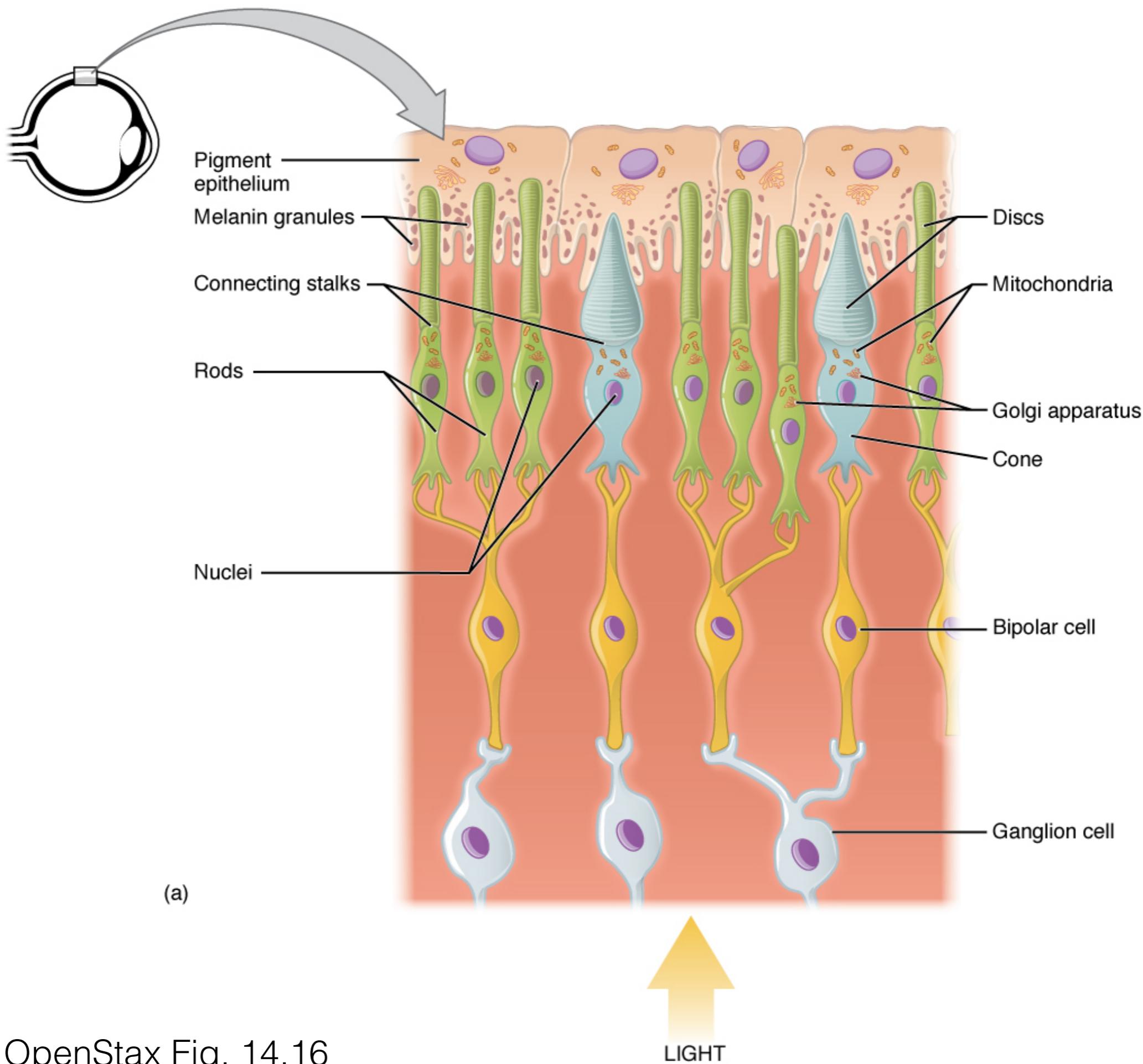


# Lecture 06 – Color

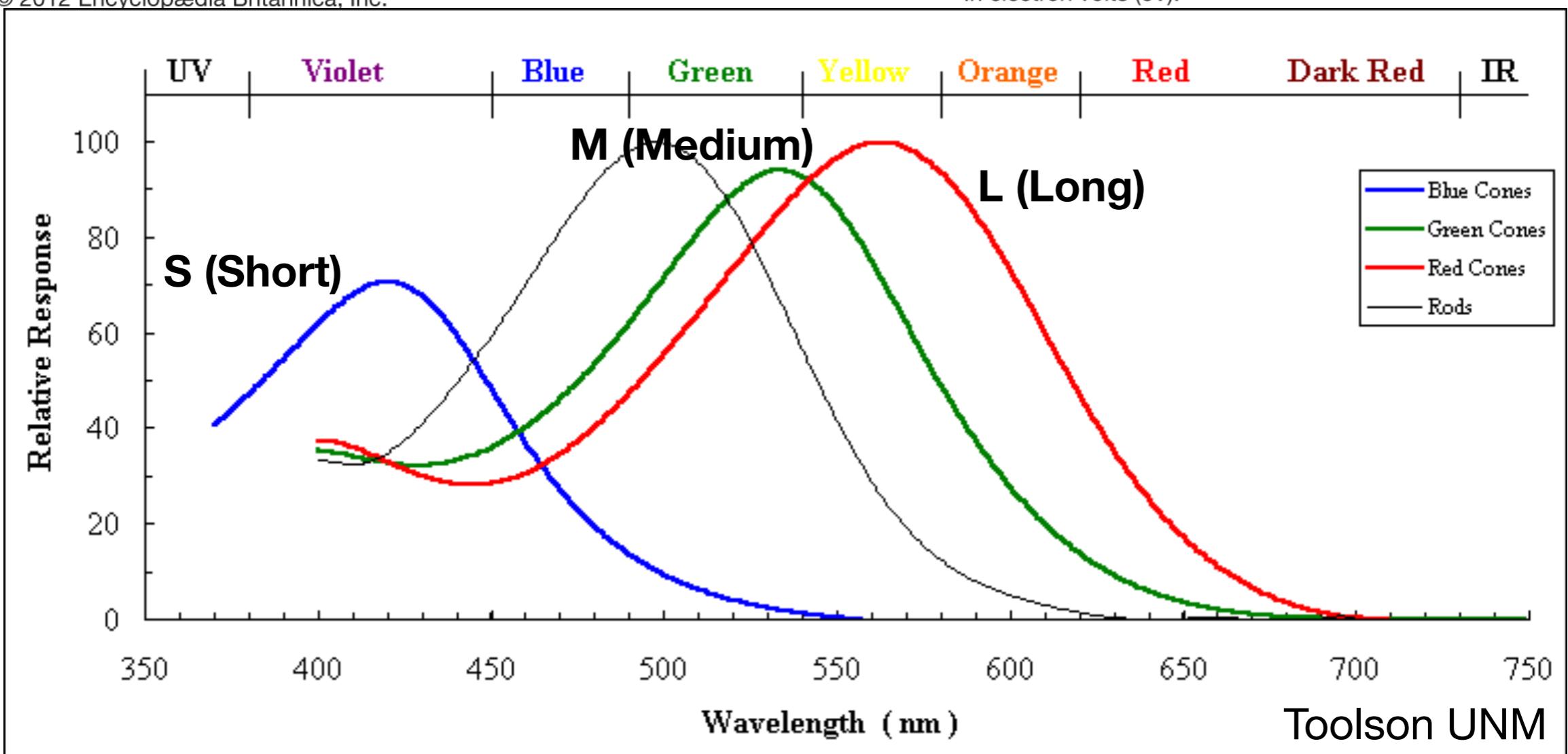
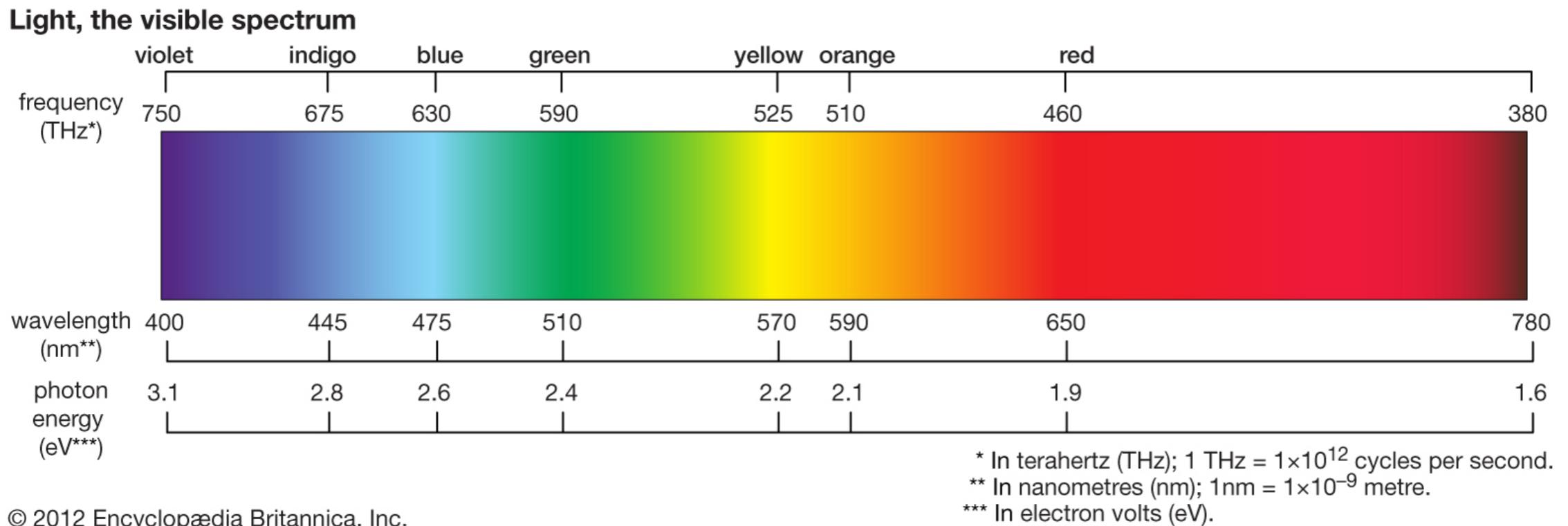
## **Today's Learning Objectives:**

