

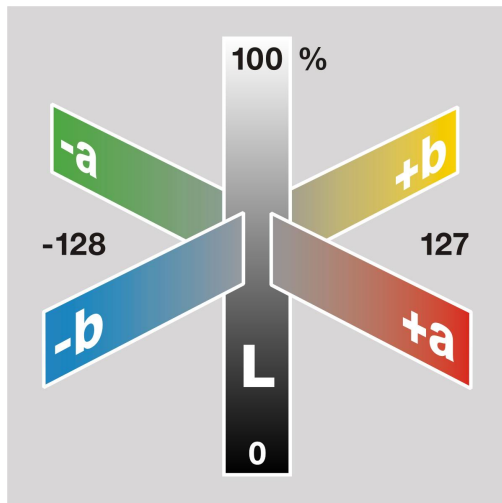
# Perceptions of matplotlib colormaps

Kristen M. Thyng

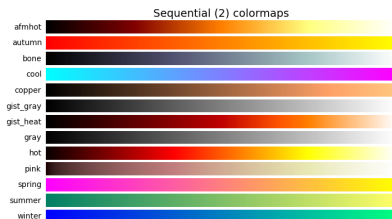
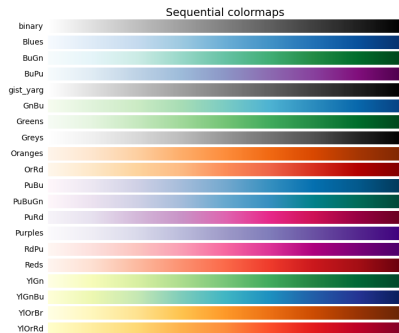
Texas A&M University

July 10, 2014

# CIELAB Color Model

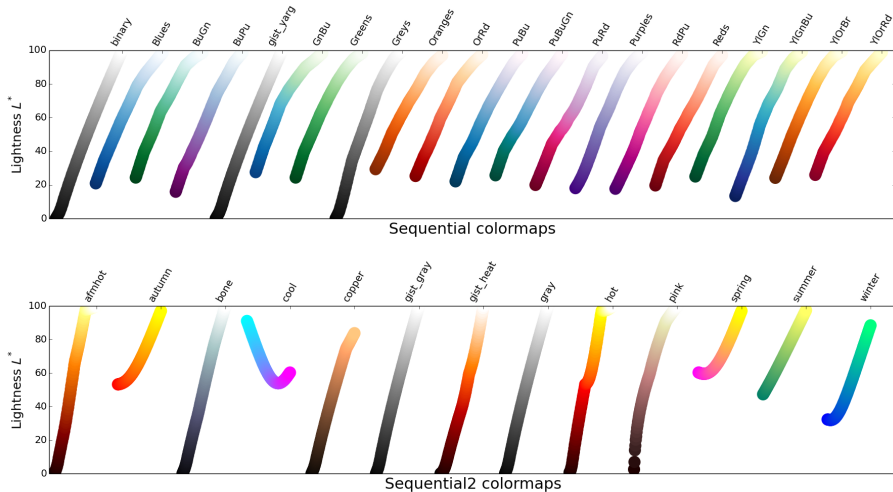


# Lightness of matplotlib Colormaps

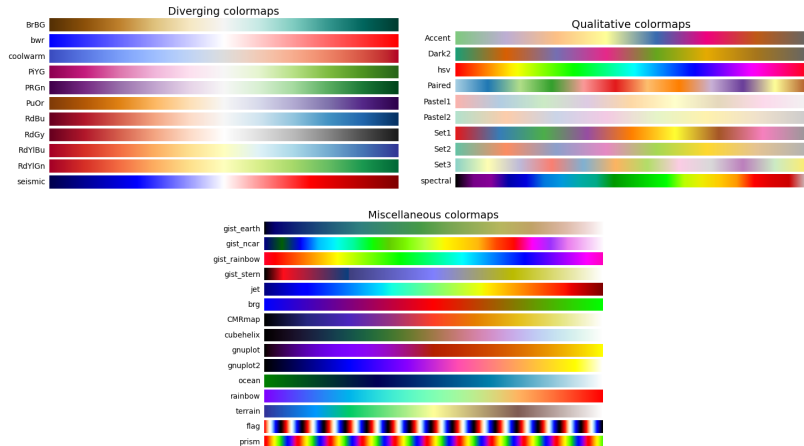


[http://matplotlib.org/examples/color/colormaps\\_reference.html](http://matplotlib.org/examples/color/colormaps_reference.html)

