

# **Comp 34I/44I - HCI**

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Spring Semester 2019

Dr Nick Hayward

## course details

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### Lecturer

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

# Course Schedule

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## 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

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## 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

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## 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%)

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- 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

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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

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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

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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

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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

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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

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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

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## Website

- course website is available at <http://csteach44l.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/csteach44l/>
- weekly notes, examples, and source code (where applicable)

## Slack

- Slack group available at <https://csteach44l.slack.com/>
  - <https://csteach44l.slack.com/>
- course updates, information on weekly assignments, general news, discussions...

## Trello

- Trello group available at <https://trello.com/csteach44l>
  - <https://trello.com/csteach44l>

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

## Group projects

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- 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*

# An Introduction to HCI - I

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## 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



# An Introduction to HCI - 2

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## 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

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## 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

# An Introduction to HCI - 4

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## 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

# An Introduction to HCI - 5

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## 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

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## 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

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## 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

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## 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

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## Introduction to Google's Material Design

DesignBytes: Intro To Material Design



YouTube - Google's Material Design



# Image - User-Interface Design Rules - 5

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## Microsoft's platform convergence...



MS One Design

# User-Interface Design Rules - 5

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## 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

# User-Interface Design Rules - 6

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## 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

# User-Interface Design Rules - 7

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## 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

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## 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	

# User-Interface Design Rules - 9

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## 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 - I

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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

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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

**Confusion at Palm Beach County polls**  
Some Al Gore supporters may have mistakenly voted for Pat Buchanan because of the ballot's design.

Although the Democrats are listed second in the column on the left, they are the third hole on the ballot.

Punching the second hole casts a vote for the Reform party.

ELECTORS FOR PRESIDENT AND VICE PRESIDENT (A vote for the candidate will actually be a vote for their electors.) (Vote for Group)	
(REPUBLICAN) GEORGE W. BUSH - PRESIDENT DICK CHENEY - VICE PRESIDENT	3
(DEMOCRATIC) AL GORE - PRESIDENT JOE LIEBERMAN - VICE PRESIDENT	5
(LIBERTARIAN) HARRY BROWNE - PRESIDENT ART OLIVIER - VICE PRESIDENT	7
(GREEN) RALPH NADER - PRESIDENT WINONA LA DUKE - VICE PRESIDENT	9
(SOCIALIST WORKERS) JAMES HARRIS - PRESIDENT MARGARET TROWE - VICE PRESIDENT	11
(NATURAL LAW) JOHN HAGELIN - PRESIDENT NAT GOLDHABER - VICE PRESIDENT	13

(REFORM) PAT BUCHANAN - PRESIDENT EZOLA FOSTER - VICE PRESIDENT	4
(SOCIALIST) DAVID McREYNOLDS - PRESIDENT MARY CAL HOLLIS - VICE PRESIDENT	6
(CONSTITUTION) HOWARD PHILLIPS - PRESIDENT J. CURTIS FRAZIER - VICE PRESIDENT	8
(WORKERS WORLD) MONICA MOOREHEAD - PRESIDENT GLORIA La RIVA - VICE PRESIDENT	10
WRITE-IN CANDIDATE To vote for a write-in candidate, follow the directions on the long stub of your ballot card.	

Sun-Sentinel graphic

Ballot Paper

### 2000 USA Presidential Ballot in Florida

## Cultural considerations...

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

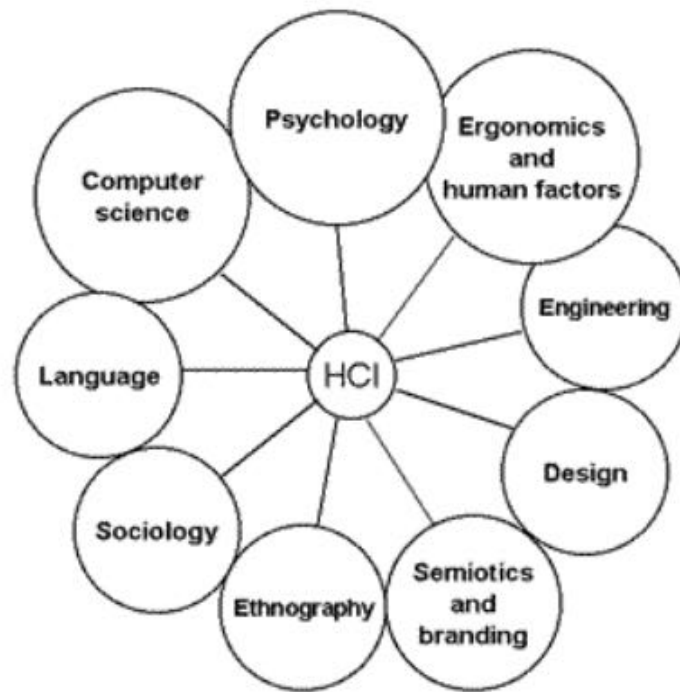
This is a very interesting consideration for interface design.

