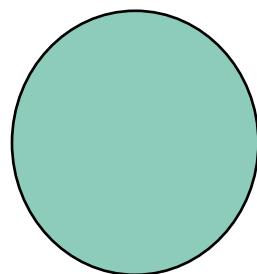
| | | |
|----------------------|--------------------|----------------|
| A Western / American | 1 Anger | 19 Desire |
| B Japanese | 2 Art / Creativity | 20 Earthy |
| C Hindu | 3 Authority | 21 Energy |
| D Native American | 4 Bad Luck | 22 Erotic |
| E Chinese | 5 Balance | 23 Eternity |
| F Asian | 6 Beauty | 24 Evil |
| G Eastern European | 7 Calm | 25 Excitement |
| H Muslim | 8 Celebration | 26 Family |
| I African | 9 Children | 27 Femininity |
| J South American | 10 Cold | 28 Fertility |
| | 11 Compassion | 29 Flamboyance |
| | 12 Courage | 30 Freedom |
| | 13 Cowardice | 31 Friendly |
| | 14 Cruelty | 32 Fun |
| | 15 Danger | 33 God |
| | 16 Death | 34 Gods |
| | 17 Decadence | 35 Good Luck |
| | 18 Deceit | 36 Gratitude |

| | | |
|-----------------|-------------------|---------------------|
| 37 Growth | 55 Luxury | 73 Royalty |
| 38 Happiness | 56 Marriage | 74 Self-cultivation |
| 39 Healing | 57 Modesty | 75 Strength |
| 40 Healthy | 58 Money | 76 Style |
| 41 Heat | 59 Mourning | 77 Success |
| 42 Heaven | 60 Mystery | 78 Trouble |
| 43 Holiness | 61 Nature | 79 Truce |
| 44 Illness | 62 Passion | 80 Trust |
| 45 Insight | 63 Peace | 81 Unhappiness |
| 46 Intelligence | 64 Penance | 82 Virtue |
| 47 Intuition | 65 Power | 83 Warmth |
| 48 Religion | 66 Personal power | 84 Wisdom |
| 49 Jealousy | 67 Purity | |
| 50 Joy | 68 Radicalism | |
| 51 Learning | 69 Rational | |
| 52 Life | 70 Reliable | |
| 53 Love | 71 Repels Evil | |
| 54 Loyalty | 72 Respect | |



If you are not careful, your colors may not be read the way you intend...

Differences in color perception



Color Oracle

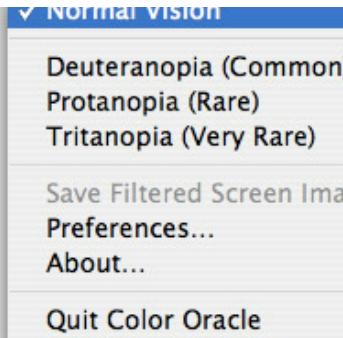
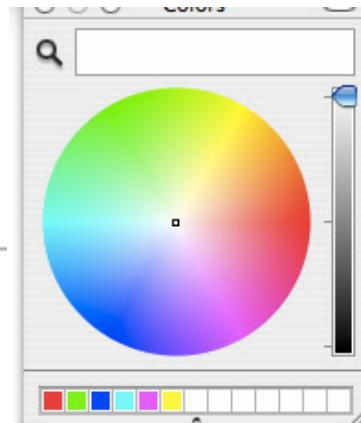
Design for the Color Impaired

Color Oracle is a free color blindness simulator for Window, Mac and Linux. It takes the guesswork out of designing for color blindness by showing you in real time what people with common color vision impairments will see.

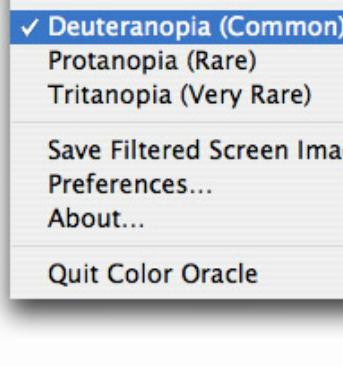
Color Oracle applies a full screen color filter to art you are designing – independently of the software in use. Eight percent of all males are affected by color vision impairment – make sure that your graphical work is readable by the widest possible audience.

Read this article for more information: [Color Design for the Color Vision Impaired](#)

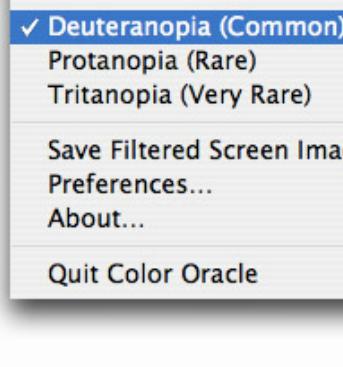
<http://colororacle.org/index.html>



Normal Vision



Normal Vision



Deuteranopia (Common)

Protanopia (Rare)

Tritanopia (Very Rare)

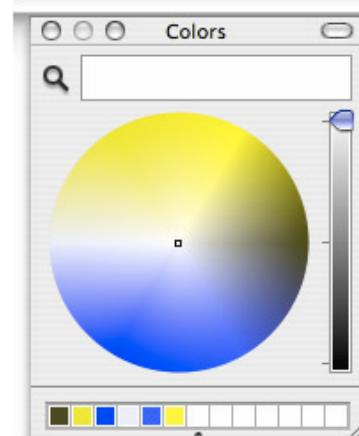
Save Filtered Screen Image

Preferences...

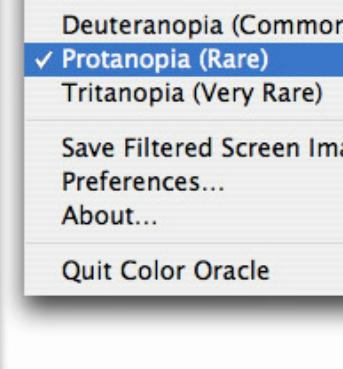
About...

Quit Color Oracle

Deuteranopia



Normal Vision



Deuteranopia (Common)

Protanopia (Rare)

Tritanopia (Very Rare)

Save Filtered Screen Image

Preferences...

About...

Quit Color Oracle

Protanopia