



UNIVERSITY OF
BIRMINGHAM

Visualisation

Week 1

Session 2



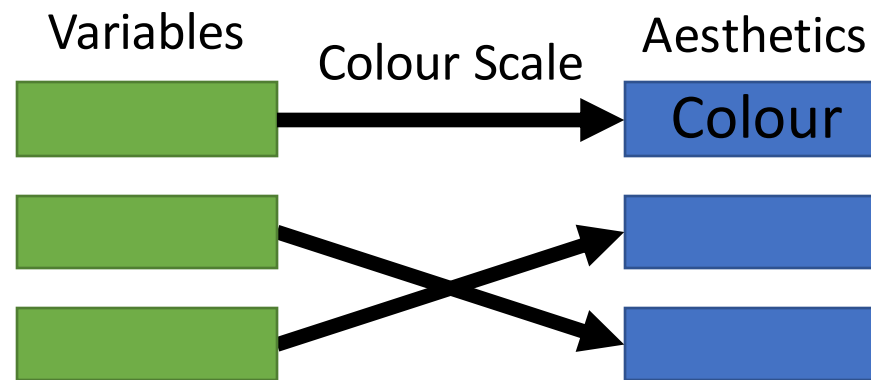
UNIVERSITY OF
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Visualisation

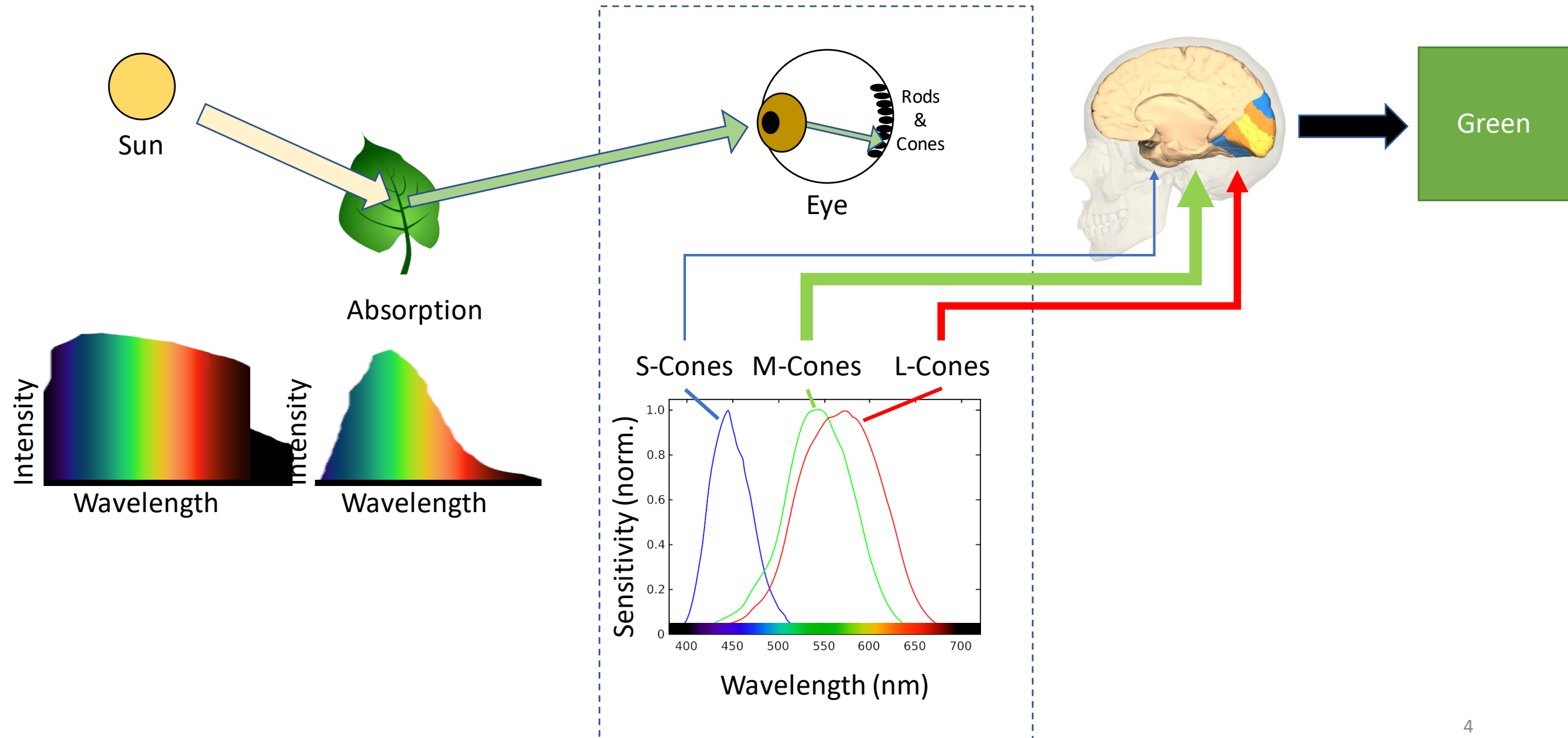
Week 1

Colour and Colour Scales

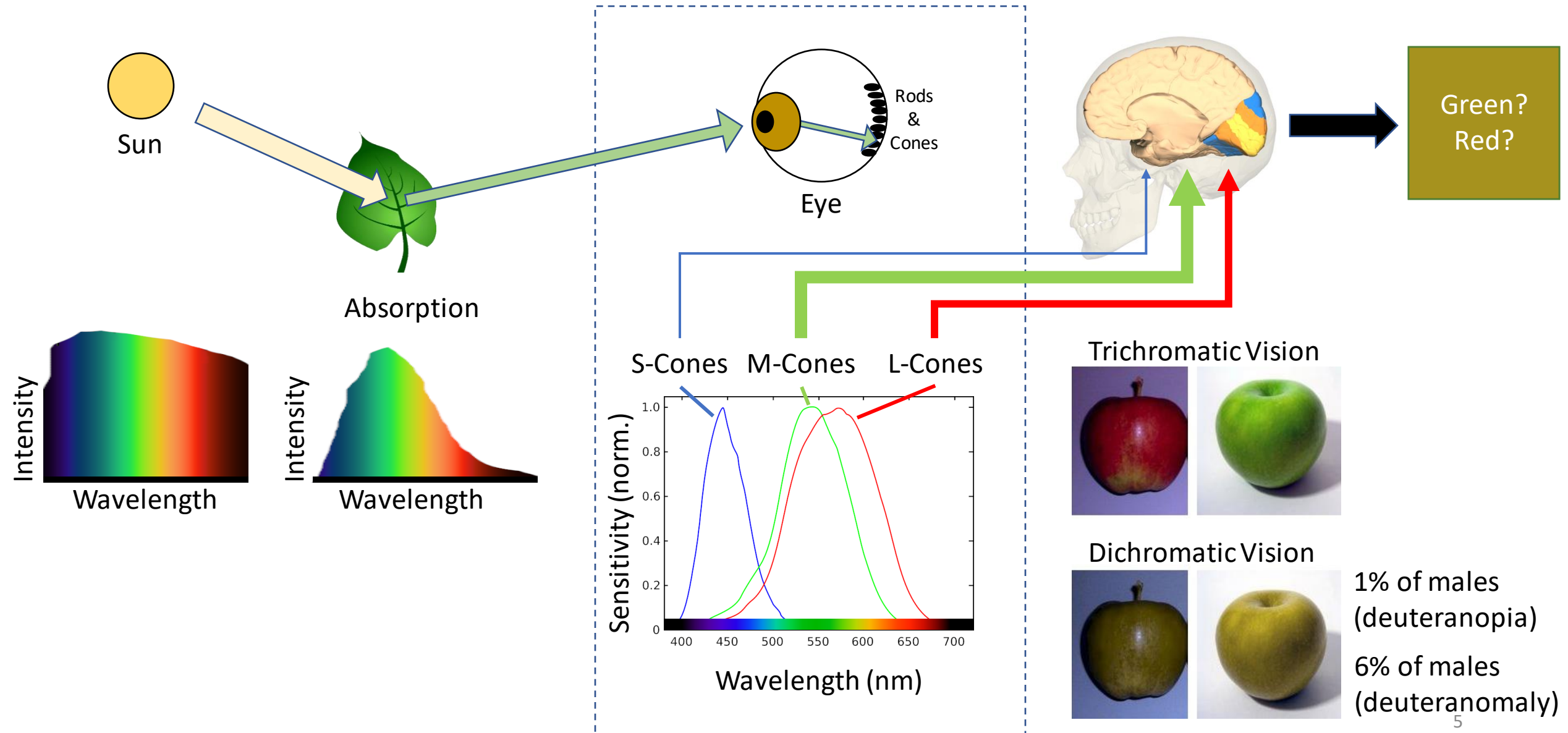
Colour Scales