- 1. List the three cone types and describe their wavelength sensitivities.**
- 2. Describe the opposition-process theory as it applies to chromatic and achromatic vision.**
- 3. Describe colorblindness and list the percentage of the population who are colorblind.**
- 4. Describe complementary color theory and how it interfaces with opposition-process theory.**
- 5. List the properties of hue, saturation, and value.**
- 6. Describe the problems using near-equal luminance colors in data visualizations.**

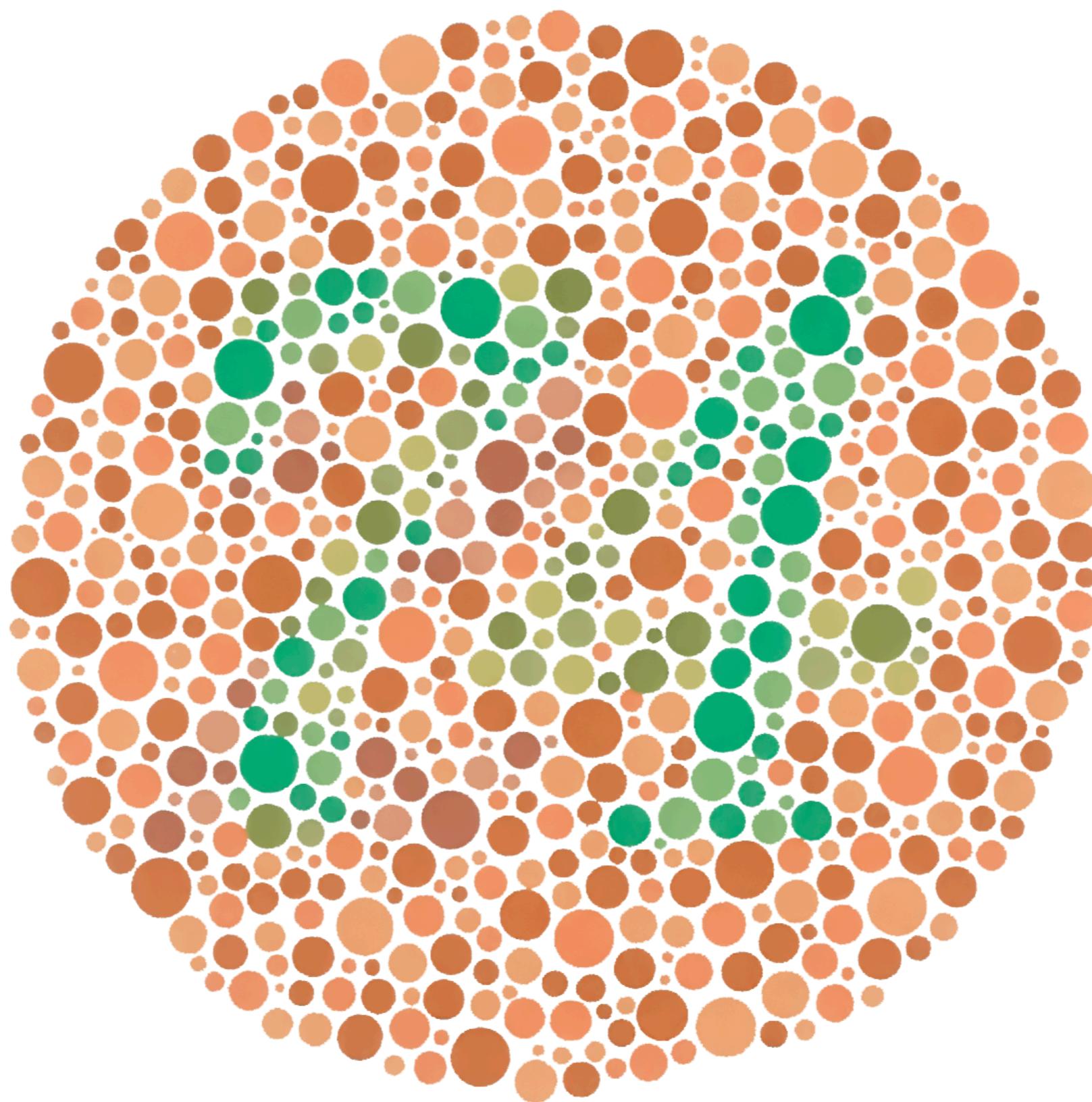


OpenStax Fig. 14.16

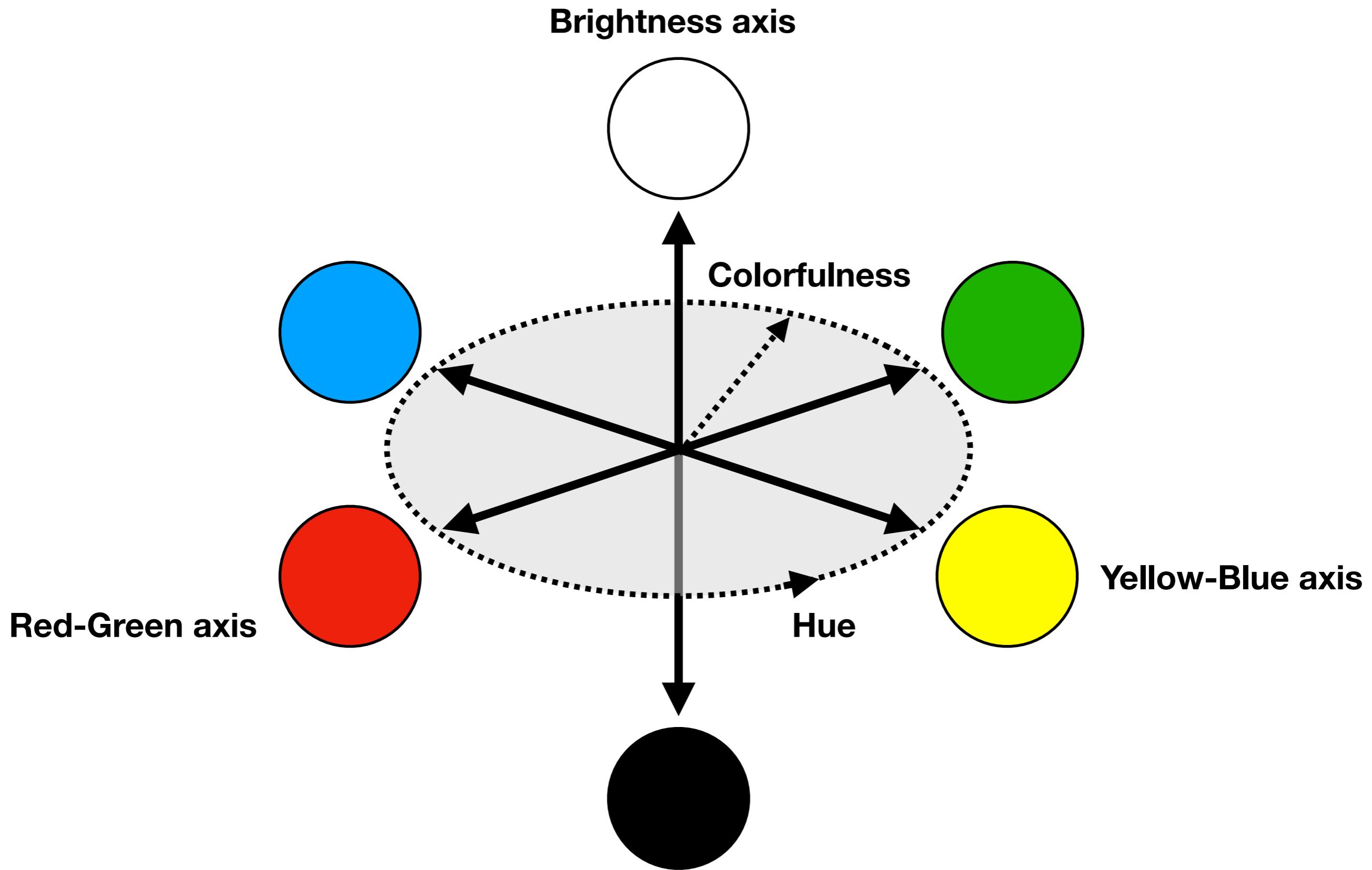
# Cone types



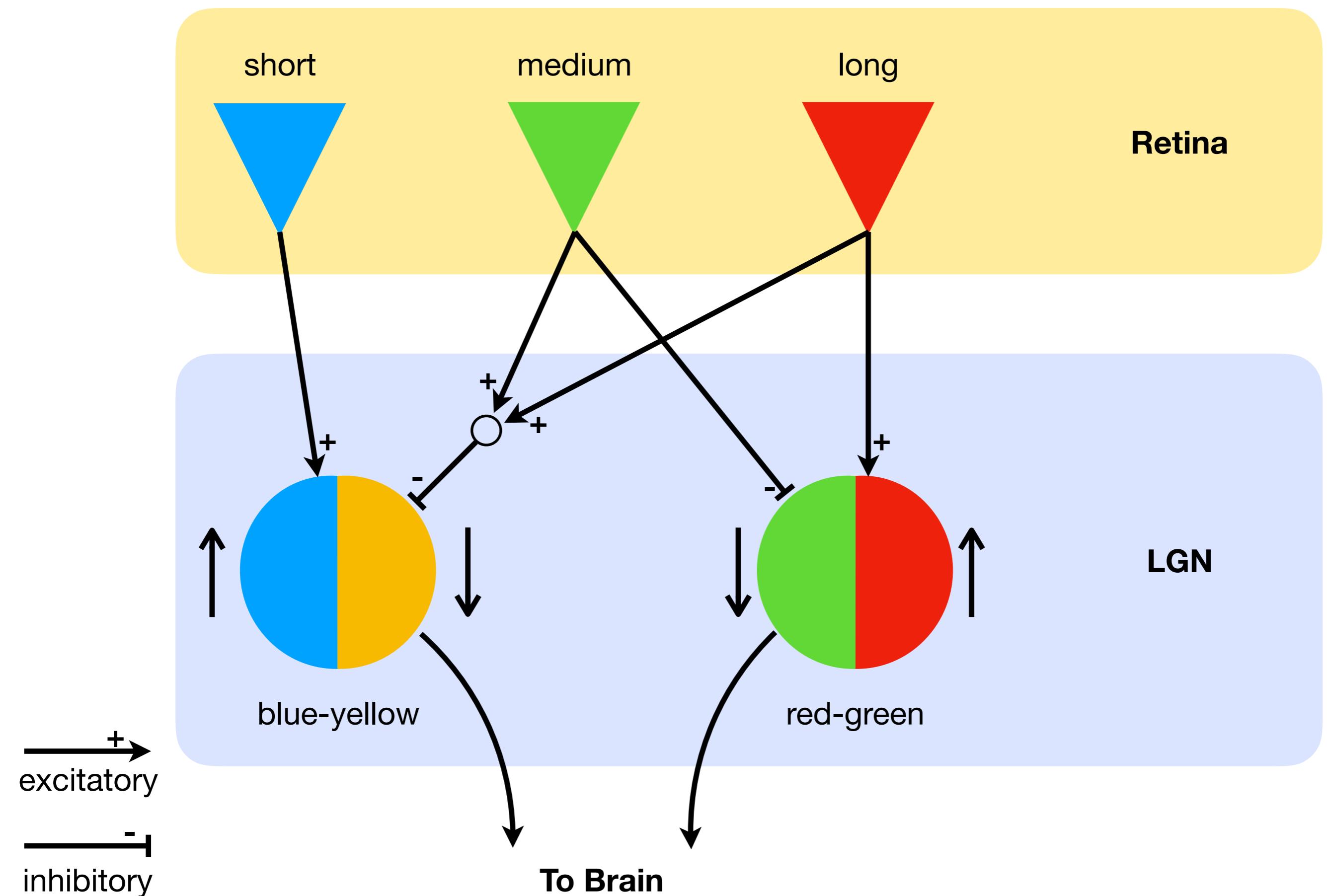
# Ishihara Plate 9 (Colorblindness Test)