More to come later in the semester.

# Image - HCI - I

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## 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

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## 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 - I

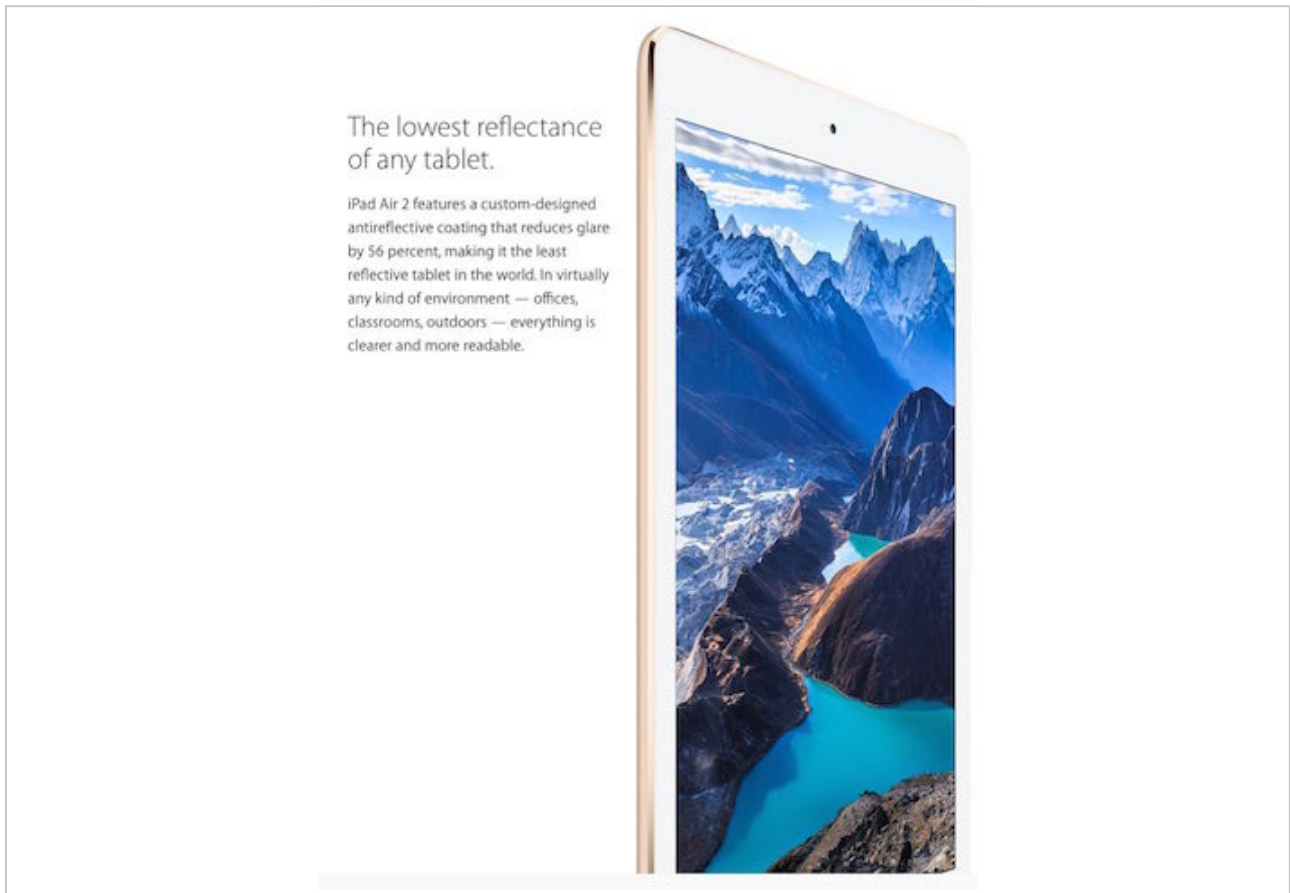
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A comparison of glare (source: Amazon)

