



BERKELEY LAB

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U.S. DEPARTMENT OF
ENERGY

Office of Science

Making colorblind-inclusive figures

Jayson Vavrek

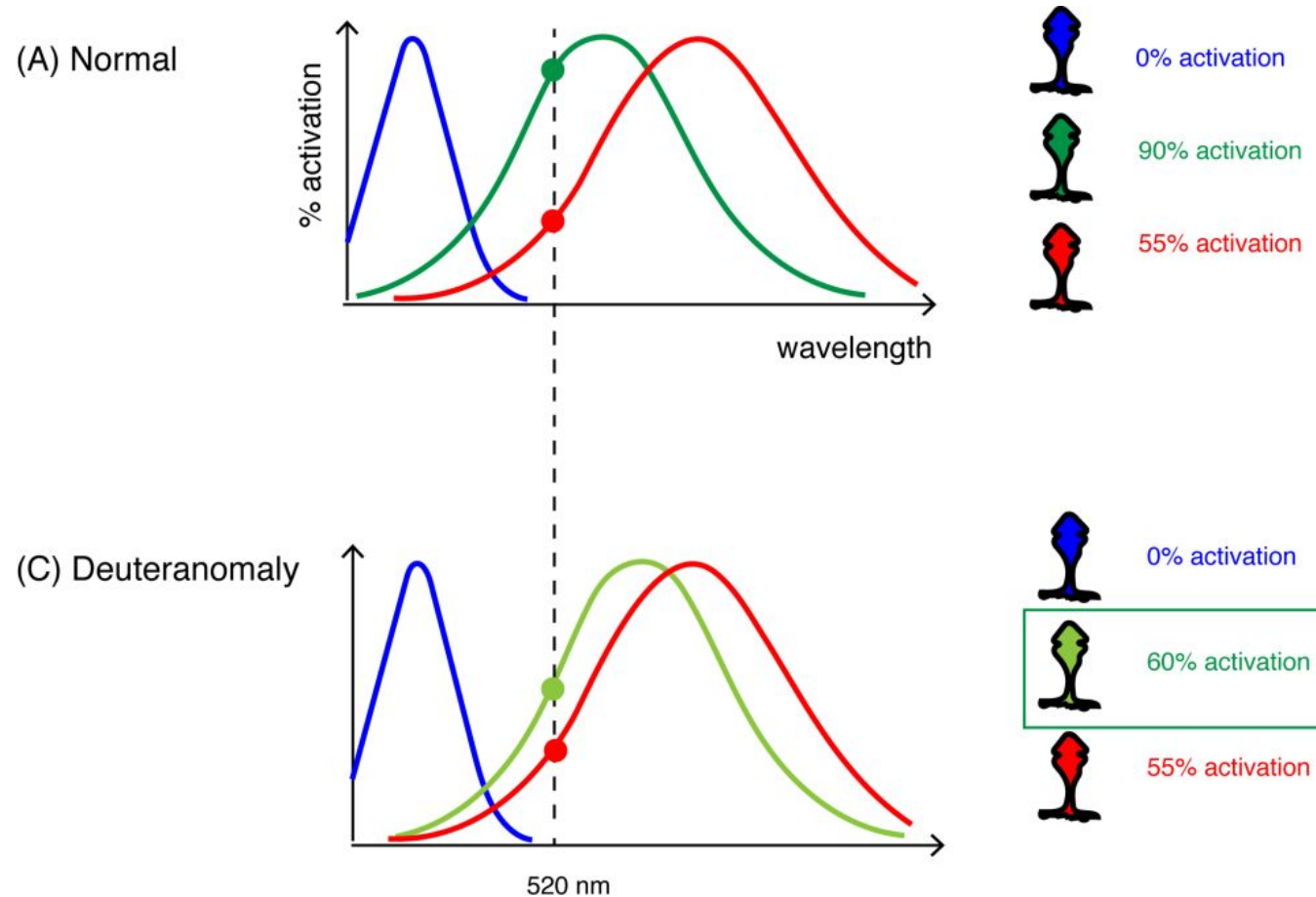
Applied Nuclear Physics | Nuclear Science Division