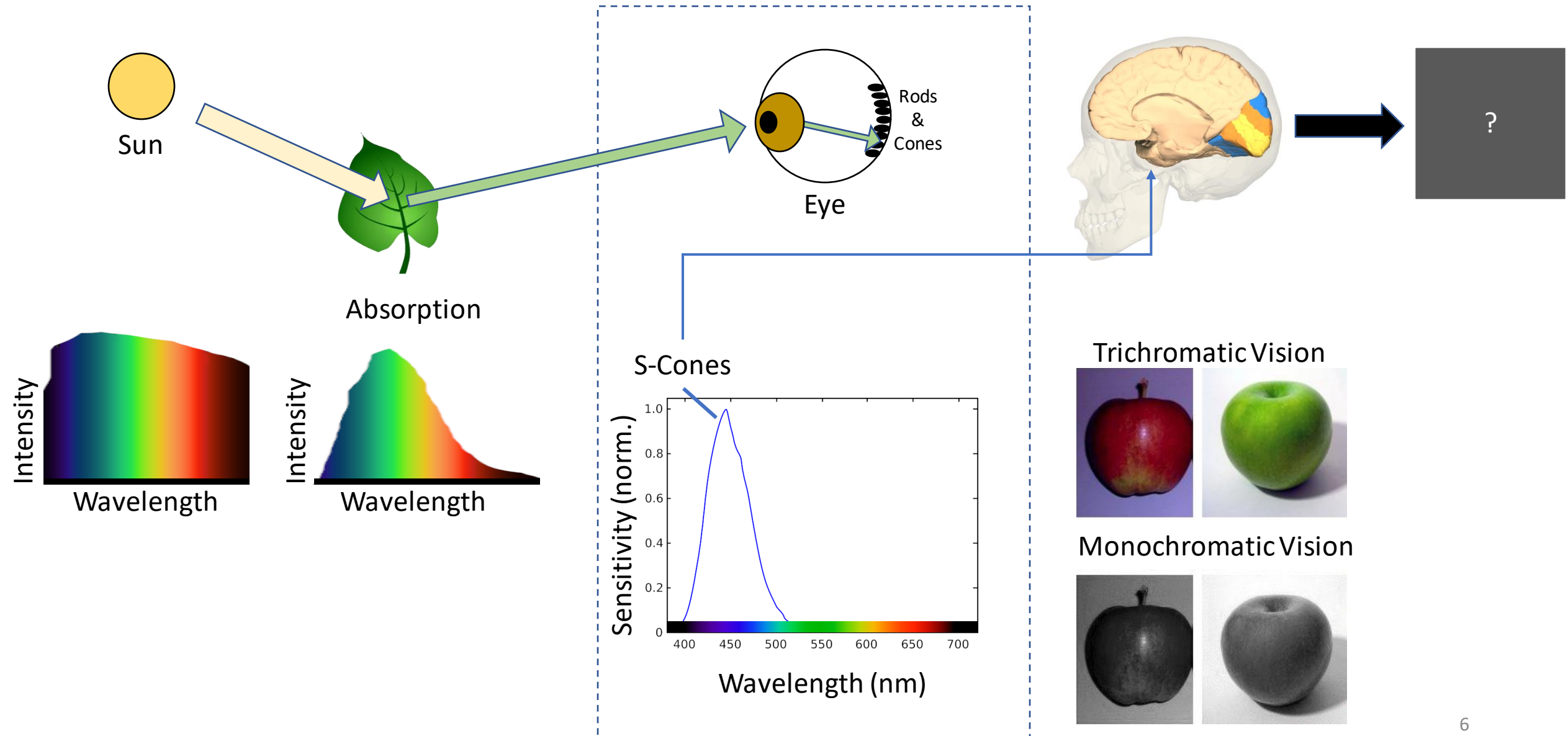
What is Colour? Trichromatic Vision



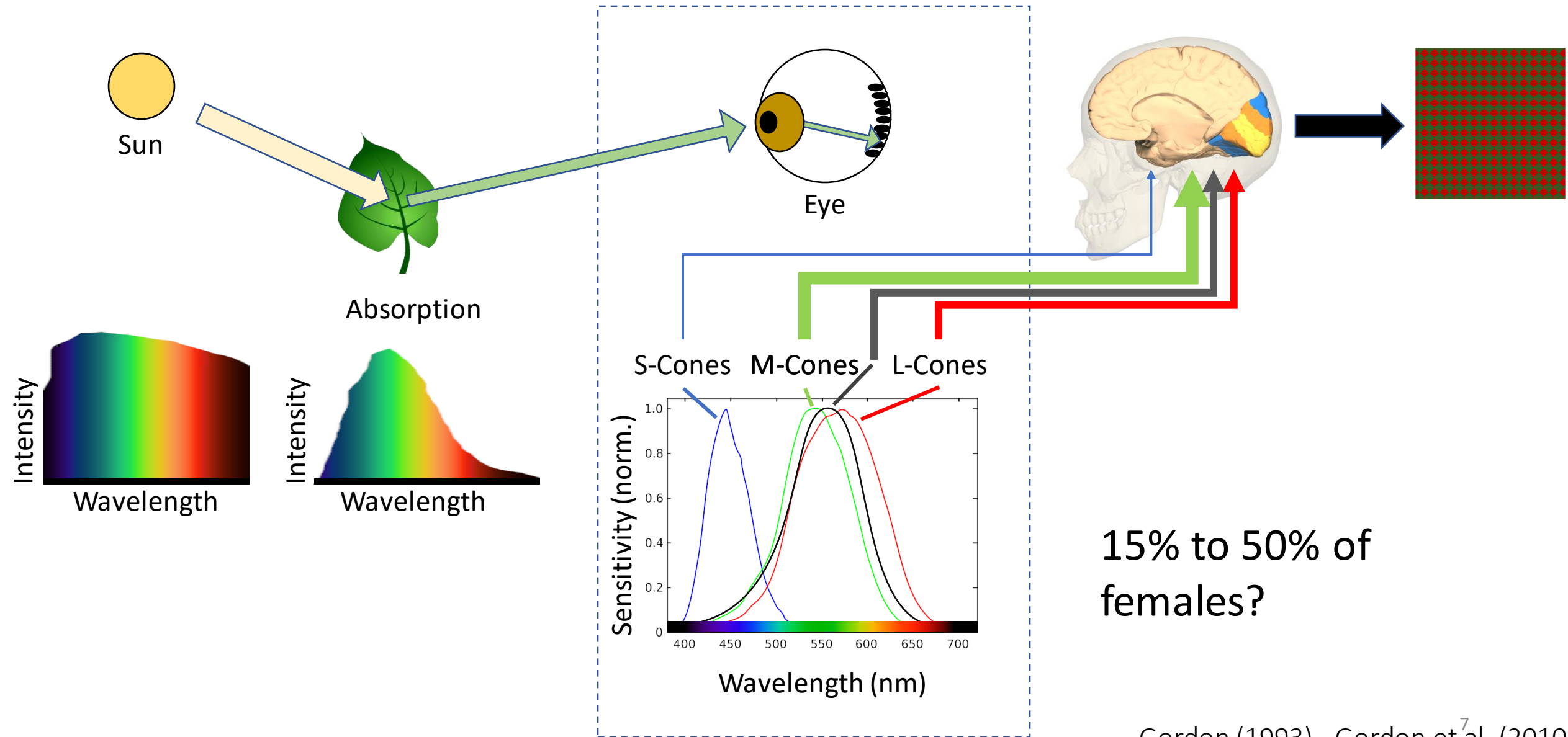
What is Colour? Dichromatic Vision



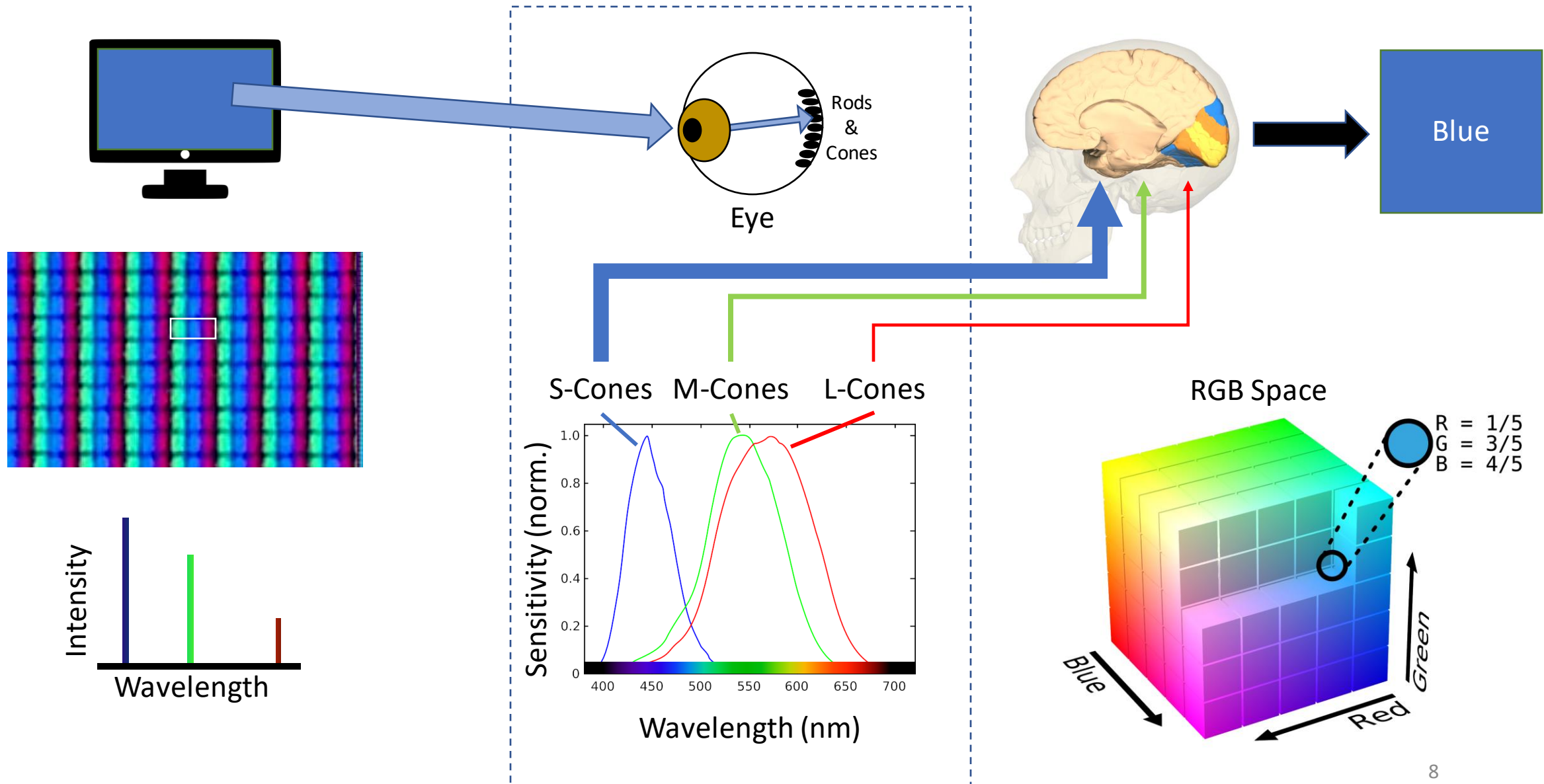
What is Colour? Monochromatic Vision



What is Colour? Tetrachromatic Vision

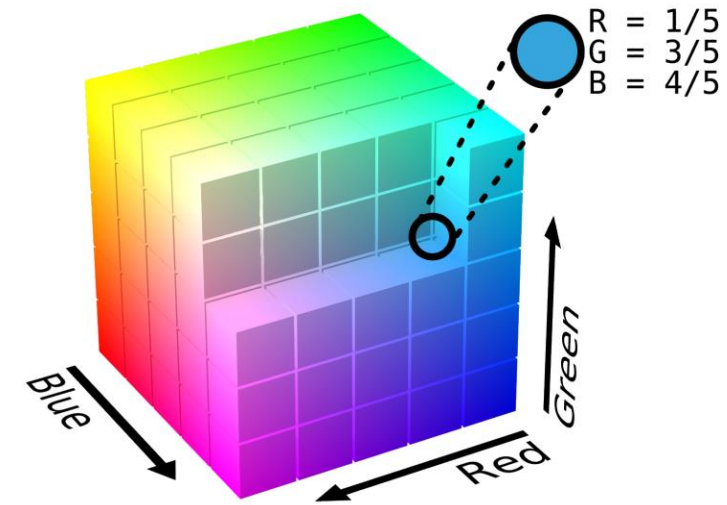


What is RGB Colour?