## Image - Display performance - 2

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

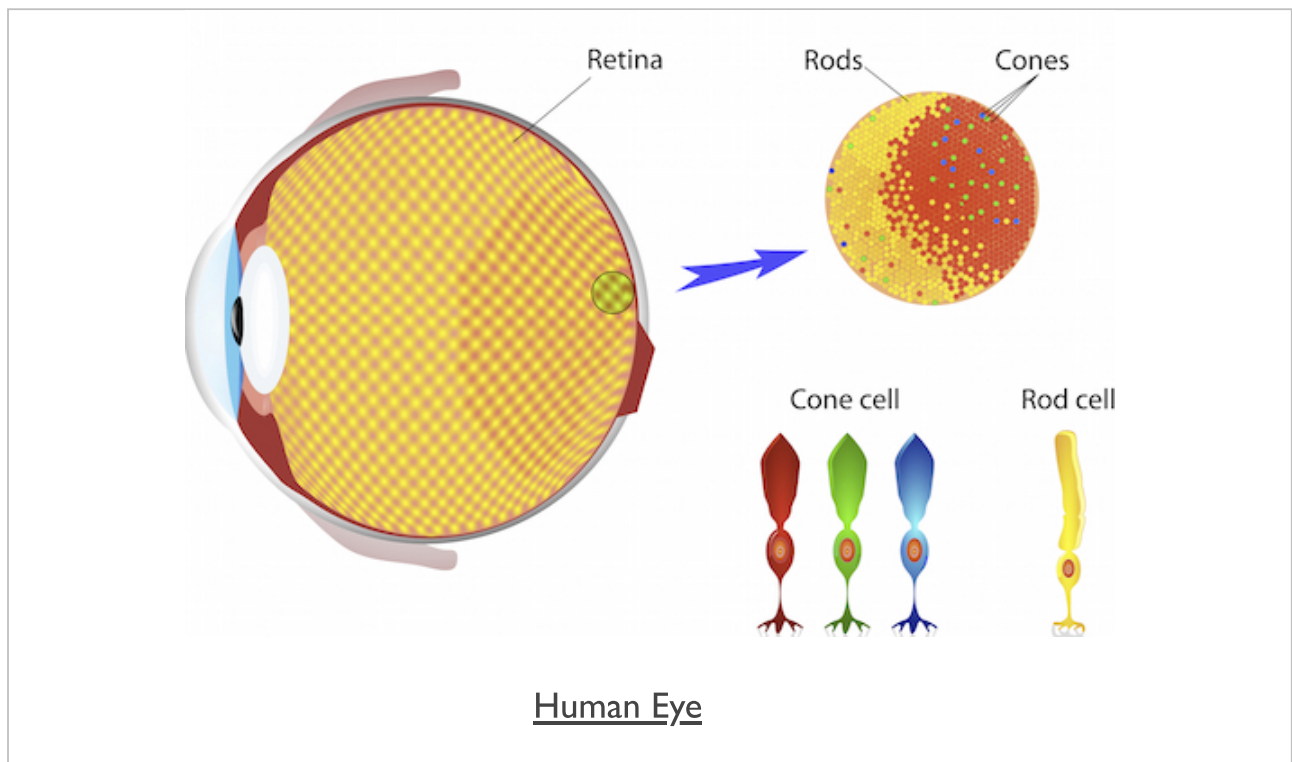
## Colour & Vision - 2

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### 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



The Human Eye (source: DoveMed)

