

## CSCU9A2

### Usability and Accessibility 3

## Computing Design Principle 4: Know Thy User

Today:

- What user information should the designer take into consideration?
- Typical (computing) users
  - average capabilities
  - cultural issues
  - equipment
- Disabled users (with severe disabilities)
  - assistive technologies
- Disabled users (with mild disabilities)
- Guidelines for use of colour

## Know Thy (Computer) User

Different people have different requirements. Consider:

- A 10-year old playing a computer game
- A grandmother receiving some pictures of her Australian grandson via email
- A student using an instant messaging chat program
- An employee using a spreadsheet to manage company accounts

The idea of user-centred design, thinking about who the user is and what they want, is a classic engineering principle.

Simple, obvious (one would think!), yet difficult to do in practice. The designer must ask many questions about the users-to-be.

## Example: Website for a Garden Centre in Fife

- What is the purpose of the site?
  - For attracting new customers
  - Retaining existing ones
  - Buying online
  - ???
- How much detail of products will customers want to view?
- Are customers local to Fife or further afield?
- What features of the garden centre might best attract customers?
- Do families visit the centre?
  - Are they going to want to know about play equipment on the website?
- Might the customer be disabled?
  - Are they going to want to know if the shop is wheelchair-accessible?
- Is the website going to vary from summer to winter?



## What are users like?

- Most of the "Know Thy User" information is specific to what is being designed.
- But there are general issues the designer should consider:

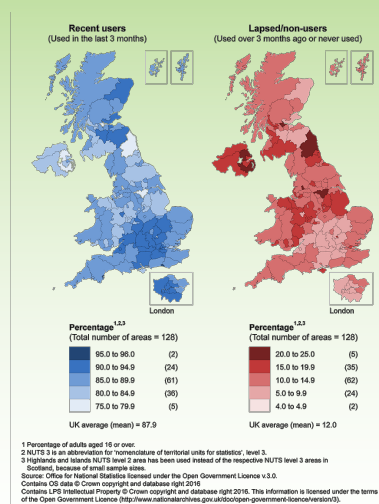
### (1) General Information

- Age, gender, education, cultural background, training, motivation, goals, personality....
- Demographics of computing users

## Internet Users in the UK - 2016

- 87.9% of adults (49.9 million adults) had used the Internet in 2016 Q2
- 82% of adults in Great Britain used the Internet every day, or almost every day.

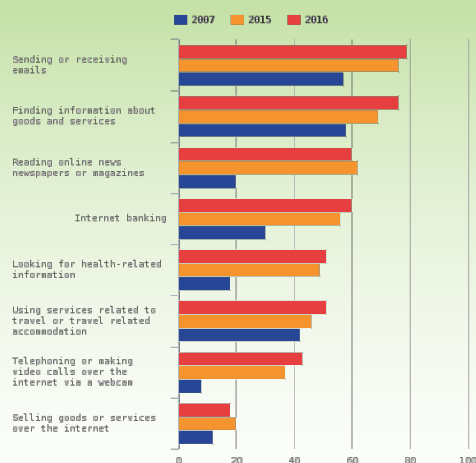
(Sources: Office for National Statistics: *Internet Access Quarterly Update – Q2 2016*)



## Internet Users in the UK - 2016

- Age: 99% of age 16-24 have used Internet (but only 39% of age 75+).
- Gender – 89.4% of all men, 86.4% of all women have used Internet
- Mobile devices
- 70% access using a mobile phone compared to 24% in 2010.
- (Sources: Office for National Statistics: Internet Access – Households and Individuals 2014)

## Internet Users (2)



• (Source: Office for National Statistics: Internet Access – Households and Individuals 2016)

## What are Users like?

### (2) How experienced is the user?

- Three main types of user:
  - Beginner (little or no experience)
  - Intermittent (infrequent, occasional)
  - Experienced (frequent user, very familiar and experienced)
- Will the user need training?
- Needs vary as to what is important, e.g.
  - On-line shopping website for a national clothing company:
    - reasonably assume intermittent/experienced web user
    - mustn't need training to use the site!
  - Operators of the payroll software for a company:
    - ok to use training
    - users will become expert frequent users

## What are Users like?

### (3) What equipment are they using?

- mouse, keyboard and monitor (and how big is their monitor?)
- trackball? touch-screen?
- mobile devices?
  - It may affect how the user is allowed to interact with the program/website

### (4) Nationality

- language
- culture
  - e.g. baseball phrases work very well in the US, but not so well in the UK!

