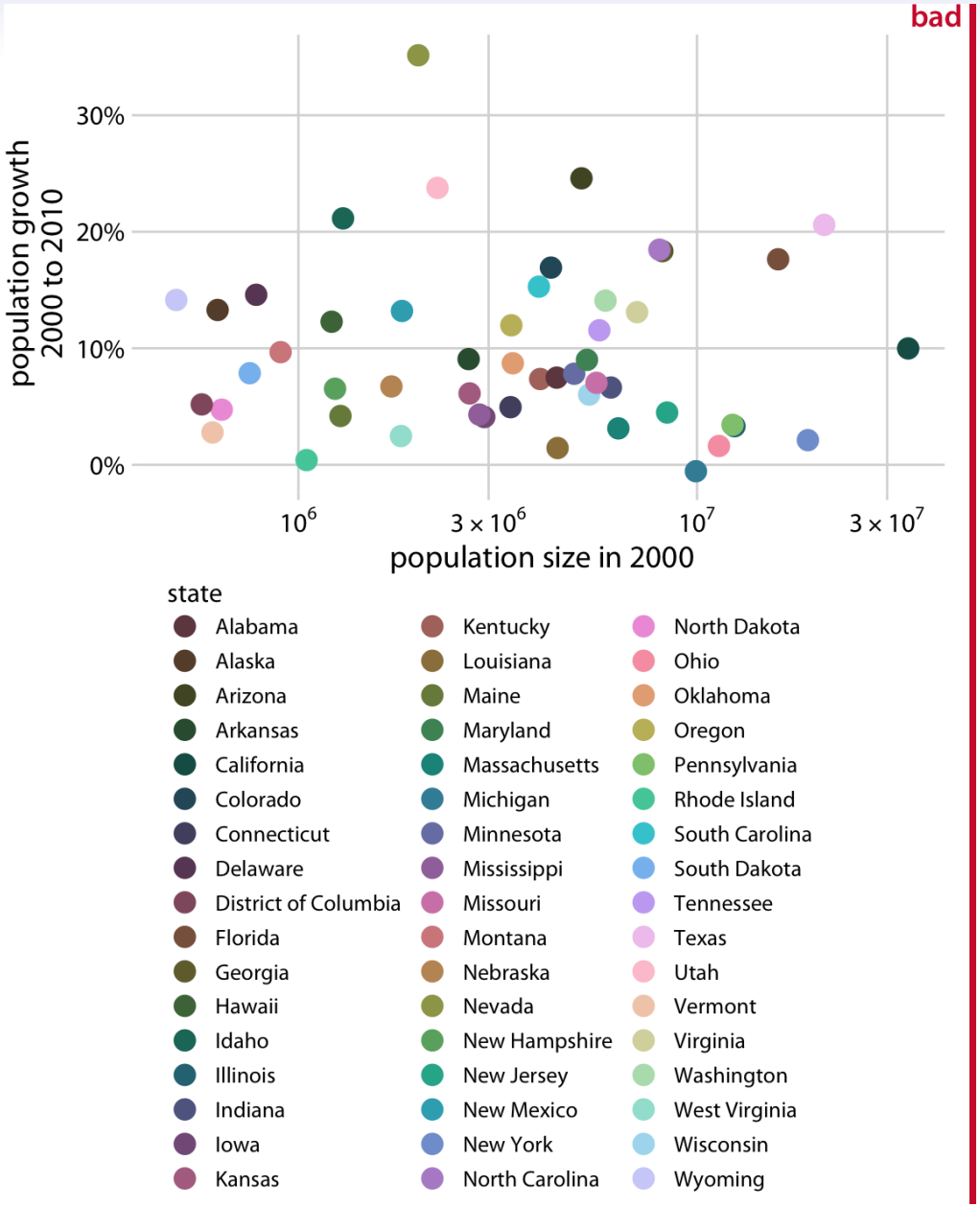
# Chapter 19
# Common pitfalls of color use

