Universal Access

Adapted from slides by Dr. Ehud Reiter, Mark Rice, Lyn Pemberton

Universal Access

- Accessibility tended to be about making systems usable by the disabled

- Universal access is about making them usable by everybody, including the disabled, the elderly, …

Universal Design, Inclusive Design

Motivation for Universal Design

- Proliferation of computer systems, from ATMs to the WWW, smart phones
- Growing appreciation of the importance (and possibility) of usability (e-commerce has been a major factor)
- Demographic trends - a greater proportion of us will be old in the future; so market opportunities

Motivation for Universal Design

- Recognition of the injustice and waste of potential brought about by unnecessary exclusion

  (e.g. EU and national policy on equal opportunities and disability discrimination legislation)
  See: https://www.youtube.com/watch?v=kziXJX6a7E4 for some opinions of disabled young people

- Disability as ultimate challenge for interaction designers - if a technique works in difficult cases, it can probably work well for everyone,

  (cf. TV remote control, speech recognition technology, ballpoint pen)

Disabilities

- **Disabled person:** ‘a physical or mental impairment which has a substantial and long-term adverse effect on his [or her] ability to carry out normal day-to-day activities’ (Disability Discrimination Act 1995)

- According to a January 2014 UK government report, in 2011/12 there were estimated to be **11.6 million** disabled people in Great Britain, including 5.7 million adults of working age (includes people with long-term illness). This is about 1 in 5 people.

- A 2000 report claims 10% of the population in Europe have some form of disability (a 2013 report claims it is 26% in the EU)

Types of ‘disabilities’

2000 report claims 720 million people in Europe are ‘disabled’, for instance:

- **Cannot walk without aid** 45 million
- **Dyslexia** 25 million
- **Intellectually impaired** 30 million
- **Profoundly deaf** 1.1 million
- **Hard of hearing** 80 million
- **Cannot use one arm** 1.1 million
- **Reduced strength** 22.5 million
- **Reduced co-ordination** 11.5 million
- **Blind** 1.1 million
- **Low vision** 11.5 million

Just to give an idea of how prevalent different conditions may be…

Some figures for the UK

From 2014 report of the Papworth Trust.

Visual impairments

- 1.87 million people with sight loss
- 1 in 9 people in UK aged 60 and over
- 143,400 people registered blind
- 25,000 blind or partially sighted children (<17)

Hearing impairments

- >10 million people with hearing loss
- 1 in 6 in population
- 42% of over 50s have some hearing loss
- >800,000 severely or profoundly deaf
- >45,000 deaf children

Also temporarily disabled…

- Any user can be disadvantaged, alienated or disabled within a particular environment. For example **loud noises**, **foreign languages**, **anxiety**, **fatigue** and **stress** can handicap any individual

- 0.5% of the UK population are disabled through illness or injury

Visual impairments

- **Blind**
- **Low vision**
  - » Cataracts
  - » Glaucoma
  - » Macular Degeneration
  - » Diabetic Retinopathy

- **Causes**
  - » Injury
  - » Illness

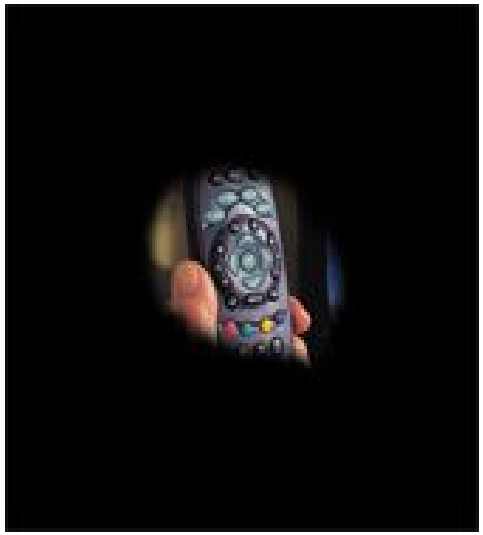
- **Complications**
  - » Numerous eye disorders
  - » Conditions can deteriorate
  - » Various degrees of disability
  - » Multiple disabilities