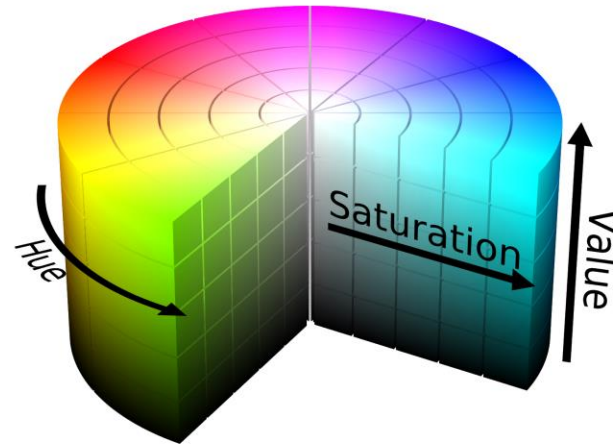


Colour is 3dimensional

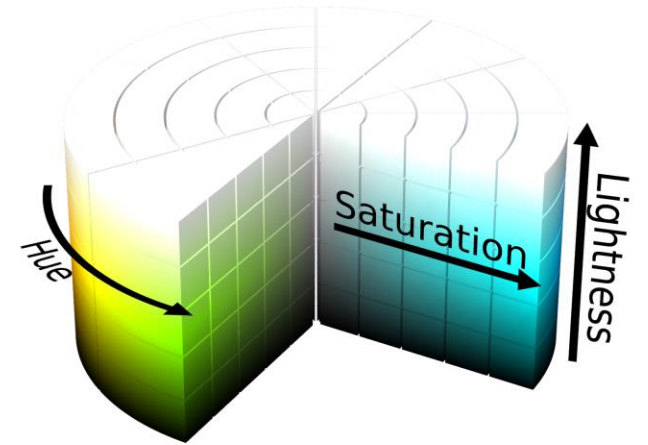
RGB Space

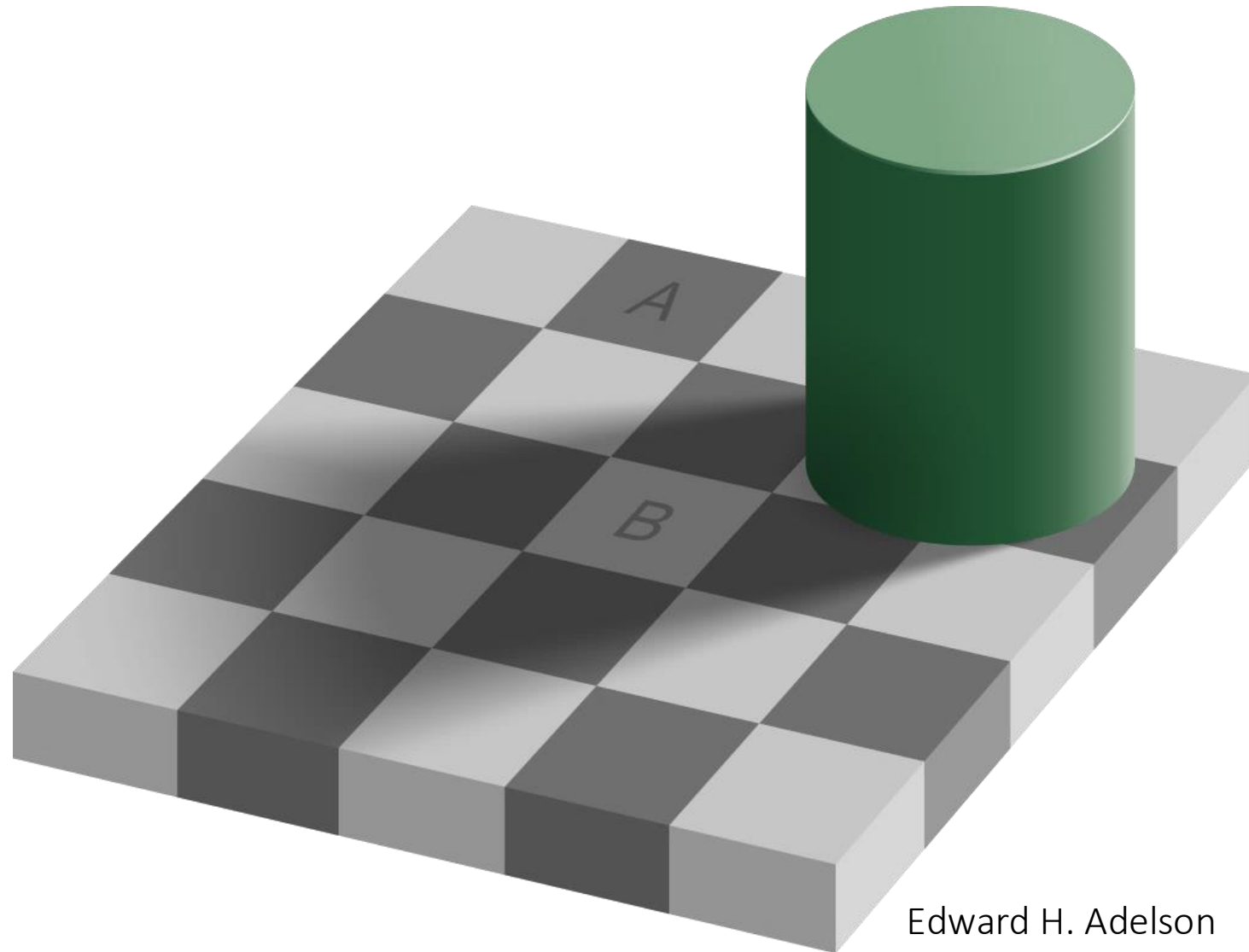


HSV Space

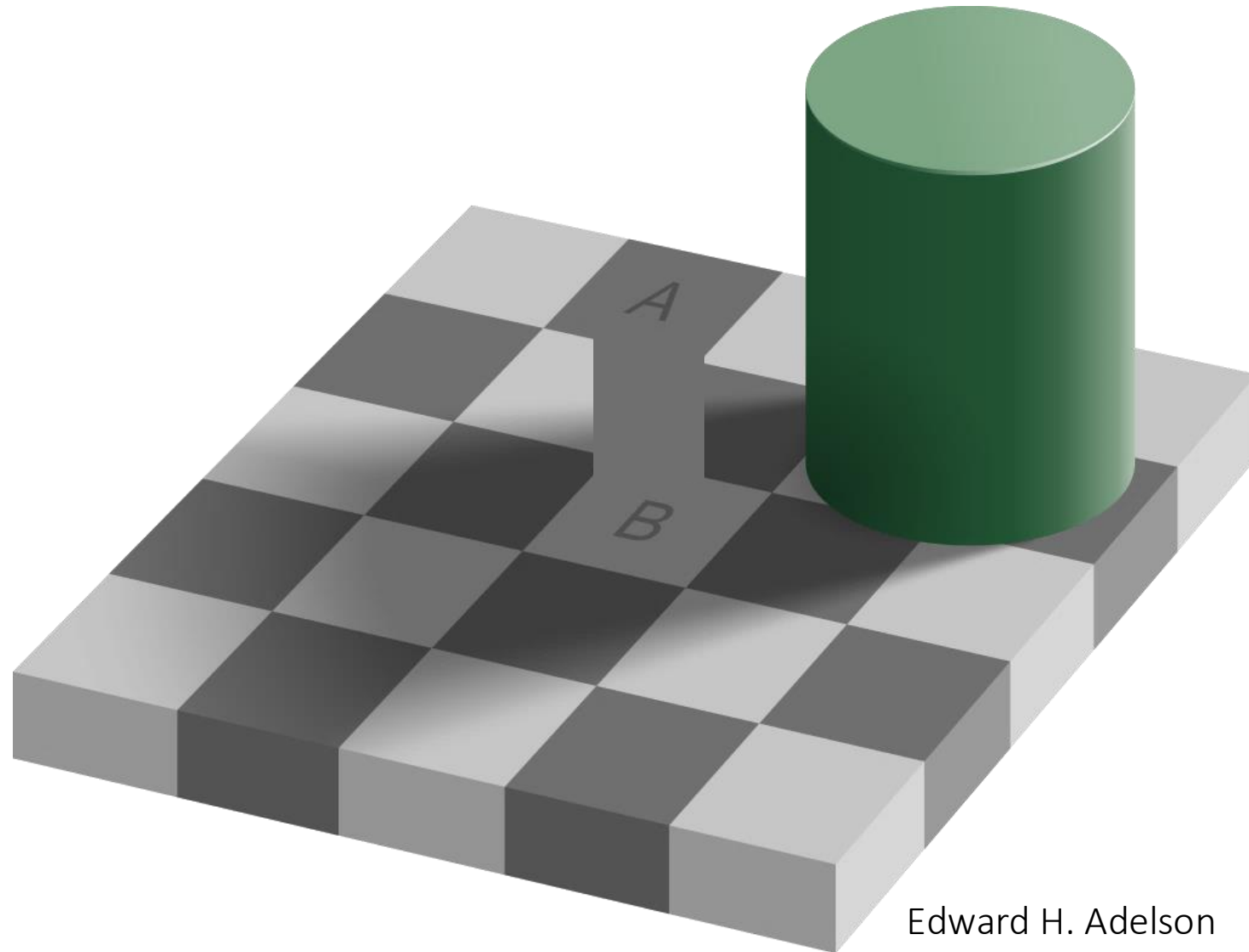


HSL Space

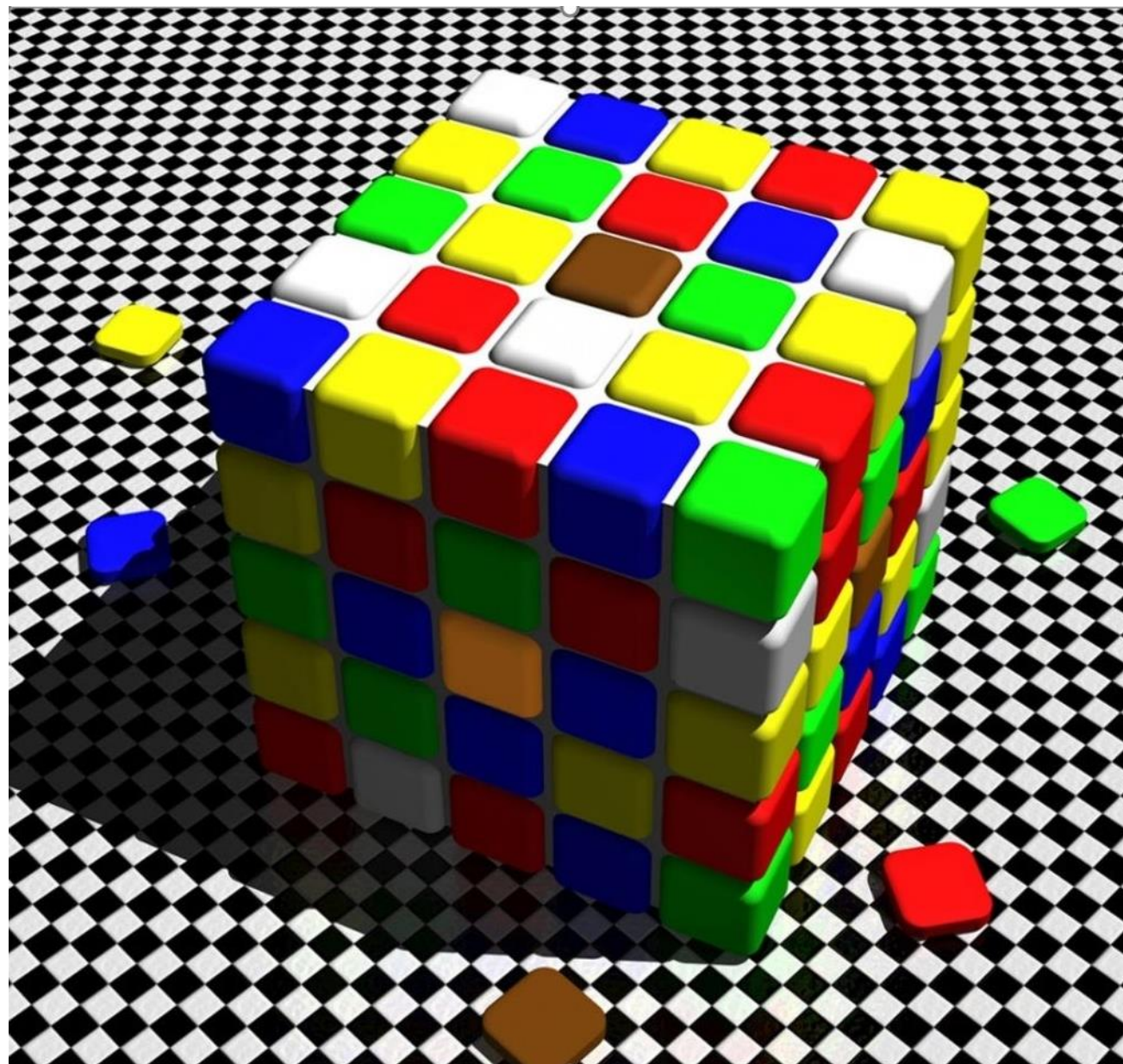




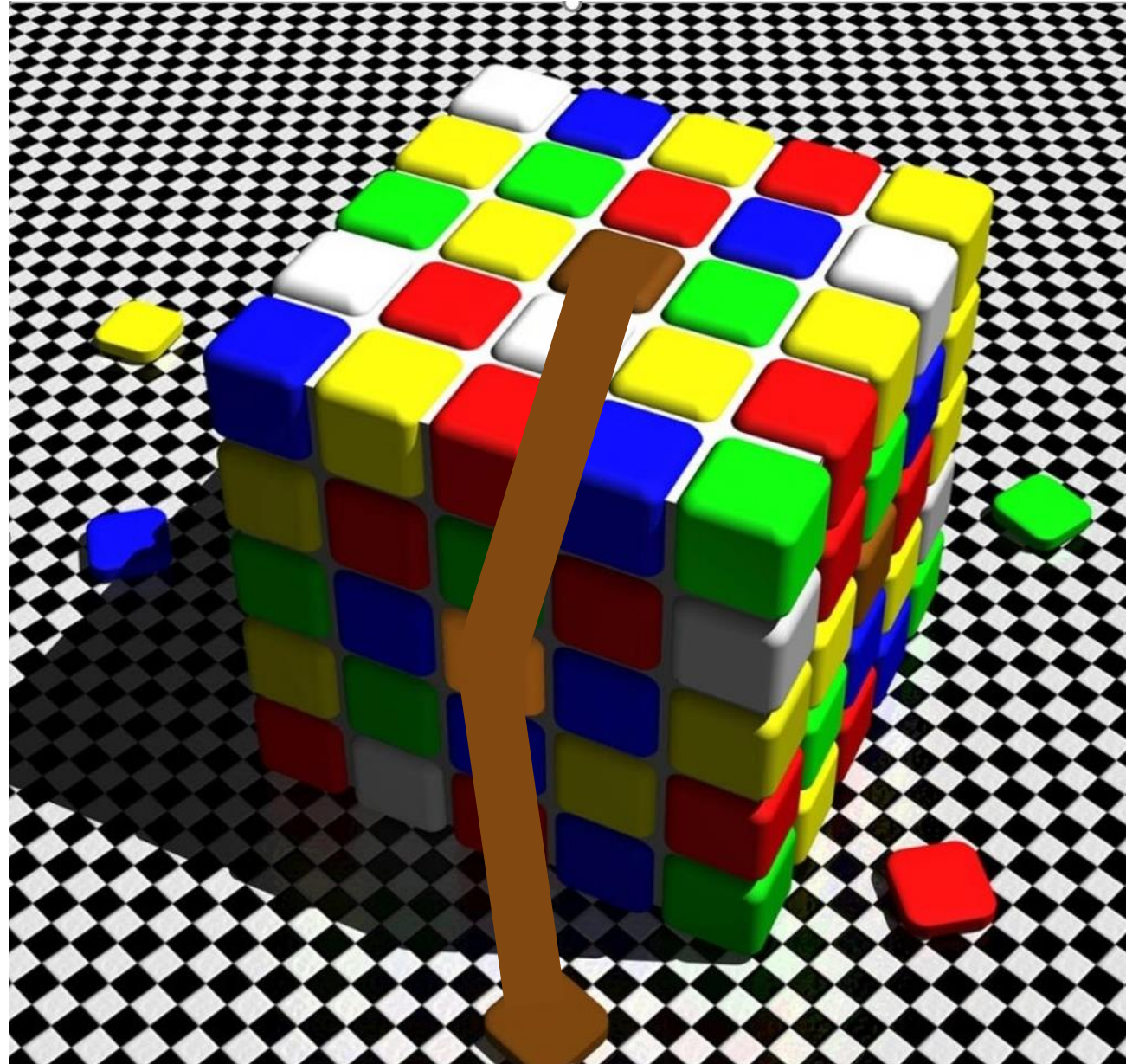
