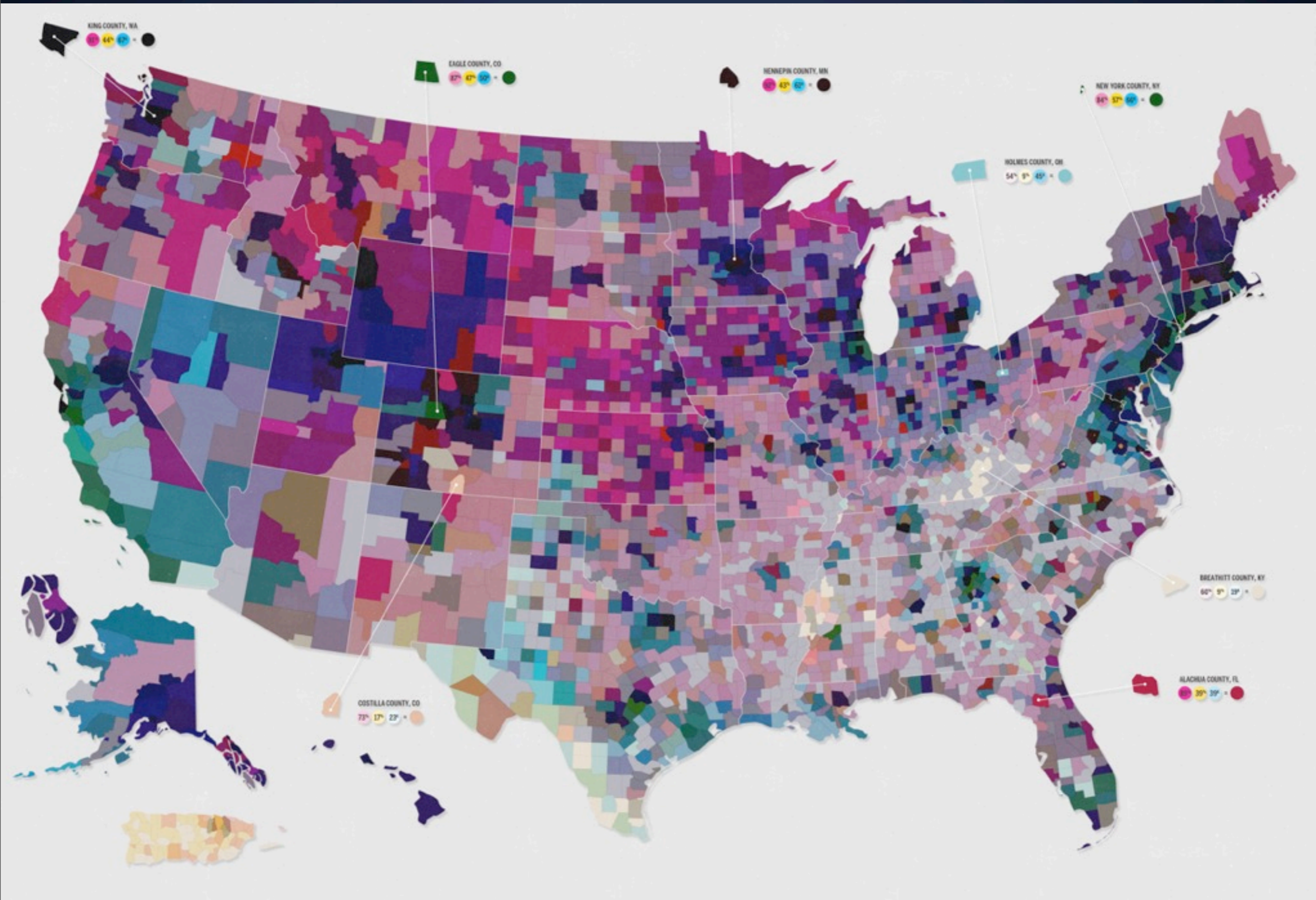


# Color

**Not as hard as it seems.**



# READING, WRITING, AND EARNING MONEY

The latest data from the U.S. Census's American Community Survey paints a fascinating picture of the United States at the county level. We've looked at the educational achievement and the median income of the entire nation, to see where people are going to school, where they're earning money, and if there is any correlation.



1 HIGH SCHOOL GRADUATES 60% 70% 80% 90%



2 COLLEGE GRADUATES 35% 40% 45% 50%

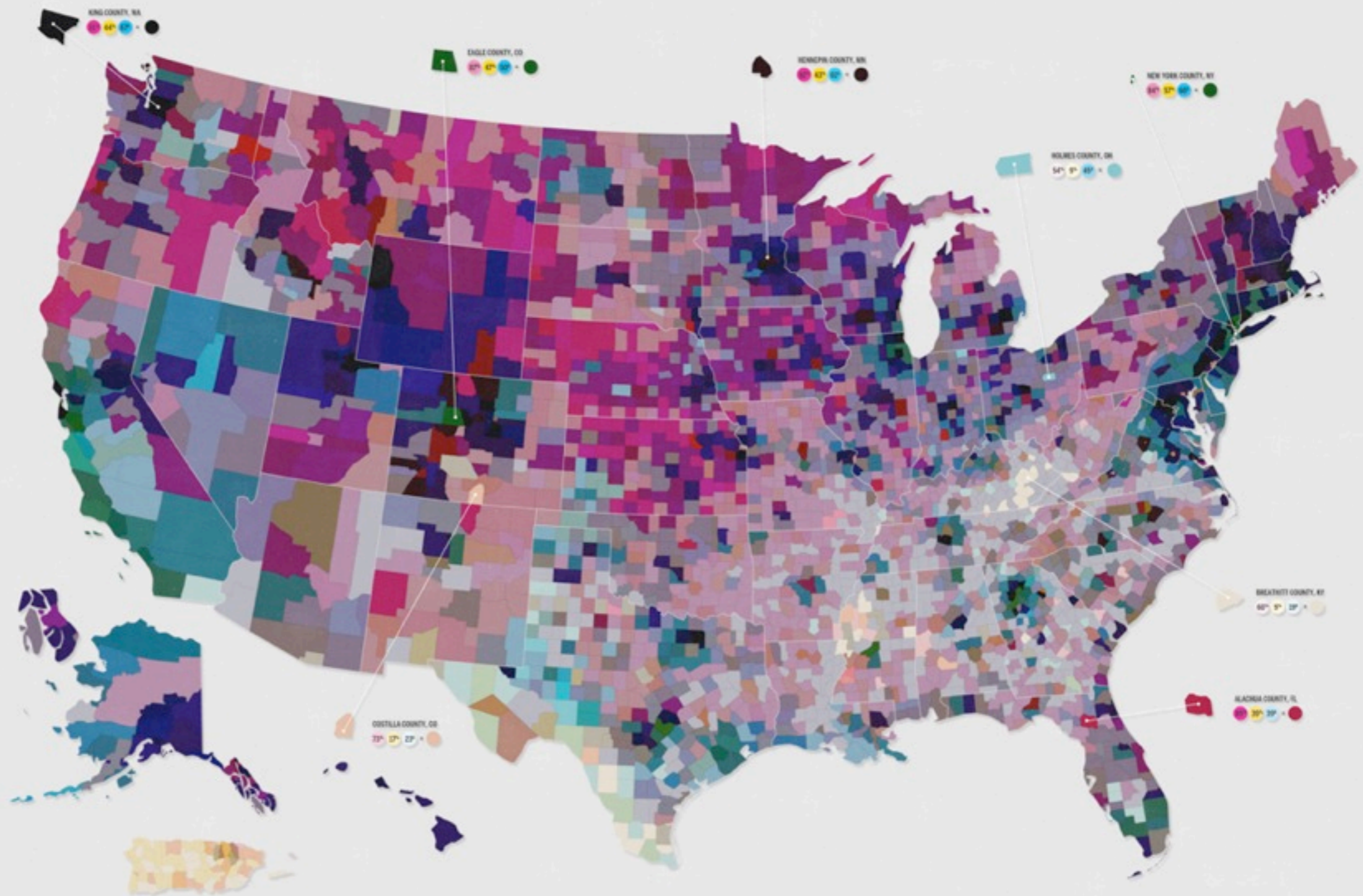


3 MEDIAN HOUSEHOLD INCOME 20K 40K 60K 80K

The map at right is a product of overlaying the three sets of data. The saturation hue and value has been produced from the data shown above. In general, darker counties represent a more educated, better paid population while lighter areas represent communities with fewer graduates and lower incomes.



A collaboration between GOOD and Gregory Hebert  
SOURCE: US Census



High School Graduates

College Graduates

Median Household Income

# READING, WRITING, AND EARNING MONEY

The latest data from the U.S. Census's American Community Survey paints a fascinating picture of the United States at the county level. We've looked at the educational attainment and the median income of the entire nation, to see where people are going to school, where they're earning money, and if there is any correlation.



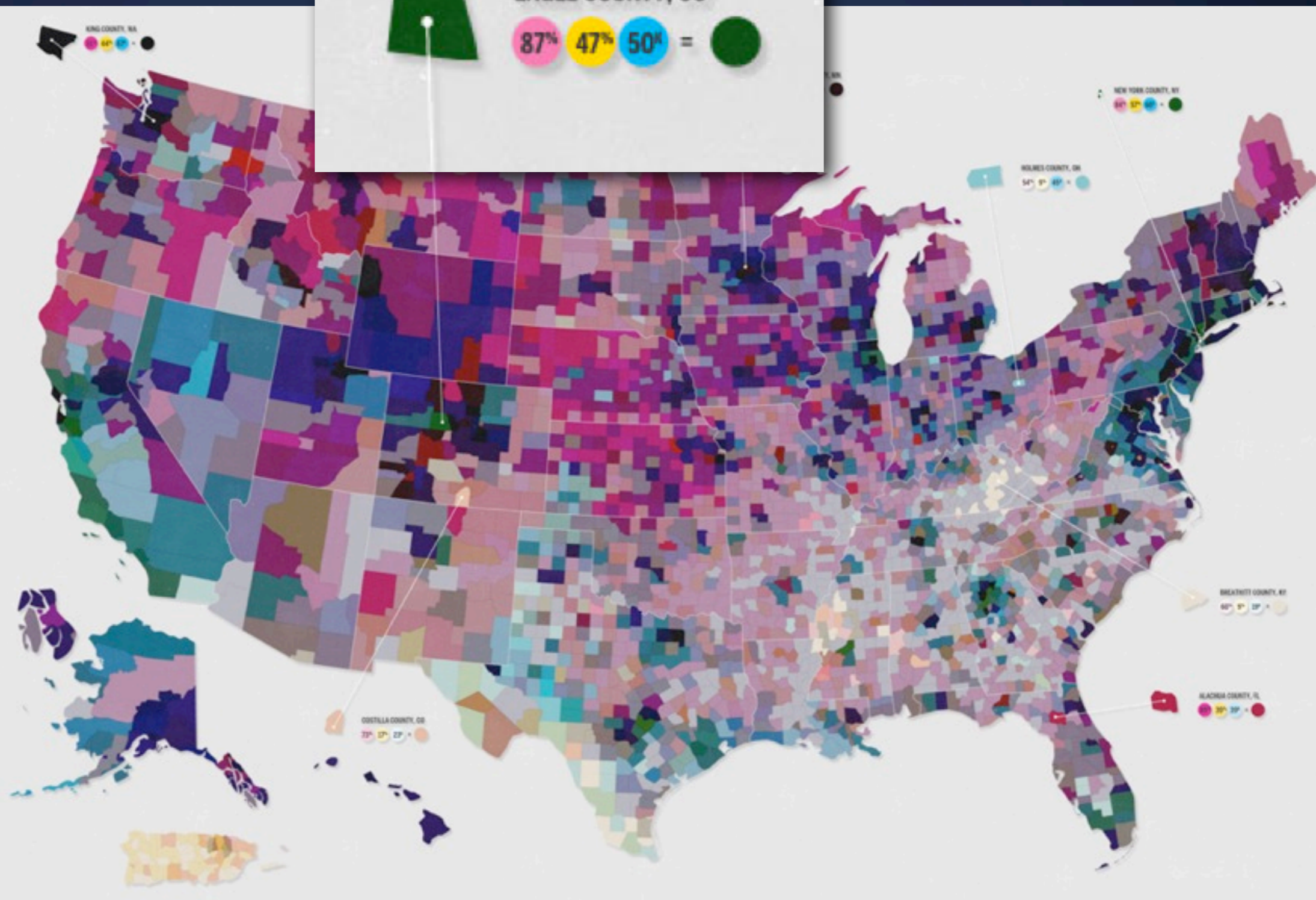
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A collaboration between GOOD and Gregory Mufson  
SOURCE: US Census