## What are Users like?

### (5) Capabilities

- memory limitations
- attention span
- left-handed or right-handed?
- abled or disabled?
- Need to understand what sorts of disabilities there are in order to design inclusively.
- Four main types of disabilities:
  - Visual Impairments
  - Hearing Impairments
  - Physical Impairments
  - Mental/Language Impairments

## Disabilities in Scotland

### A few key statistics:

- 22% of men aged 16+ and 26% of women aged 16+ have a long-standing illness or disability.
- 1 in 5 of 16-24 year olds report at least one long-standing illness.
- 5% of students in higher education report a disability
- Disability increases with age: nearly 7 in 10 people aged 75+ report at least one long standing illness.
- Around 200,000 people have significant sight loss.
  - 1 in 8 of those aged 75+ have significant sight loss
- 1,012,000 people have some degree of hearing loss
  - 54% of these are aged 60+
- 1 in 10 households have someone who uses a mobility aid.
- 23,391 adults have learning disabilities.

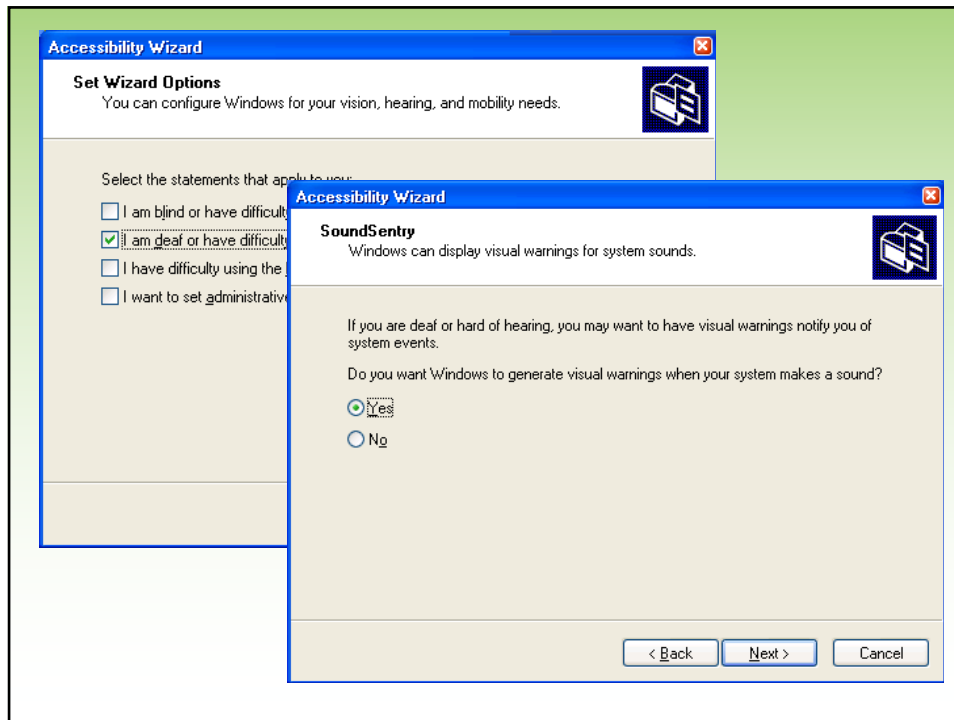
[Sources: Scottish Household Survey 2010; Disability in Scotland 2004: Key Facts and Figures; <http://www.healthscotland.com/equalities/disability/demographics.aspx>, accessed 10/04/2013]

## Visual Impairments

- Visual impairment covers a very varied range from poor vision, to being able to see light but no shapes, to no vision at all
- Low vision includes
  - dimness, foggy vision, spots before the eyes, distortion, colour distortions, tunnel vision, light sensitivity, night blindness
- Assistive technologies:
  - screen magnifiers, glare reducers
  - braille displays (touchable, uses mechanical pins)
  - scanners, magnification software,
  - speech synthesizers
  - [screen readers](http://webaim.org/simulations/screenreader) (<http://webaim.org/simulations/screenreader>)