Edward H. Adelson



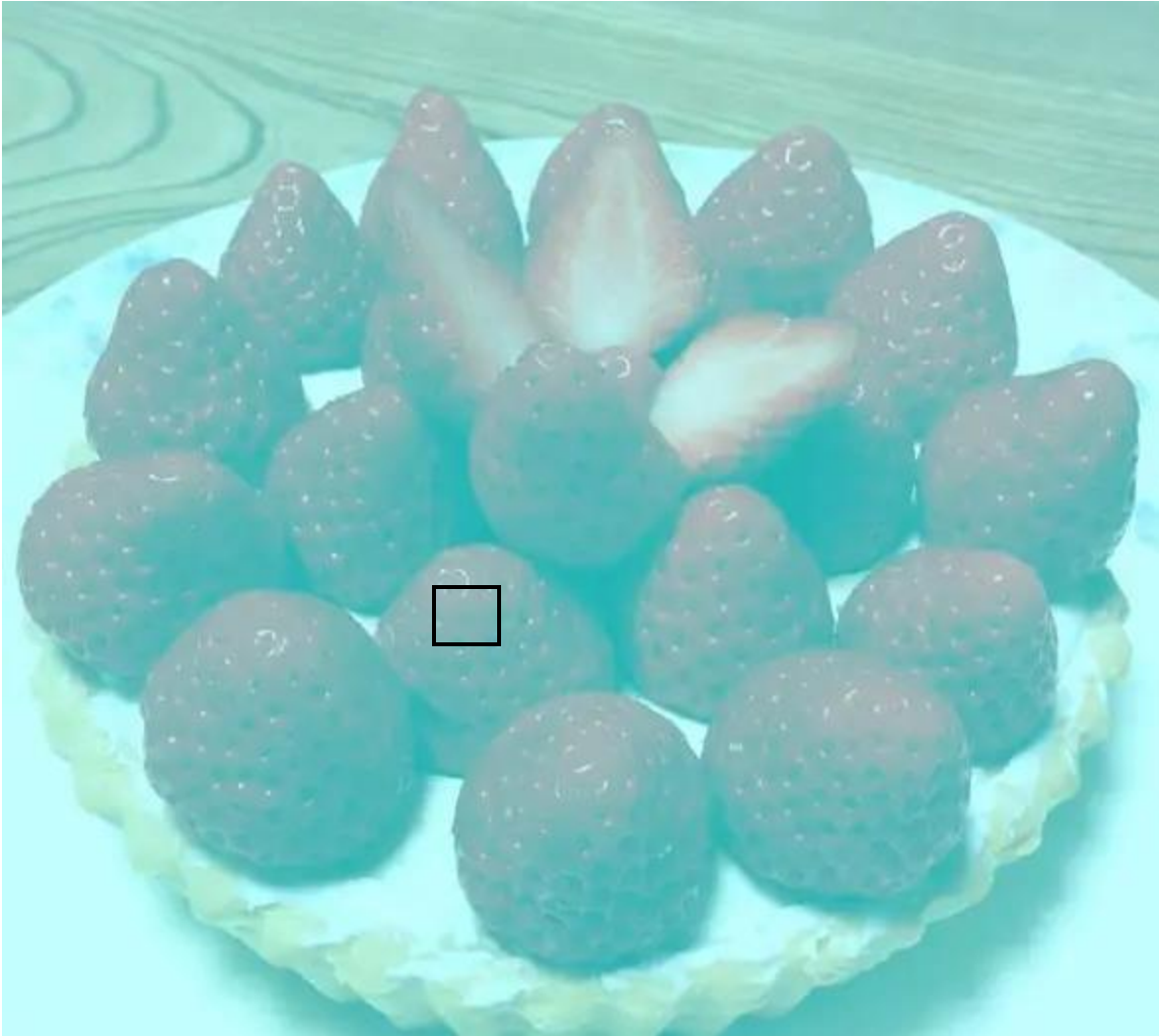
Edward H. Adelson



Context Dependent Perception



Context Dependent Perception

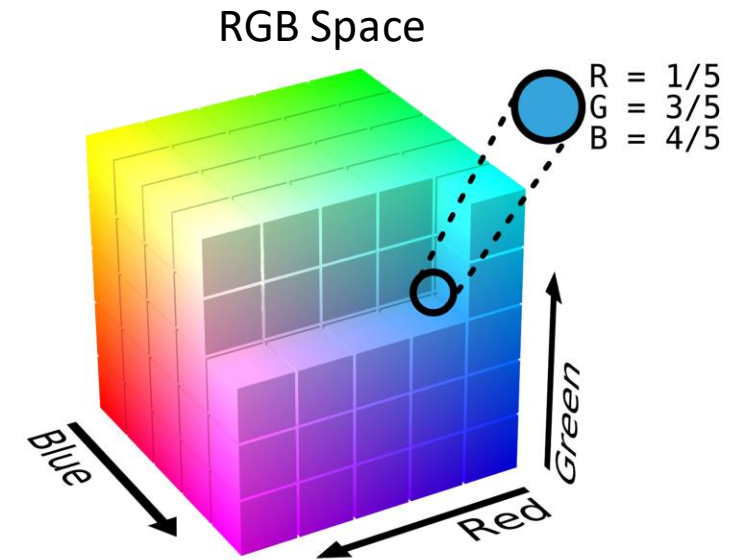
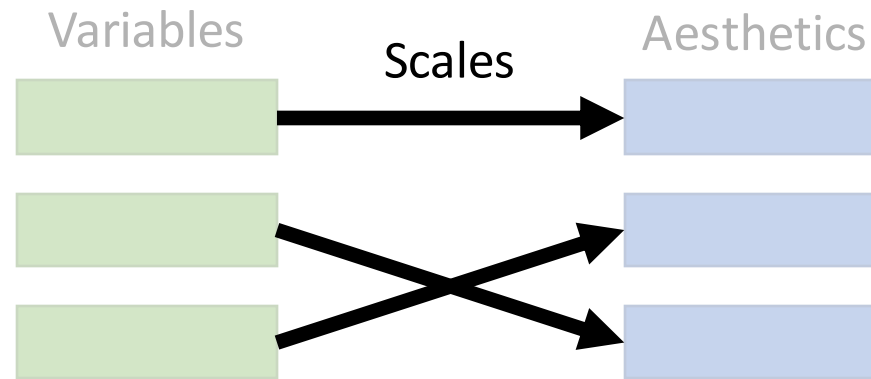


Akiyoshi Kitaoka

Colour Scales

aka Colour maps

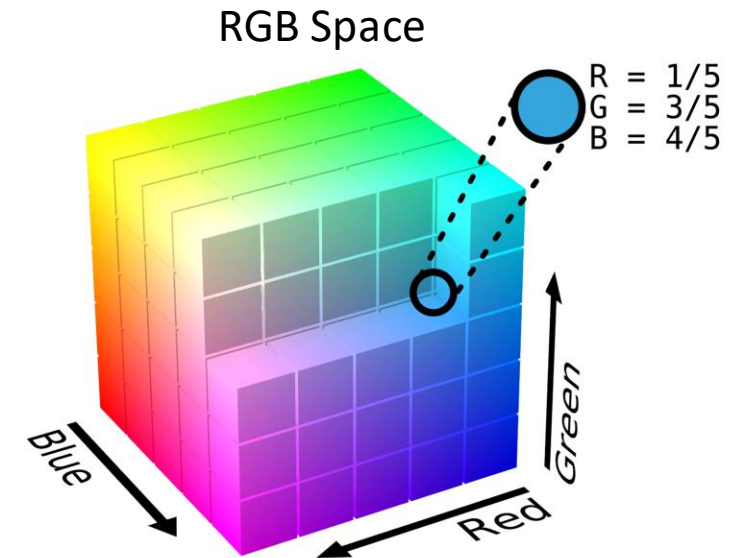