**EAGLE COUNTY, CO**

87% 47% 50% =



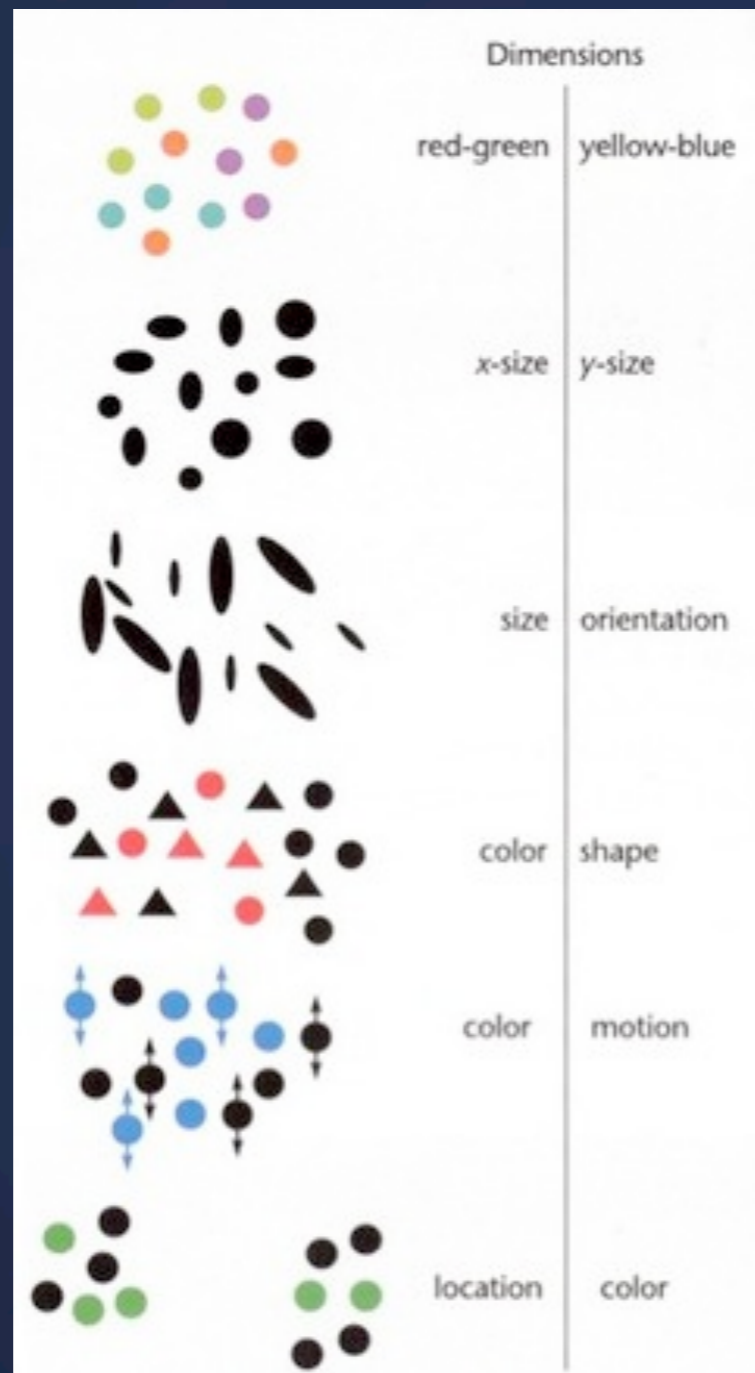
High School Graduates

College Graduates

Median Household Income

# Addendum to Last Week

Integral vs separable

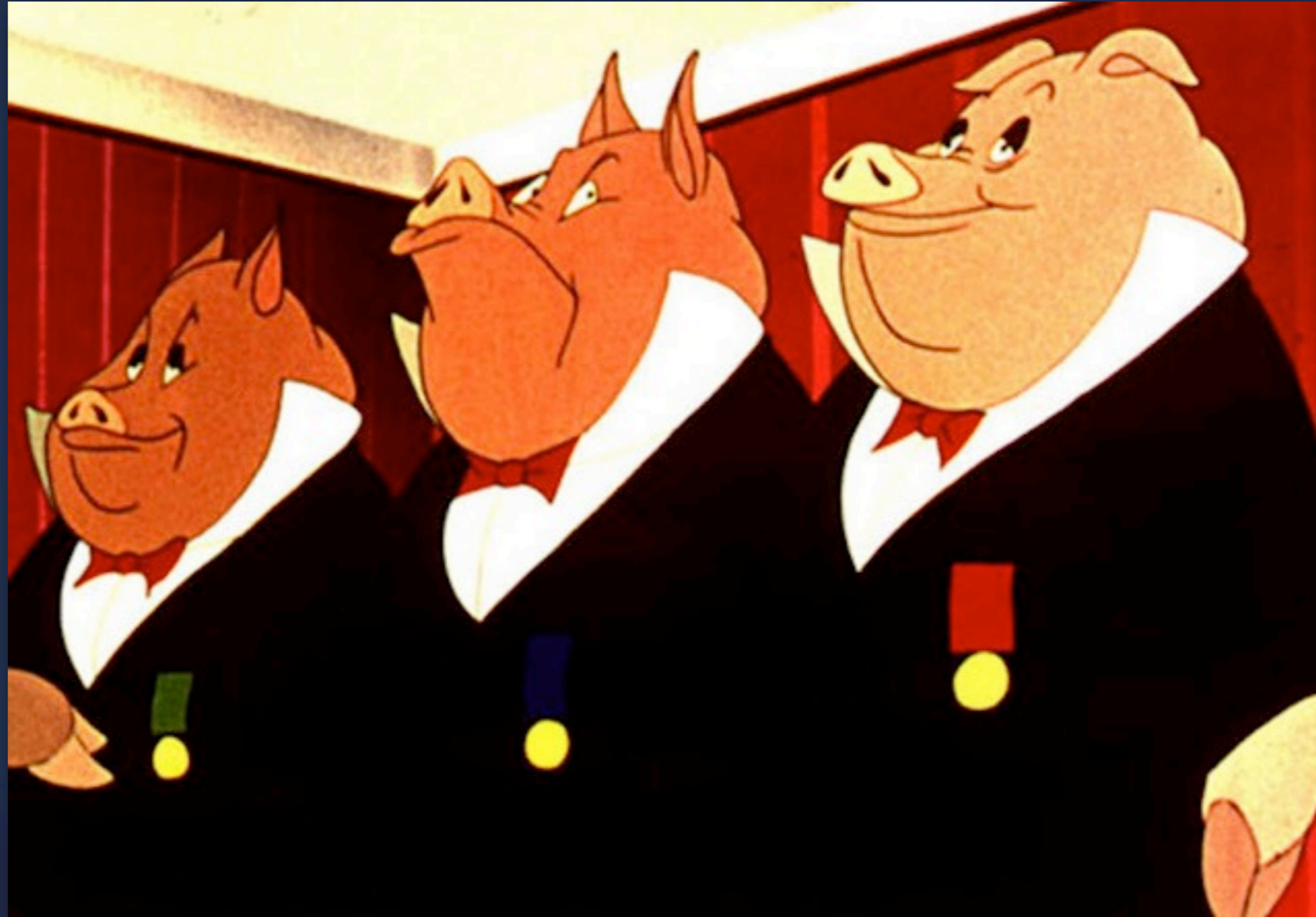


integral

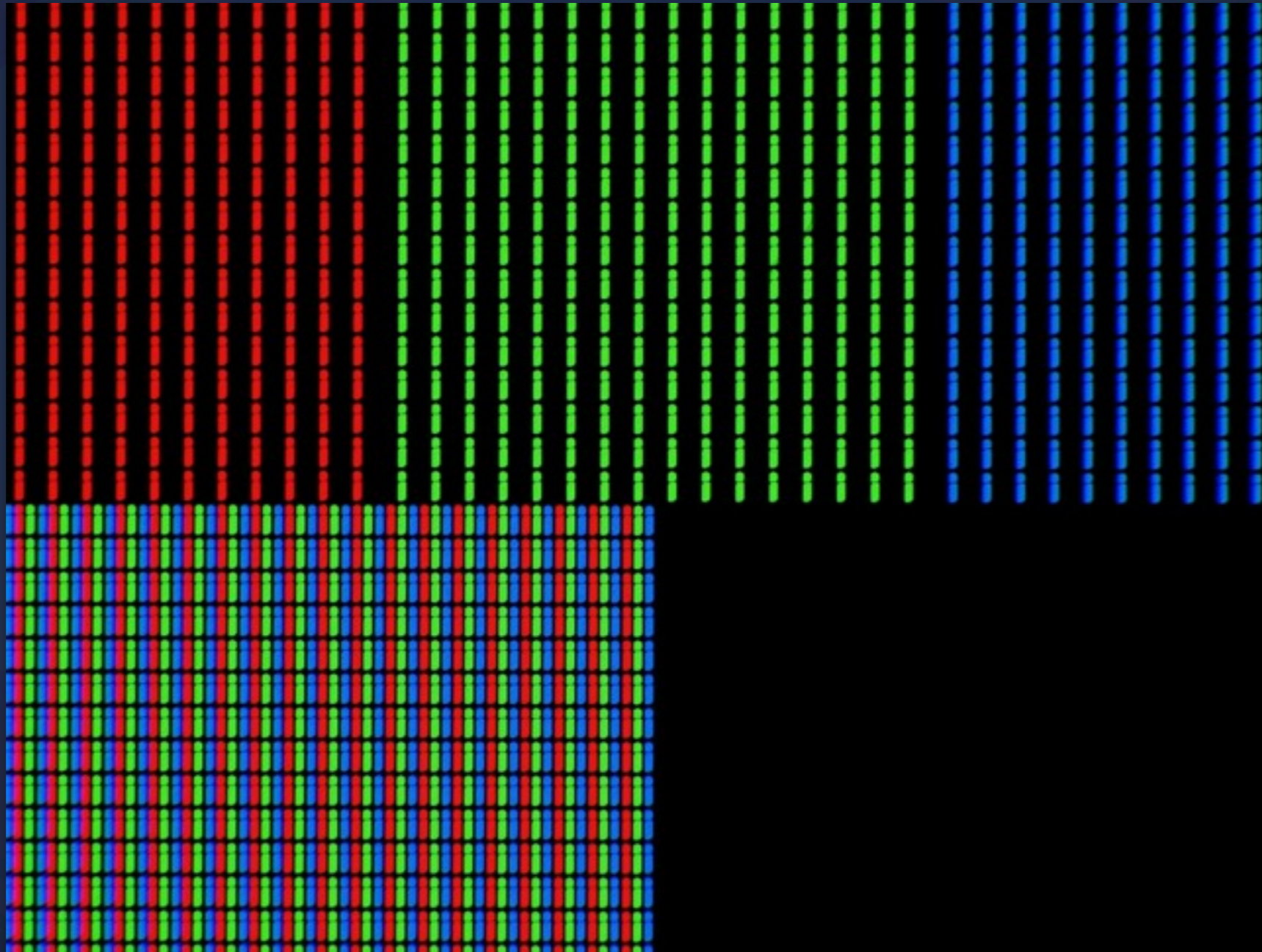


separable

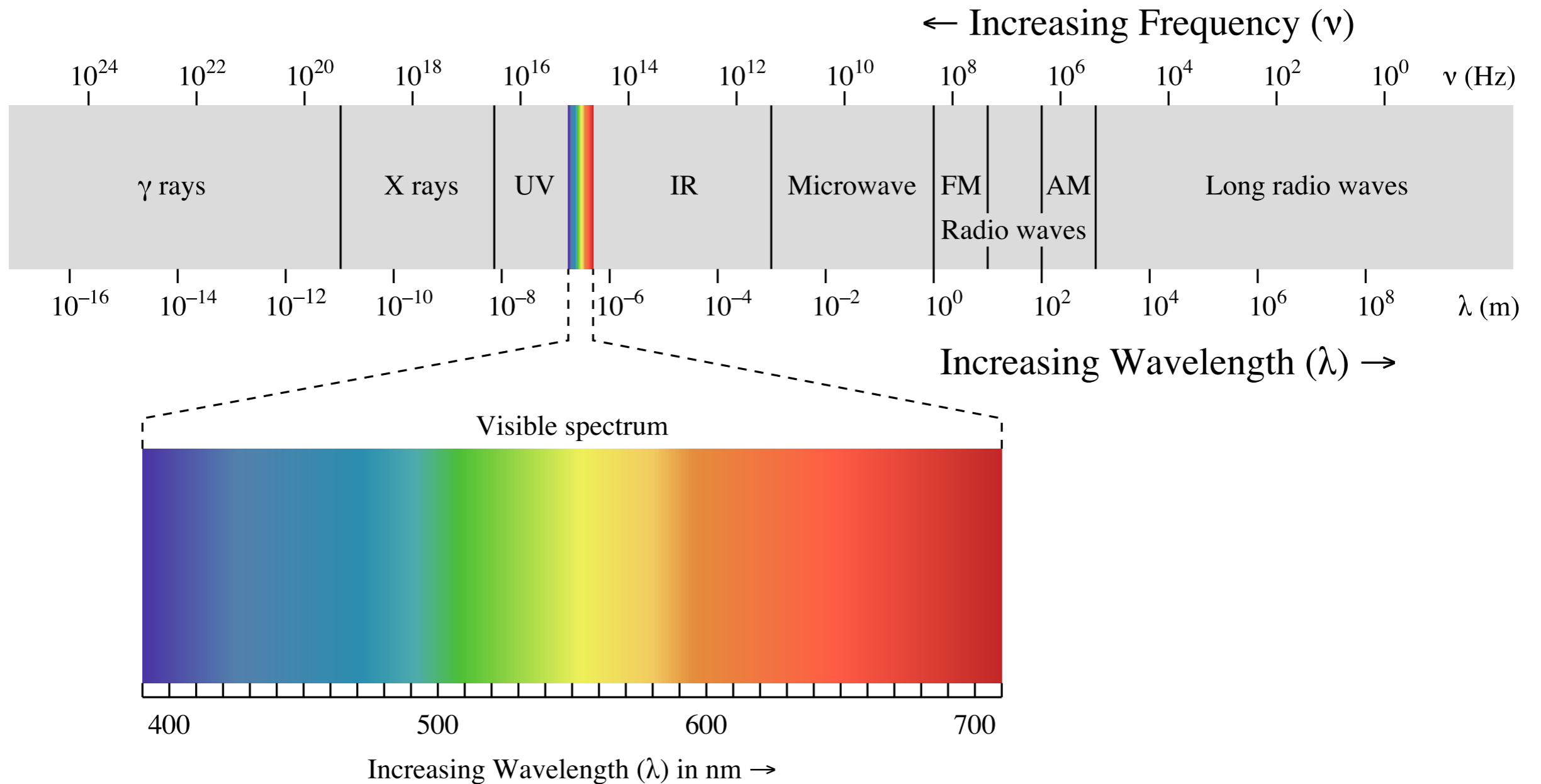
