Comp 341/441 - HCI

Spring Semester 2020 - Week 2

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Cultural considerations…

- standardising an interface or localising…
- local issues arise from cultural misunderstanding
  - *Cardiff City Football Club change their colours…then change them back again*
    - Report

This is a very interesting consideration for interface design.

More to come later in the semester.

Image - HCI - 1

The many fields of HCI

Field of HCI

Not just computer science and design...

HCI Components

- Guidelines
- Methods
- Models
- Principles
- Techniques
- Theories

HCI is

- Creative
- Design aware
- Evaluative

Design

- design is all around us
  - *art, music, culture in general*
- to be good designers we have to appreciate the arts
- understand the rich history of graphic design
  - *its trends, products, and leading figures*
- Vimeo - Milton Glaser Intro (http://vimeo.com/11577085)

Colour & Vision - 1

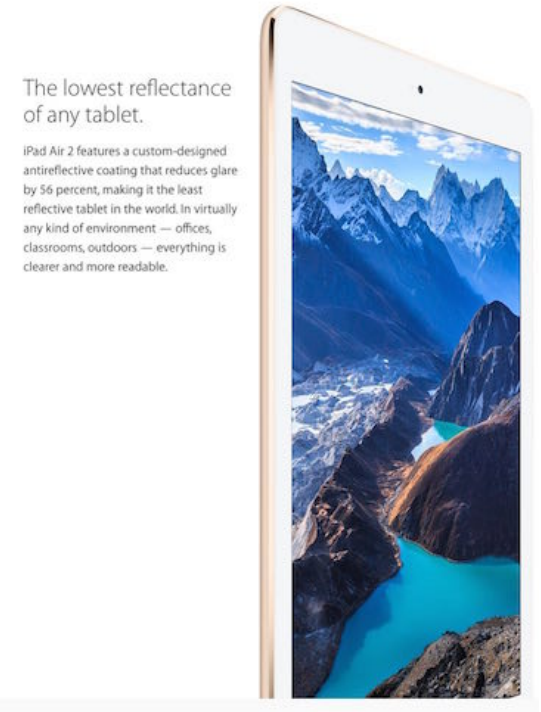
Perception

- colour perception in humans
  - *inherent strengths and weaknesses*
- a few limitations in everyday lives
- considerations as UI designers
  - *presentation of colours affects a user's ability to recognise and distinguish them*
  - *display influences a user's perception of colour*
    - eg: their monitor, screen or other viewing device
  - *user's vision optimal at detecting contrasts, edges*
    - not absolute brightness
  - *some users may have some degree of colour-blindness*

Image - Display performance - 1

A comparison of glare (source: Amazon)

Image - Display performance - 2

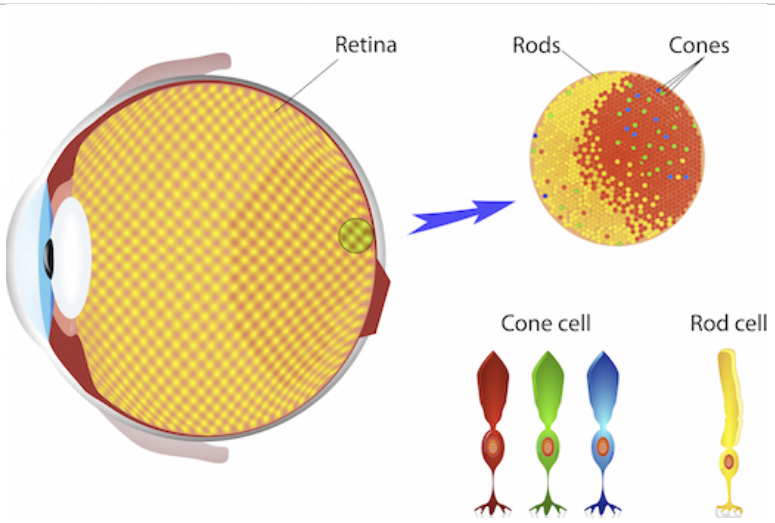


Reducing glare - Apple iPad Air 2 (source: Apple)

Rods and Cones

- retina at the back of the eye is used for focusing images
- retina has two types of light receptor cells
  - *known as rods and cones*
- *rods* detect light levels, but not colours
- *cones* detect colours
  - *three types sensitive to red, green, and blue light*
  - *often compared to video cameras, monitors…*