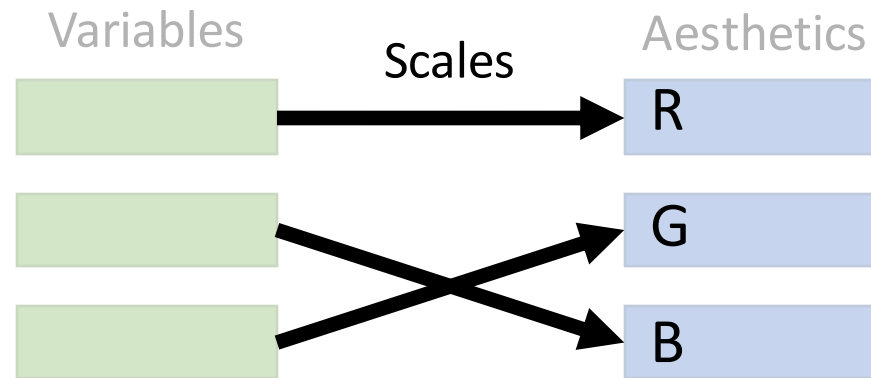
aka Colour palettes



Colour Scales

aka Colour maps

aka Colour palettes



- Can we use all 3 colour dimensions?
- Not a good idea in practice ☹️

An Exception - Optical Flow Fields

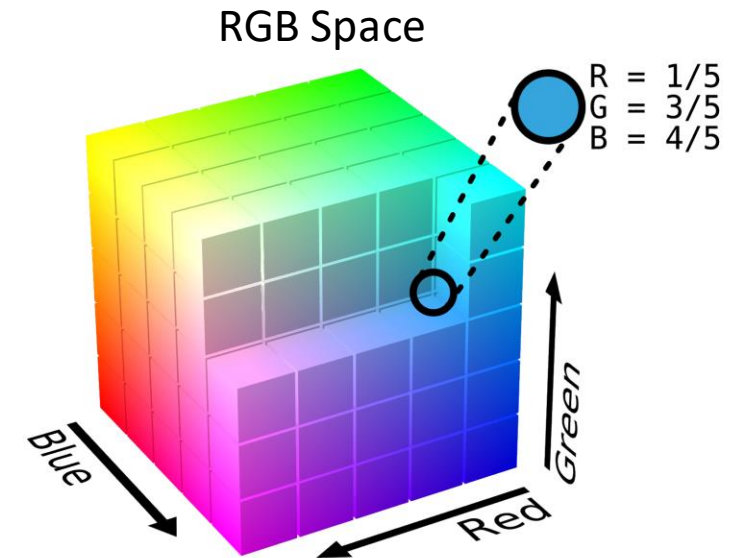
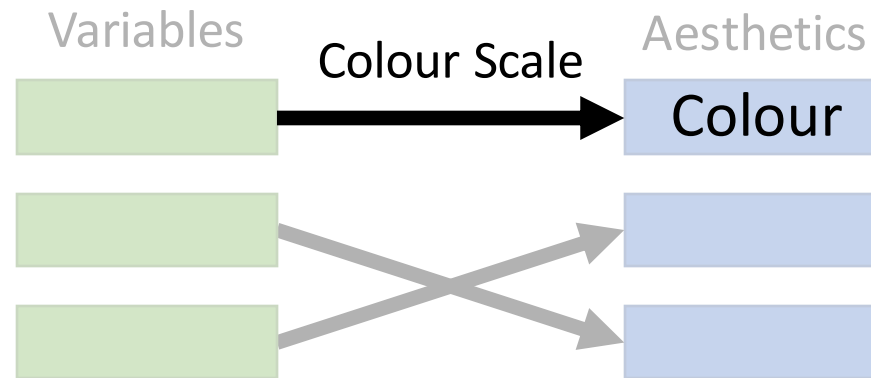