# All Colors Are Equal



# Computer screens



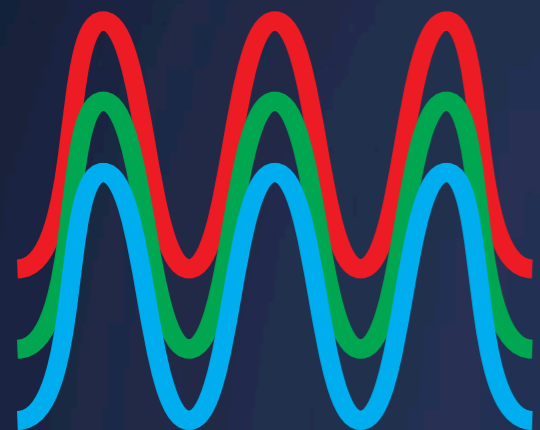
# Our eyes



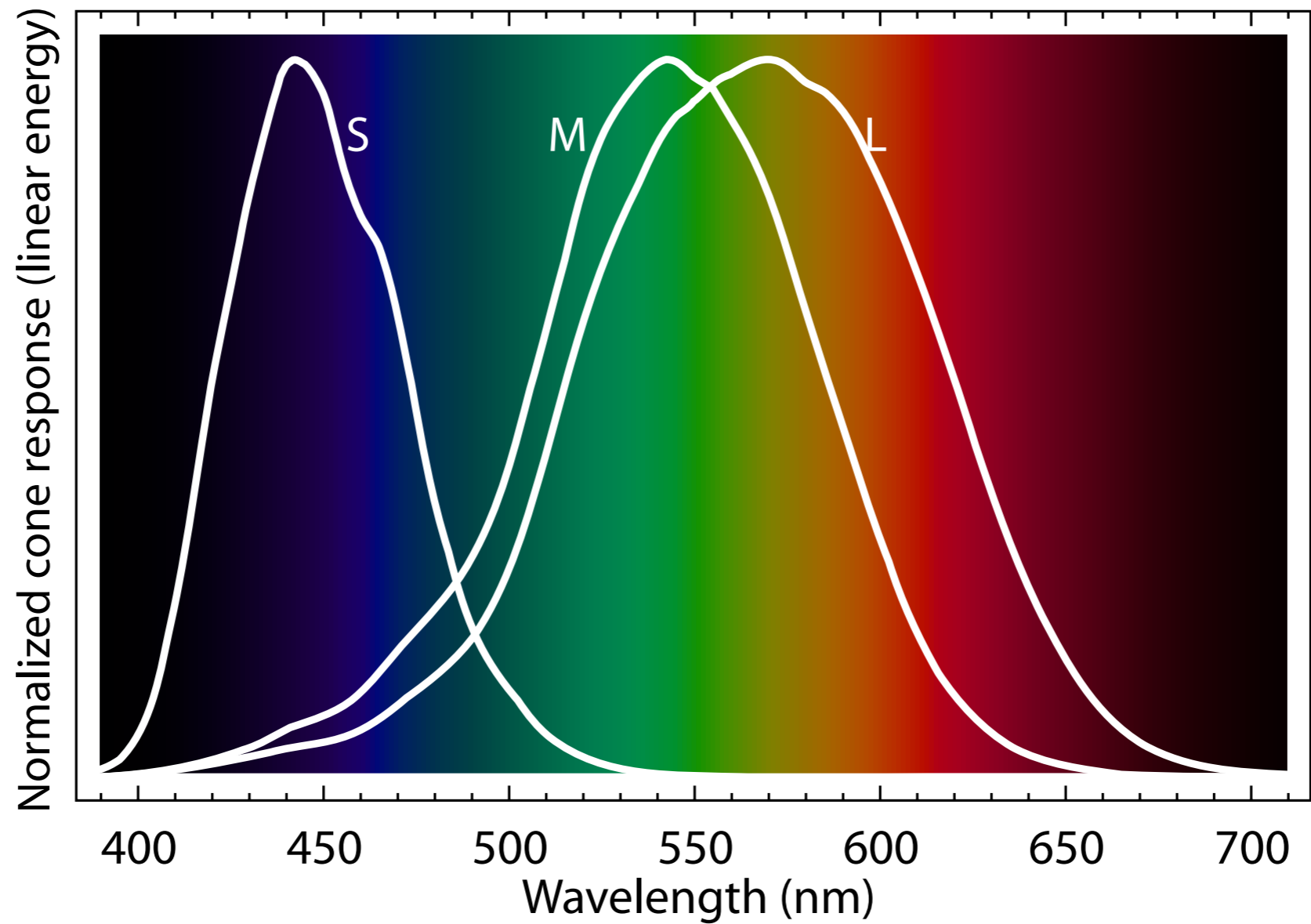


# From Light to Color

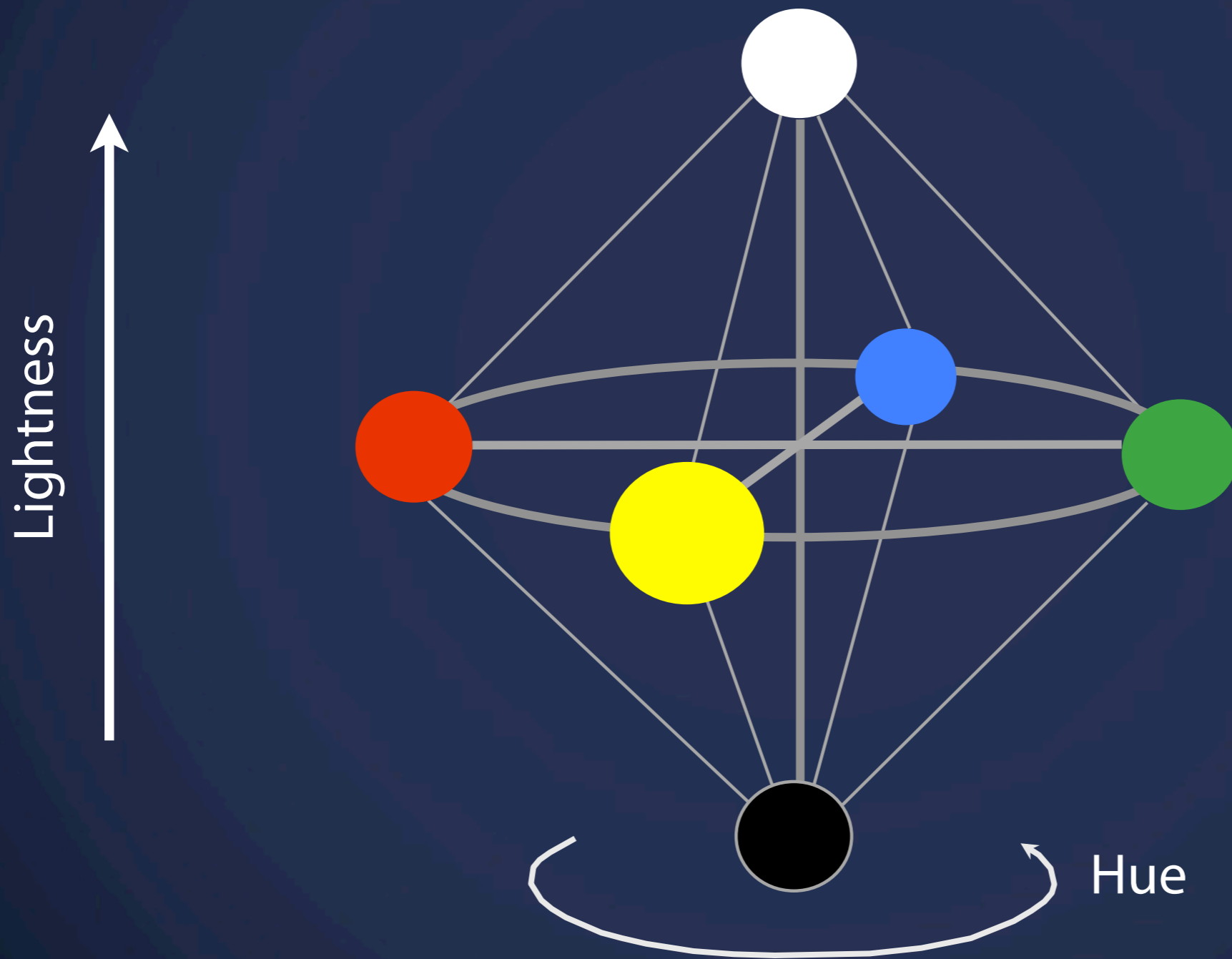
Interpretations and Interpolations



# 3 Types of Cones

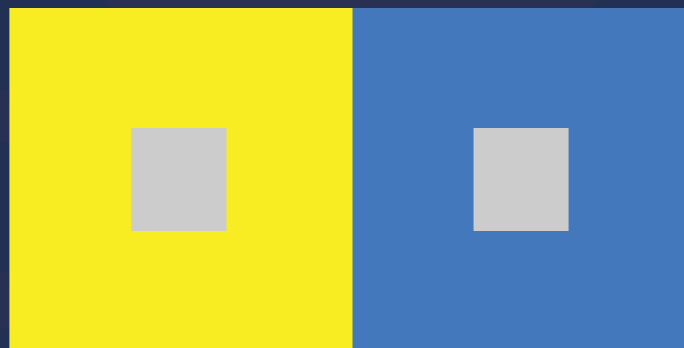
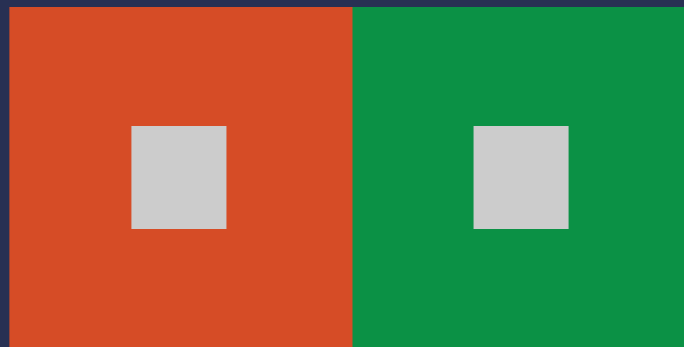
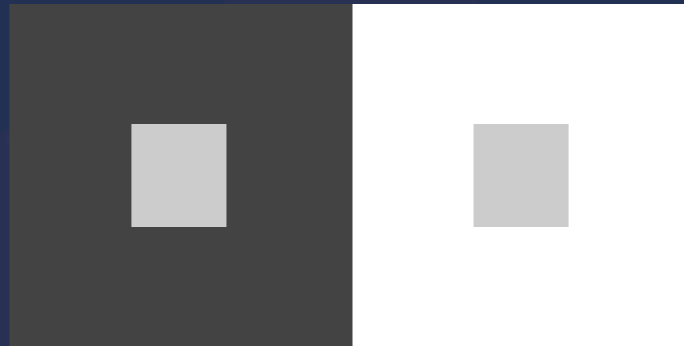