# Lightness of matplotlib Colormaps

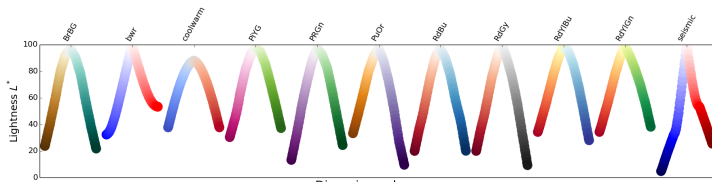


# Lightness of matplotlib Colormaps

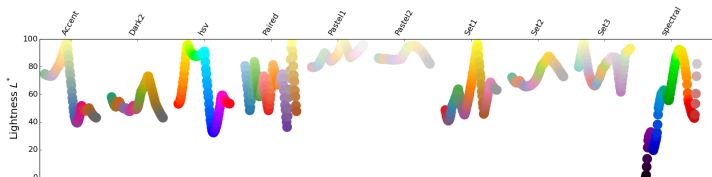


[http://matplotlib.org/examples/color/colormaps\\_reference.html](http://matplotlib.org/examples/color/colormaps_reference.html)

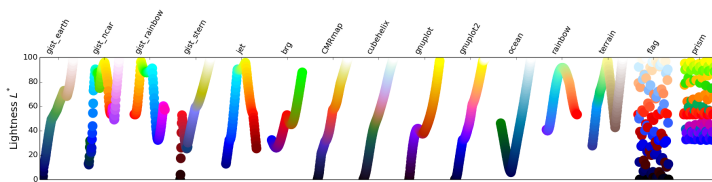
# Lightness of matplotlib Colormaps



Diverging colormaps

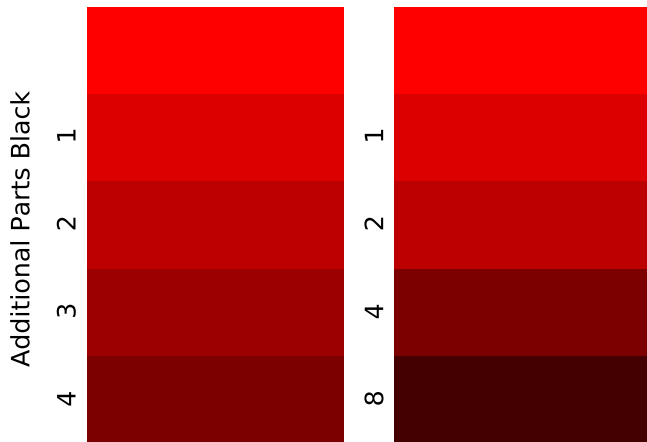


Qualitative colormaps



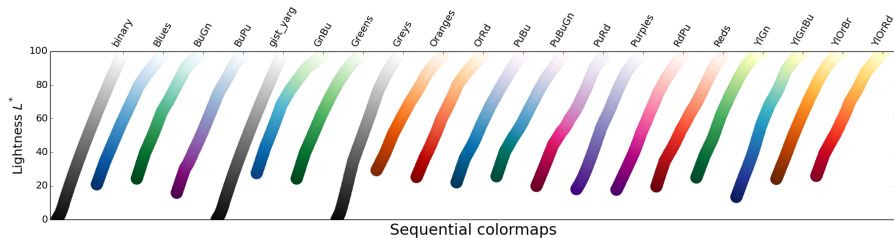
Miscellaneous colormaps

# Perceived Lightness: Weber-Fechner Law (and Stevens)



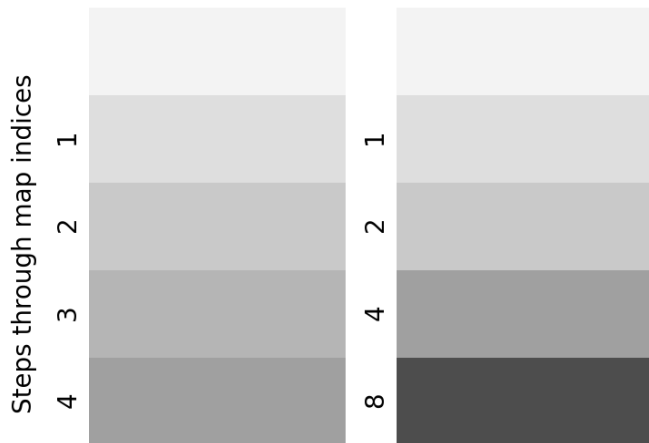
Albers, J. (1975). Interaction of color. Yale University Press.