<http://www.jarnoralli.fi>

Colour Scales

aka Colour maps

aka Colour palettes



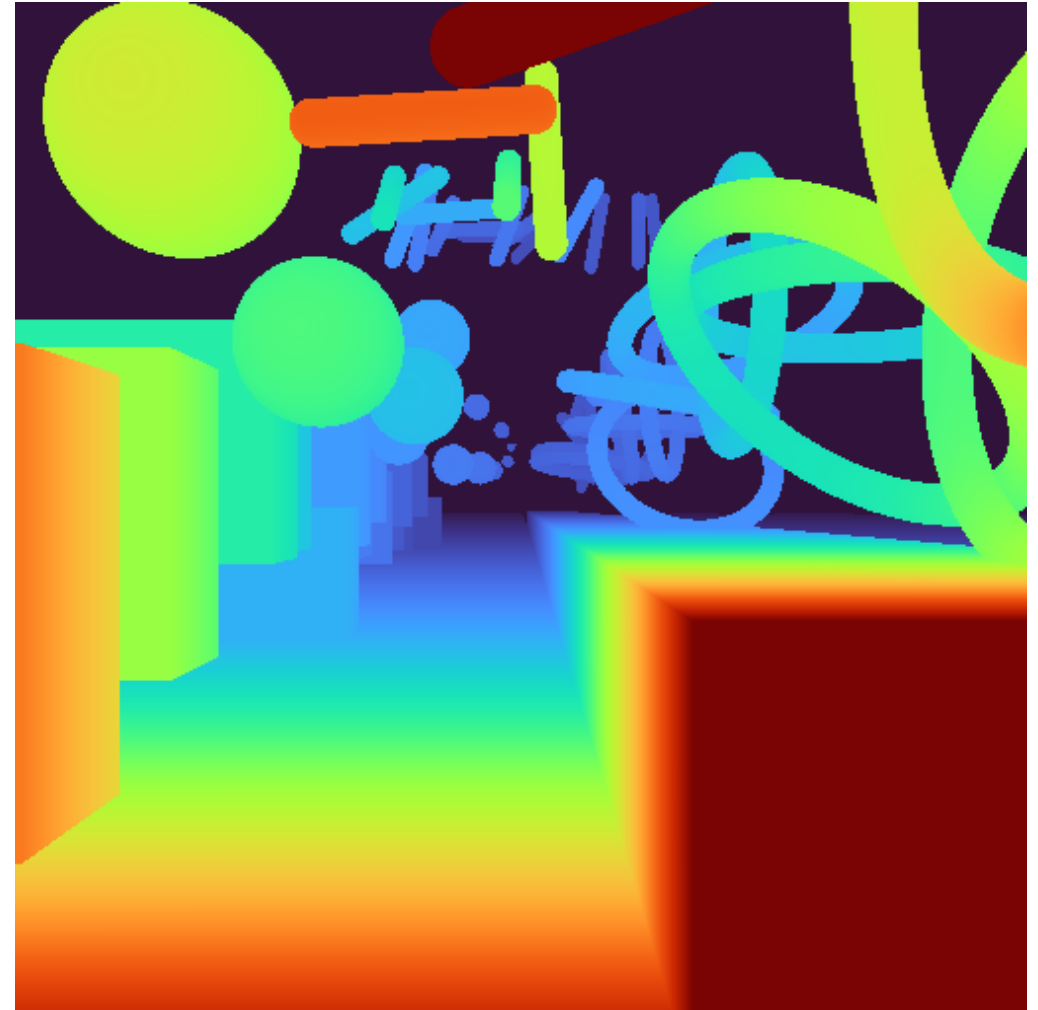
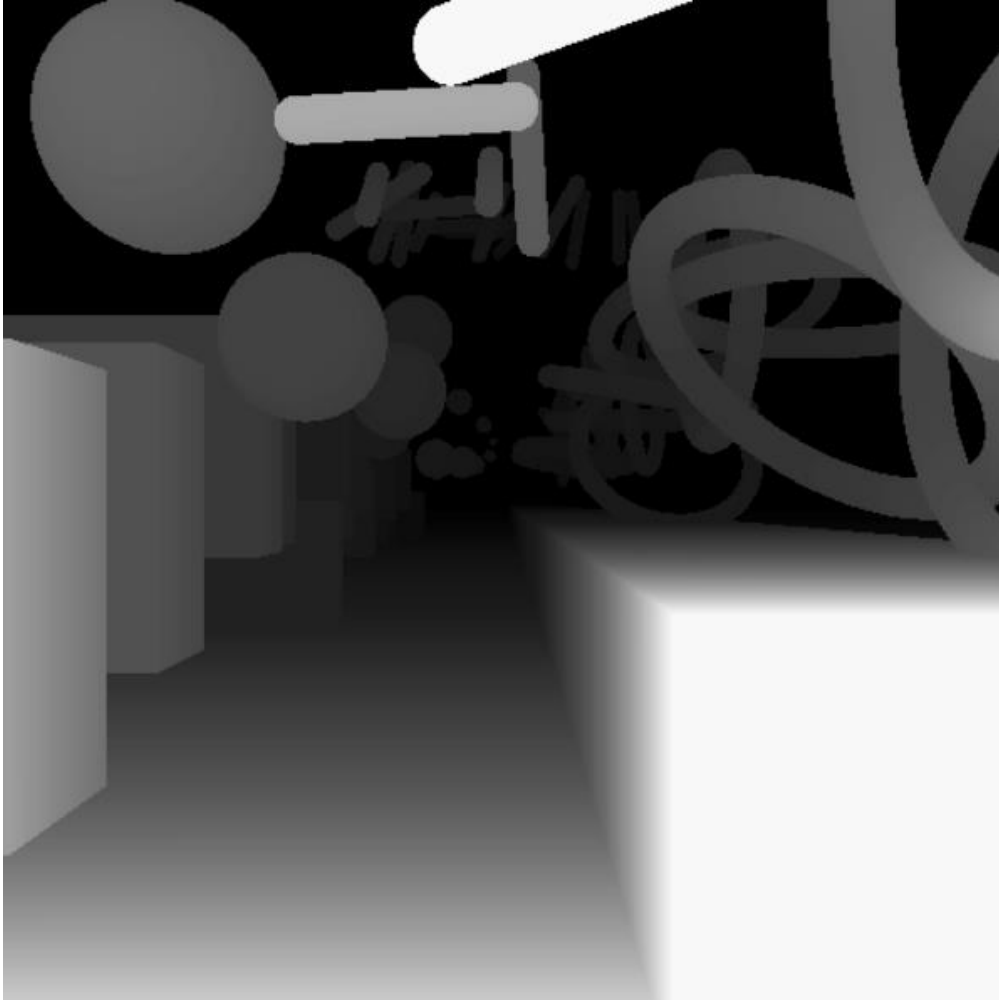
- Usually Colour is single aesthetic.
- Colour scale maps 1 variable to 3D colour.

What's wrong with grey?



Kenneth Moreland (2009)

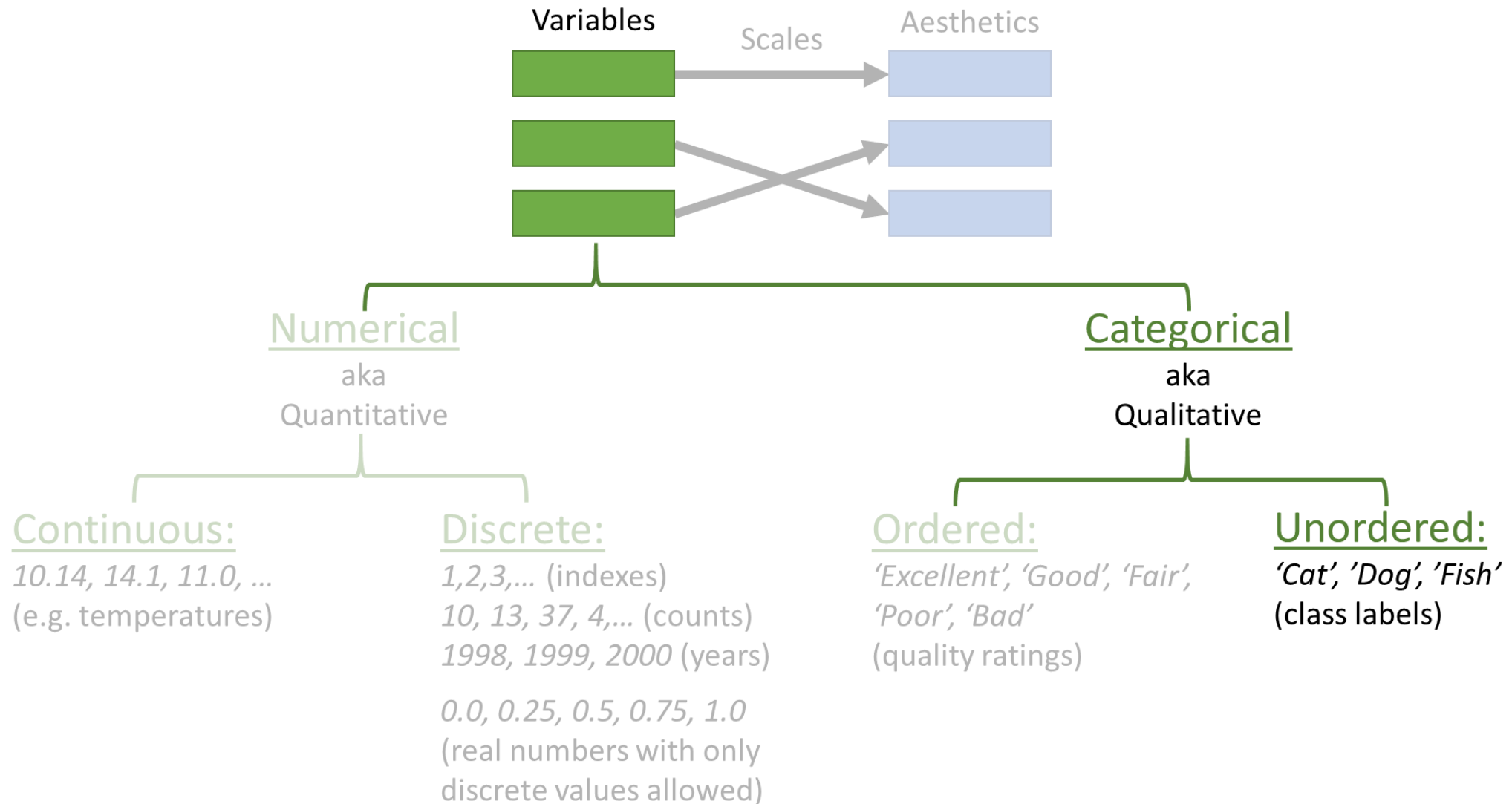
What's wrong with grey? – Dynamic Range



Anton Mikhailov (2019) Google AI blog

Colour Scales for Unordered Variables

aka *Categorical* Colour Scales



Colour Scales for Unordered Variables

Goals:

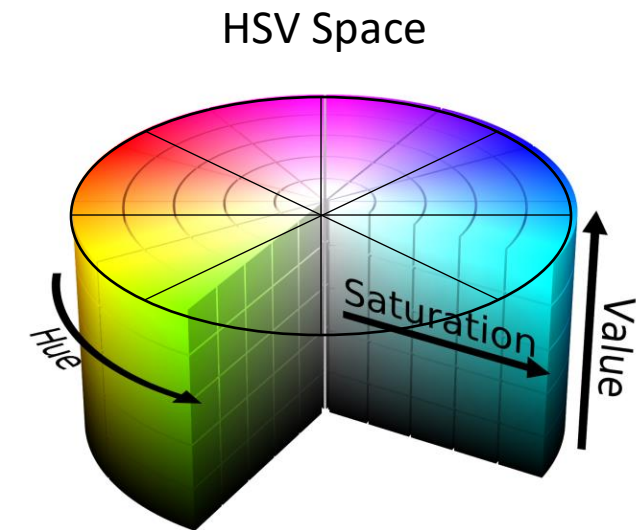
- Easily distinguishable
- Should not imply order
- None should stick out



tab10 (seaborn)