# Perceptual Color Space



# Opponent Color

Contrast is essential



# Opponent Color

Watch out – Color Blindness



Deuteranope



Protanope

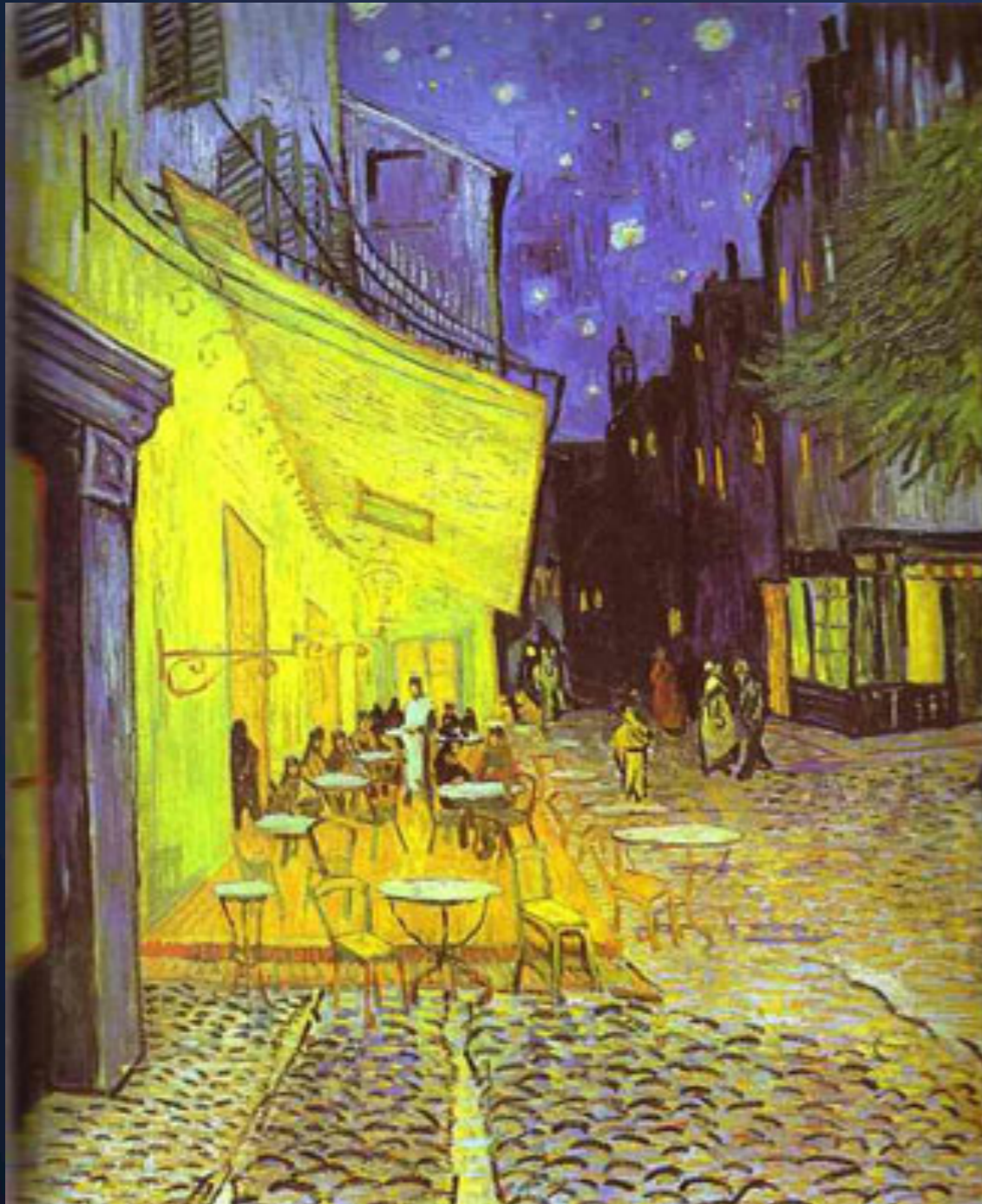


Tritanope

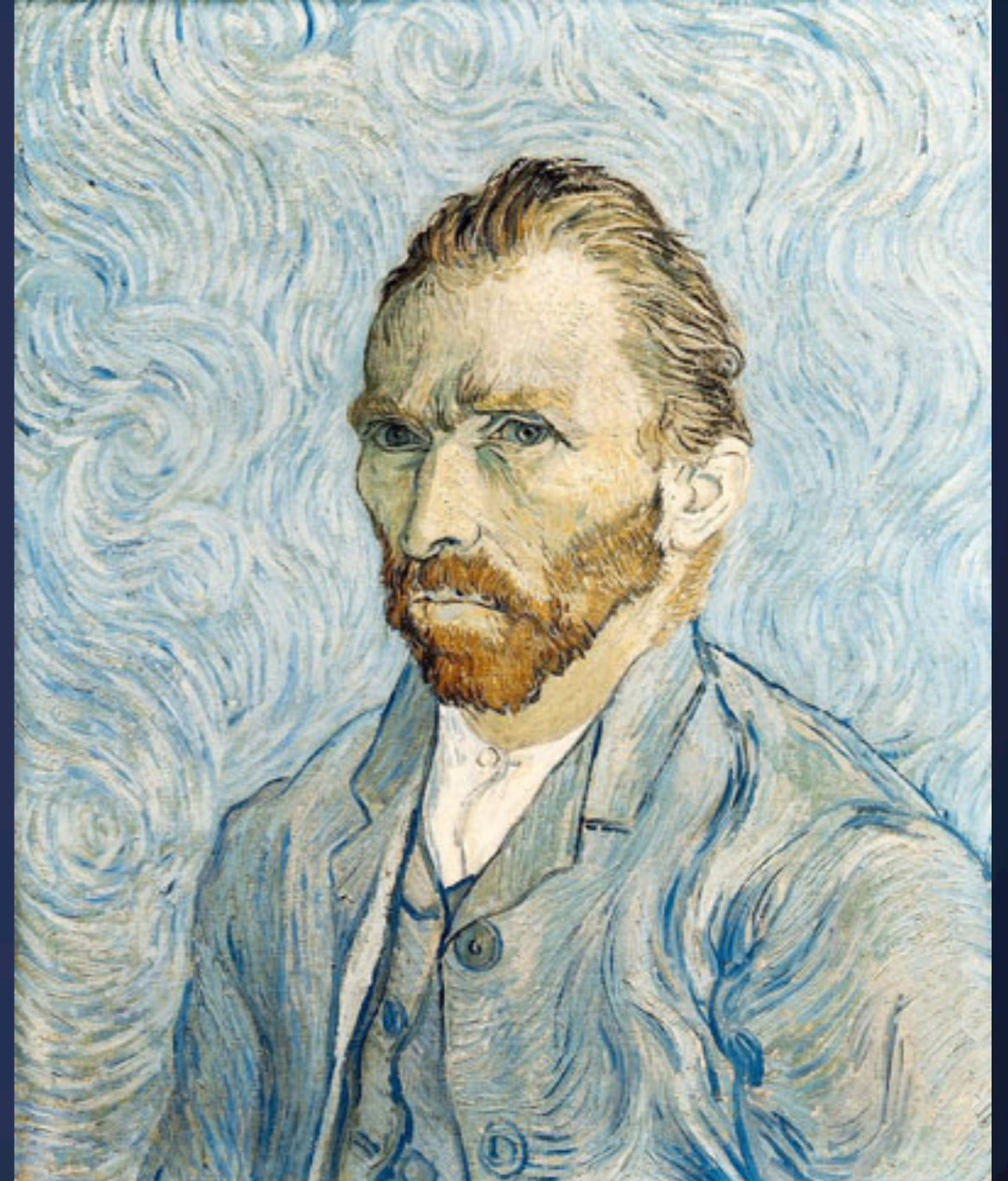
Red-Green

Blue-Yellow

# Van Gogh for Colorblind People

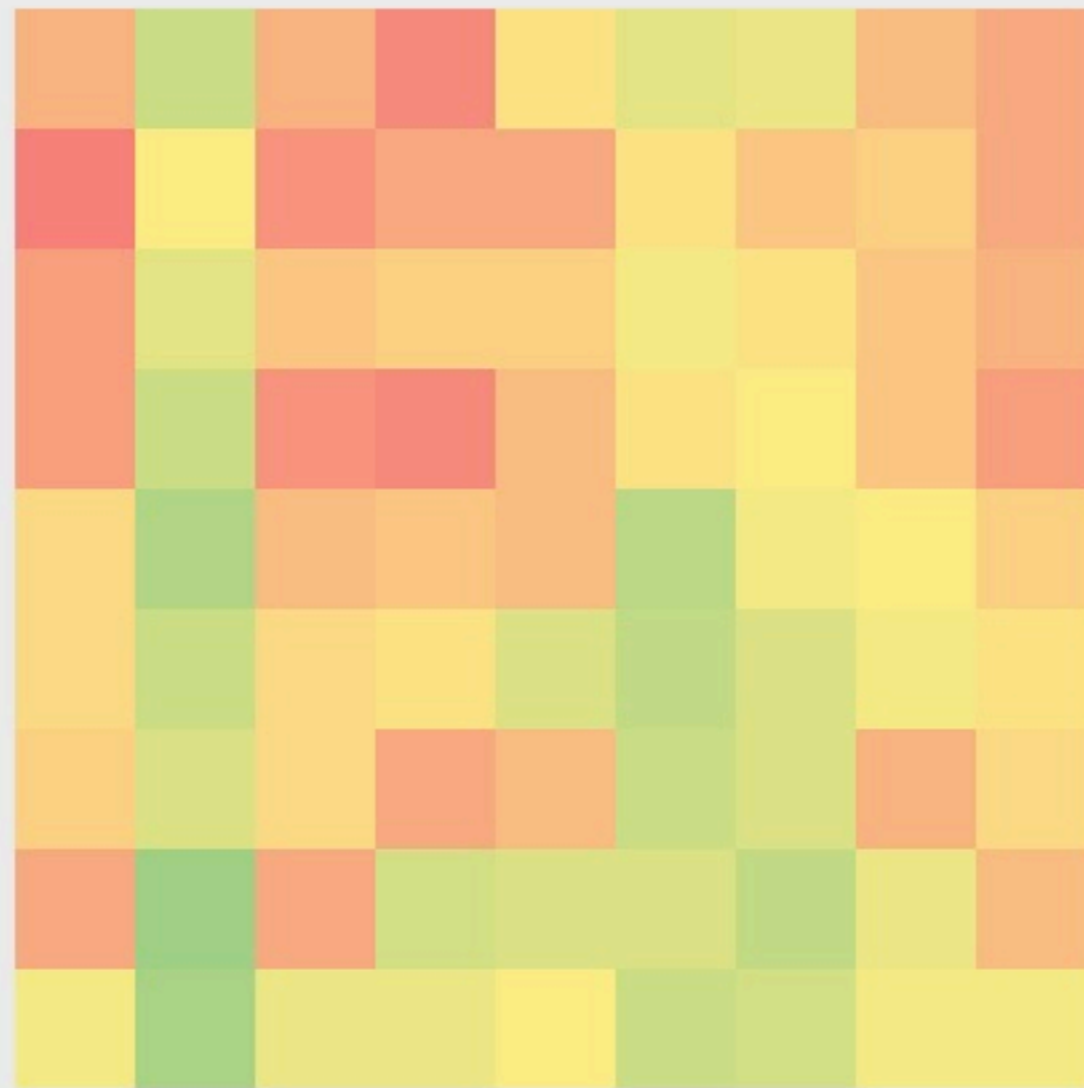


# Van Gogh for Colorblind People



# Color Blindness

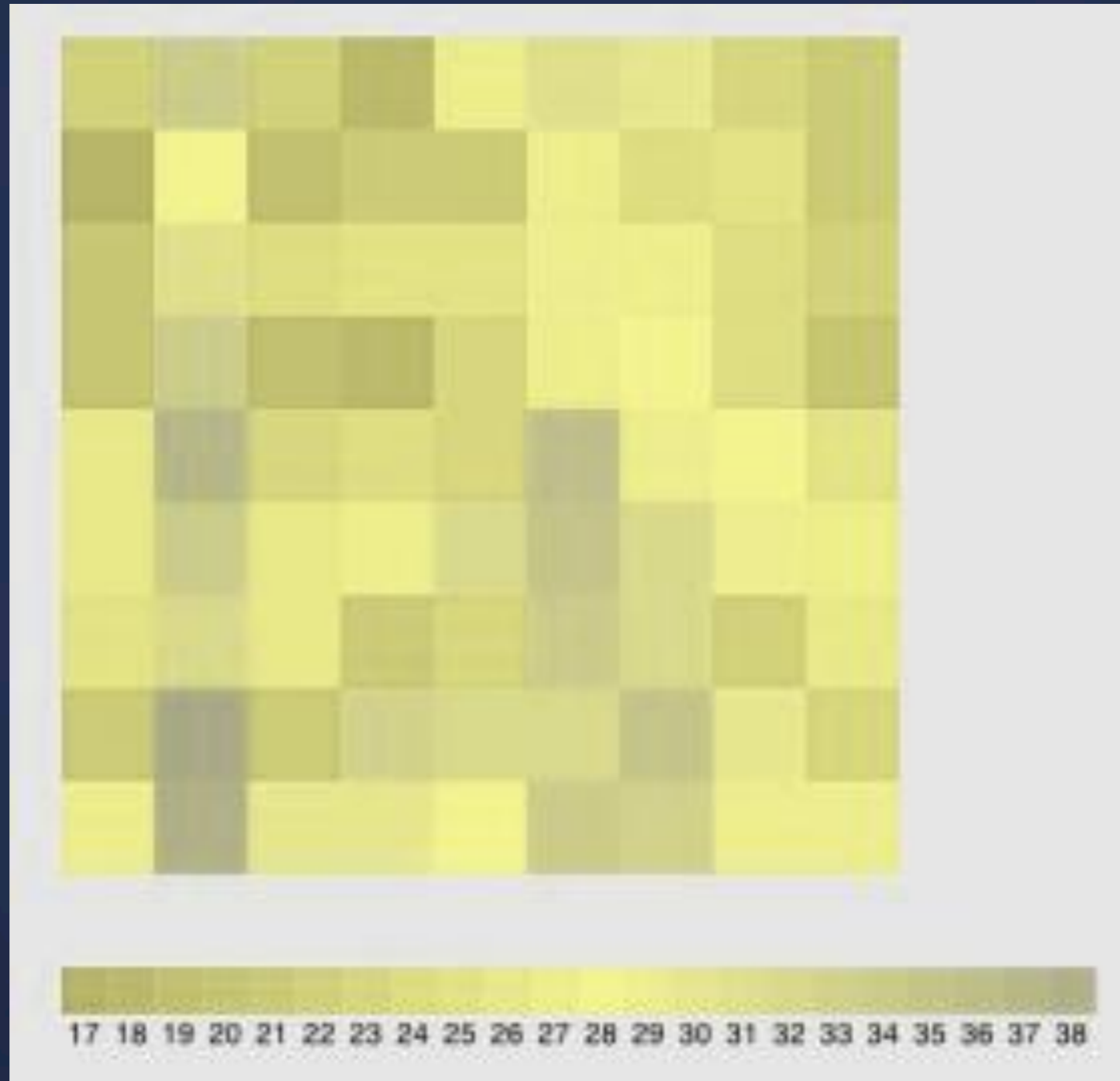
## Consequences





# Color Blindness

## Consequences



# All Colors Are Equal

... but they're not perceived the same

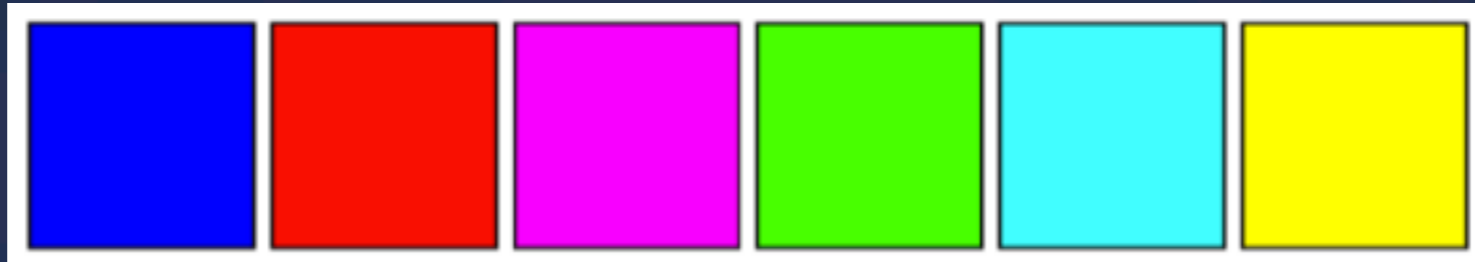
6 corners of the RGB color cube



# All Colors Are Equal

... but they're not perceived the same

6 corners of the RGB color cube



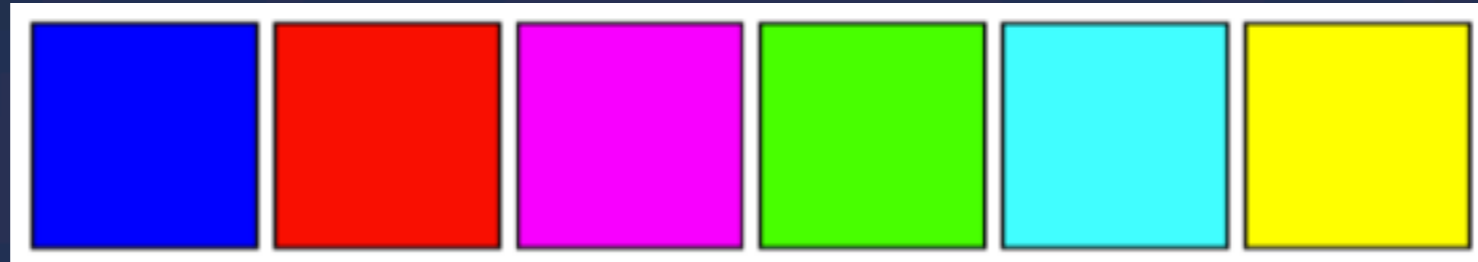
Luminance Value



# All Colors Are Equal

... but they're not perceived the same