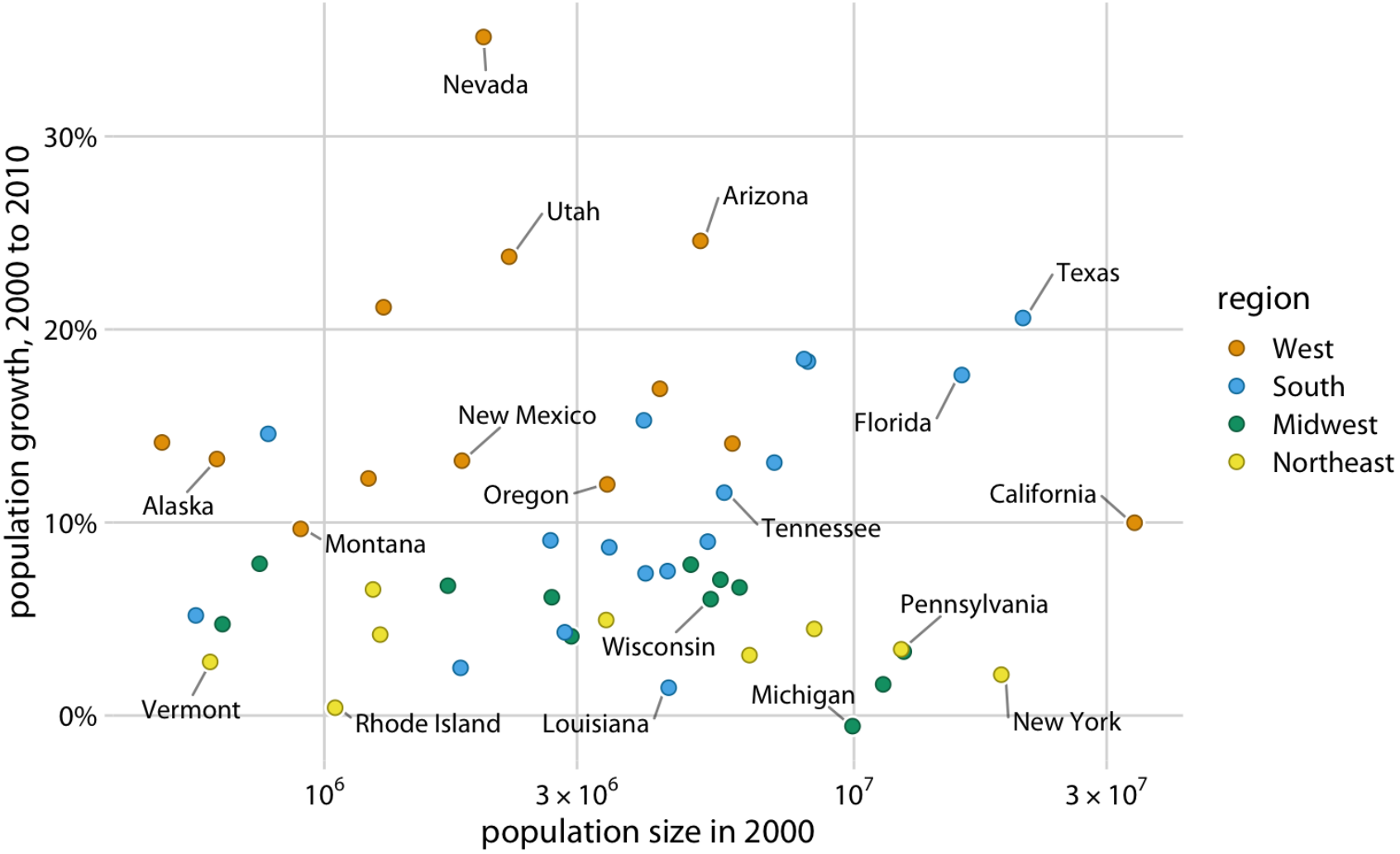
Fundamentals of Data Visualization

May 6, 2023

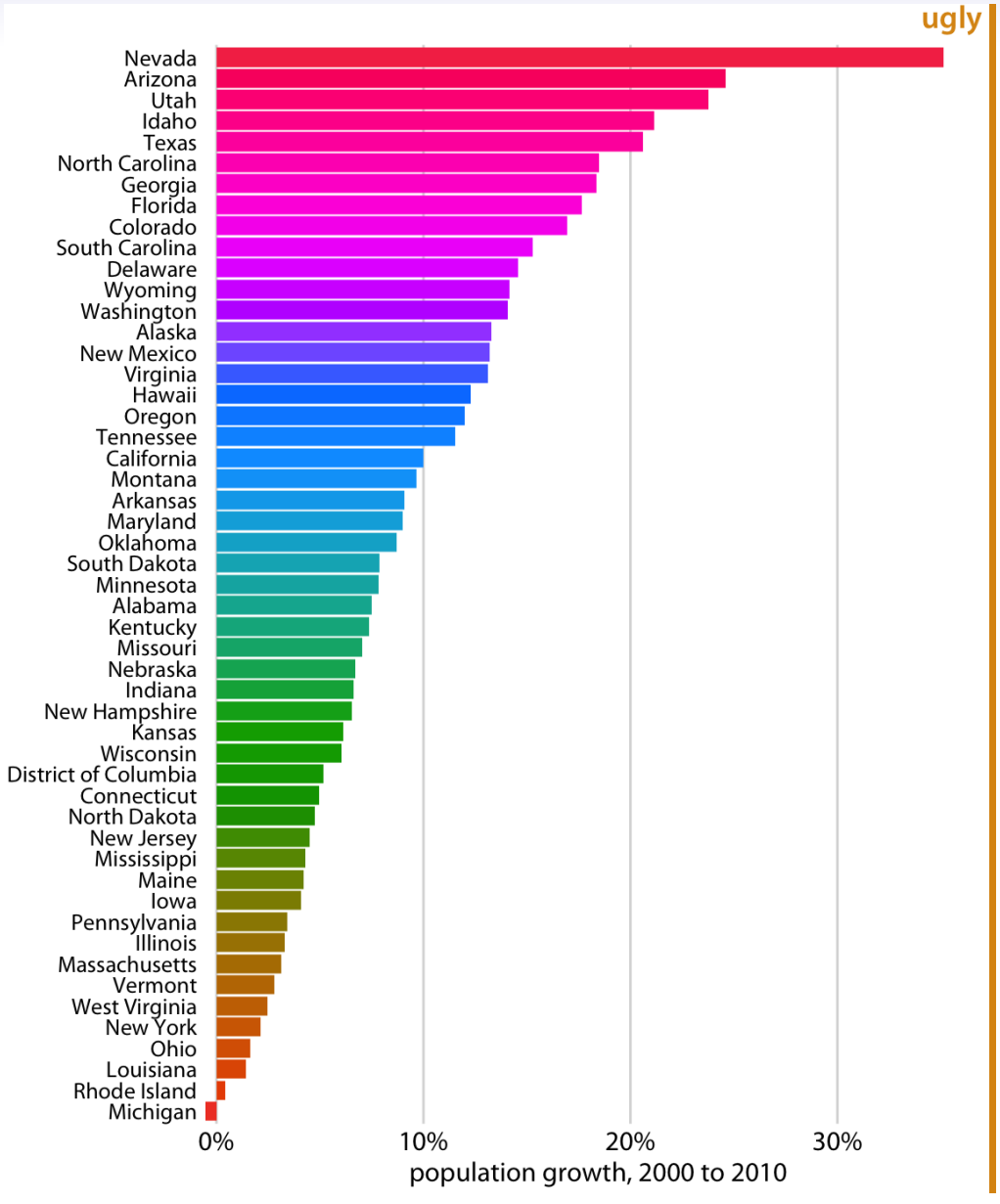



- Pitfalls of color use:
- too much information.

# Direct labelling




- Use direct labeling instead of colors when you need to distinguish between more than about eight categorical items.




- Pitfalls of color use:
  - color with no purpose.
- Avoid large filled areas of overly saturated colors. They make it difficult for your reader to carefully inspect your figure.