# Opponent-Process Theory of Sight

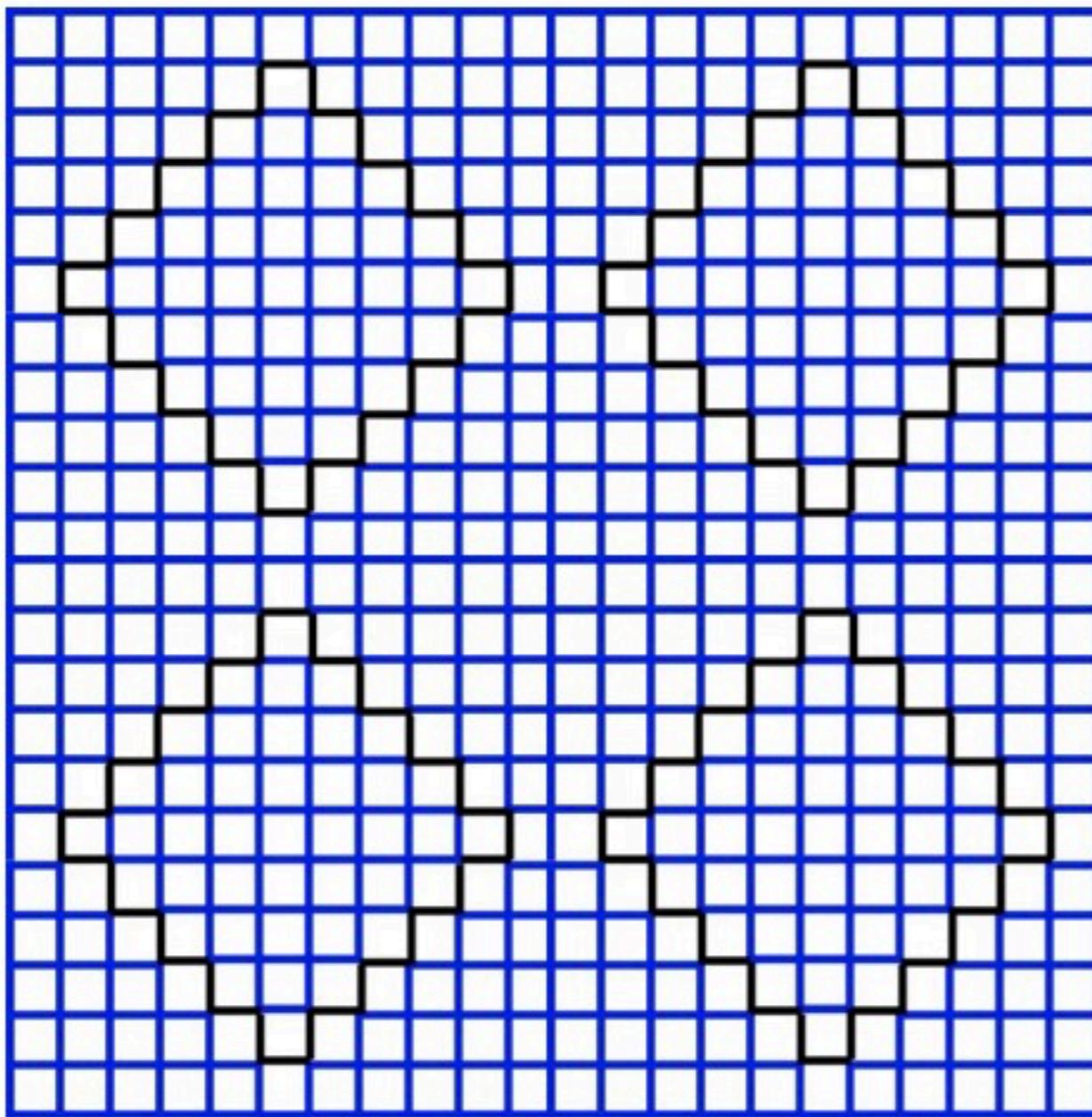


# Opponent-Process Theory of Color (Chromatic)

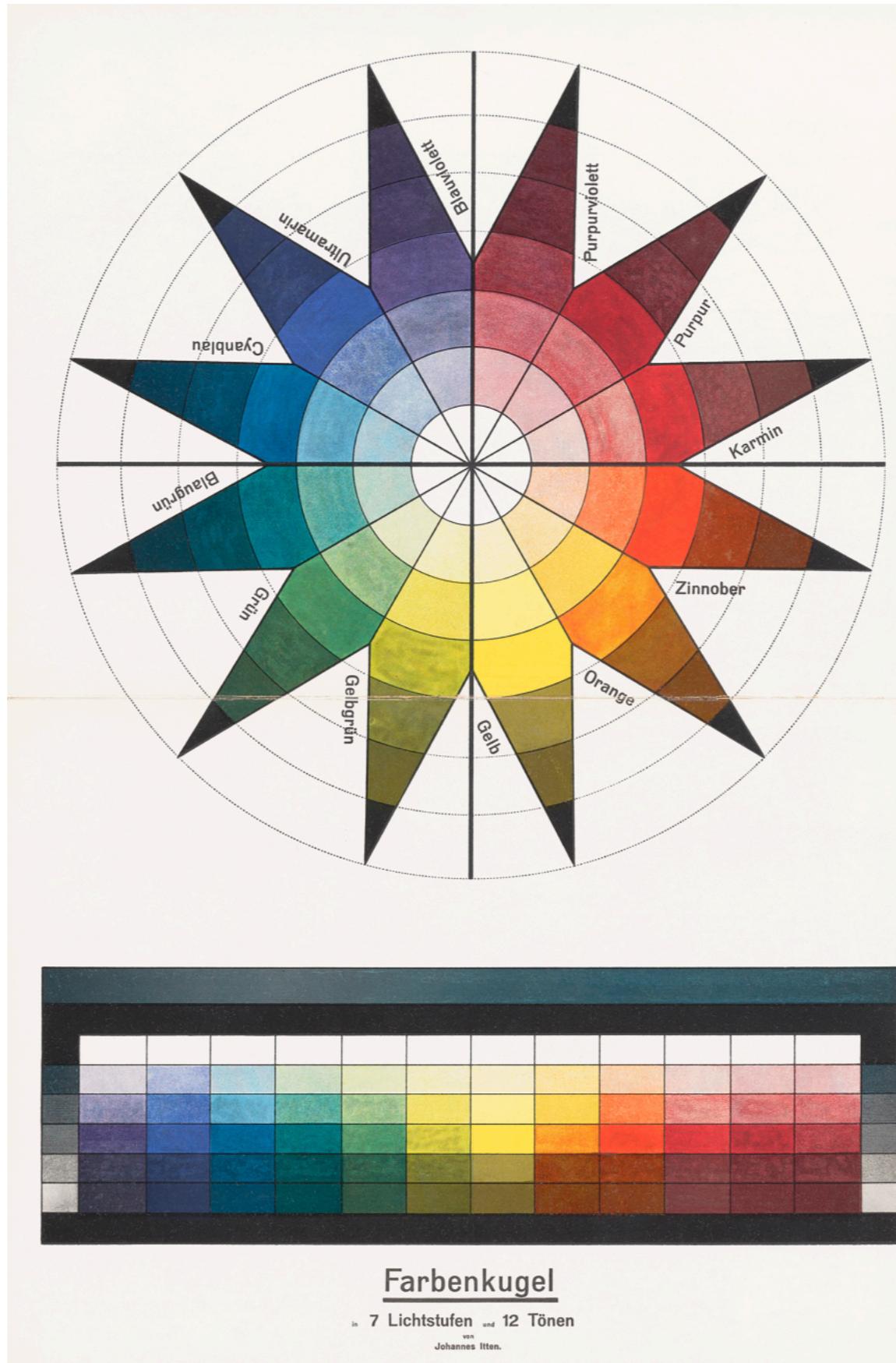


