Comp 341/441 - HCI

Spring Semester 2019

Dr Nick Hayward

course details

Lecturer

- Name: Dr Nick Hayward
- Office: Doyle 307 (LSC)
- Office hours
  - *Monday afternoon by appointment (LSC)*
- Faculty Page

Course Schedule

Important dates for this semester

- Project outline and mockup
  - *presentation & demo: Wednesday 13th February 2019 @ 7pm*
- Spring Break: Monday 4th to Saturday 9th March 2019
  - ***n.b.*** *no formal class: Wednesday 6th March 2019*
- DEV week: Wednesday 13th to Wednesday 20th March 2019
  - *presentation & demo: Wednesday 20th March 2019 @ 7pm*
- Final class: Wednesday 24th April 2019
  - *presentation & demo: Wednesday 24th April 2019 @ 7pm*
- Exam week: Monday 29th April to Saturday 4th May 2019
  - *Final assessment due on Wednesday 1st May 2019 by 7pm*

n.b. NO final exam

Coursework schedule

Presentations, reports &c.

- project outline & mockup
  - *due Wednesday 13th February 2019 @ 7pm*
- DEV week demo
  - *due Wednesday 20th March 2019 @ 7pm*
- final team demo
  - *due Wednesday 24th April 2019 @ 7pm*
- final team report
  - *due Wednesday 1st May 2019 @ 7pm*

Assignments and Coursework

Course will include

- weekly bibliography and reading
- weekly notes, examples, extras...

Coursework will include

- preparatory work
  - *assigned at the end of each section*
  - *may include demos, designs, testing, prototypes...*
- final demo
  - *presentation and demo*
- final report
  - *explain implemented differences throughout semester*
    - where and why did you update the project?
    - benefits of updates
  - *clearly detail design and development process*
    - outline testing, prototypes &c.
    - explain pros and cons of existing interface
    - contrast old and new interface
    - ...
- work may be conducted individually or in groups (max. 4 persons per group)
  - *group report must clearly define each student's work and contributions, where applicable*
    - no attribution, no mark

Weekly exercises & discussions (20%)

- exercises
  - *help develop course project*
  - *test course knowledge at each stage*
  - *get feedback on project work*
- discussions
  - *sample websites and applications*
  - *design topics, UI and UX concepts*
- extras
  - *design and application reviews*
  - *various other assessments*
  - *peer review of demos*

Project outline & mockup assessment

Course total = 15%

- begin outline and design of group project
- design a new or re-imagined UI and UX for a chosen application or device
- outline concept, research conducted to date
- consider applicable design patterns
- mockups, designs, paper prototypes...
  - *demo current designs, concepts, and mockups*
  - *any working tests or models...*

Project mockup demo

Assessment will include the following:

- brief presentation or demonstration of current project work
  - *~ 5 to 10 minutes per group*
  - *analysis of work conducted so far*
  - *presentation and demonstration*
    - outline current state of app concept and design
    - show mockups, designs, &c.
  - *due Wednesday 13th February 2019 @ 7pm*

DEV Week Assessment

Course total = 25%

- continue to design a new or re-imagined UI and UX for a chosen application or device
- outline concept, research conducted to date
- consider applicable design patterns
- prototyping
  - *demo current prototypes*
  - *any working tests or models etc*
- anything else to help explain your updated project and app...

DEV Week Demo

DEV week assessment will include the following:

- brief presentation or demonstration of current project work
  - *~ 10 minutes per group*
  - *analysis of work conducted so far*
    - e.g. during semester & DEV week
- presentation and demonstration...
  - *outline app*
  - *show prototypes and designs*
  - *explain what does & does not work*
  - ...
- due Wednesday 20th March 2019 @ 7pm

Final Assessment

Course total = 40%

- continue to develop your app concept and prototypes
- working app
- explain design decisions
  - *describe patterns used in design of UI and interaction*
  - *layout choices...*
- show and explain implemented differences from DEV week
  - *where and why did you update the app?*
  - *perceived benefits of the updates?*
- how did you respond to peer review?
- final demo
  - *due on Wednesday 24th April 2019 @ 7pm*
- final report
  - *due on Wednesday 1st May 2019 @ 7pm*

Goals of the course

A study of the interaction between humans and computer-based systems.