## Hearing Impairments

- Hearing impairment covers a broad range from mild to severe
  - Definition of **deafness**:
    - inability to use hearing for communication
  - **Hard of hearing**:
    - a lesser degree of impairment than deafness
- Assistive devices involve presenting the information in visual or touchable form (Universal Design Principle 4)
  - Common assistive devices:
    - hearing aids, sign language,
    - TDDs (Telecommunication Devices for the Deaf)
- Much of the information on a computer is visual, so computer use not generally too problematic
  - offering visual versions of sound is helpful



## Physical Impairments

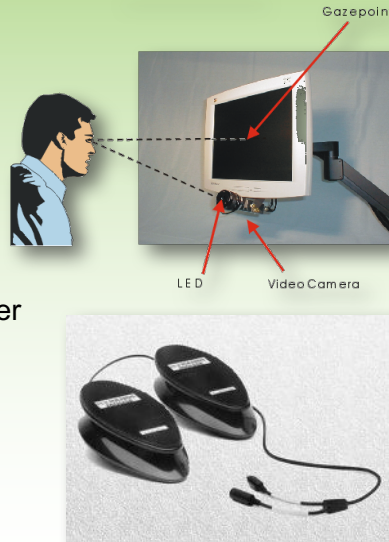
- Common mobility problems:
  - poor muscle control, fatigue,
  - difficulties with: walking, speaking, reaching, grasping, complex manoeuvres (such as push-and-turn)
- Wide range of assistive devices for computing
  - Examples:
    - pointing and typing aids (mouth/head sticks)
    - pointing devices (e.g. by eye movements)
    - voice recognition software
    - switches [pictured]





## Assistive Devices for Pointing

- Eye movement tracking devices (slow blink to click!),
- Speech recognition software
- Mice can be operated by other parts of the body (head, feet, tongue, finger, ...), not just useful for the disabled, but also for avoiding conditions such as (eg) RSI or carpal tunnel syndrome

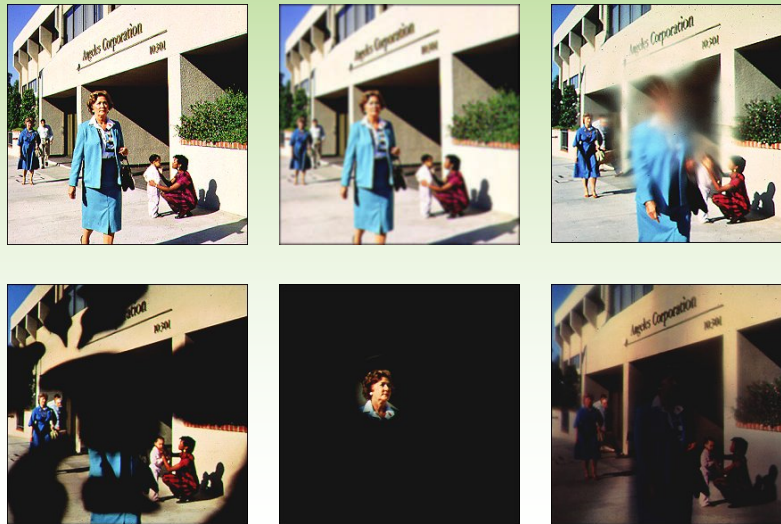


## Mental/Language Impairments

Many different types of impairments:

- Language/Learning Difficulties
  - e.g. Dyslexia, Aphasia
- Age-related
  - e.g. Alzheimer's Disease, Dementia
- A few assistive technologies available, e.g.:
  - spelling/grammar checkers and screen readers may help dyslexics
- Also, following the design guidelines helps, e.g.
  - simple displays, no over-complicated language
  - reducing the user's memory load

## Partial Sight Simulations



## Partial Sight

- 2 million blind and partially sighted people in the UK (RNIB)
- Most people with serious sight problems have some useful vision, and read with their eyes, not a screen reader.
- Their needs vary considerably:
  - some need larger text
  - some need smaller text
  - most need a highly contrasting colour scheme
- *"There is nothing more frustrating than coming across something you're sure you're going to find really interesting... and then you can't access it."*  
CW, RNIB customer, Cambridgeshire, UK