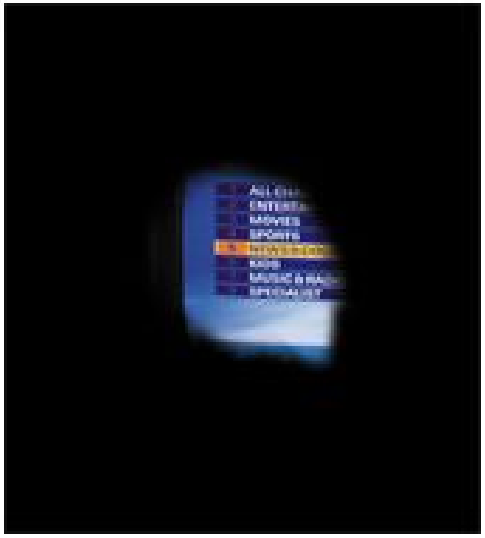
Cataracts

- Clouding of the eye's lens
- Symptoms include seeing double, poor vision in bright light, yellowish tinge on colour vision
- Half the people over 65 will suffer from this condition

Glaucoma

- **Tunnel vision**
- Vision loss is caused by damage to the optic nerve
- Symptoms include headaches, eye pain, nausea, rainbows around lights at night, and very blurred vision.





Diabetic Retinopathy

- Gradually deteriorating disease
- 2% of the population are effected by diabetes
- Causes fragile blood vessels in the retina to leak or become blocked
- Scarring forces the risk of retinal detachment

Macular Degeneration

- The **macula** is the most sensitive part of the eye for distinguishing detail
- For reading, recognising faces and detecting colours

Colour Blindness

- Effects more than 10% of males but less than 0.5% of females
- Hereditary condition
- Cannot distinguish red from green (or green from blue)

Visual Disabilities

- Blind
  - » interface must use text and keyboard
  - » text is spoken or displayed in Braille
- Poor vision
  - » large fonts, screen magnifiers
  - » don’t rely on diffs in colours, fonts, etc
- Colour blind
  - » don’t rely on diffs in colours

Braille display

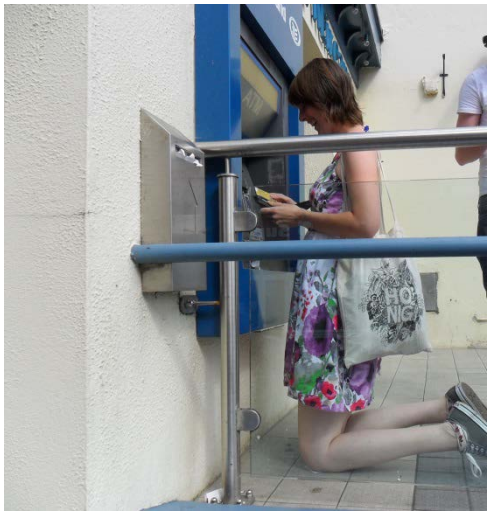
Hearing Difficulties

- Can’t hear, or poor hearing
  - » don’t rely on audio signals (eg, beeps)
    - – have pop-up dialogue box as well
  - » good idea in any case since some users turn off sounds!

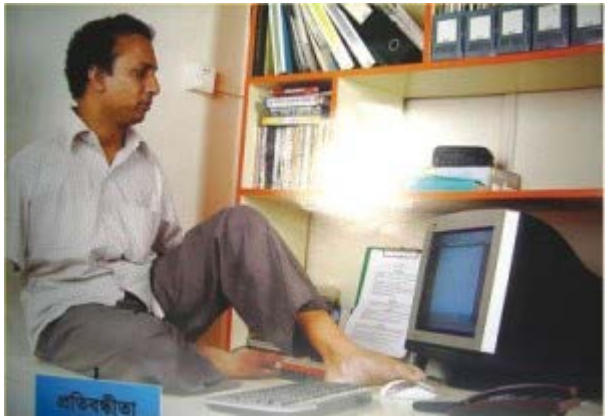
Mobility Disabilities

- Wheel chair
  - » Ensure user can reach the controls

- But without making it very hard for others to use…



Mobility Disabilities



- No hands
  - » alternative data-entry
    - – point with head tracker?
    - – Click with sup/puff switch?
    - – Type by pointing to on-screen keyboard?
  - » Word prediction
- Poor control of hands
  - » keyboard is tolerant of erratic typing, etc
  - » don’t need simultaneous keys (shift+A)
  - » arrow keys instead of mouse