Course will provide

- methods for evaluating, designing, and developing better interfaces
- focus upon interface design
  - *guidelines and examples*
  - *prototyping*
  - *testing...*
- additional details on interaction
- acquire an awareness of different design and evaluation methods
- practical and effective methods for improving interfaces and interaction

Course Resources

Website

- course website is available at http://csteach441.github.io
  - *timetable*
  - *course overview*
  - *course blog*
  - *assignments & coursework*
  - *bibliography*
  - *links & resources*
  - *notes & material*

n.b. NO Sakai

GitHub

- course repositories available at http://github.com/csteach441/
- weekly notes, examples, and source code (where applicable)

Slack

- Slack group available at https://csteach441.slack.com/
  - *https://csteach441.slack.com/*
- course updates, information on weekly assignments, general news, discussions...

Trello

- Trello group available at https://trello.com/csteach441
  - *https://trello.com/csteach441*

- project groups, weekly assignments, organise research and development...

Group projects

- add project details to course's Trello group, *COMP 441 - Spring 2019 @ LUC*
  - *Week 1 - Project Details*
  - *https://trello.com/b/PxADyged/week-1-project-details*
- create channels on Slack for group communication
  - *please add me to the private channel*
- start working on an idea for your project
- plan weekly development up to and including DEV Week
  - *13th to 20th March 2019*
  - *DEV week demo on 20th March 2019*

What is human-computer interface design?

- inherently a simple topic or concept
- simple act of inserting a mediating computer
- eg: a user wants to send a message or play some music...
  - *could use paper and pen, or play an instrument*
  - *may involve an intermediary tool*
  - *essence of design and usage bears some resemblance to HCI*
  - *related discipline of human factors*
- it is the computer that makes HCI distinctive

Adding a computer

- transforms the representation of a task and required skills
- changes our user's act of writing or playing a musical instrument
  - *flesh out a message or story*
  - *compile, contrast, splice, and manipulate our music*
- add users, become a crowd or group
- add networks and more machines
- disparate variants of computer mediation forming our concept of HCI

An Introduction to HCI - 3

HCI Components

- an object, an artifact that needs engineering and implementing
- the process of design for the interaction, and the objects themselves
- the principles, theories, abstractions, guidelines, facts...surrounding HCI

We can consider these as

- engineering interaction
- designing interaction
- the actual science of interaction itself

HCI as a technology

- importance of linking engineering, design, and science together
- technologies largely derived from other technologies
  - *Brian Arthur, W. 'The Nature of Technology: What it is and how it evolves.' Free Press. 2011.*
- technologies composed of disparate parts, each technologies as well
- technologies devolve to a point where they cease to be a technology
  - *this is the point where science plays a role*
  - *eg: keyboards and electrical capacitance*
- exploitation of natural occurrence of capacitance
  - *provides HCI function of signaling known, reliable interaction*

For example, text editor keypress demo

HCI and Science

- science should continue to play an important role in the development of HCI
- development and promotion of theory
- enables further *explanatory evaluation*
  - *expand upon rudimentary A-B testing*
  - *limited without an understanding of why*
- enables *generative design*
  - *allows us to modify design based upon an understanding of interaction*
  - *adjust design according to interaction*