# Improvement to Binary Colormap?





# Improvement to Binary Colormap?

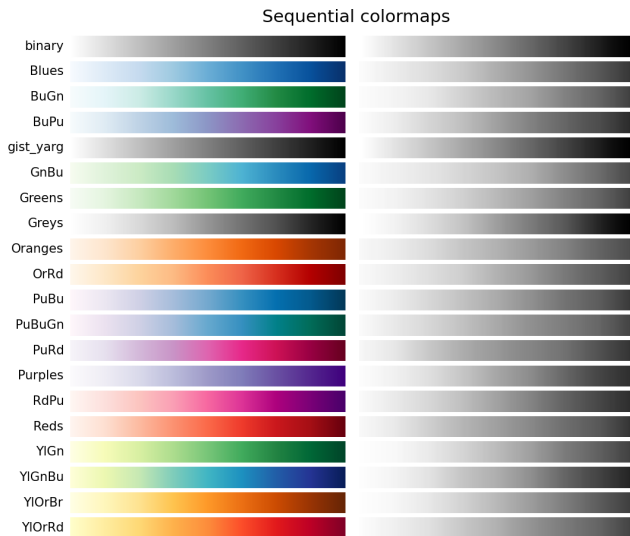


# Printing to Grayscale

- Lots of ways to convert to grayscale
- $\text{Gray} = (\text{Red} * 0.2126 + \text{Green} * 0.7152 + \text{Blue} * 0.0722)$  (or similar\*)
- Use luminance

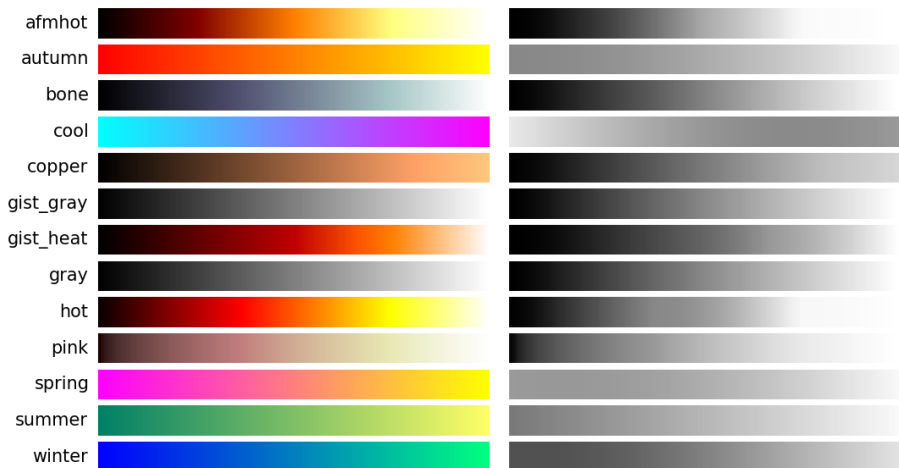
\* <http://www.tannerhelland.com/3643/grayscale-image-algorithm-vb6/>