## Colour blindness

- Colour blindness is not a “blindness”.
  - It is a common myth that colour blind people cannot see colours.
  - Colour blind people *can* see colours, but see a different range of colours
- Cone receptors in our eyes (commonly called red, green and blue cones) see colours
  - Different amounts of red/green/blue light is how we tell the difference between colours
  - e.g. we detect purple because our red and blue cones detect strongly, but green cones only weakly
- Colour-blind people have cones (usually the red or the green ones) that are missing, weaker, or detect differently
- **1 in 12 men** and **1 in 200 women** have some type of colour-blindness

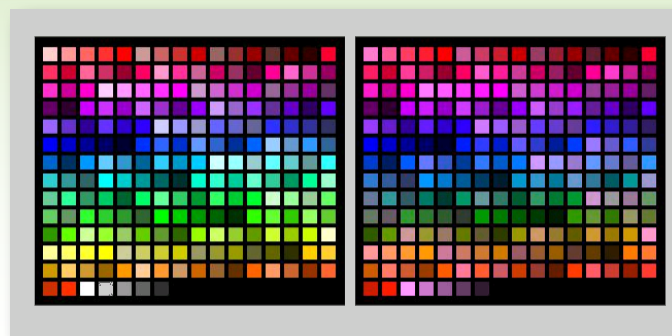


## Red-Green Colour Blindness

- The most common form of colour blindness (deuteranomaly) arises from weak green cones
- All colours, but greens not very strongly seen
- 5% of men are affected

Original

Deuteranomaly

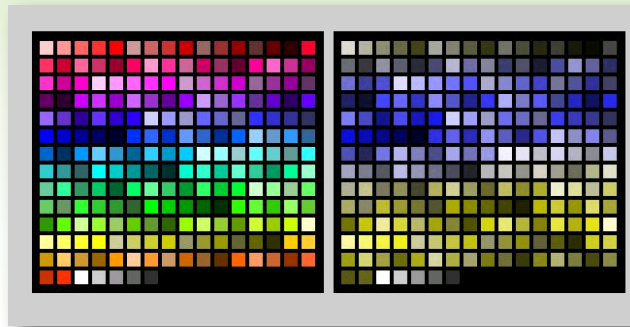


## Red-Green Colour Blindness

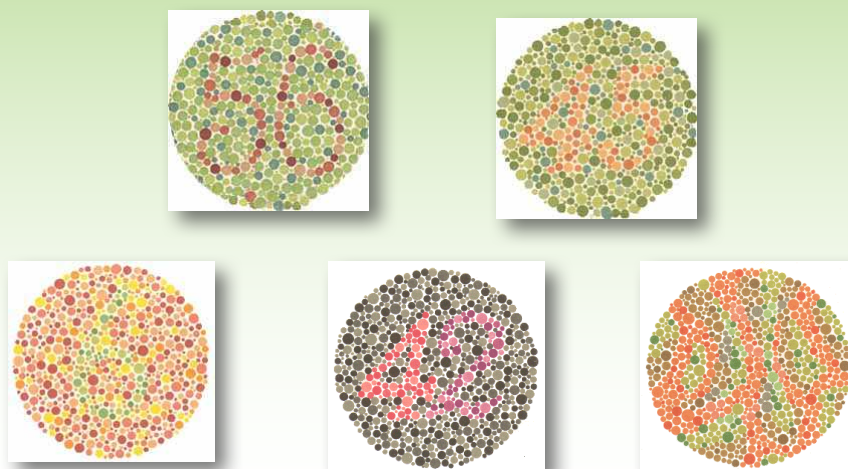
- More severe colour-blindness comes from missing red or green cones (protanopia or deuteranopia)
- 2% of men are affected
- Colours made up of red+green light (red / green / orange / yellow / brown) are easily confused

Original

Protanopic



## Some colour-blindness tests



## Effects on everyday life

- Lack of thought by designers is the major problem facing those who are colour-blind - colours are relied upon **unnecessarily**

- Examples:

- red/green lights on the back of laser-quest vests
- colour coding on maps/diagrams



- As one colour-blind man puts it:

*"One in twenty white men are colour blind.*

*We don't buy things we can't use.*

*We don't hit web pages we can't read"*

## Dyslexia

- Dyslexia is a specific learning difficulty that hinders the learning of literacy skills
  - Dyslexia has *nothing* to do with intelligence
  - Dyslexia describes a group of related factors concerning the brain's processing of written information
- Computers can be very helpful
  - word-processing software can help with writing, editing, spelling and grammar
  - with a speech synthesizer, a computer can read back text

## Meares-Irlen Syndrome

- Some people with dyslexia (and some without) may be affected by the glare of the light as they read
- This is Meares-Irlen Syndrome, and sufferers may prefer to use one of the following for reading:
  - dim lighting
  - tinted glasses
  - coloured overlays
  - printing on coloured paper

## Use of Colour

- Colour plays an important role
  - in printed materials, like magazines, books
  - on web pages
  - on software interfaces
    - e.g. syntax colouring in BlueJ
- Colour is not just used for decoration: it's one of the main clues as to how to interpret information
  - it allows classification
  - it assists recognition
    - e.g. colour helps us recognise a logo

## Guidelines for Colour Use

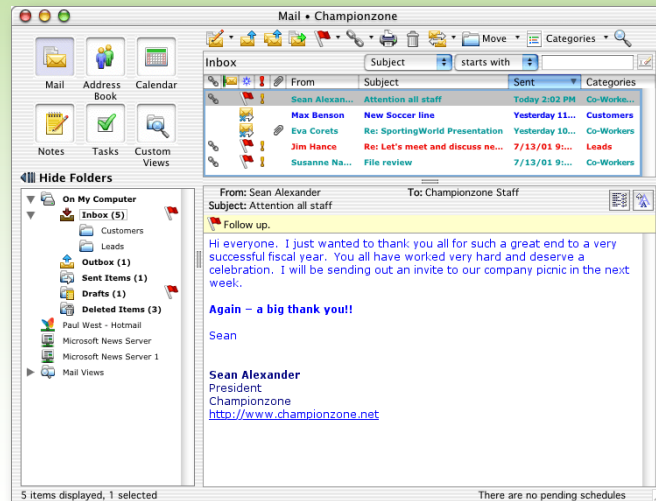
- When choosing text and background colours, choose strong light-on-dark or dark-on-light contrasts
  - not medium/light or light/medium
  - not medium/dark or dark/medium,
  - especially not medium/medium!
- Sometimes, a bright white computer screen is a bit hard on the eyes, especially in the dark!
  - So consider choosing a pale coloured background
  - Also, a pale-coloured (non-white) background may help those with Meares-Irlen (but different people prefer different colours!)
  - So, allow the user to change colours (particularly the background)

<http://www.imagitek.com/bcs.html>

## Colour Schemes

- Pick a mostly neutral colour scheme
  - greys, pastels and earth colours work best; not too strongly coloured
  - occasional touches of colour add emphasis
- Remember international differences in colour associations, e.g.
  - 71% of Hong Kong Chinese associate “white” with “cold”
  - 96% of Americans associate “blue” with “cold”
- Colour is a powerful attention-getter - use sparingly!
  - Don't overuse colour (the “Las Vegas” effect)
- Textures should not be too textured
  - stick to a smallish low-contrast repeated pattern

## Example: Las Vegas Effect



## Colour-blindness and Design

- Don't rely solely on colour to convey information
  - e.g. say "the button on the left", not "the red button"
- If you must, choose colours that won't be problematic for colour-blind people
  - pay special attention to red, yellow, green, orange, brown, as these are easily confused
  - if you must, blue, white, yellow, black are less problematic
- If you're *not* colour-blind (or only mildly so), use colour-blindness simulators to test your design yourself
  - Simulators available include [www.vischeck.com](http://www.vischeck.com) - an online image/web page tester
  - also try printing your design out on a black-and-white printer
- If you *are* colour blind, get a non-colour blind friend to give their opinion of the tastefulness of the colour scheme





## Design example: Euro bank notes

- The view taken was that "a good design for the blind and partially sighted is a good design for everybody". Note designed in cooperation with the European Blind Union
- Design features:
  - Each of the banknotes is a different size
  - Each has a dominant colour
  - Strong colour contrasts have been chosen between each consecutive pair of notes
  - The numerals on the front are large and in bold
  - These numerals are also printed in relief and can be perceived by touch



End of Lecture