User-Interface Design Rules - I

Historical Background

- advent of interactive computer systems and promotion of *good* design
- publication of user-interface design guidelines
- notable examples since early 1976
  - *1976: CHERITON and early interactive computer systems*
  - *1983: NORMAN's rules for designing user-interfaces based upon human cognition*
  - *1986: SMITH & MOSIER penned one of the most comprehensive sets of user-interface design guidelines*
  - *1987: SHNEIDERMAN's "Eight Golden Rules of Interface Design", which is now in its fifth edition.*
  - *1988: BROWN wrote a set of design guidelines, simply entitled "Human-Computer Interface Design Guidelines"*
  - *1990: NIELSEN & MOLICH suggested a set of design rules for the application of heuristic evaluation of user interfaces.*
  - *1992: MARCUS presented guidelines for graphic design in online documents and user interfaces*

User-Interface Design Rules - 2

21st Century Approach

- growing popularity of mobile platforms and online systems
- new and targeted user-interface guidelines
- notable examples include
  - *2005: STONE et al outlined general guidelines for user-interface design and evaluation*
  - *2006: KOYANI et al addressed design and usability guidelines specifically for research-based web design*
  - *2007: JOHNSON suggested some common user-interface design do's and don'ts*
  - *2009: SHNEIDERMAN updated his well-known tome to its current 5th edition*

User-Interface Design Rules - 3

Platform Guidelines

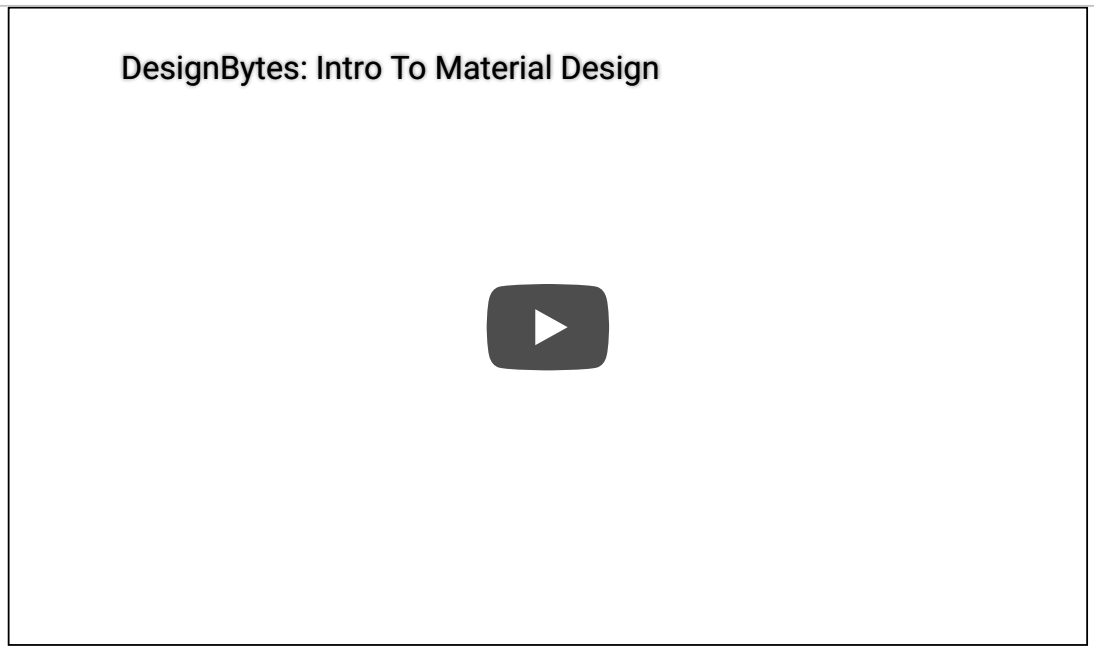
- new century saw more platform specific publications
  - *Apple, Google, Microsoft...many, many others*
- each set promotes design suggestions, preferences, rules for their given platform
- examples include
  - *Apple - UI Design Basics*
  - *Gnome - Human Interface Guidelines*
  - *Google - Material Design*
  - *Microsoft - Guidelines for Windows Runtime apps*
  - *and many, many more...*

Links & Resources

More to come later in the semester.

Video - User-Interface Design Rules - 4

Introduction to Google's Material Design



YouTube - Google's Material Design

Image - User-Interface Design Rules - 5

Microsoft's platform convergence...