# matplotlib Colormaps in Grey Scale



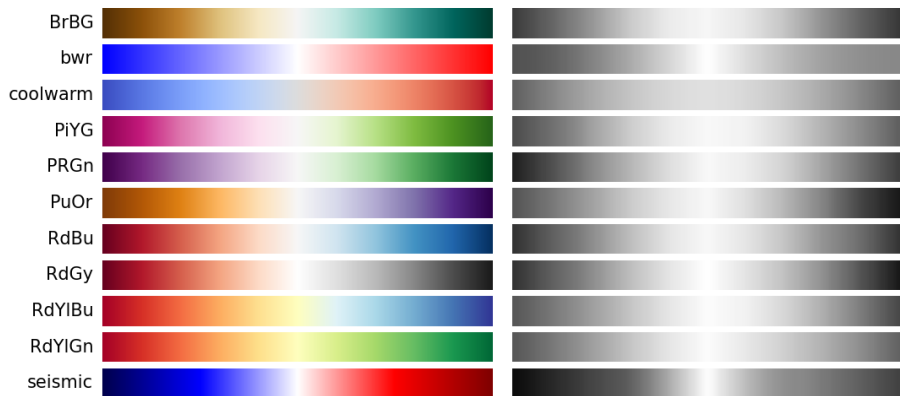
# matplotlib Colormaps in Grey Scale

Sequential (2) colormaps



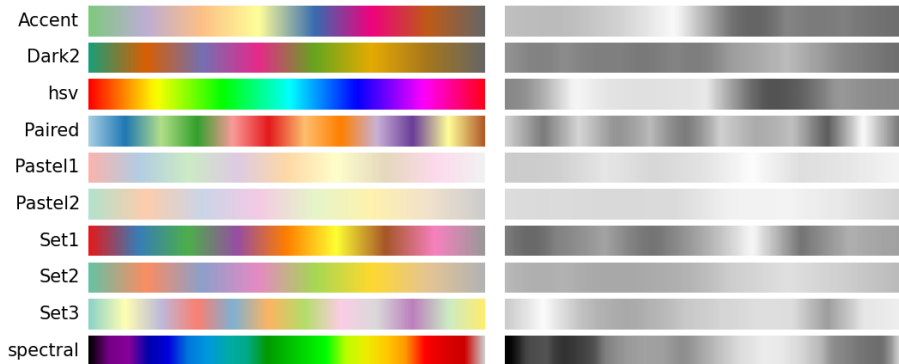
# matplotlib Colormaps in Grey Scale

## Diverging colormaps

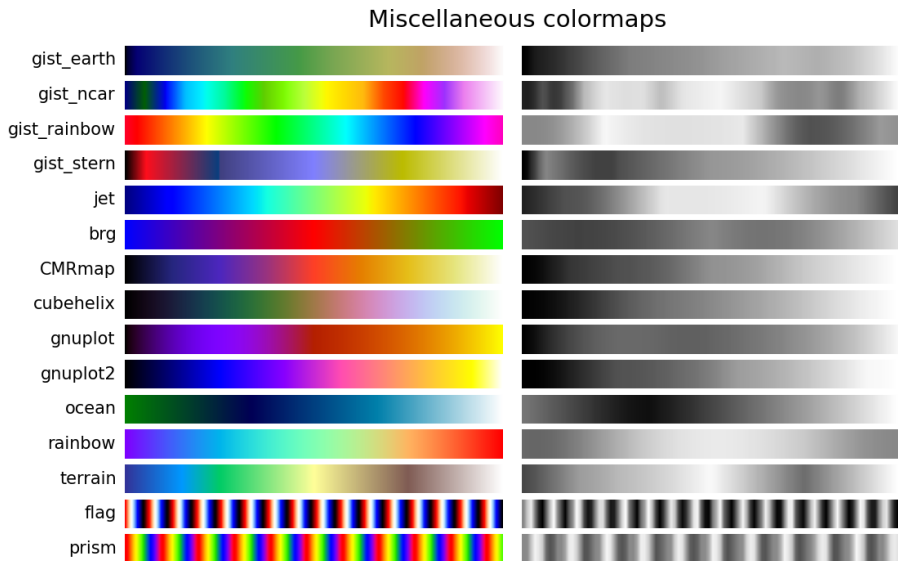


# matplotlib Colormaps in Grey Scale

## Qualitative colormaps

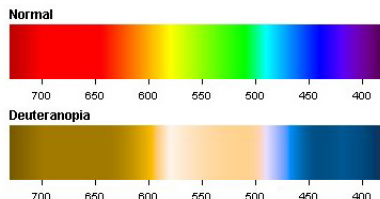


# matplotlib Colormaps in Grey Scale

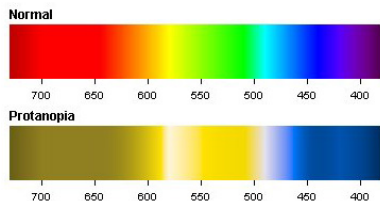


# Color Blindness

Protanopia (2% male population, half mild form)