Image - Colour & Vision - 3



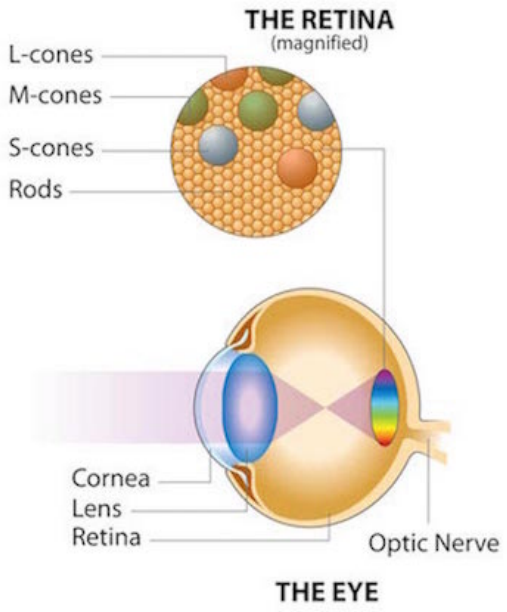
Human Eye

The Human Eye (source: DoveMed)

Modern Environmental Influences

- we need to consider the effect of environmental conditions on human vision
  - *modern working and living spaces*
- rods are sensitive to the environment's overall brightness
- three types of cones sensitive to different frequencies of light
- bright artificial lights dramatically reduce the use of rods
  - *rods designed for low levels of light*
  - *navigating low-light environments*
- bright artificial lights max out our rods
  - *rods provide no real useful information*
- vision becomes reliant on input from cones

Image - Colour & Vision - 5



Human Eye

The Human Eye (source: Verilux)

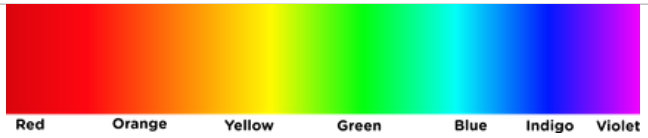
Video - Colour & Vision

how we see colour

TedEd - How we see color

Source - TedEd - How we see color - YouTube

Image - Colour & Vision - 6



Visible Light Spectrum

Visible Light Spectrum (source: Wikimedia)

- S-cone = short-wavelength sensitivity
  - *sensitive to light over almost the entire range of visible light*
  - *most sensitive to the middle (yellow…) and low (red…) frequencies*
- M-cone = middle-wavelength sensitivity
  - *less sensitive than S-cones*
  - *sensitive to light ranging from high-frequency (blues…) through middle frequency (yellows & oranges…)*
- L-cone = long-wavelength sensitivity
  - *less sensitive than either S or M-cones*
  - *most sensitive to upper end of visible light spectrum (violets through blues…)*
  - *our eyes are less sensitive to violets through blues than other colours*

Combinations in the brain

- our brain works on the principle of subtraction
- visual cortex at the back of our brain does the work
  - *neurons subtract signals coming along the optic nerves from S and M-cones*
    - produces red-green *difference* signal channel
  - *neurons subtract signals from L and S-cones*
    - produces yellow-blue *difference* signal channel
  - *third set of neurons as the signals from S and M-cones*
    - produces an overall black-white, or luminance, channel
- three channels known as *colour-opponent* channels

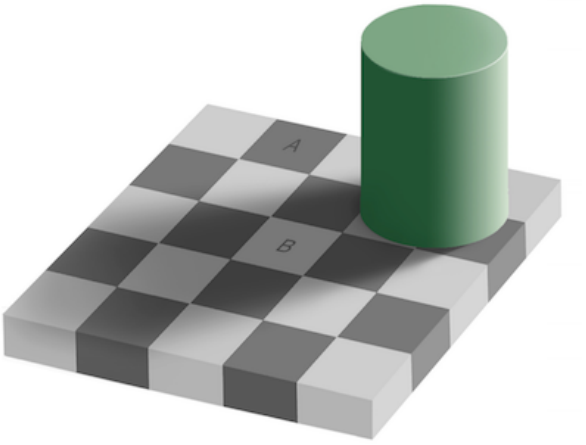
Vision & Contrast - 1

Sensitivity

- our vision is now much more sensitive to differences in colour and brightness
  - *greater sensitivity to contrasting colours and edges*
  - *less sensitivity to absolute brightness levels*
- greater sensitivity to contrast is an advantage
  - *more easily discern objects in varied light*
- sensitivity to colour contrasts rather than absolute colours
  - *allows us to discern colour of an object in bright light or shade*