Head Tracker with Sip/Puff

Cognitive Problems

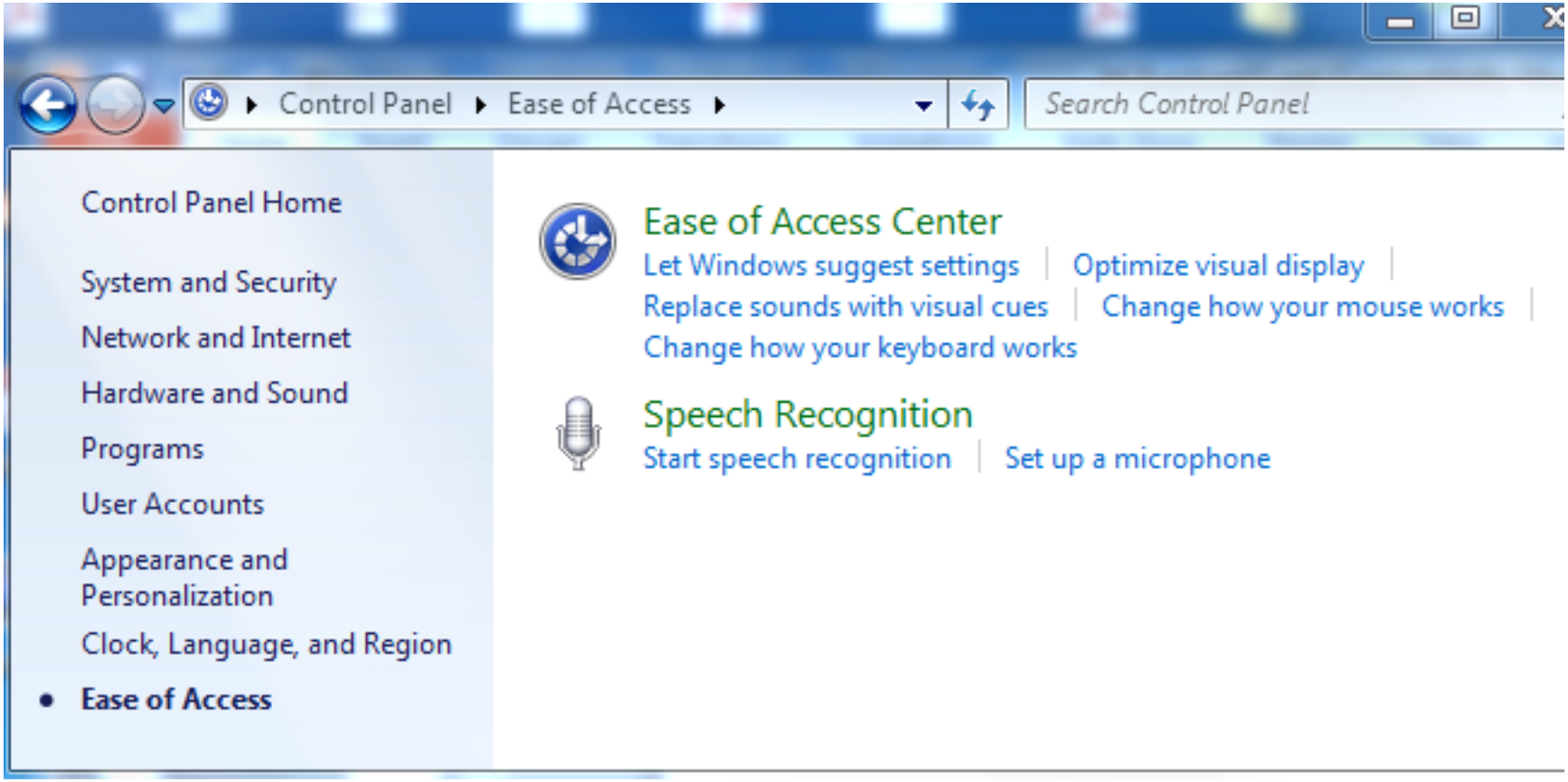
- Too many to characterise
- General ideas
  - » Consistency!!!
  - » Redundancy
  - » Simplicity