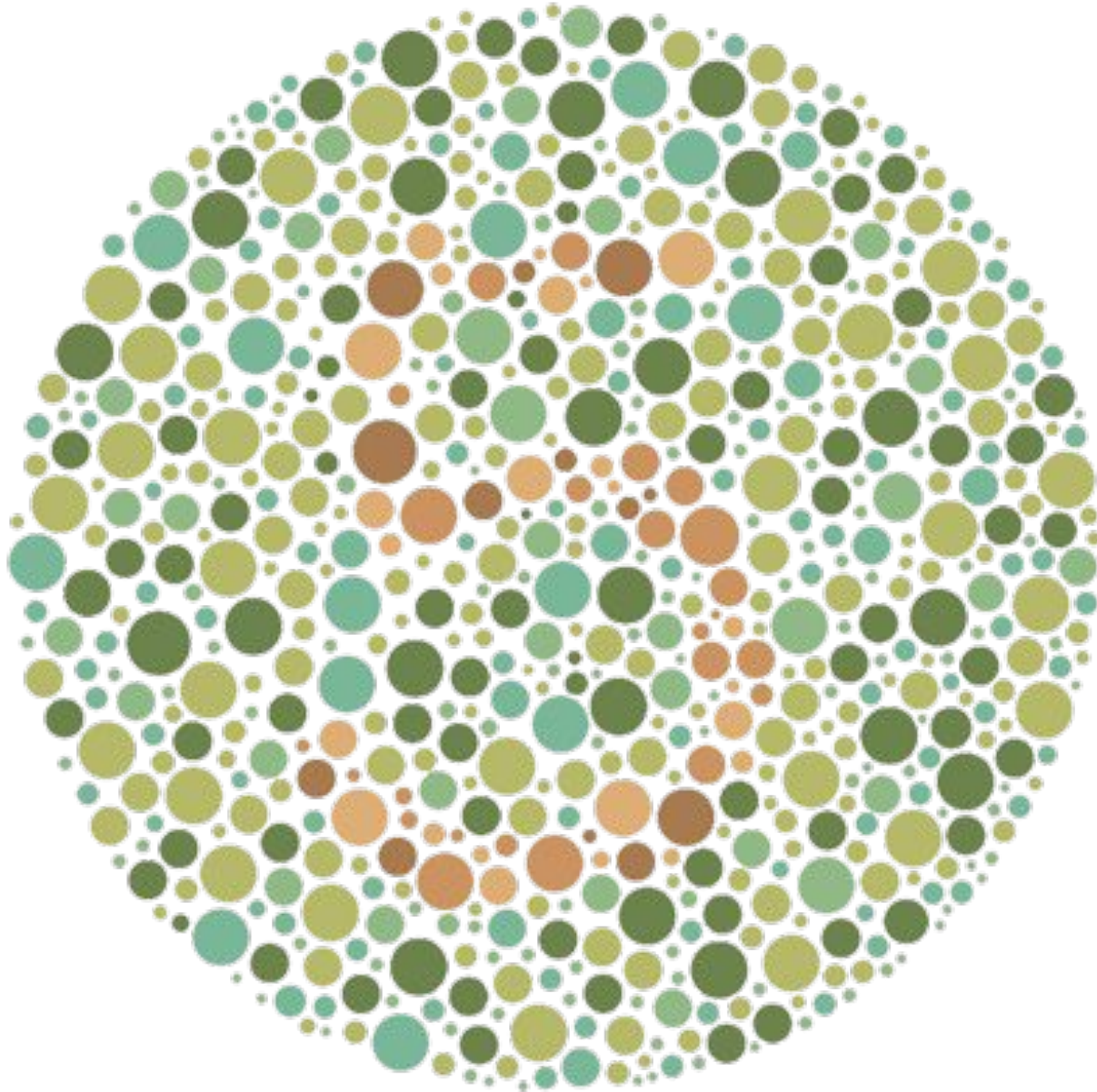
September 27, 2022

NSD IDEA seminar

Biophysics of colorblindness (color vision deficiency)