# Opposition-process color illusions

## Yellow-blue illusion



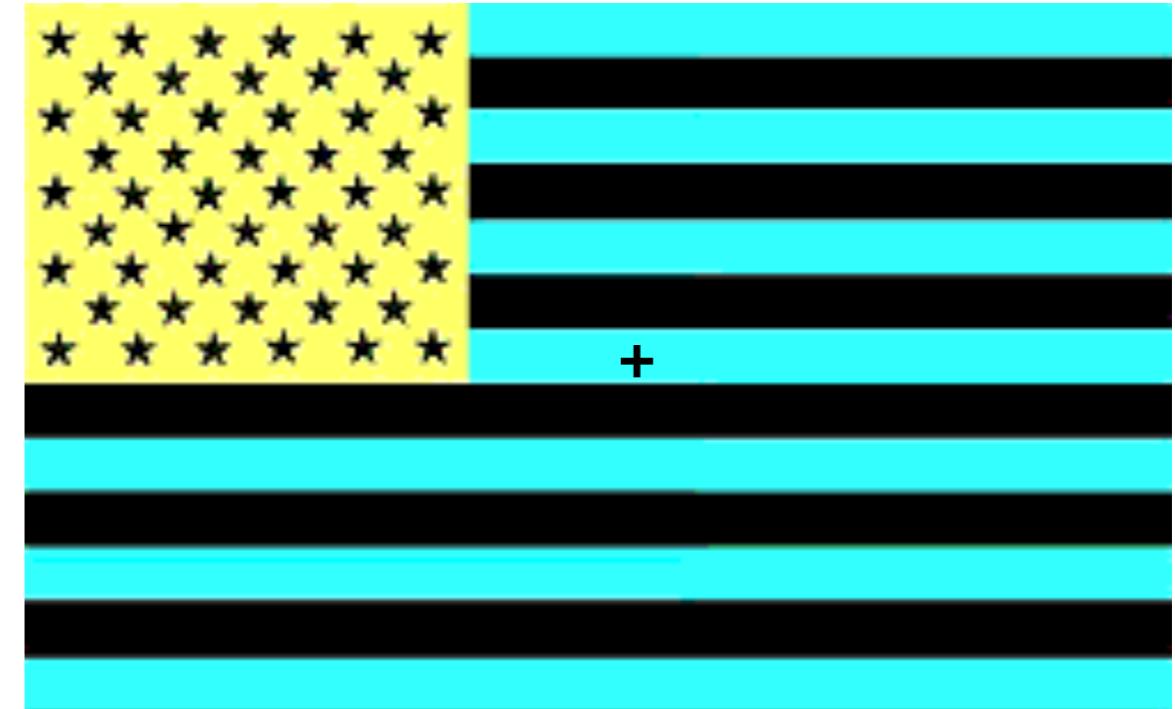
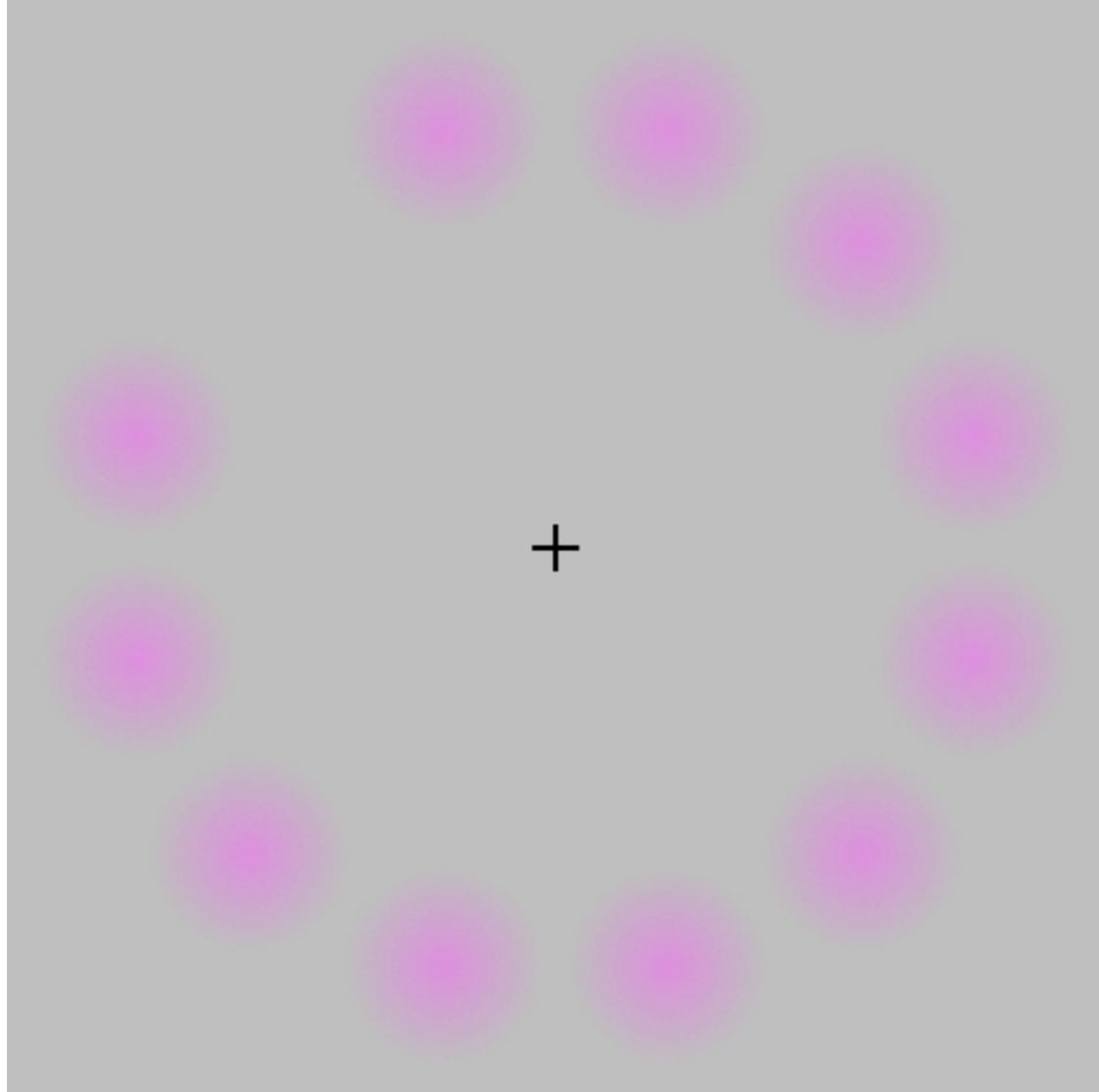
# Complementary Color Theory