6 corners of the RGB color cube



Luminance Value

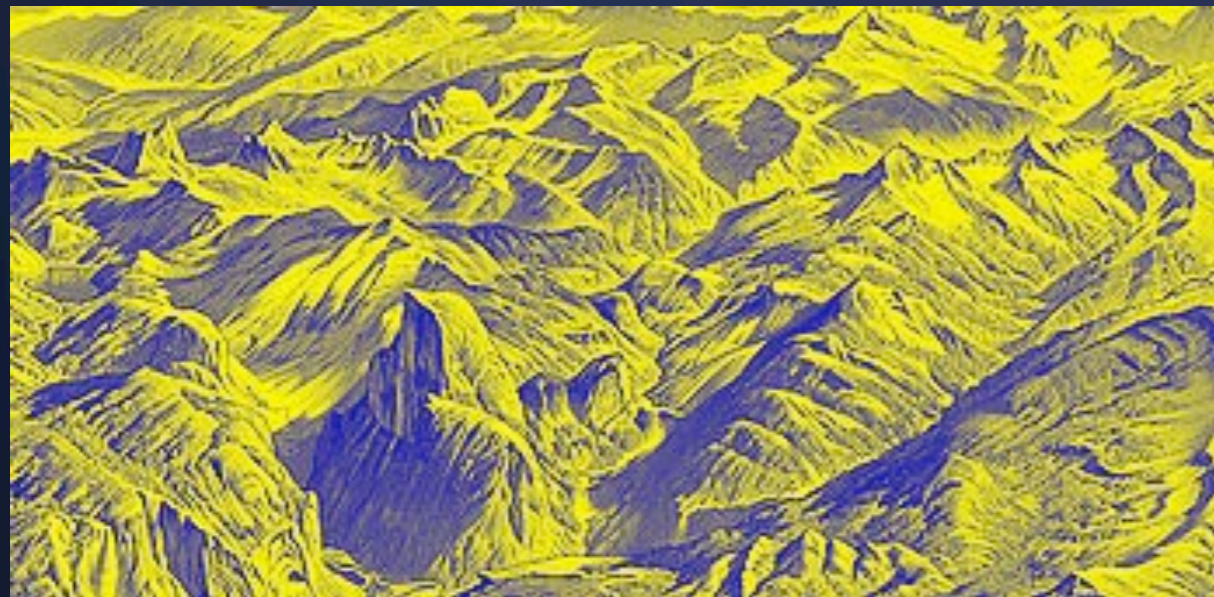


Perceived Lightness



# Luminance and 3D

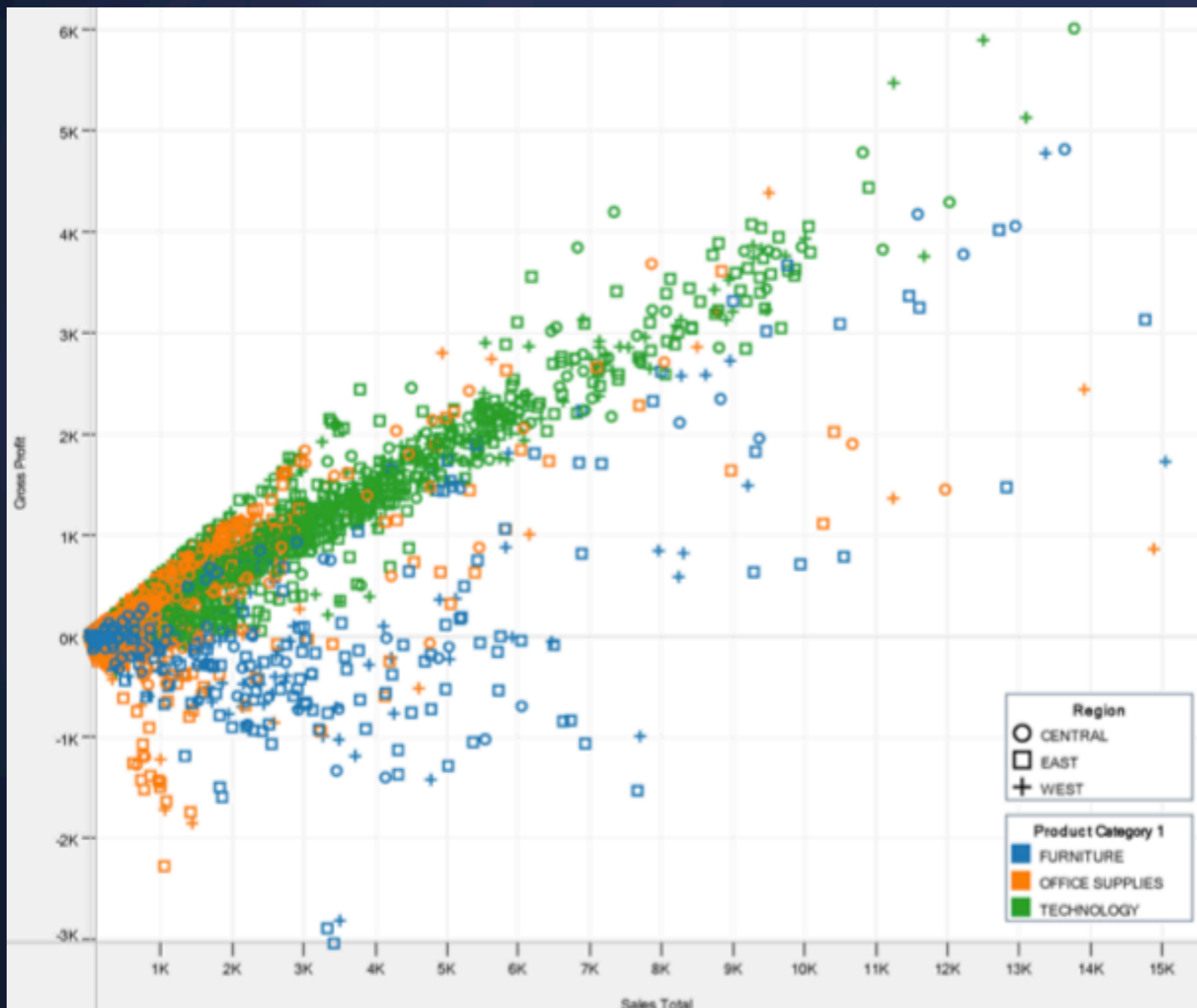
Contrast is not enough



# **When to use color**

# To Label

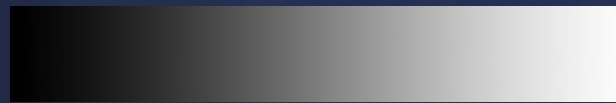
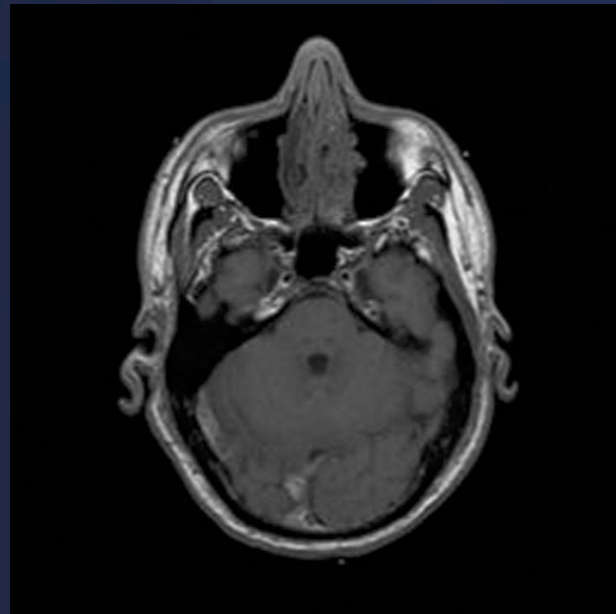
## Product Categories



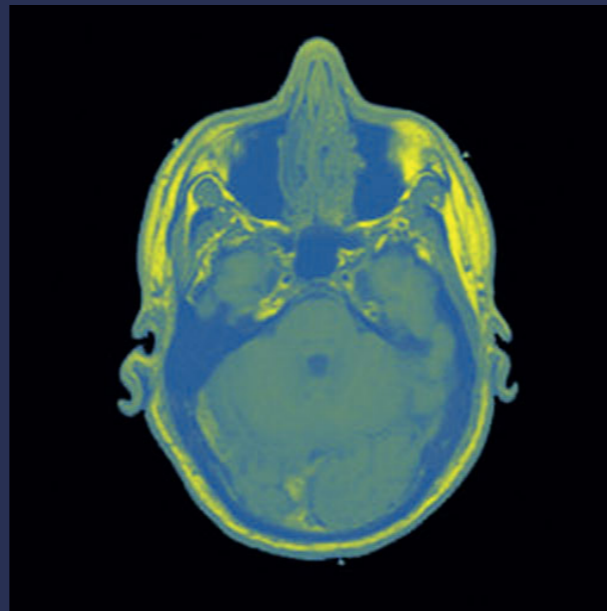
Categorical Data

# To Measure

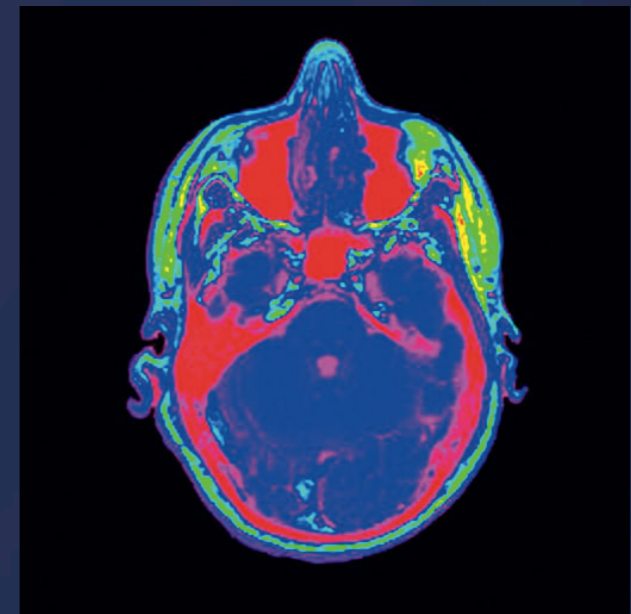
Data to Color; different scales



Lightness Scale



Lightness scale with  
hue and chroma  
variation

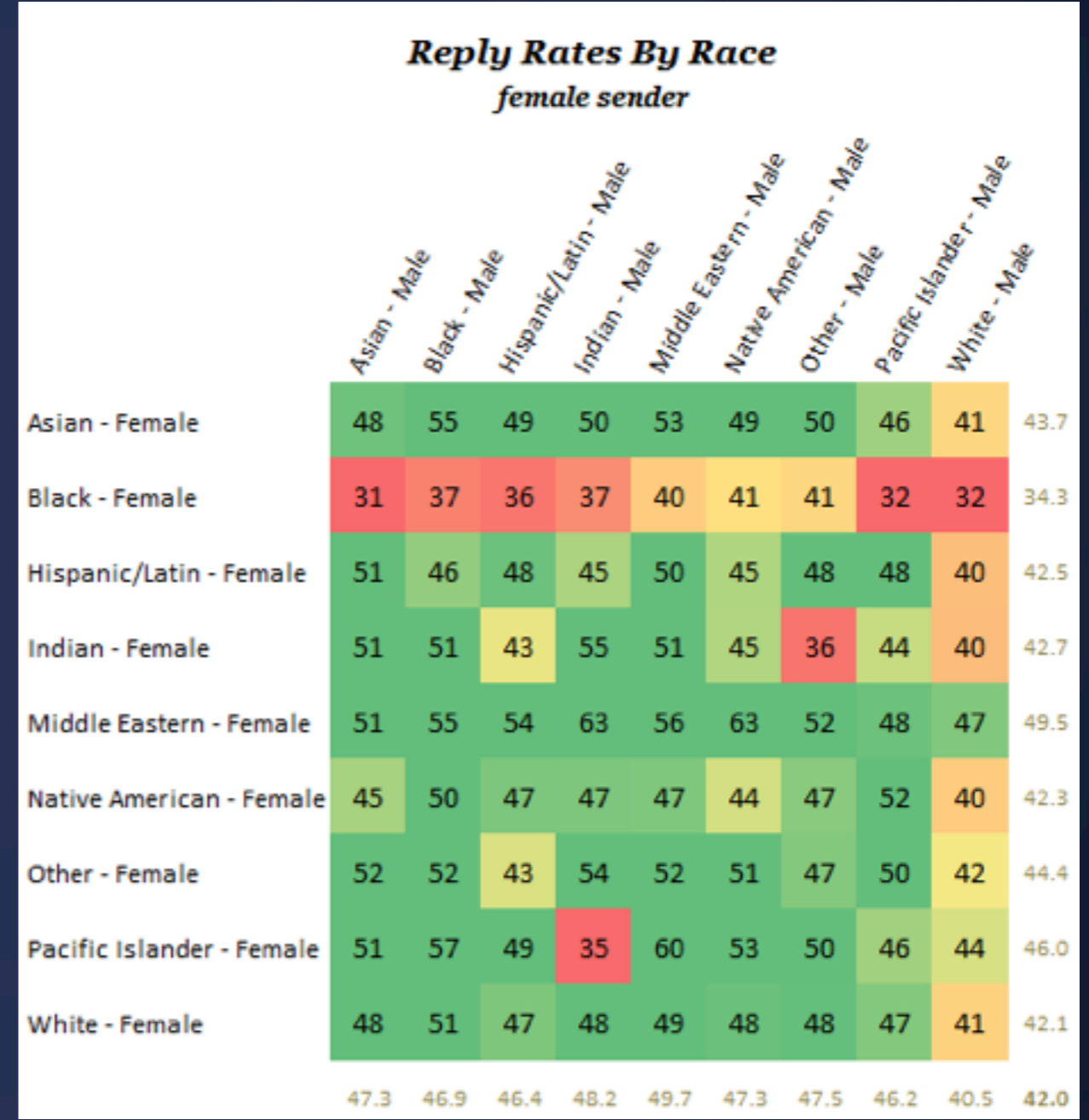


Hue scale with  
lightness variation



# To Measure

Data to Color: Hue scale with three colors



# Sequential Color Scales

Ordinal and Continuous Data

RGB



Lab



HSL



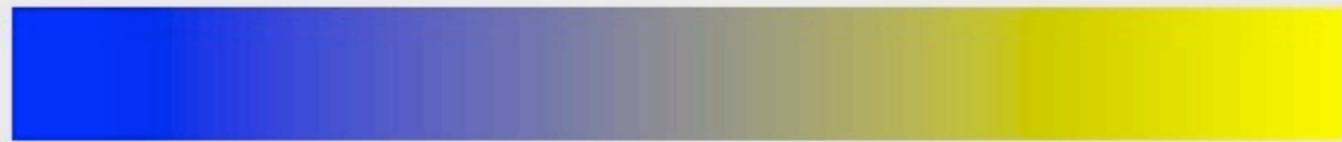