Cone cell response functions are shifted in wavelength vs normal vision



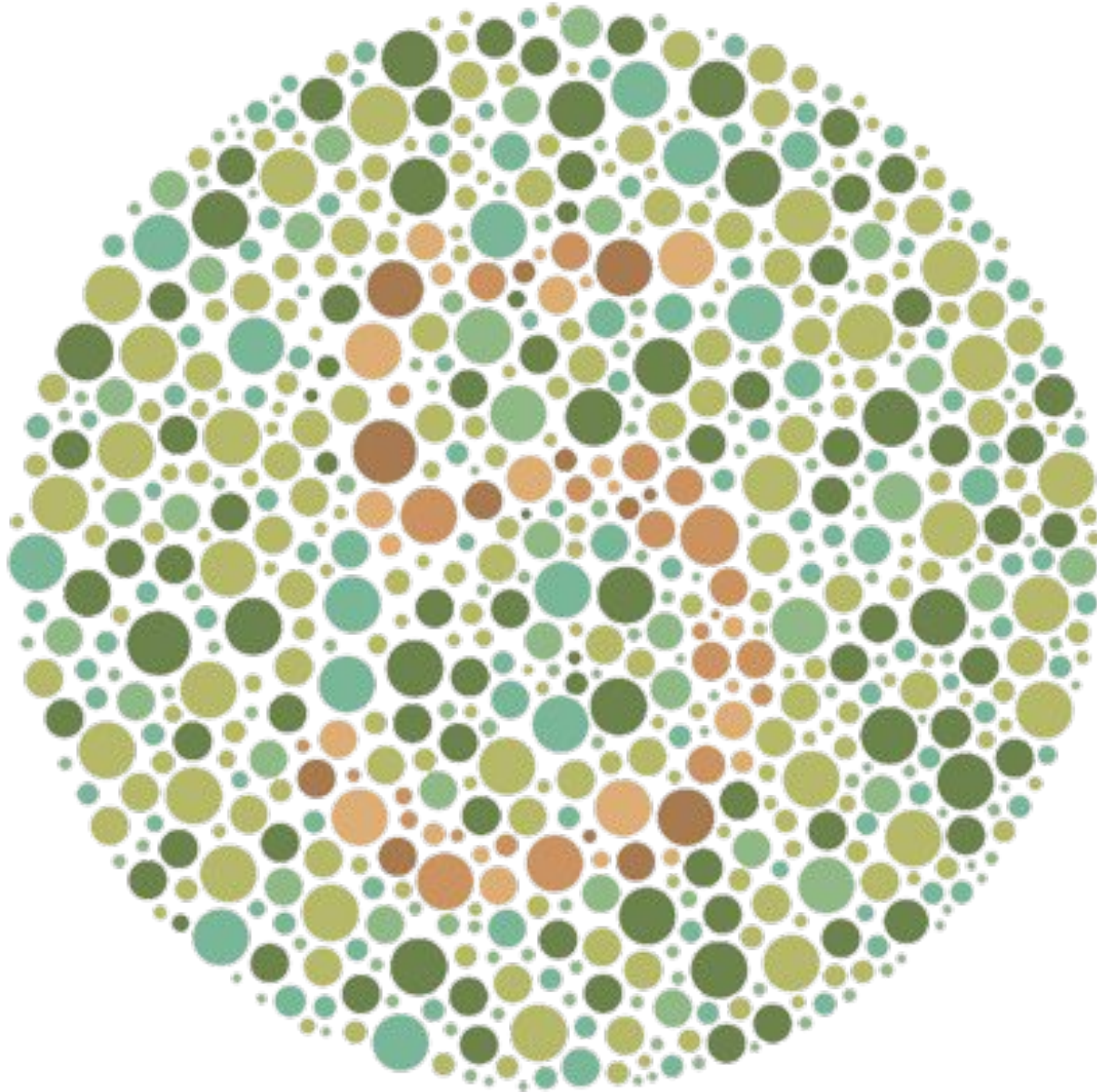


<https://www.clintoneye.com/color-blindness.html>

~5% of people have color vision deficiency (CVD)

- 8% of men
- 0.5% of women

→ A substantial fraction of your audience will have CVD!