Johannes Itten, *Utopia*, The Getty Research Institute

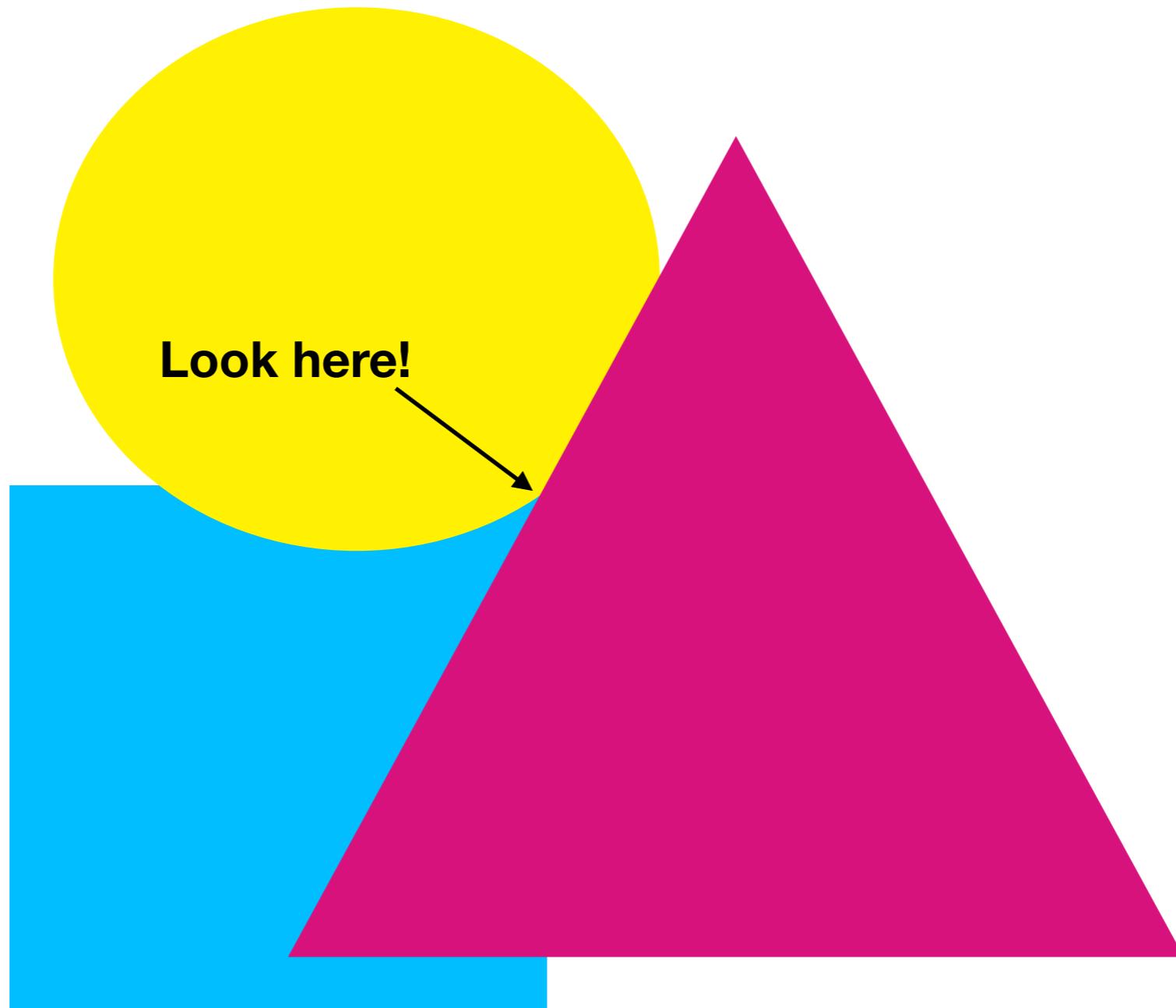
# Complementary Color illusions

“Lilac Chaser”

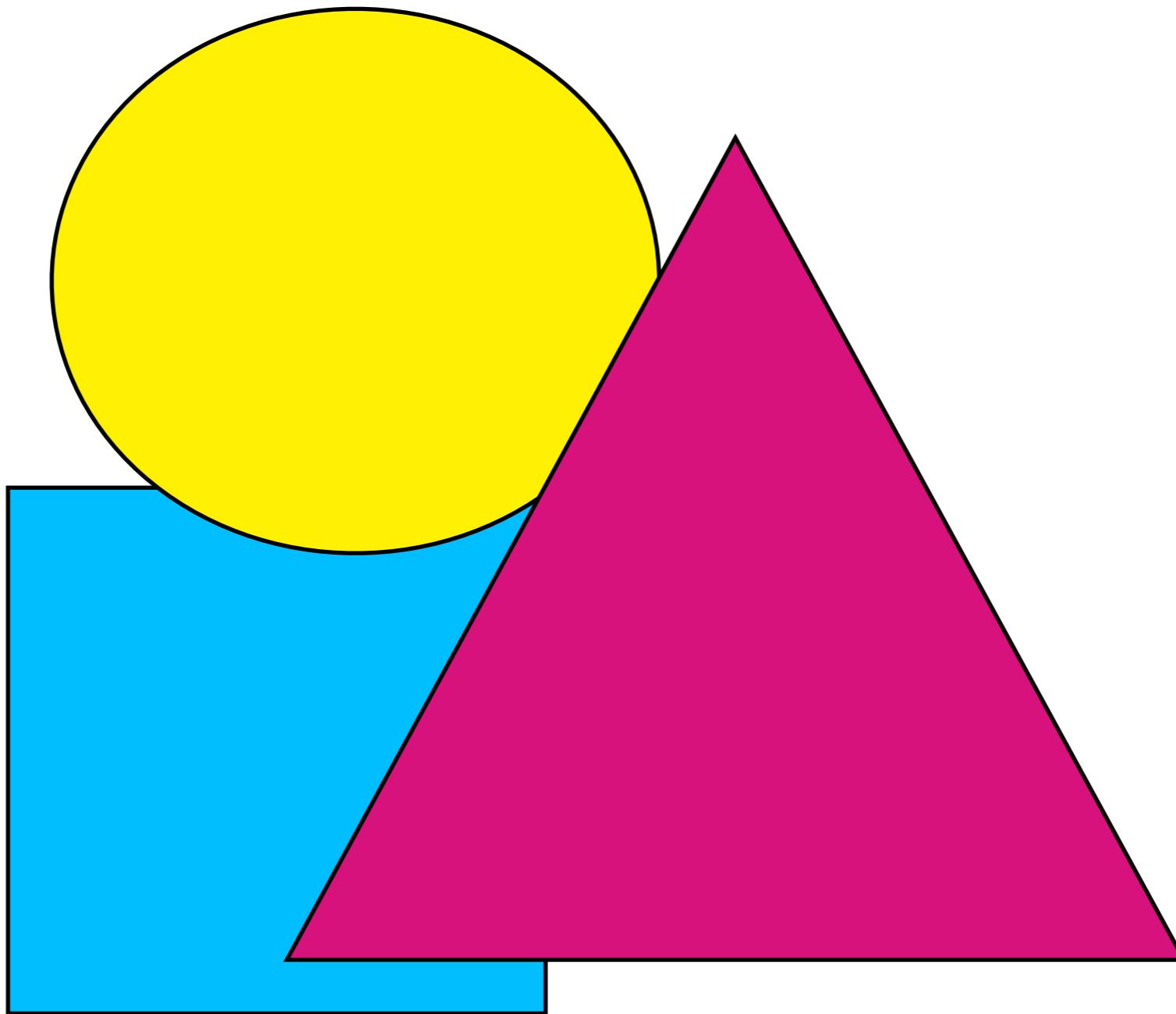


[https://en.wikipedia.org/wiki/  
Visual adaptation](https://en.wikipedia.org/wiki/Visual_adaptation)