MS One Design

Resolving Conflicts

- following user-interface design guidelines is not always simple
- aspirational goals of design rules and guidelines
  - *inherently general to broaden potential application*
  - *often open to broad interpretation*
- many rules will appear to be suitable for a given design situation
- applicable design rules will often appear to conflict
- application of these rules will suggest potentially different designs
- designers will need to choose their preferred design rule for a given situation...
- designers choose an order of precedence for their design

Conflicting Goals

- design problems and scenarios will often present conflicting goals
- potential for conflicting design guidelines and rules
- examples such as
  - *Powerful and Simple*
  - *High Resolution and Fast Loading*
  - *Multifunctional and Easy to Learn*
  - *WYSIWYG and Accessible for the Blind*
- designers need to address such conflicts and make informed decisions
- decisions guided, not restricted or dominated, by design guidelines and rules

Application of Laws

- consider user-interface design rules and guidelines as a set of laws
  - *instead of step-by-step recipes*
- laws interpreted and applied by experienced practitioners
- understand the basis for user-interface rules
- learn from experience the application of these rules
- focus upon an understanding of how to apply these guidelines
- understand the underlying rationale of user-interface rules

User-Interface Design Rules - 8

Quick Comparison: User-Interface Design Guidelines

Nielsen & Molich (1990)	Shneiderman & Plaisant (2009)
Aesthetic & minimalist design	Cater to universal usability
Consistency & standards	Design task flows to yield closure
Error prevention	Make users feel they are in control
Flexibility & efficiency of use	Minimise short-term memory load
Help users recognise, diagnose, and recover from errors	Offer informative feedback
Match between system and real world	Permit easy reversal of actions
Provide online documentation & help	Prevent errors
Recognition rather than recall	Strive for consistency
User control & freedom	
Visibility of system status	

Origin of Design Guidelines

- similarity between each set of rules is not simply due to coincidence or inheritance
  - *not the result of author's whim...*
- noticeable similarity, and close association in context and emphasis
- due to the influence of human psychology
  - *how we learn, perceive, reason, remember, process and convert intentions into actions*
- many authors of guidelines had a background in psychology
  - *this was then applied to the design of computer interfaces*
- Brown, Molich, Nielsen, Norman, and Shneiderman...
  - *applied knowledge of cognitive and perceptual psychology*
  - *improve the design of interactive systems*

User-Interface guidelines are based upon human psychology.