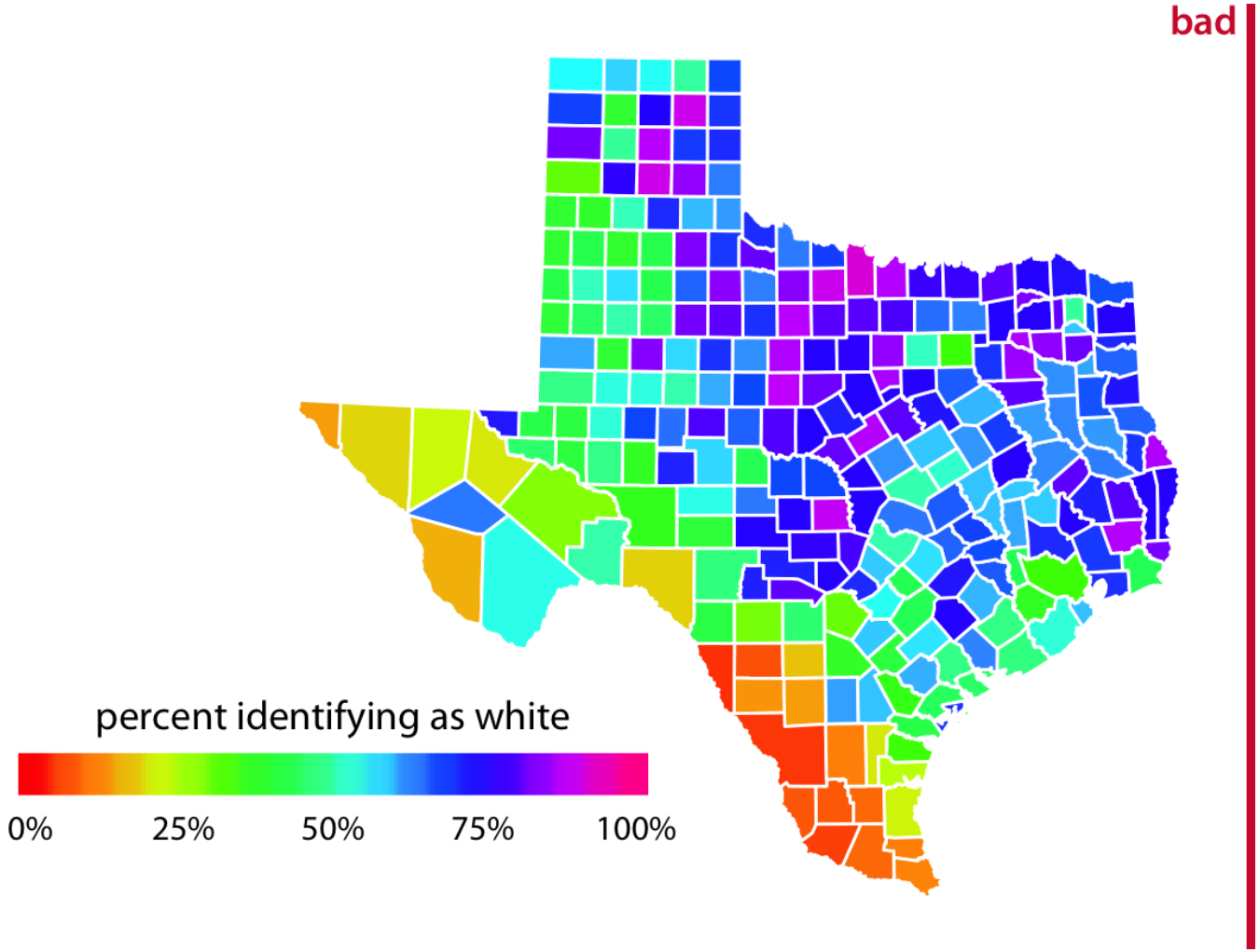
# Non-monotonic color scales

rainbow scale

rainbow converted to grayscale

- Colors at two ends are the same.
- Areas where colors change rapidly.
- Areas where colors change slowly.
- Grayscale shows the brightness changes randomly.

# Rainbow scale




- Painful to look at for a long time.
- Highlights some things, obscures others.

# Color blindness

- deuteranomaly/deuteranopia: difficulty seeing green
- protanomaly/protanopia: difficulty seeing red
- tritanomaly/tritanopia: difficulty seeing blue
- anomaly: some impairment in the perception
- anopia: complete absence of perception of that color
- Approximately 8% of males and 0.5% of females suffer from some sort of color-vision deficiency
- red/green deuteranomoly is most common form