## Colour & Vision - 4

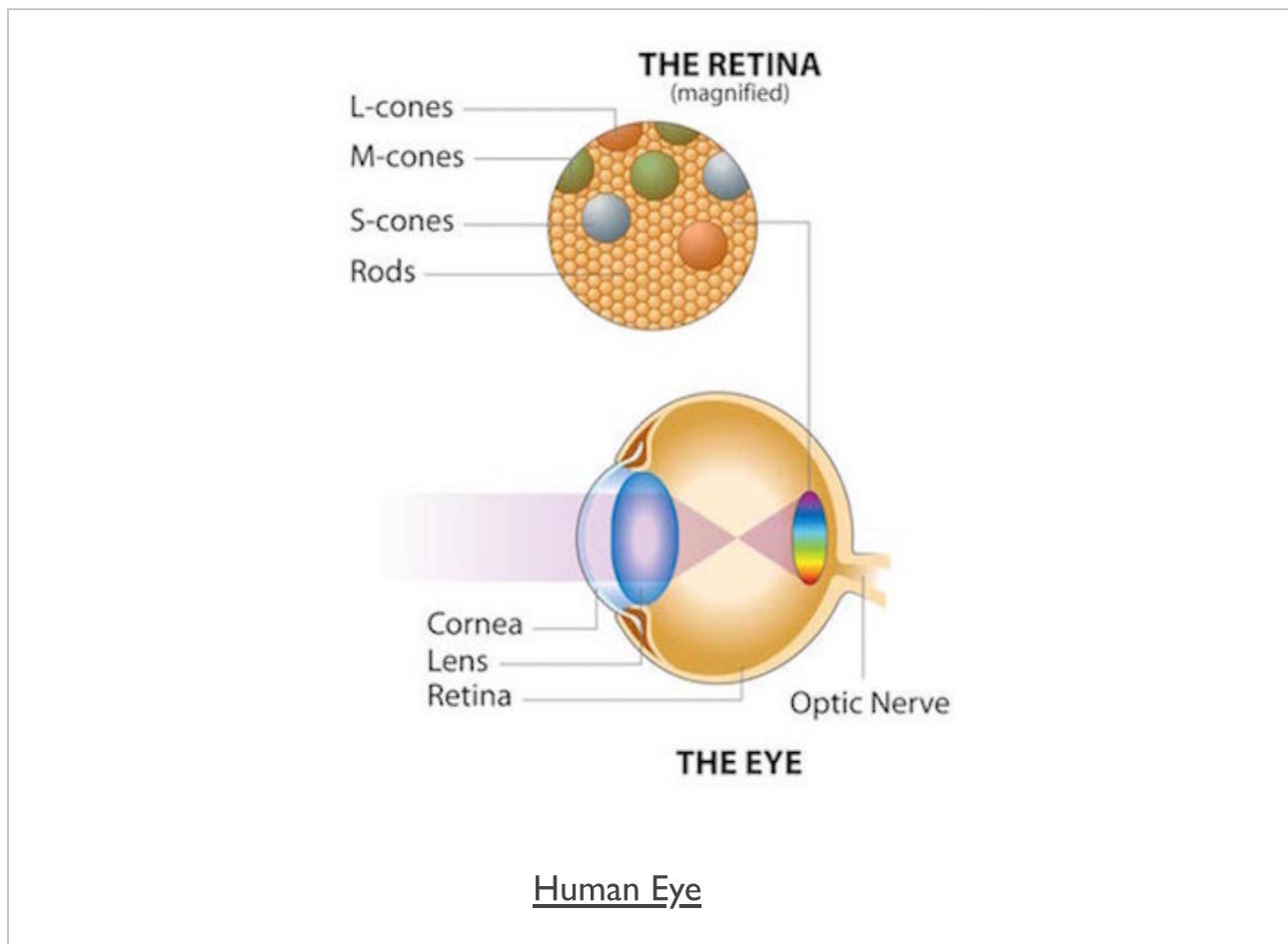
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### Modern Environmental Influences

- 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

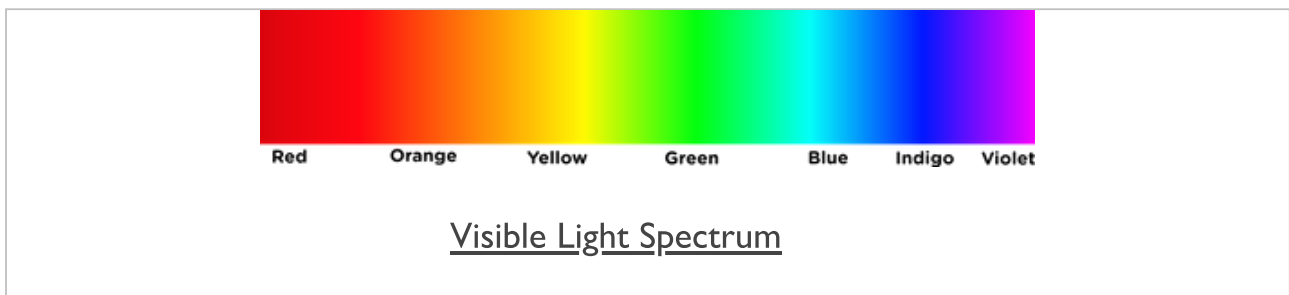
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The Human Eye (source: Verilux)

# Image - Colour & Vision - 6

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## 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*

# Colour & Vision - 7

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## 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

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- 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.