HCL



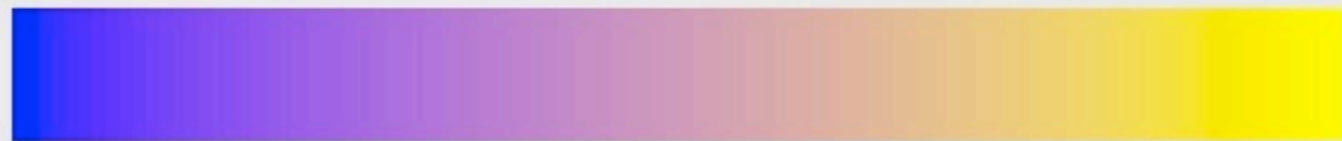
# Sequential Color Scales

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

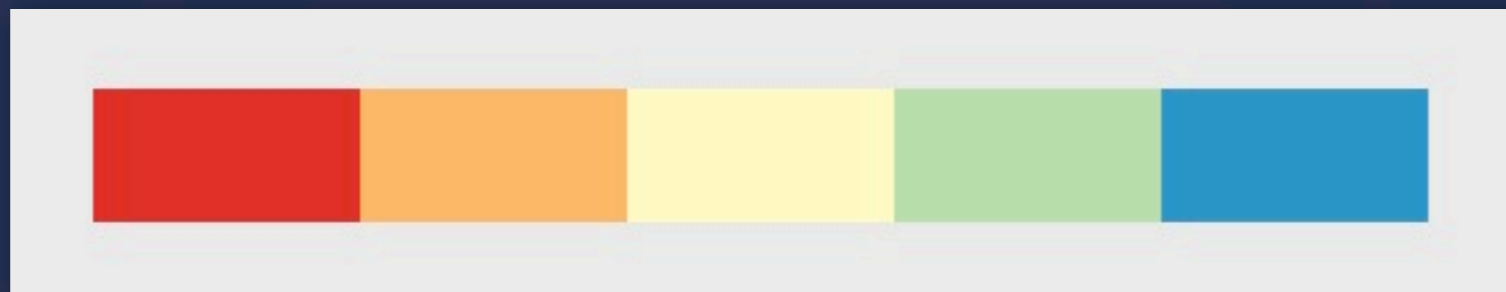


HCL



# 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 Cynthia Brewer): Focus on legibility

The image shows the Color Brewer 2.0 web application interface. The main area displays a map of the United States with a sequential color scale from yellow to red. The interface includes several control panels on the left:

- number of data classes on your map:** Set to 3.
- the nature of your data:** Set to sequential.
- pick a color scheme: YlOrRd**
- pick a color system:** RGB selected. Values: 255, 237, 160 (yellow), 254, 178, 76 (orange), 240, 59, 32 (red).
- adjust map context:** borders checked.
- select a background:** solid color selected.