Image - Vision & Contrast - 2

Optical Illusions

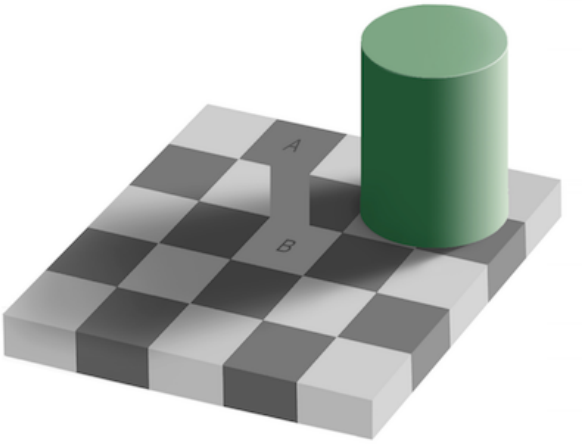


Grey Square Illusion

Grey square optical illusion - Edward H. Adelson (source: Wikipedia)

Image - Vision & Contrast - 3

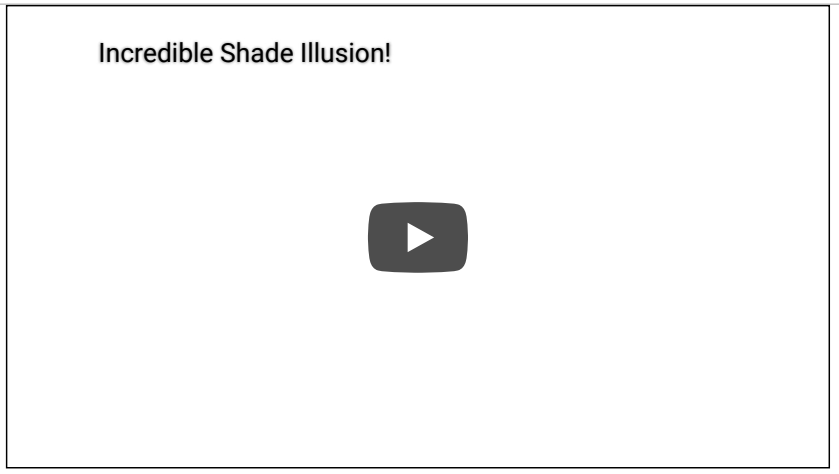
Optical Illusions



Grey Square Illusion

Grey square optical illusion - Edward H. Adelson (source: Wikipedia)

Video - Vision & Contrast - 4



Grey Square Optical Illusion - Source: YouTube

Vision & Contrast - 5

Shade and Shadow

- on the 2D plane
  - *we often struggle to understand why the two colours are the same*
- importance and effect of shade
  - *its effect on the brain's perception of colour*
- our brain is compensating
  - *for the shadow &*
  - *adjusting the colour of square B*
- our eyes see the squares as the same grey colour
- our brain adapts perception
  - *to match what we think is actually the real representation*
  - *i.e. real representation of colours and square B*

Image - Vision & Contrast - 6

Chiaroscuro

Supper at Emmaus, Caravaggio

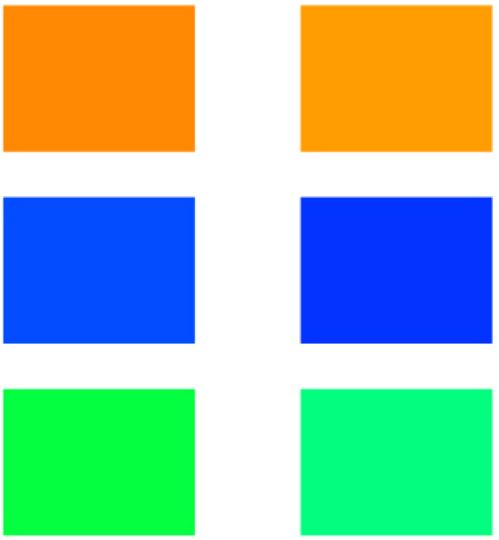
Supper at Emmaus, Caravaggio. Further details

Video - Vision & Contrast - 7

Scotoma - The Da Vinci Code - Source: YouTube

Image - Vision & Contrast - 8

Colour presentation



Colour blocks

Colour Presentation (source: National Geographic - Modified)

Vision & Contrast - 9

Presentation factors

- colour patch size
  - *harder to discern colour as objects get smaller or thinner*
  - *text is a good example of thin rendering*
  - *text colour is often hard to discern - e.g. black and navy…*
- paleness
  - *as colours become more pale, it's harder to differentiate similar tones*
- separation
  - *as colour blocks become more separated*
    - harder to determine their colours
    - particularly true with eye motion from one colour block to another

a few suggestions

A few things to avoid in images & graphics

- try to avoid overly pale colours
- avoid pale colours juxtaposed
- avoid pale colours for smaller blocks or zones
  - *often simply lost in the noise of larger zones and blocks*
- carefully consider chosen colours for charts, graphs, infographics…

Vision issues - 1

colour blindness

- does not infer an inability to see colours
  - *a defect with one or more colour subtraction channel*
- makes it difficult to distinguish certain pairs of colours
- most common form of colour blindness is lack of red-green perception
- ~8% of men & ~0.5% of women suffer
  - *source: Wolfmaier, 1999*