Dyslexia

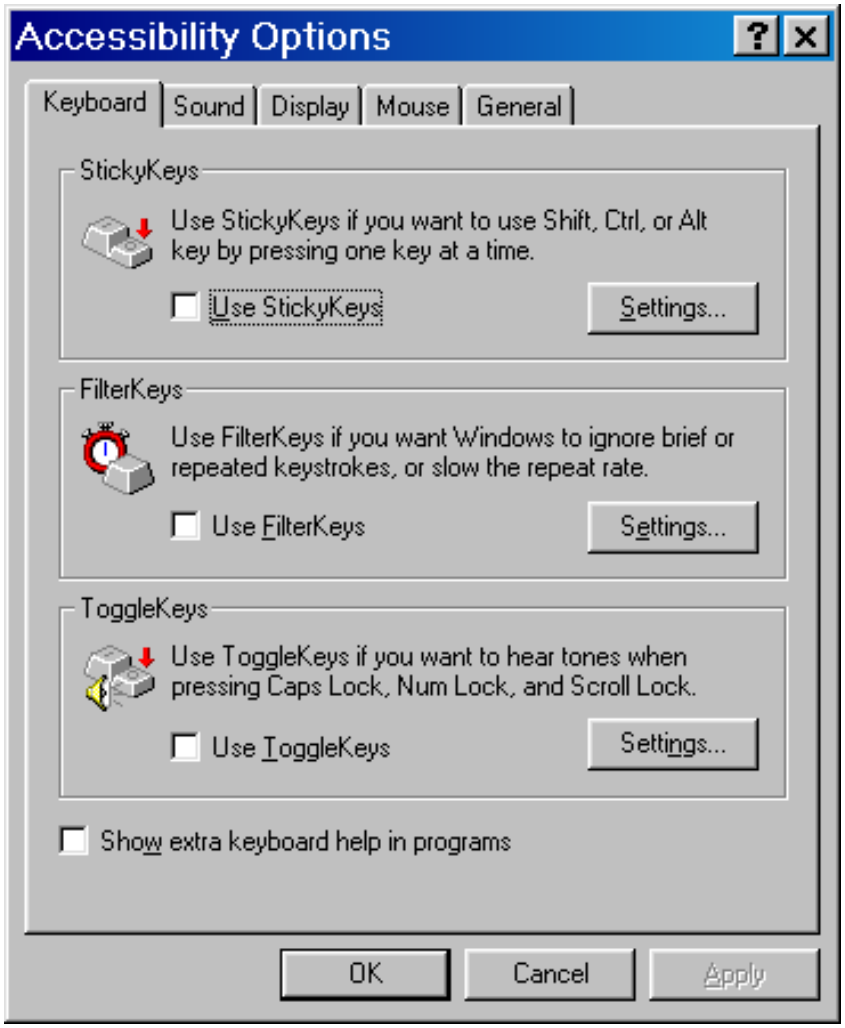
- Most common problem in students?
- Follow design guidelines
  - » For example: www.bdadyslexia.org.uk/common/ckeditor/filemanager/userfiles/About_Us/policies/Dyslexia_Style_Guide.pdf
  - » Avoid white backgrounds
  - » Don’t justify text
  - » Short sentences
  - » Avoid italics
  - » etc