Additional features include a "SCORE CARD" on the right, "EXPORT YOUR COLORS >>" at the bottom, and navigation links for "how to use", "updates", and "credits".

# Good Color Scales

Adobe Kuler: Focus on aesthetics

The screenshot displays the Adobe Kuler web interface. At the top left is the 'ku kuler' logo. On the right side, there are links for 'Register' and 'Sign In'. The main interface is divided into several sections:

- Create:** A list of options including 'From a Color', 'From an Image', 'Themes', 'Community', 'Pulse BETA', and 'Links'.
- Select a Rule:** A list of color rules including 'Analogous', 'Monochromatic', 'Triad', 'Complementary', 'Compound', 'Shades', and 'Custom'. The 'Analogous' rule is currently selected.
- Color Wheel:** A circular color wheel with a white center and a white border. A red circle is placed on the wheel, and several lines radiate from it to other colors, representing an analogous color scale. Below the wheel is a horizontal slider with a red line and a white triangle.
- Form Fields:** A 'Title:' text input field, a 'Save' button, and radio buttons for 'Public' and 'Private' visibility settings. Below these is a 'Tags:' text area and a message: 'Please sign in to save your theme.'
- Color Scale:** A horizontal bar with five color swatches: dark red, orange, red, magenta, and bright pink. Below this bar are three horizontal sliders with white triangles, used for adjusting the width and position of the color swatches. The first slider is labeled 'Base Color'.

# Good Color Scales

I Want Hue: Focus on maximizing distinction, good for categorical data



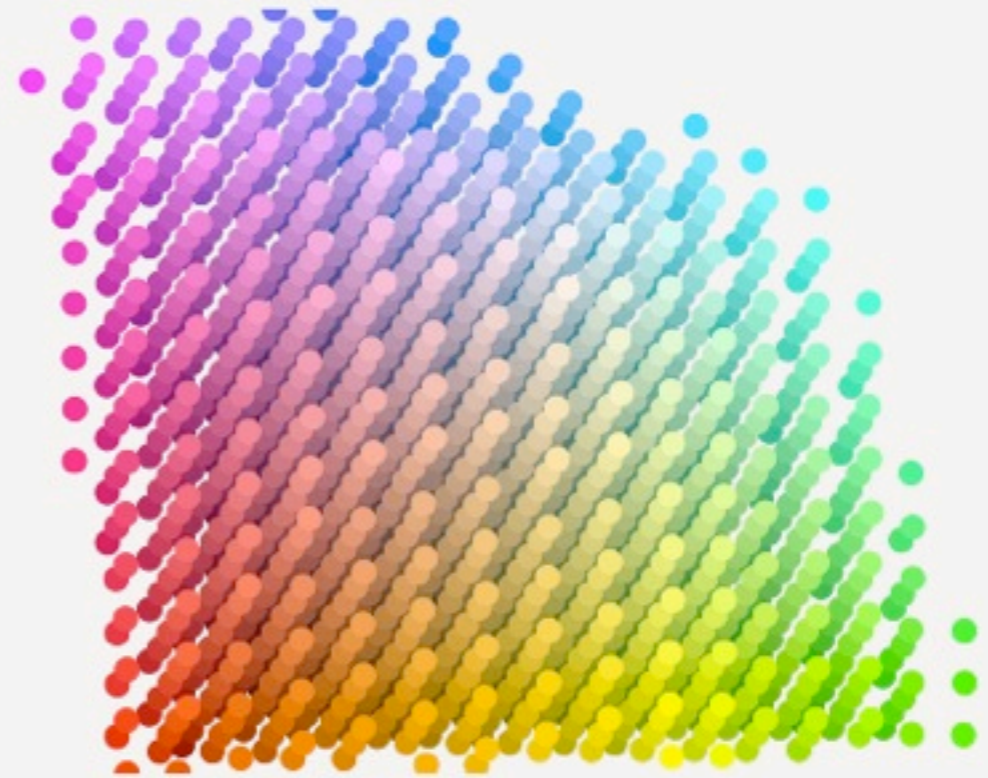
i want hue

## Color space

Presets...



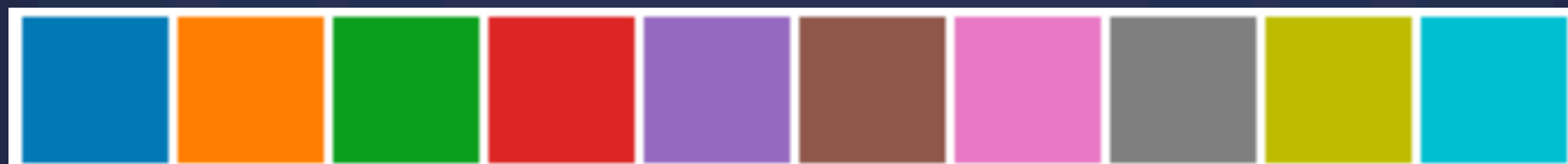
Dark background



# Good Color Scales

D3 color palettes: Cookie cutter solution

```
d3.scale.category10()
```

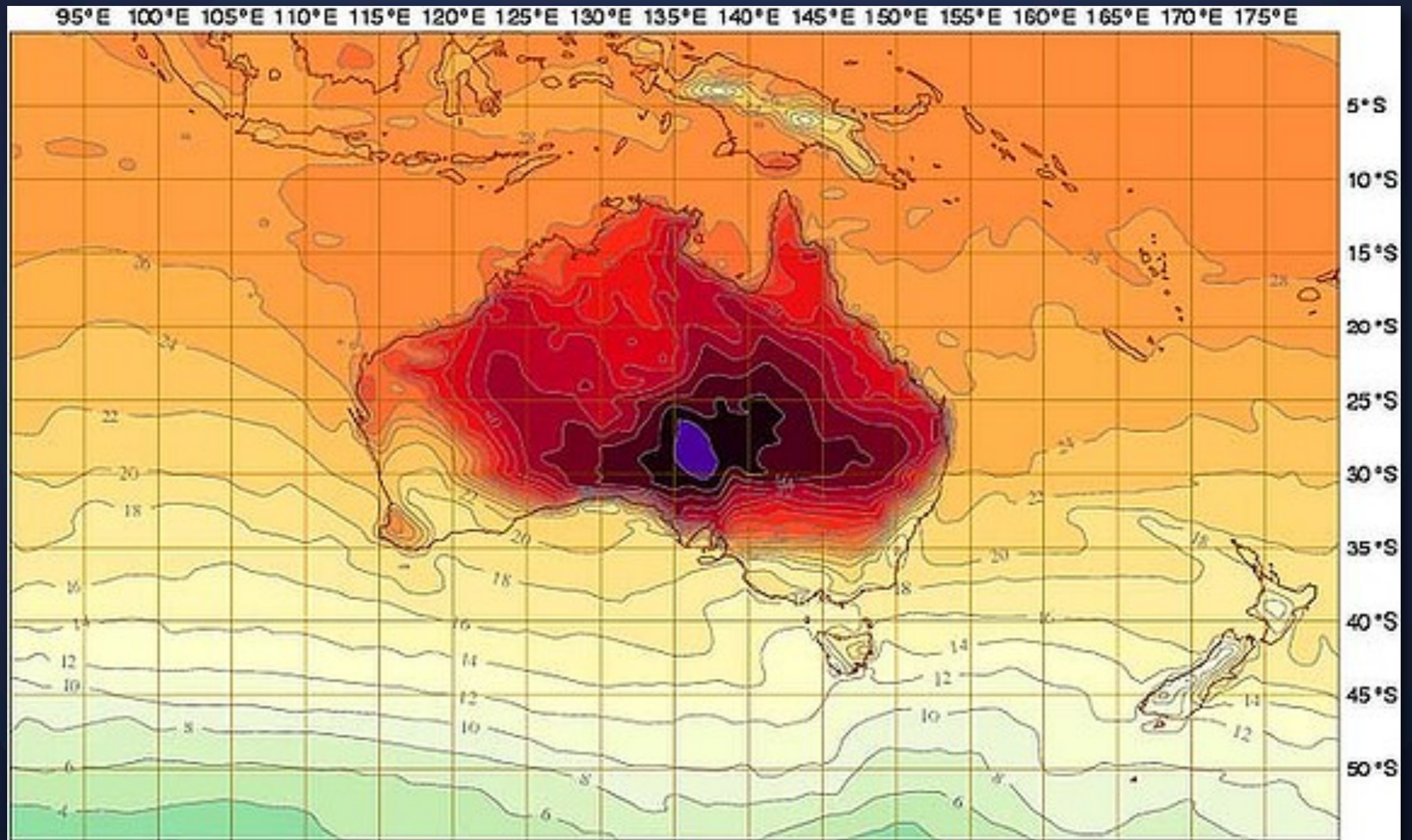


# Examples

Good or bad?

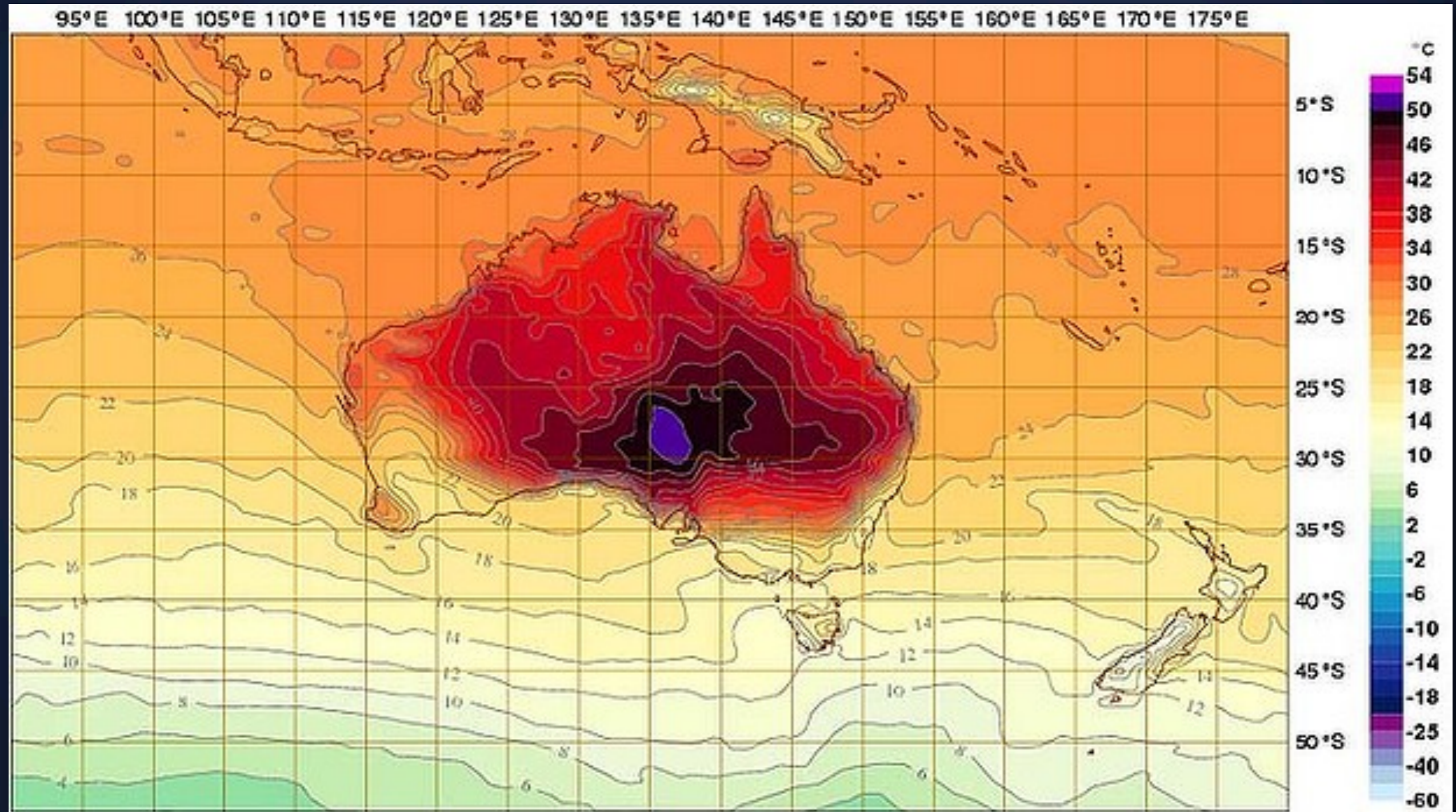
# “Deep Purple”