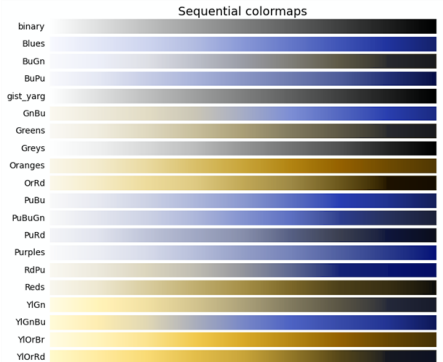
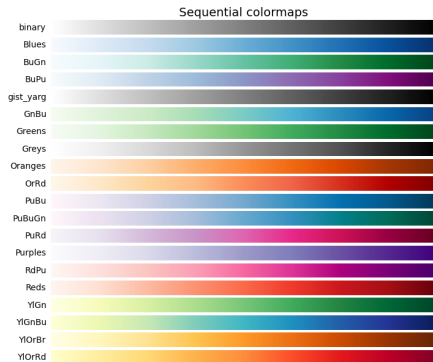


Deuteranopia (6% male population, mostly mild form)

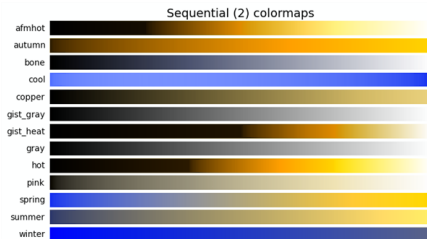
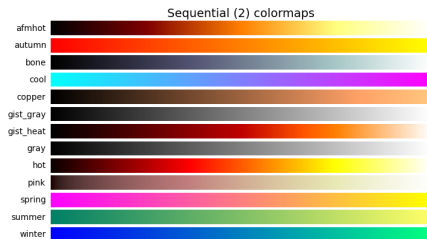




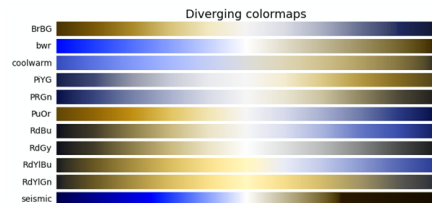
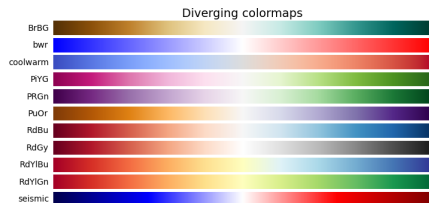
# Color Blindness



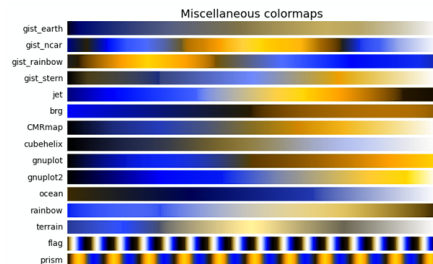
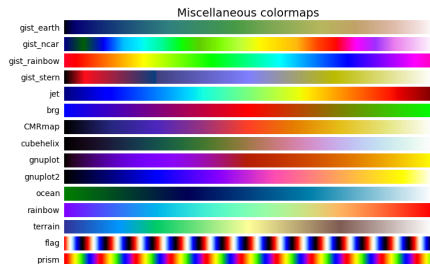
# Color Blindness



# Color Blindness



# Color Blindness



<http://aspnetresources.com/tools/colorBlindness>

# Recommendations

- Best colormap depends on application, but for form information, perceptual colormaps are best
- Perceptual colormaps monotonically increase with lightness
- Not clear (to me) what functional relationship with L is best
- Many ways to convert to grayscale — luminance is a good proxy to decide on a good map
- Most common color blindness problem is red-green — try to avoid for reaching audiences most effectively

All around helpful information on colormaps:

Matteo Niccoli: <http://mycarta.wordpress.com/2012/05/29/the-rainbow-is-dead-long-live-the-rainbow-series-outline/>

Comparison of 7 methods of converting to grayscale:

<http://www.tannerhelland.com/3643/grayscale-image-algorithm-vb6/>

Color blindness: <http://www.color-blindness.com>

Link to slides:

<https://github.com/dmcdougall/scipy14-colormaps>