<https://www.clintoneye.com/color-blindness.html>

Live demo of Color Oracle

- free software for simulating CVD on-screen
- Windows/Mac/Linux
- <https://colororacle.org/>

Design considerations

Green-good red-bad color coding is confusing



<https://axesslab.com/colorblind-accessibility-web-fail-success-cases/>

Design considerations

Augmenting color with text or symbols can help substantially

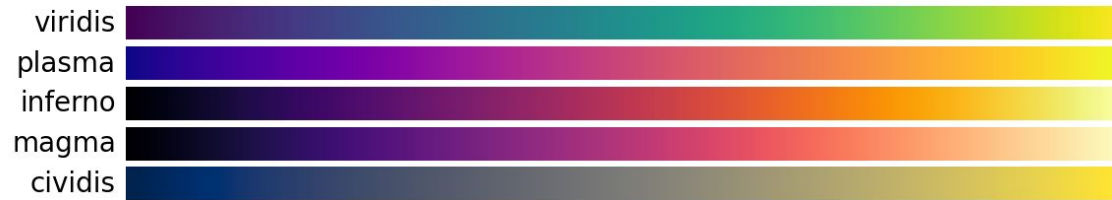


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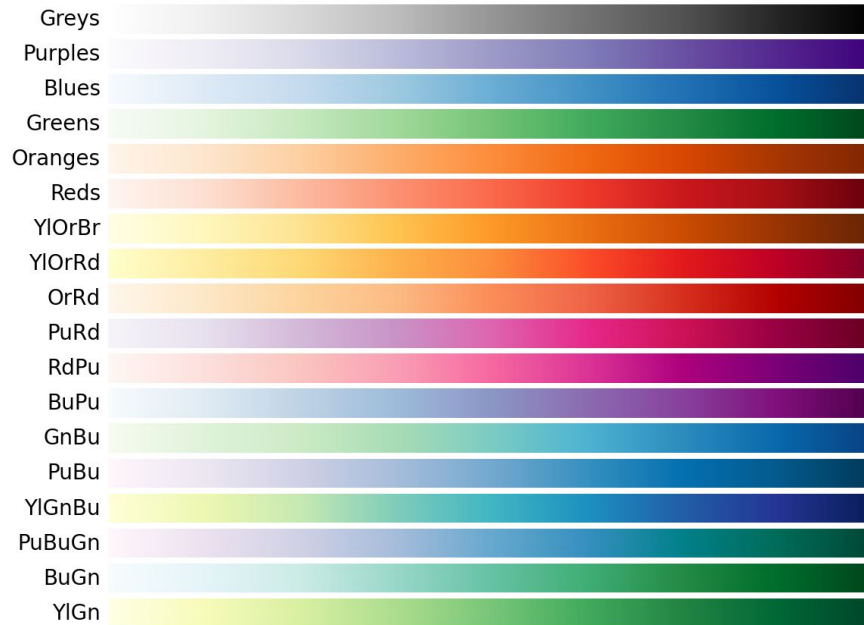
Design considerations

Use perceptually uniform colormaps—becoming more common defaults in matplotlib, ROOT

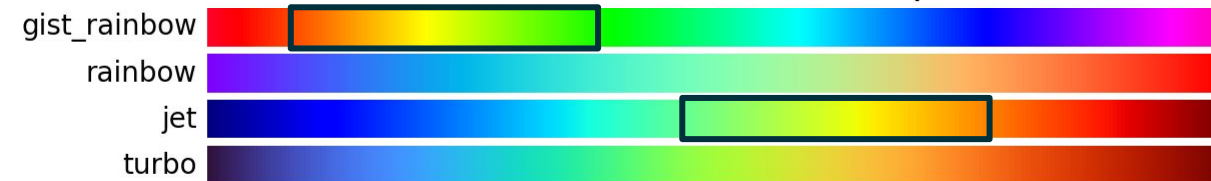
Perceptually Uniform Sequential colormaps