# Complementary Color illusions

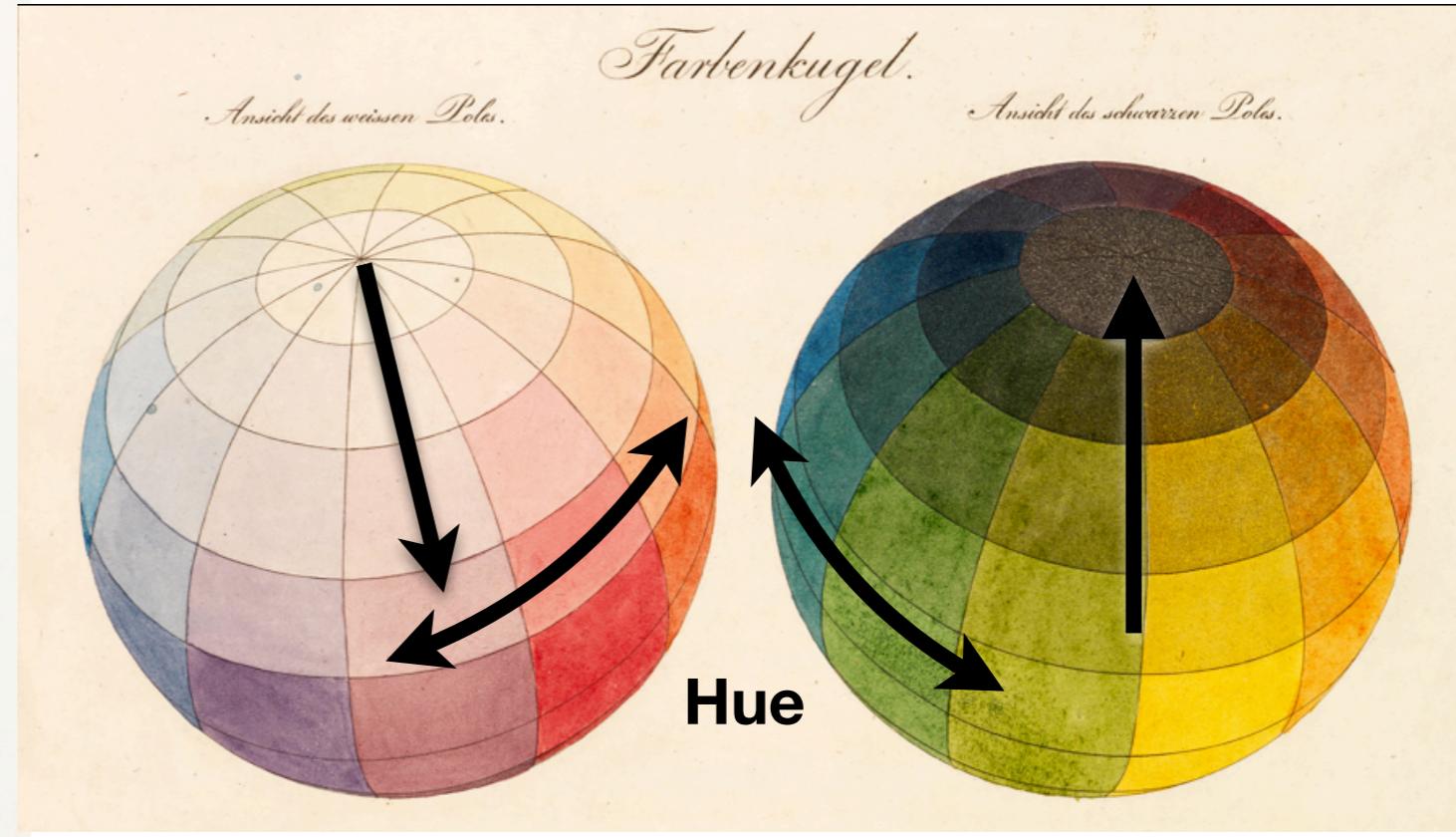
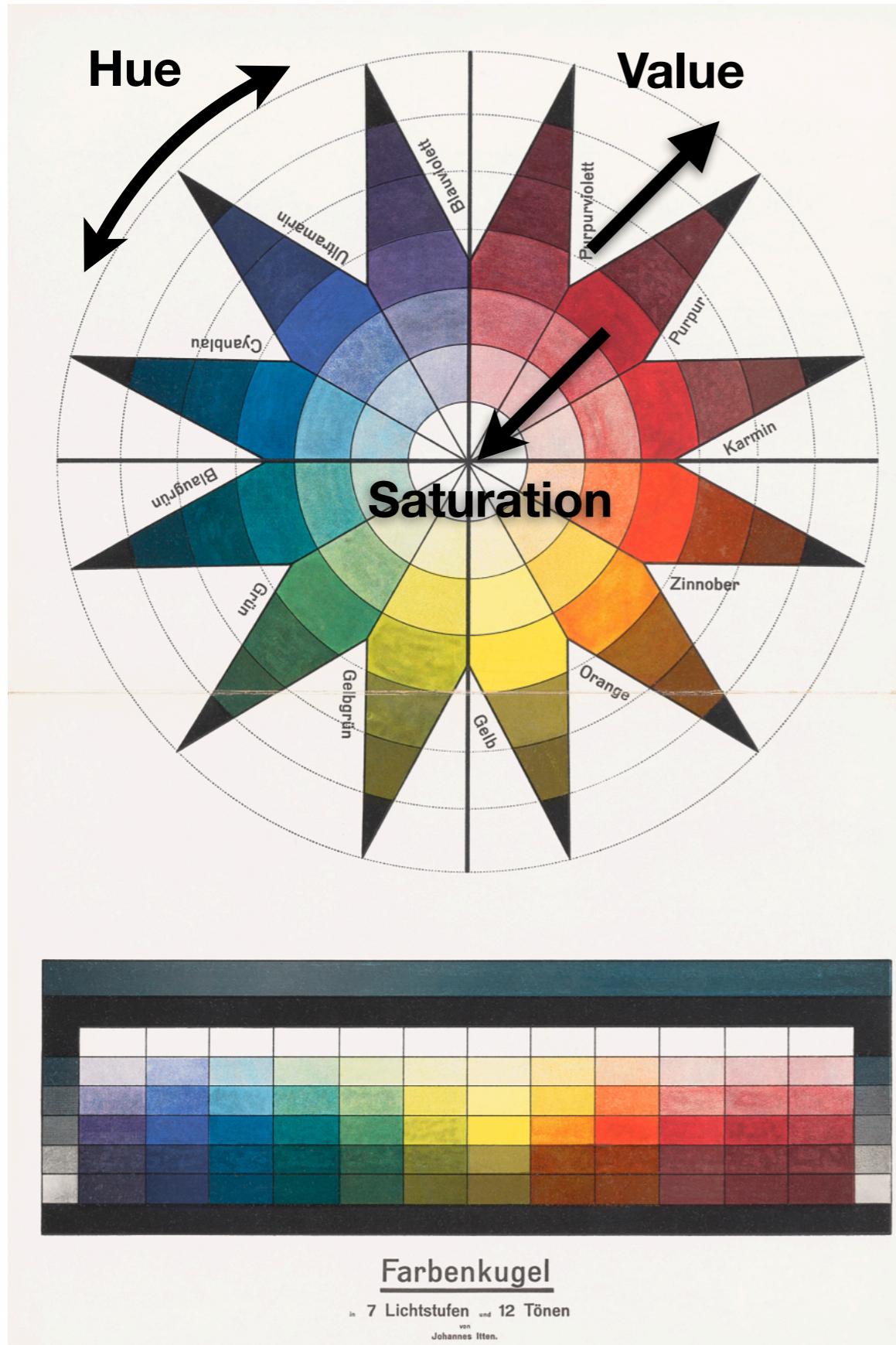