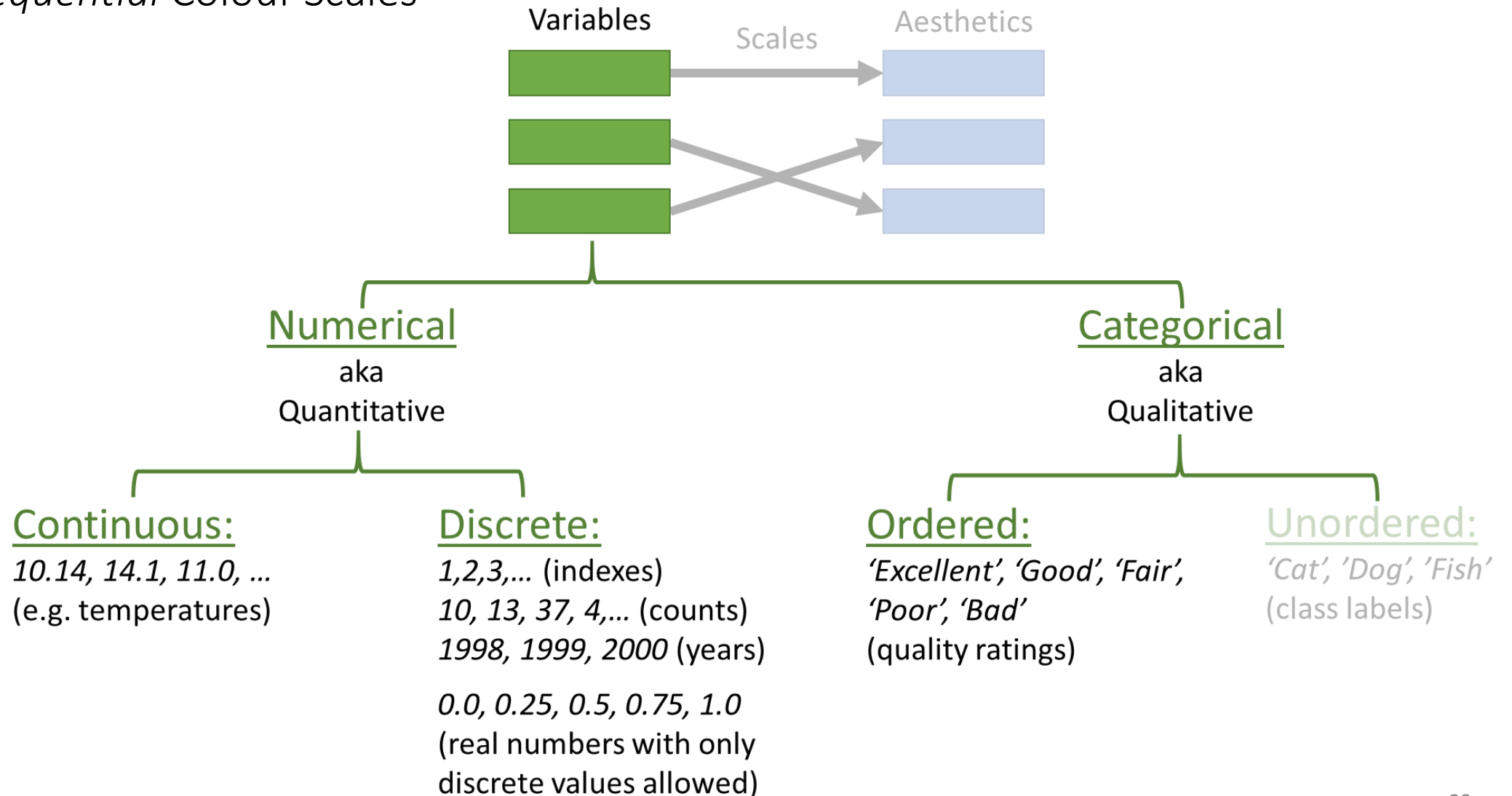
Set2 (colorbrewer)



- Fix saturation and value
- Subdivide hue

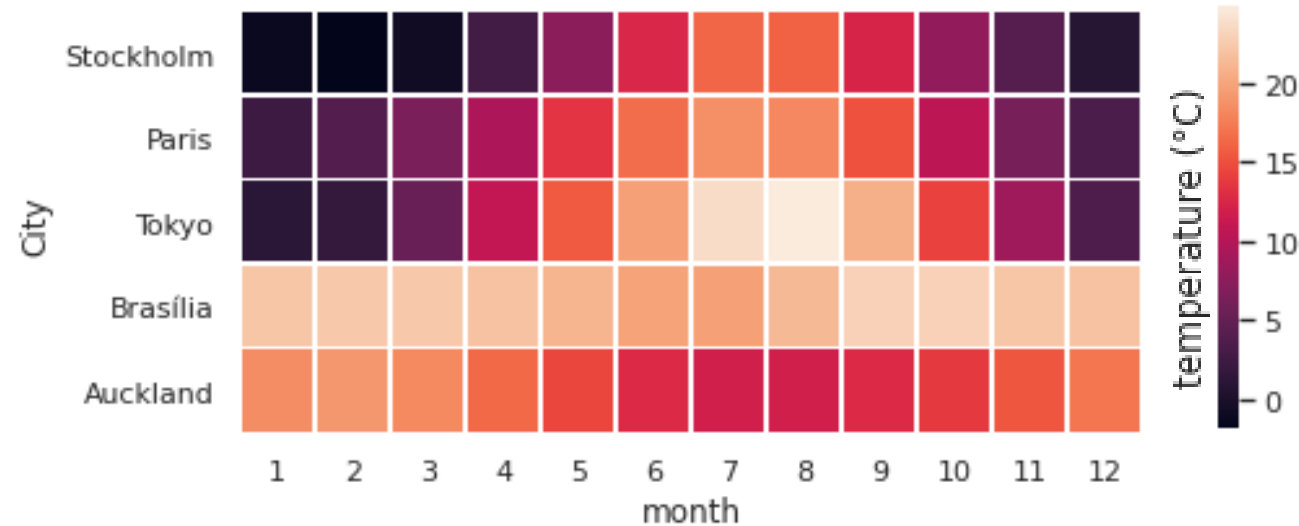
Colour Scales for Ordered Variables

aka *Sequential* Colour Scales



Colour Scales for Ordered Variables

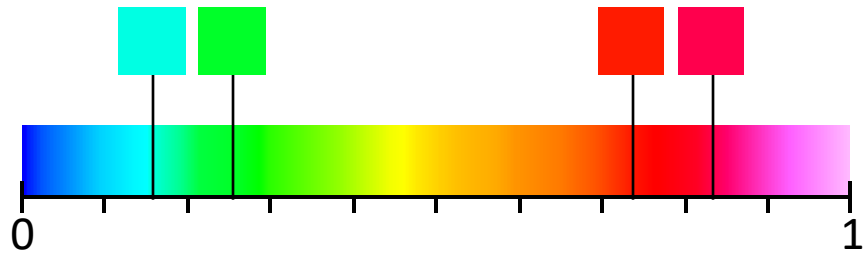
aka *Sequential* Colour Scales



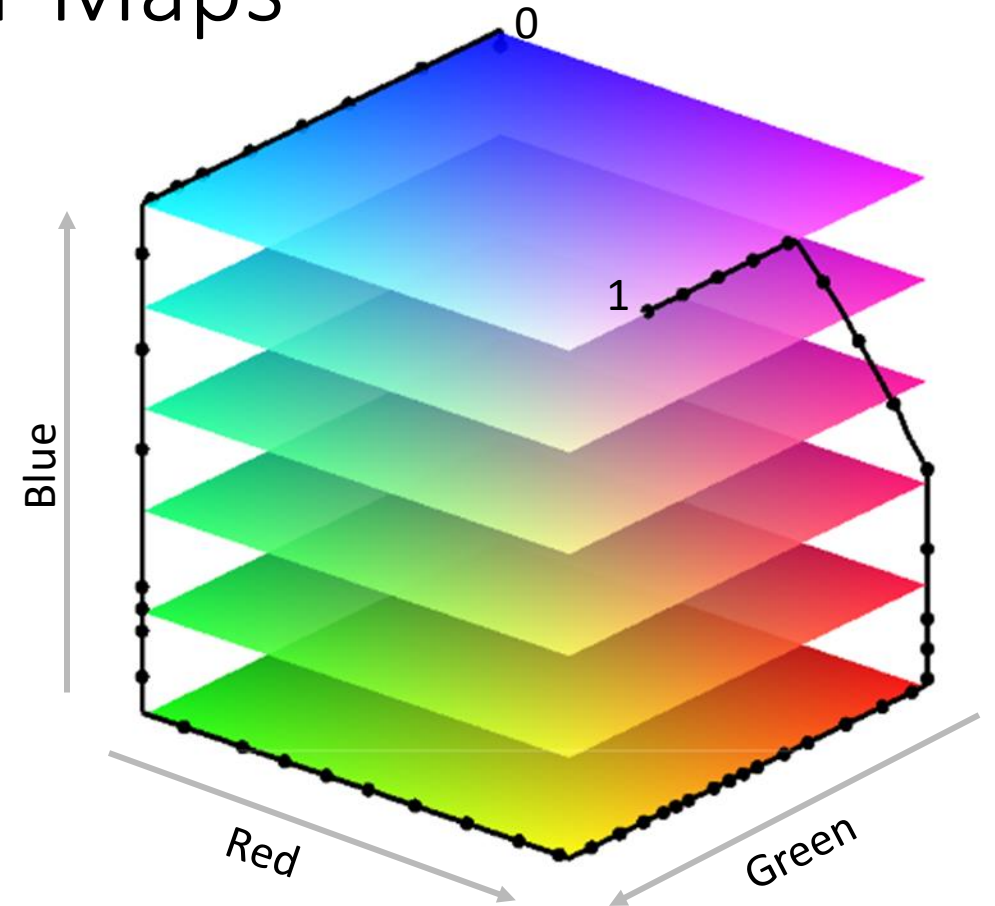
Goals:

- Indicate which of two values is larger.
- Indicate how far apart two values are.

Perceptually Uniform Colour Maps



Perceptually uniform, colour-blind-friendly, grayscale compatible

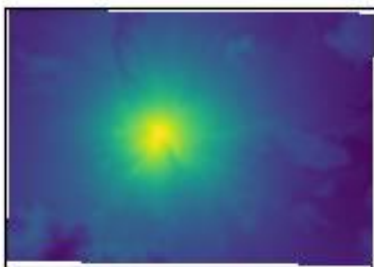


P. Kovesi (2015)

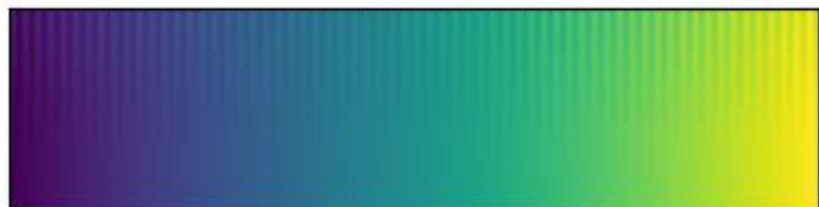
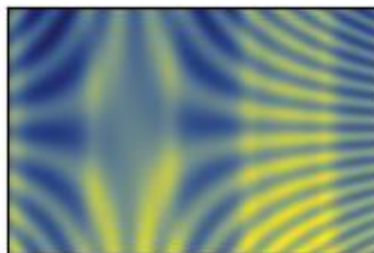
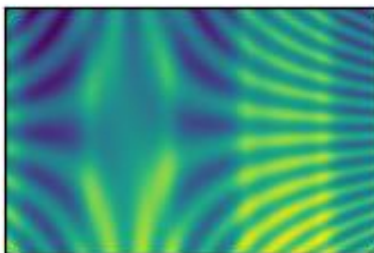
Not quite perceptually uniform



Sample images



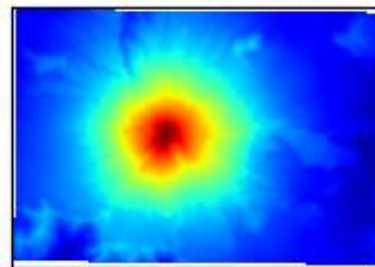
Moderate deuter.