Sequential colormaps

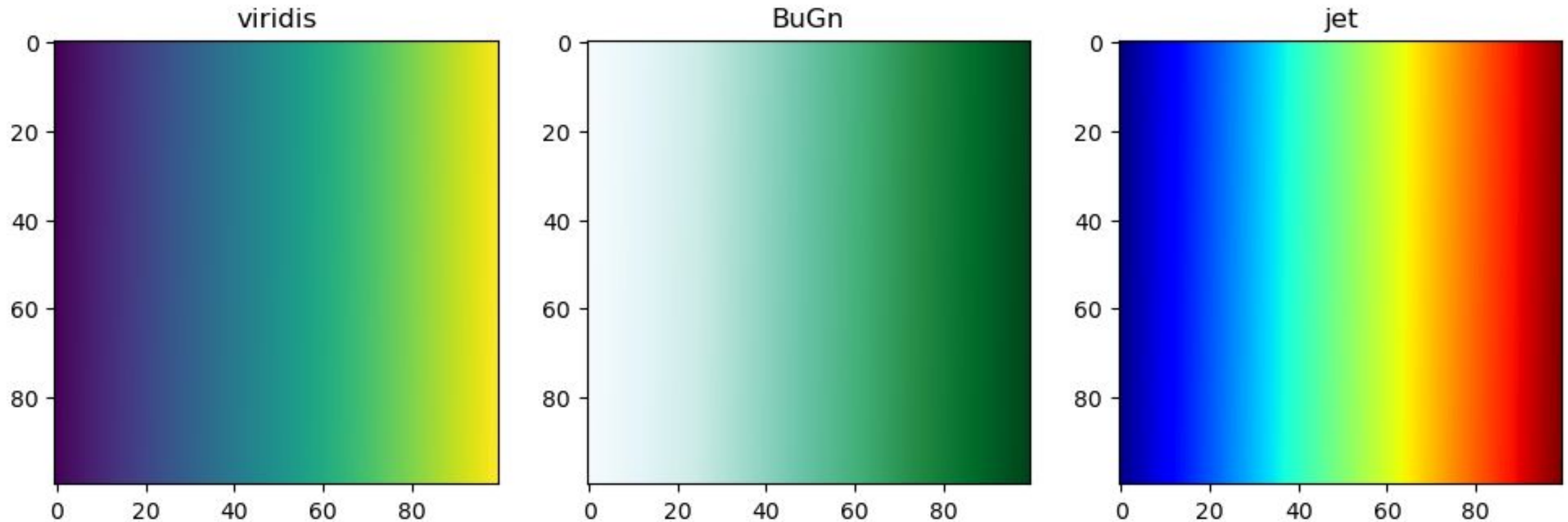


Miscellaneous colormaps



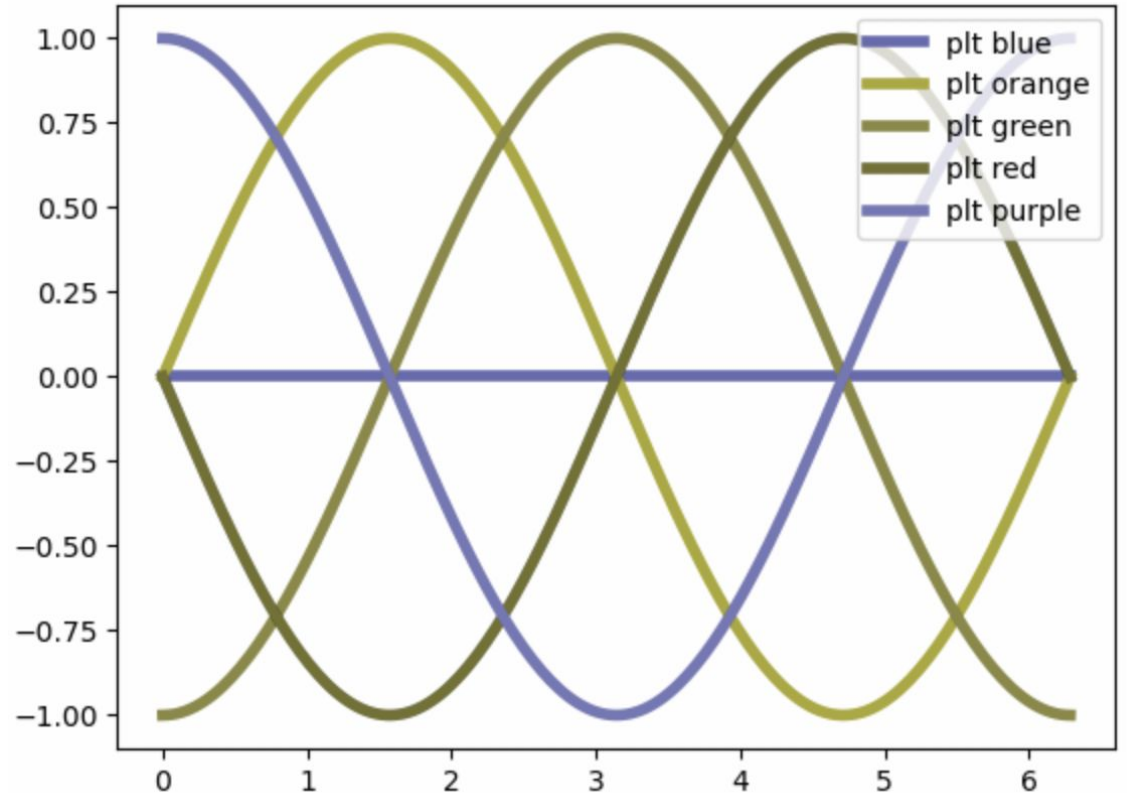
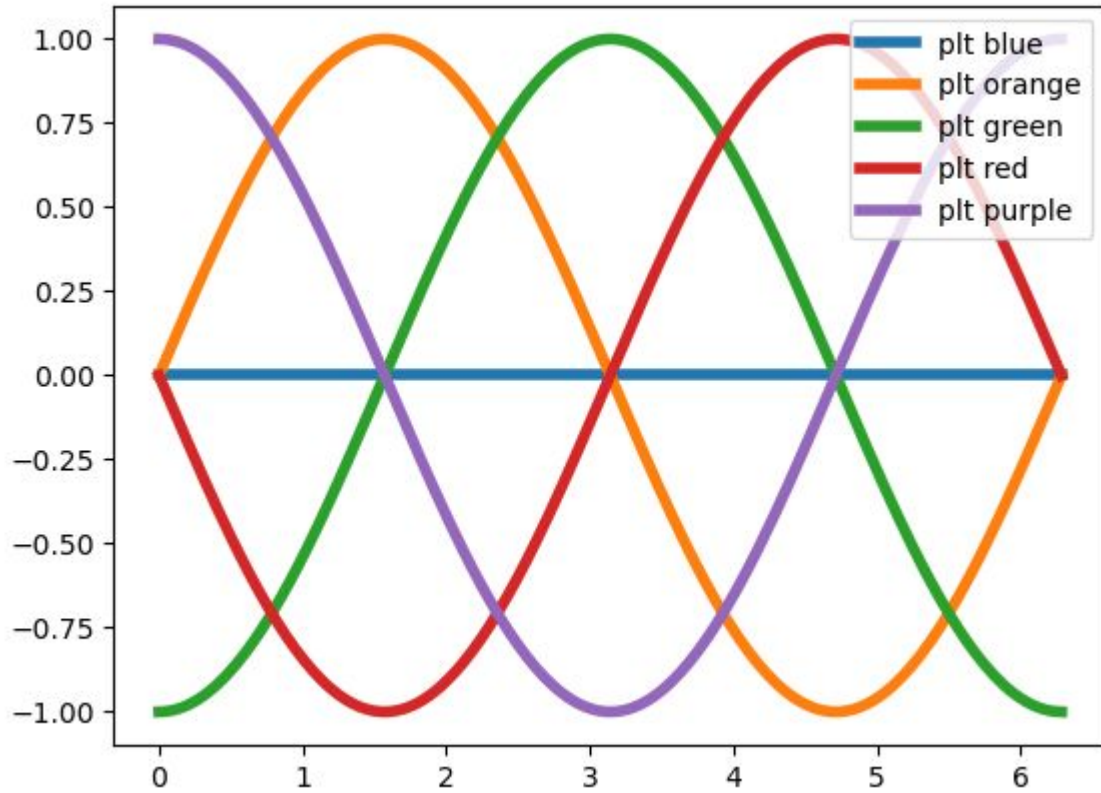
Design considerations

Use perceptually uniform colormaps—becoming more common defaults in matplotlib, ROOT



Design considerations

But default color cycles for line plots (here matplotlib.pyplot) still leave much to be desired



Takeaways

A substantial portion of your audience may have color vision deficiency (CVD)

1. Avoid green-good red-bad color coding
2. Avoid rainbow color maps
3. Default line plot colors can still be difficult for CVD individuals
4. Some online tools:
 - a. On-screen simulation: Color Oracle: <https://colororacle.org/>
 - b. Color schemes: Color Brewer: <https://colorbrewer2.org/>
 - c. Augmented reality on Mac/iOS: Sim Daltonism: <https://michelf.ca/projects/sim-daltonism/>

Thank You