# Three fundamental types of color scales

- sequential scales
- diverging scales
- qualitative scales

# Sequential scales

original

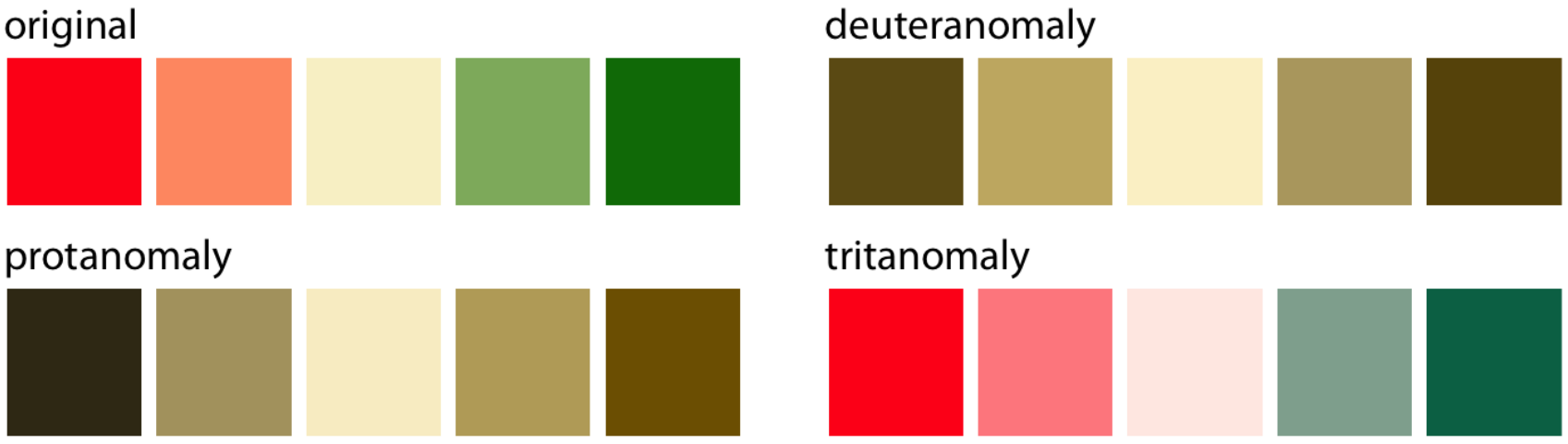
deuteranomaly

protanomaly

tritanomaly

- Clear gradient from dark to light with all deficiencies.
- Safe to use

# Diverging scales: red-green




- Not safe for deutans and protans.

# Diverging scales: blue-green

original

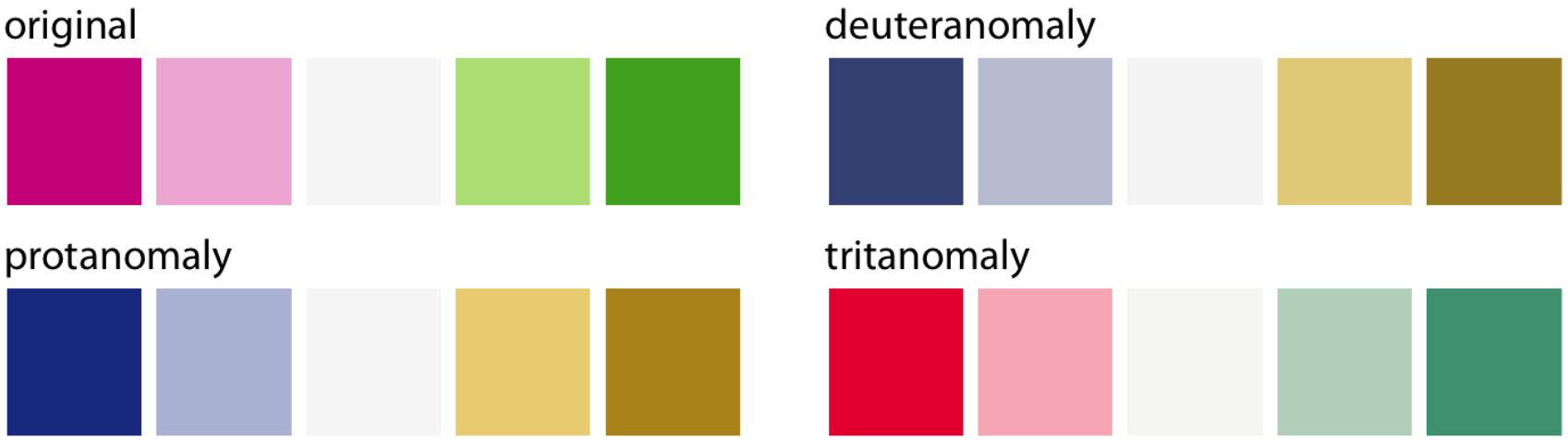
deuteranomaly

protanomaly

tritanomaly

- Not safe for tritans.

# Diverging scales: pink to yellow-green




- ColorBrewer PiYG (pink to yellow-green) scale.
- Looks red/green to normal color vision.
- Still distinguishable for people with cvd.

# Qualitative scales: difficult challenge


- Okabe-Ito works well for all cvd
- You should not be using more than 8 qualitative colors anyway.

`http://jfly.iam.u-tokyo.ac.jp/color/`

# Colors don't work well with thin lines and small dots

original

deuteranomaly

protanomaly

tritanomaly

# Use a cvd simulator

- https://www.color-blindness.com/coblis-color-blindness-simulator/