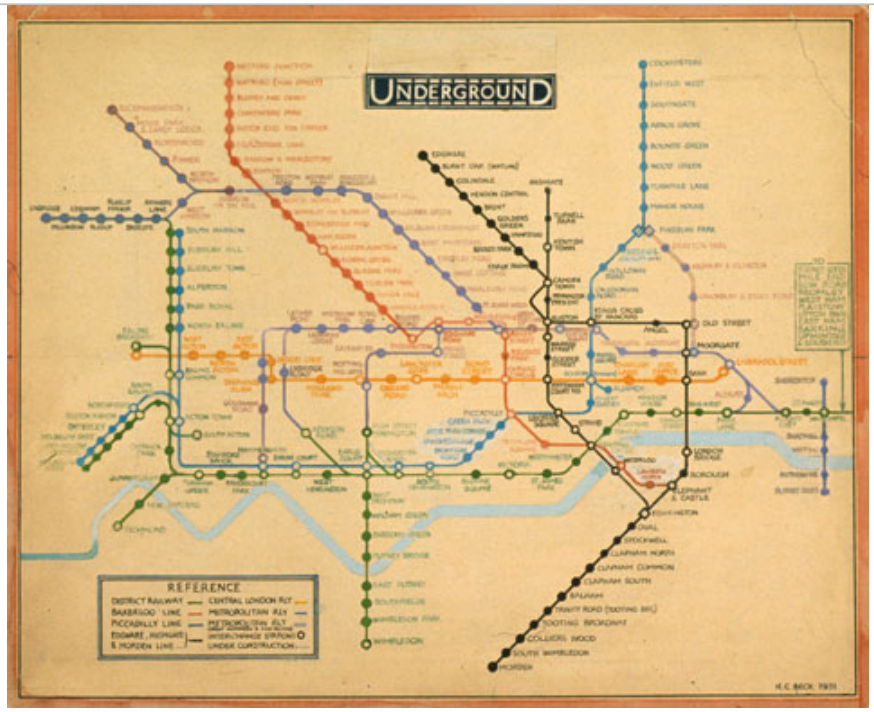
Image - Design Example - 1

The world is awash with poorly designed things...

Remote controls are a prime example!

Image - Design Example - 2

and many good things aswell...



1931 London Underground Map

1931 London Underground Map

Image - Design Example - 3

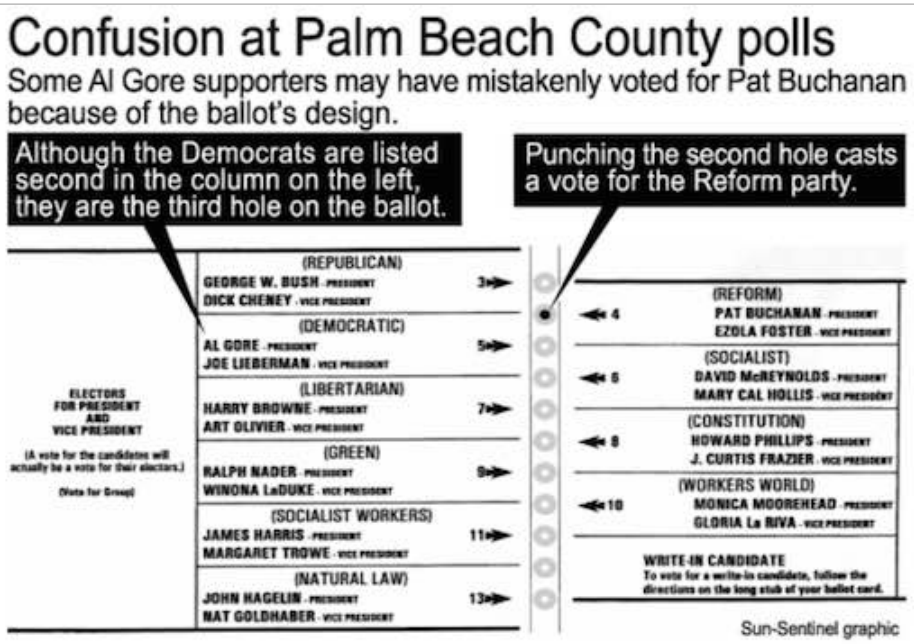
Does it really matter if things are poorly designed?

No Camping!

You may camp in the wrong place, and at the wrong time...

