“Colour used poorly is worse than no colour at all” - Edward Tufte

- “Above all, do no harm”
- Colour can cause the wrong information to stand out and
- Make meaningful information difficult to see.
Colour space

A colour space is a mathematical model for describing colour.

- RGB, HSB, HSL, Lab and LCH

RGB is the most common in computer use,
- but least useful for design
- our eyes do not decompose colours into RGB constituents

HSV, describes a colour in terms of its hue, saturation and value (lightness),
- models colour based on intuitive parameters
- more useful.
Colourimetry

- **Hue (colour)**
  - around the circle

- **Saturation**
  - Inside to outside
  - Colour to grey scale

- **Lightness (value)**
  - top to bottom
Brewer Palettes

Brewer palettes (colorbrewer.org) provide a range of palettes based on HSV model which make life easier for us.

Avoid the use of hue to encode quantitative variables

Quantitative encoding e.g. heat maps

Two-sided quantitative encodings

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**QUALITATIVE**

- set1
- set2
- pastel2
- dark2

**SEQUENTIAL**

- blues
- greens
- reds
- ylorbr

**DIVERGING**

- spectral
- rdylbu
- rdylgn
- piyg

Fig. Courtesy of M. Krzywinski,
Examples

Poor use of colour

one color dominates

difficult to distinguish

murky

Brewer colours

recolored with Brewer palettes

M. Krzynski, behind every great visualization is a design principle, 2012
Conversion to Grey scale

- Ensure chosen colour set works well in grey scale
  - Sequential palette works well here
Trouble with perceptual colour....
Context Affects Perceived Colour

Figs. Courtesy of S Rogers, ONS
Accessibility (W3C):
10-20% of population are red/green colour blind. (74? 21? No number at all?)....
8% males of USA descent

Red-green

Red-green

Blue-yellow

Fig. Courtesy of M Krzywinski
BioVis Example: Immunofluorescence images

red-green image of P2Y1 receptor and migrating granule neurons, effectively remapped to magenta-green using the channel mixing method.
Blue-Yellow might be better than Green-Magenta. Talk about same colours.

Gabriel Landini & D Giles Perryer, Image recolouring for colour blind observers
From Data to Visualization…

- The properties of the data or information
- The properties of the image
- The rules mapping data to images
Adapted from Mackinlay J (1986) Automating the design of graphical presentations of relational information.
## Mapping data types to encoding

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Mackinlay J (1986) Automating the design of graphical presentations of relational information.
Don’t forget Salience…

- Physical properties that set an object apart from its surroundings
  - Distinct features have high salience
- Encodings have differences in discrimination and accuracy
- Context affects salience
- Choose salient encodings for primary navigation
  - Colour is good for categories - salience decreases with more hues.
- Focus attention by increasing salience of interesting patterns
- Unexpected or bad things can happen when unimportant elements in a figure are salient.
  - The reader will use salience to suggest what is important.