# Complementary Color illusions

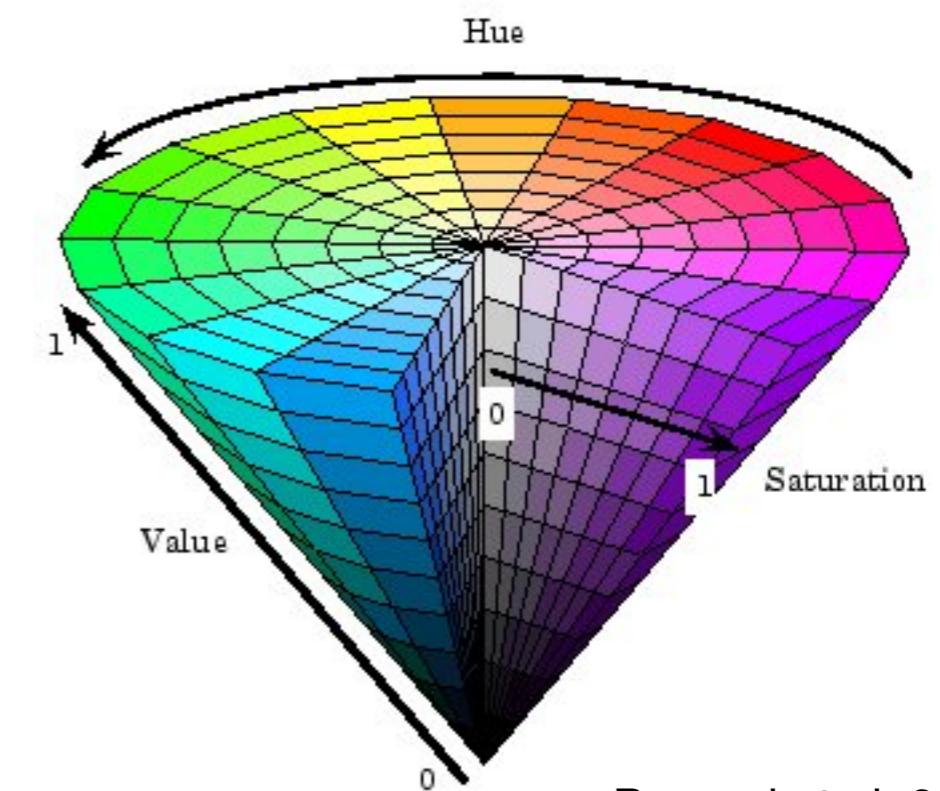


Livingstone 2014 reproduction

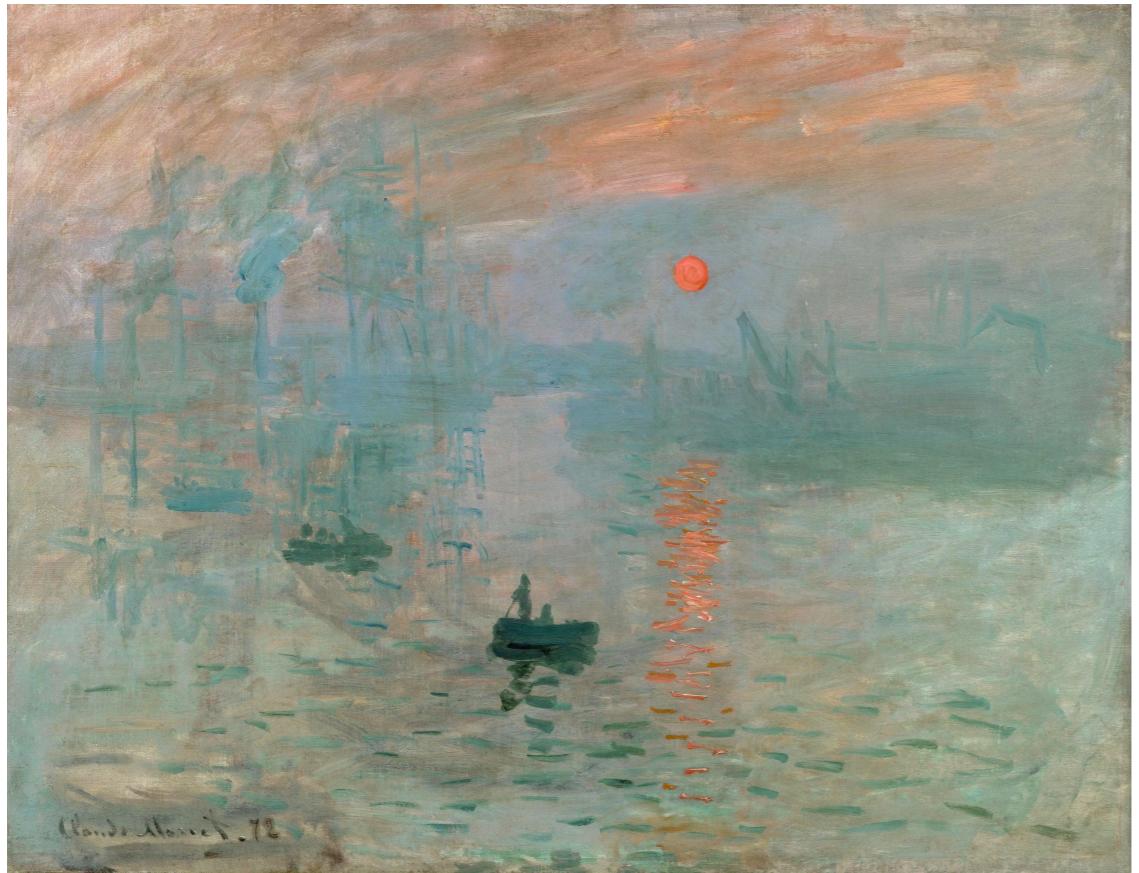
# Hue, Saturation, and Value



**Saturation**      **Hue**      **Value**



# Be careful of equal luminance in hues!



**Text, lines, and other design elements should not be of equal or close luminance to the background. Near-equal luminance objects are very hard to pick out, and near-equal luminance text is very difficult to read. Use luminance contrast that is sufficiently different to avoid problems.**

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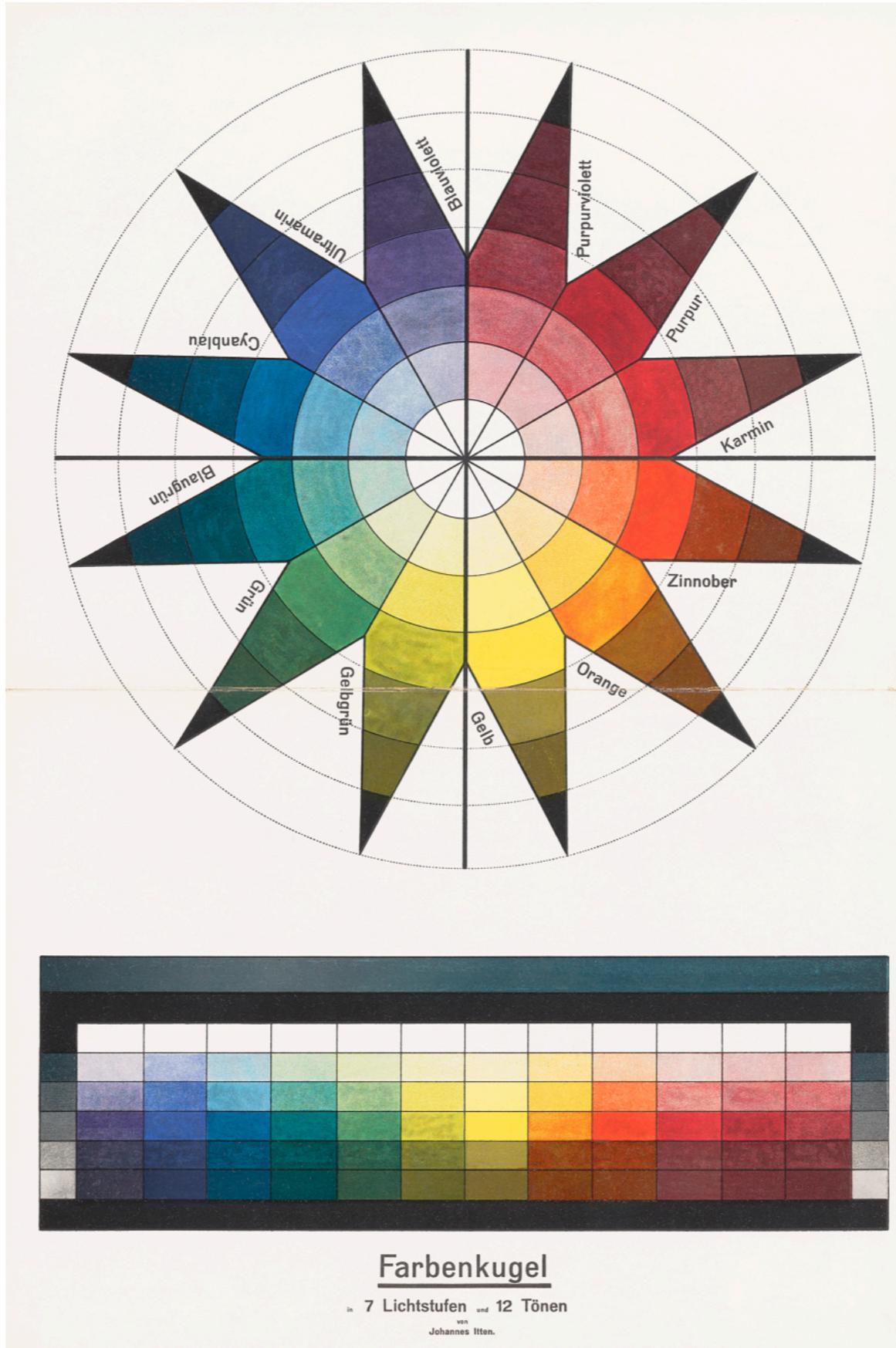
**Be careful of equal luminance in hues!**



# The Dress



# Group work: Reproduce the Bauhaus Color Wheel in R.



Johannes Itten, *Utopia*, The Getty Research Institute

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