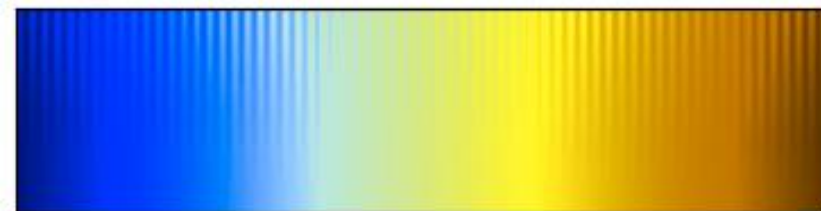
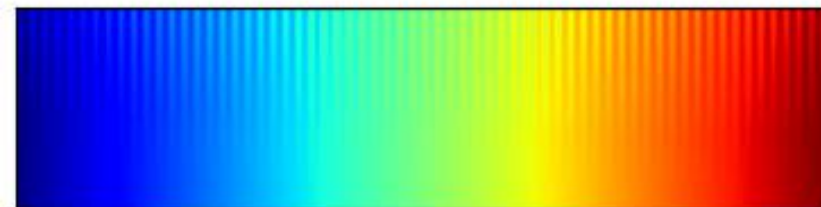
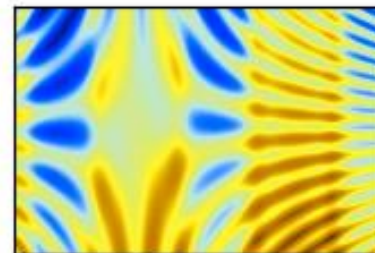
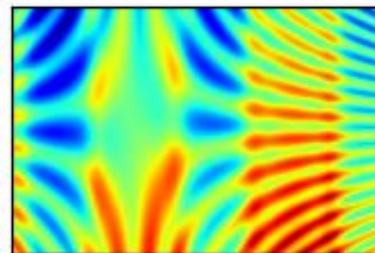
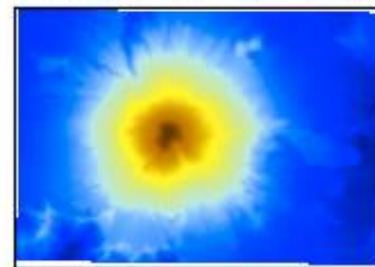
Moderate
deuter.

Viridis

Sample images



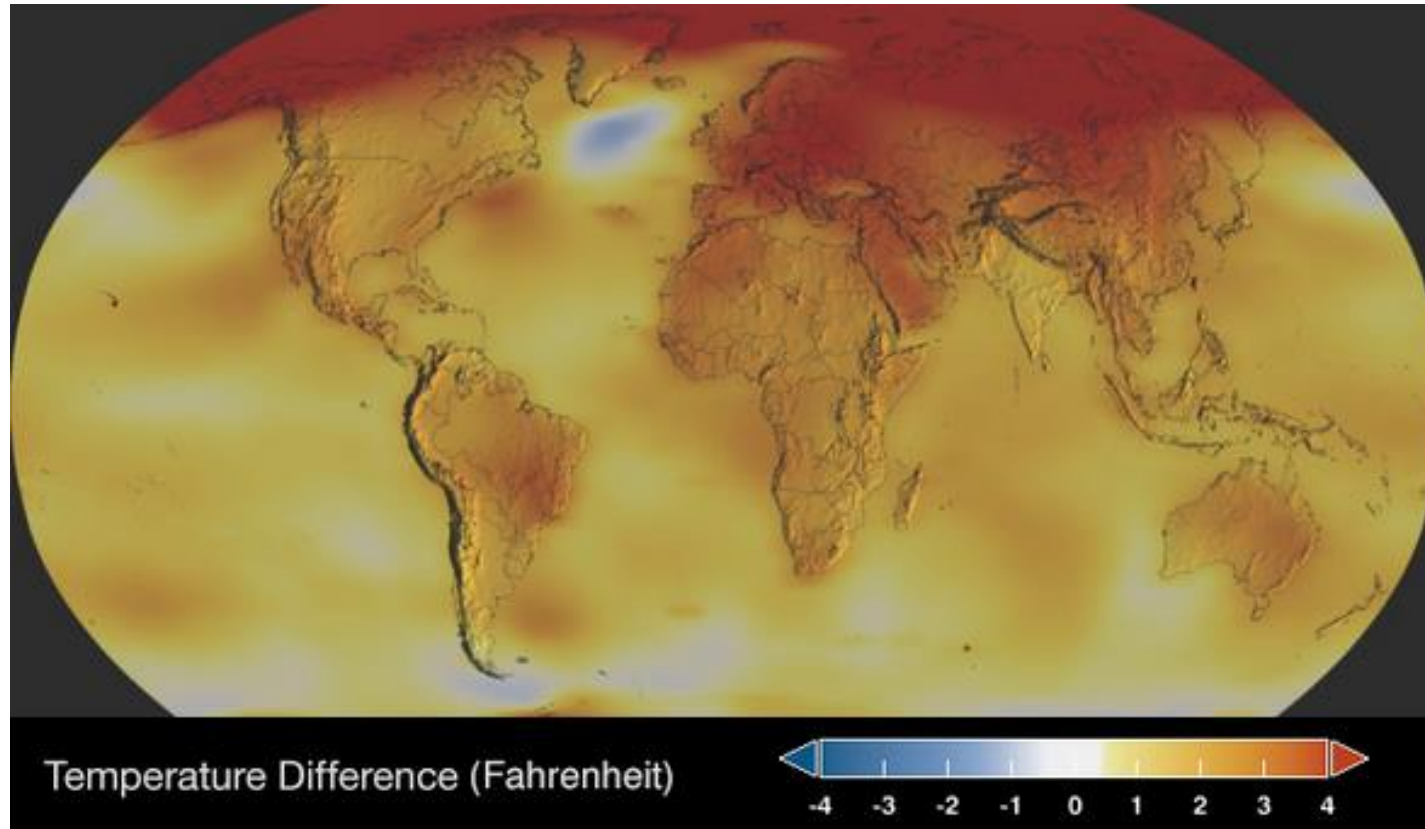
Moderate deuter.



Moderate
deuter.

Jet

Diverging Colour Scales



Perceptually uniform

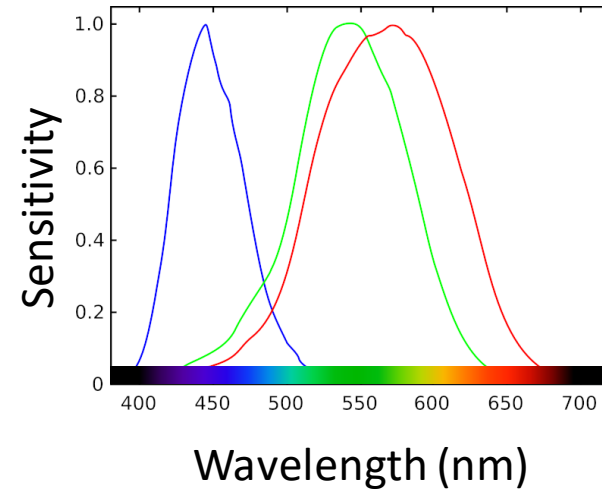
climate.nasa.gov/vital-signs/global-temperature/

Vlag

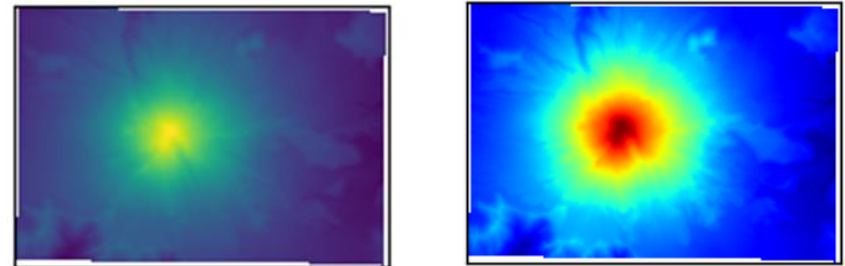
Icefire

Take Home Messages

- We are (mostly) trichromats.
 - Light spectra are high dimensional.
 - Our colour perception is 3D.



- Choose your scales carefully. Keep in mind:
 - Ordered versus unordered
 - Perceptual uniformity
 - Colour-blind-friendliness



(e) Consider a dataset that contains the following variables for a set of different countries:

- (i) The continent the country is located on.
- (ii) The difference between the average life expectancy in the country and worldwide average life expectancy.
- (iii) The number cities with a population greater than 10 million.
- (iv) A rating assigned by an NGO for the country's education system, taking the values: *outstanding*, *excellent*, *good*, *fair*, *mediocre*, *poor*, *bad*.

Imagine you were to display each of the variables using a colour scale. Each of the colour scales below is suitable for one or more of the variables above. Assign each variable to a suitable colour scale. Briefly explain each choice (no more than one sentence each).

[12 marks]

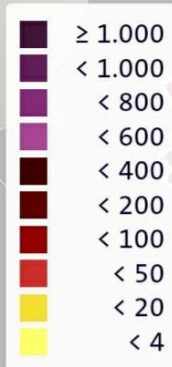


Covid-19: Neuinfektionen pro 100.000 Einwohner binnen 7 Tagen

Zuletzt aktualisiert: **18.11.2021 03:11 Uhr**

Altersgruppe auswählen: (Gesamt) ▾

Kreis/Stadt auswählen...



Geobasis-DE / BKG 2021

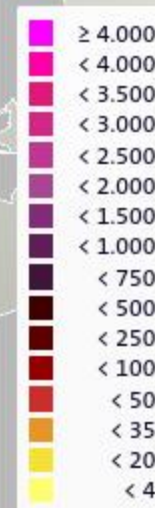


Covid-19: Neuinfektionen pro 100.000 Einwohner binnen 7 Tagen

Zuletzt aktualisiert: **31.01.2022 03:50 Uhr**

Altersgruppe auswählen: Gesamt ▾

Kreis/Stadt auswählen...



Geobasis-DE / BKG 2021 Quelle: Robert Koch-Institut, eigene Berechnungen