Image - Design Example - 4

Confusion due to poor design



Ballot Paper

2000 USA Presidential Ballot in Florida

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 - I

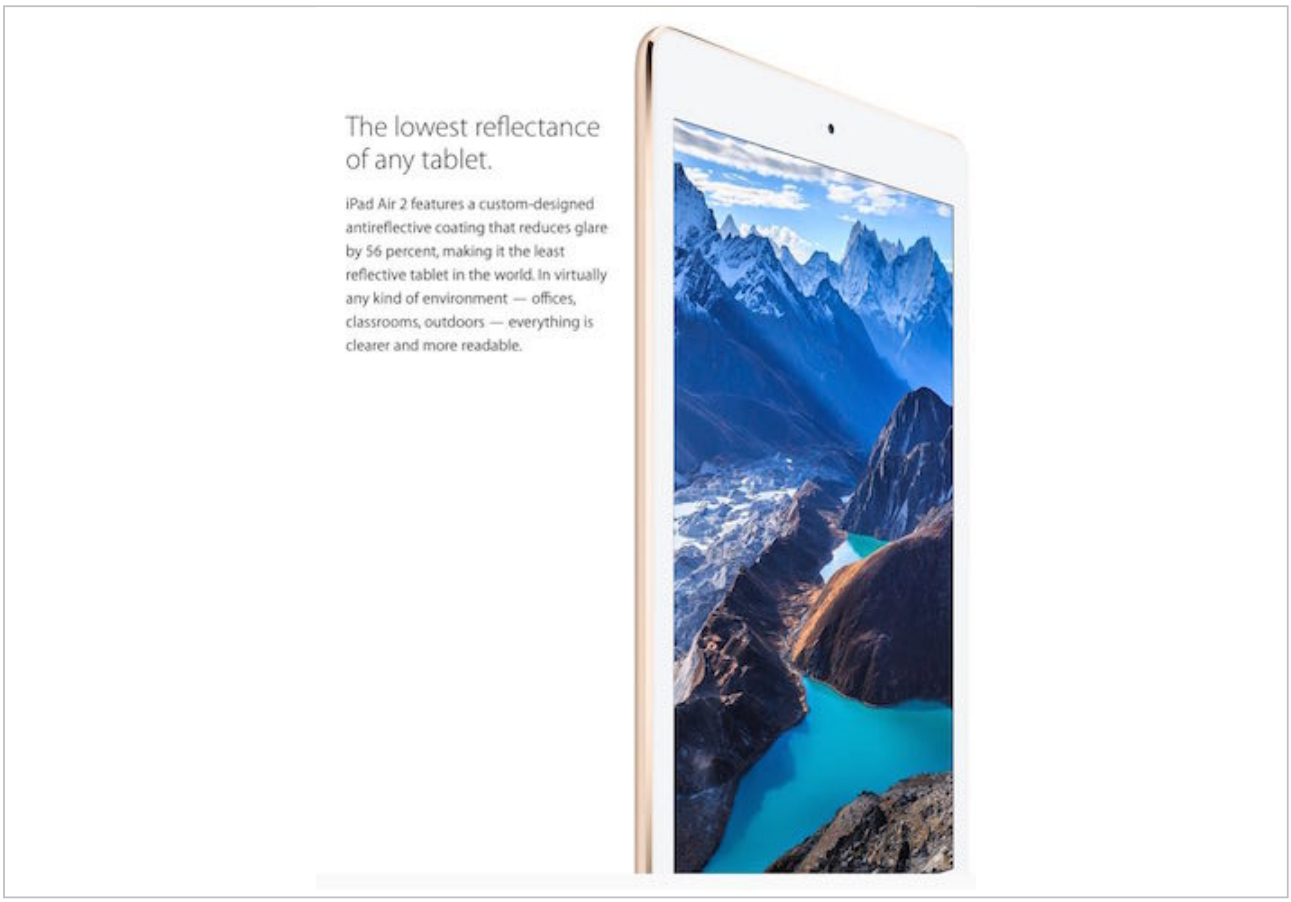
Perception

- 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



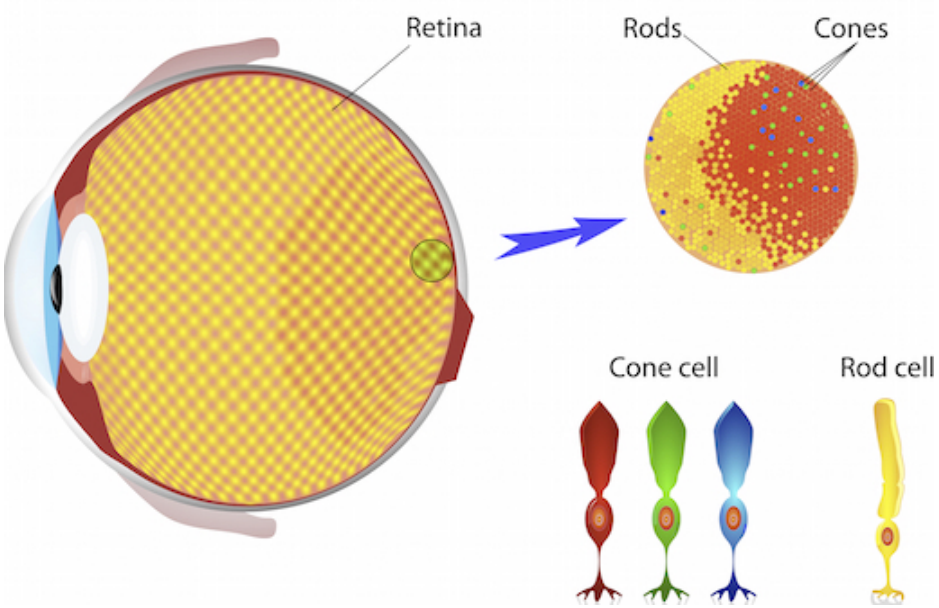
Reducing glare - Apple iPad Air 2 (source: Apple)

Colour & Vision - 2

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



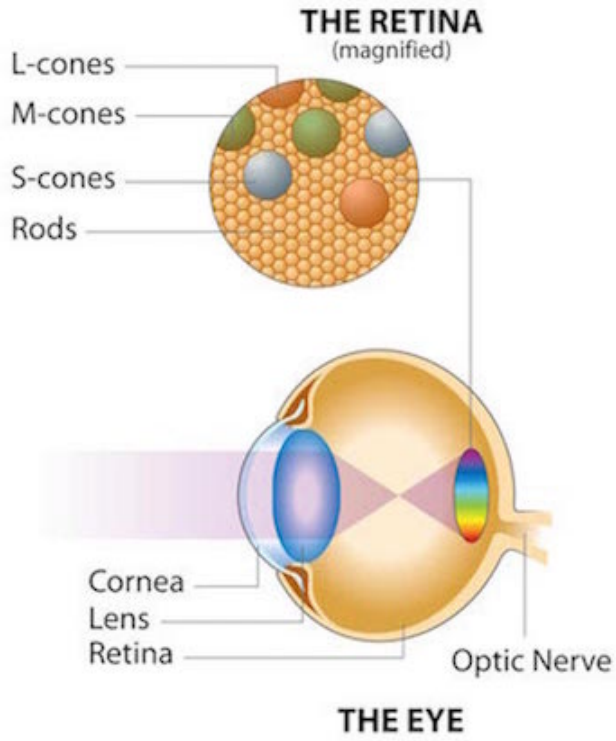
Human Eye

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

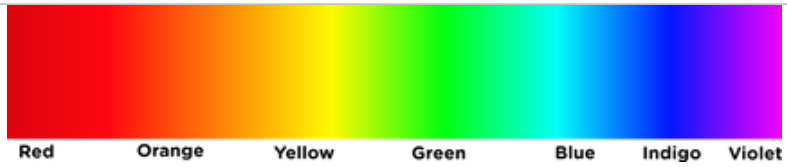
Image - Colour & Vision - 5



Human Eye

The Human Eye (source: Verilux)

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

Resources

- Brown, CM. "Human-computer interface design guidelines." Ablex Publishing Corp. 1988.
- Cheriton, DR. "Man-machine interface design for time-sharing systems." *Proc ACM National Conference*. 1976. PP.362-380.
- Koyani, SJ. et al. "Research-based web design and usability guidelines." *U.S. Dept of Health and Hum Serv*. 2006.
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- Nielsen, J. & Molich, R. "Heuristic evaluation of user interfaces." *Proc ACM CHI'90 Conference, Seattle*. 1990. PP.249-256. (NB: Updated by Nielsen, J. & Mack, RL. "Usability Inspection Methods." John Wiley & Sons, Inc. 1994.)
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- Stone, D. et al. "User interface design and evaluation." Morgan Kaufmann. 2005.