Australia Bureau of Meteorology



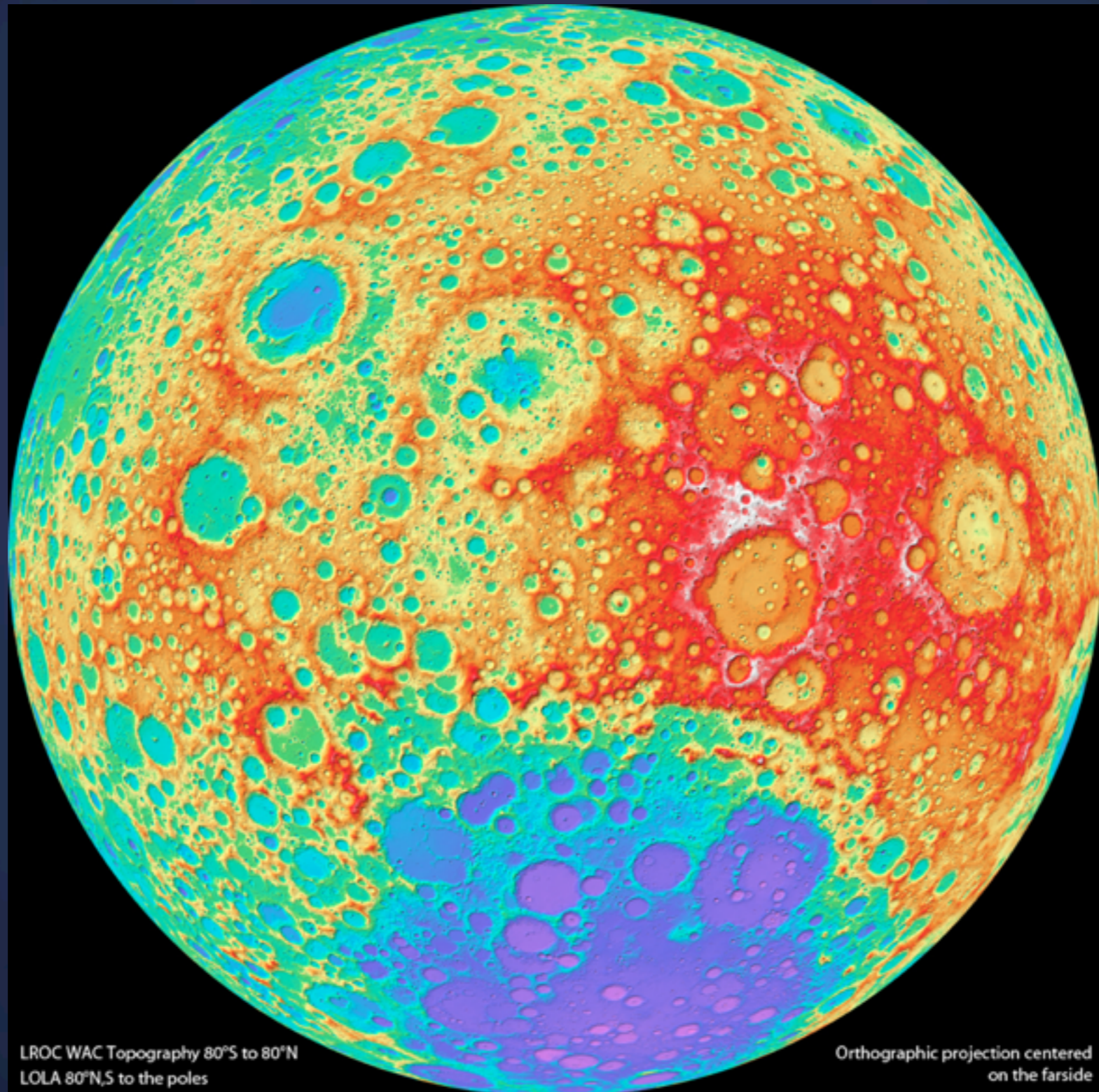
# “Deep Purple”

Australia Bureau of Meteorology



# Topography of The Moon

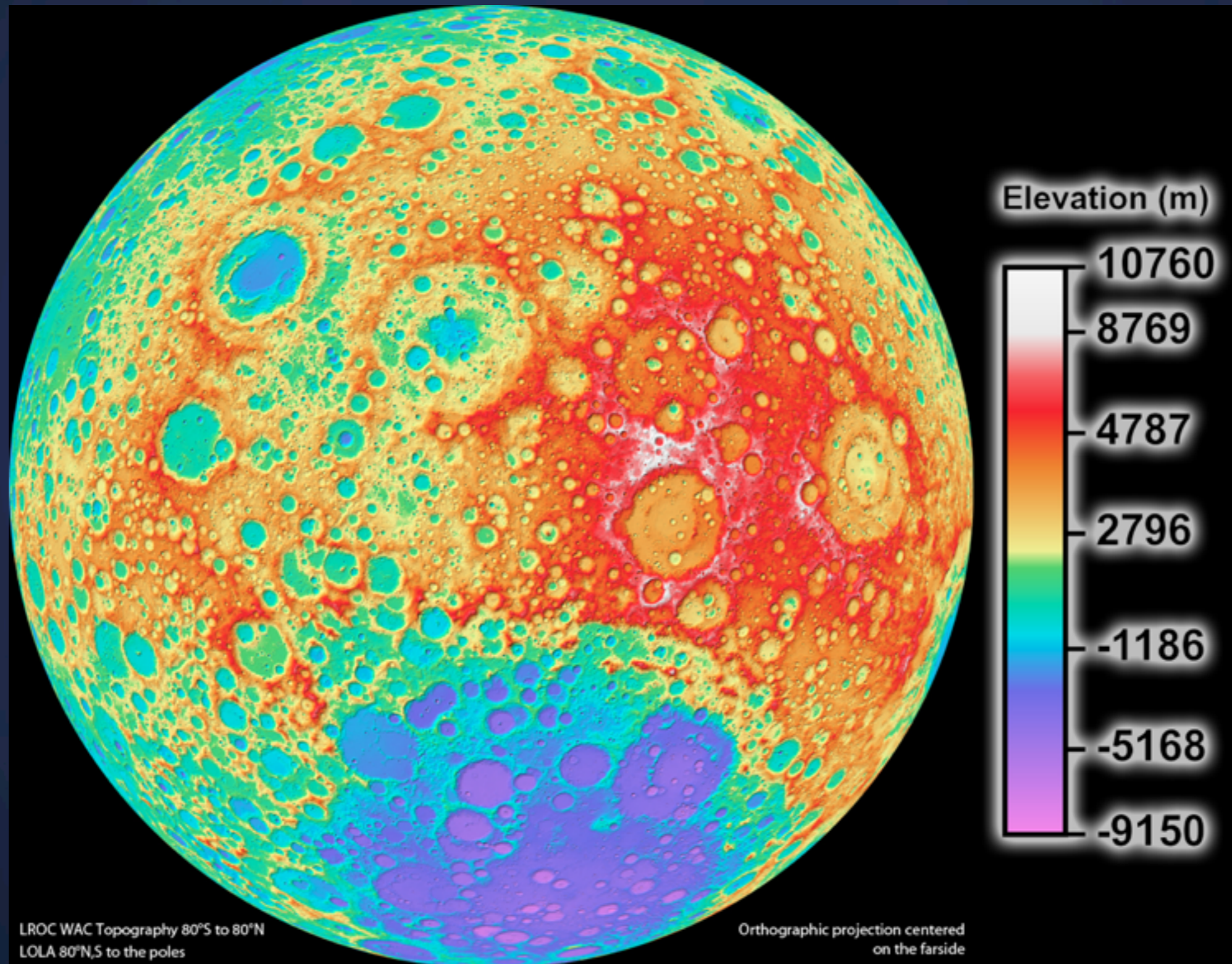
NASA





# Topography of The Moon

NASA





# OECD Better Life Index

## 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.



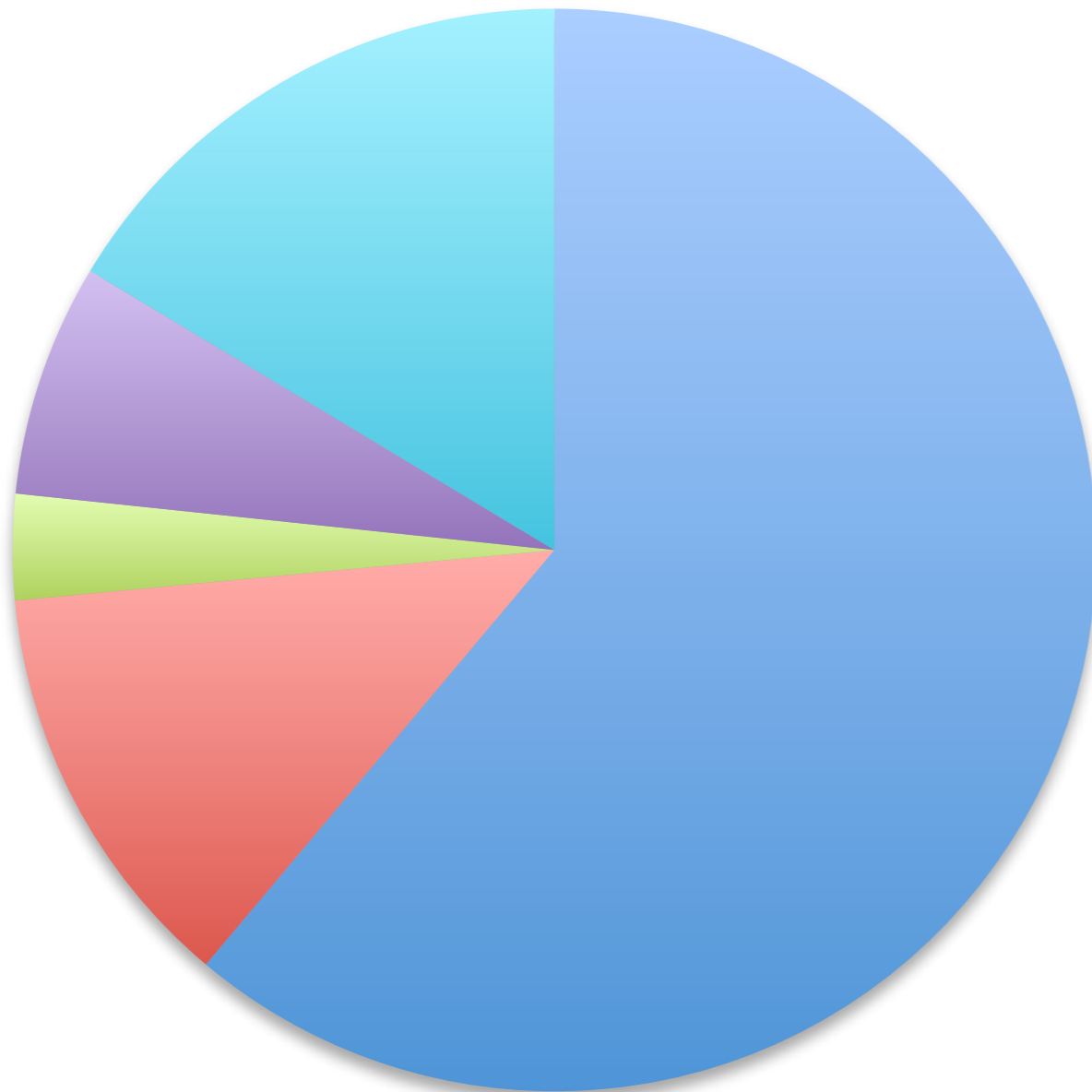
## Create Your Better Life Index

Rate the topics according to their importance to you:

Housing	<input type="range"/>
Income	<input type="range"/>
Jobs	<input type="range"/>
Community	<input type="range"/>
Education	<input type="range"/>
Environment	<input type="range"/>
Civic Engagement	<input type="range"/>
Health	<input type="range"/>
Life Satisfaction	<input type="range"/>
Safety	<input type="range"/>
Work-Life Balance	<input type="range"/>

# Standard Pie Chart

Excel for Mac 2011



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

# Lab Thursday

D3.js

# **Next Lecture**

**Interaction**