Image - Vision issues - 2

human colour perception

Key

- left = normal human colour vision
- right = human Red-Green colour blindness

Colour Blindness

Colour Blindness - Red-Green (source: Ask a Mathematician / Ask a Physicist)

Video - Vision issues - 3

Colour blind

‘No Such Thing as Color - what it’s like to be color blind’
Source: YouTube

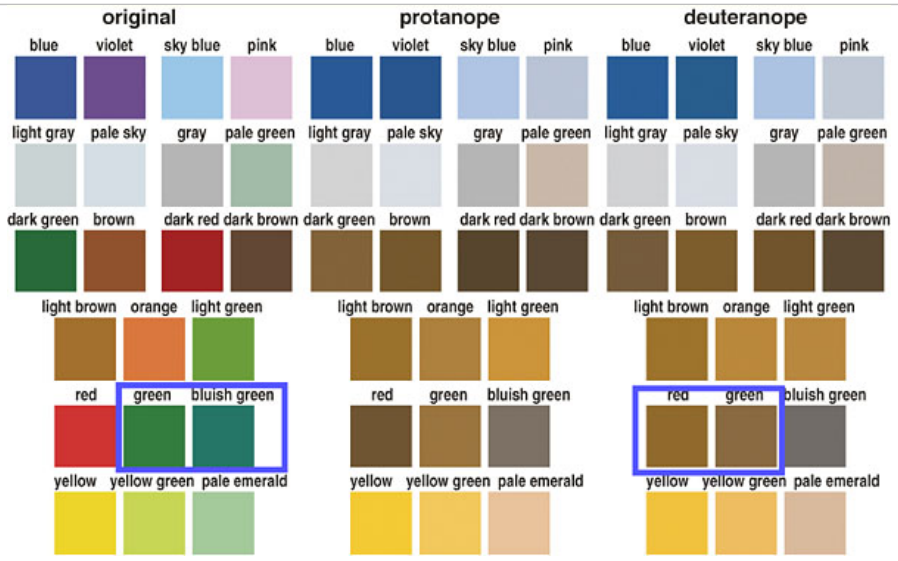
Vision issues - 4

colour differentiation & impact

- consider data visualisation
  - *we may use colour to differentiate quantity, scale, percentages…*
- for a person with red-green colour blindness
  - *impacts their ability to discern such data differentiation solely based upon colour*
- we may rectify this issue in at least two respects
  - *modify our colours to match those perceived by red-green colour blindness*
  - *offer supporting data and explanation for the visualisation*
- not always possible to create a full data visualisation for colour blindness
  - *e.g. one that easily differentiates such quantities and values*
  - *due to limited palette for red-green colour blindness*

Image - Vision issues - 5

colour differentiation



Colour Differention - Red/Green Blindness

Colour perception (source: Okabe, M & Ito, K. 2008)

other issues to consider…

Other issues to consider…

- ambient lighting has a direct impact upon a user's display
  - *washed out, distorted colours*
  - *light and dark areas may persist*
  - *mobile & wearable considerations*
- display viewing angle affects a user's interpretation of colour
  - *cheaper, non-IPS displays offer poor viewing angles and colour shifting*
- mono or greyscale displays directly influence design choices
- variation in colour across competing display technologies
  - *deeper blacks, richer colours, varied viewing angles*

The Bible with Sources Revealed - Source: Amazon

Colour suggestions

Colours - Red/Green Blindness

- subtle colour differences versus saturation, brightness, and hue
  - *test in monochrome to discern zones of coloured differences*
- distinctive colours aid a user's visual system in the combination of colours and visual recognition
  - *black, white, red, green, yellow, and blue*
- try to avoid colour pairs that colour blind people can't distinguish
  - *eg: dark red vs black, dark red vs dark green, blue vs purple, and light green vs white*
  - *try those colours against yellows and greens*
- try adding supporting recognition to colours within your interface
  - *eg: icons, keys, notes…*

Resources

- Laing, R.D., Phillipson, H. & Russell Lee, A. *Interpersonal perception: a theory and a method of research* Tavistock Publications. 1966.
- Okabe, M. & Ito, K. *Color Universal Design (CUD) - How to make figures and presentations that are friendly to Colorblind people.*
  - *J Fly. 2008. http://jfly.iam.u-tokyo.ac.jp/color/.*
- Waloszek, G. *Vision and visual disabilities: An introduction.* SAP Design Guild. 2005. http://www.sapdesignguild.org/editions/highlight_articles_01/vision_physiology.asp
- Wolfmaier T. *Designing for the color-challenged: A challenge.* ITG Publication. 1999.