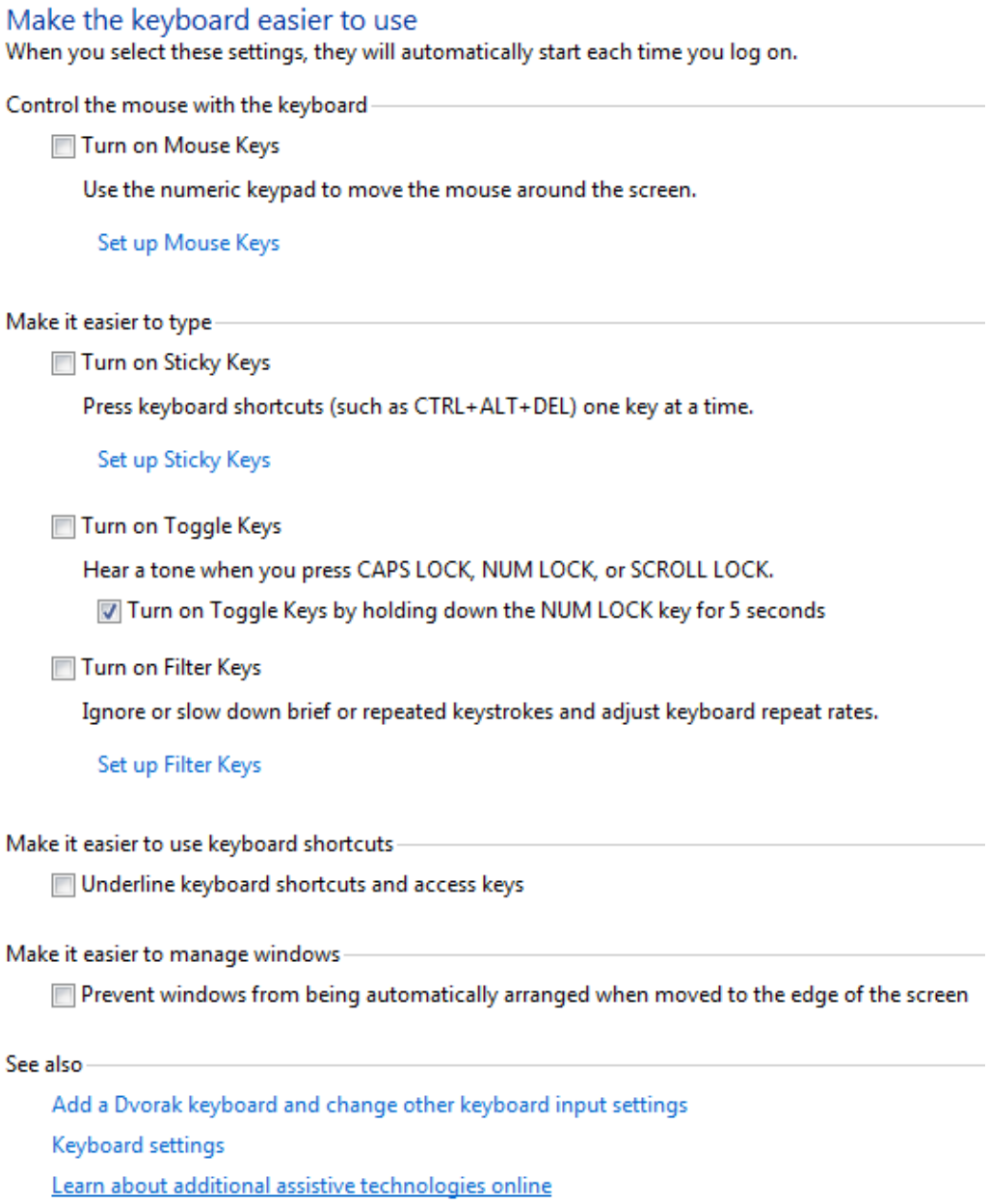
Windows Accessibility

- Control panel
  - » keyboard - sticky shift keys, ignore brief key presses
  - » sound - visual warning whenever sound
  - » display - low resolution, contrasting colours
  - » mouse - cursor keys simulate mouse


Control Panel ▸ Ease of Access ▸
Search Control Panel
Control Panel Home
System and Security
Network and Internet
Hardware and Sound
Programs
User Accounts
Appearance and Personalization
Clock, Language, and Region
Ease of Access
Ease of Access Center
Let Windows suggest settings
Optimize visual display
Replace sounds with visual cues
Change how your mouse works
Change how your keyboard works
Speech Recognition
Start speech recognition
Set up a microphone

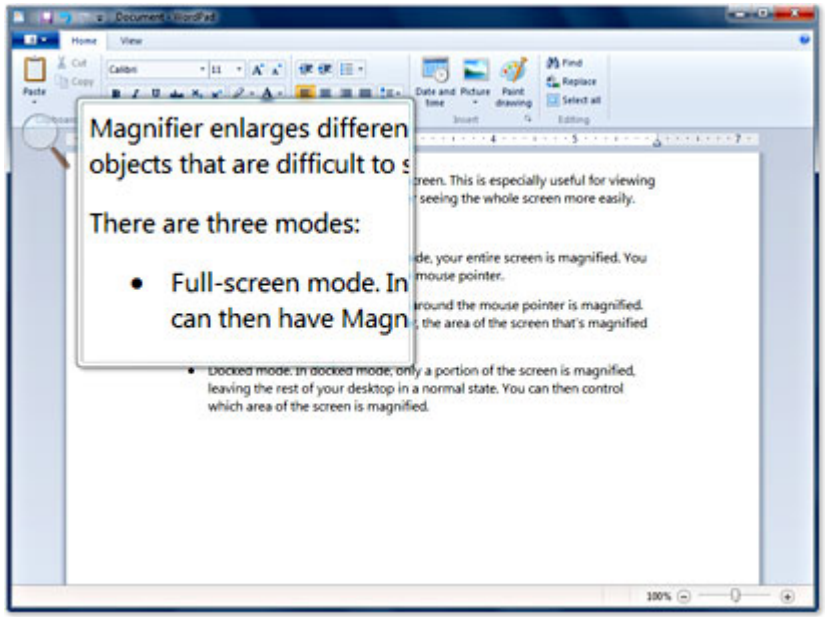
Adapt the keyboard



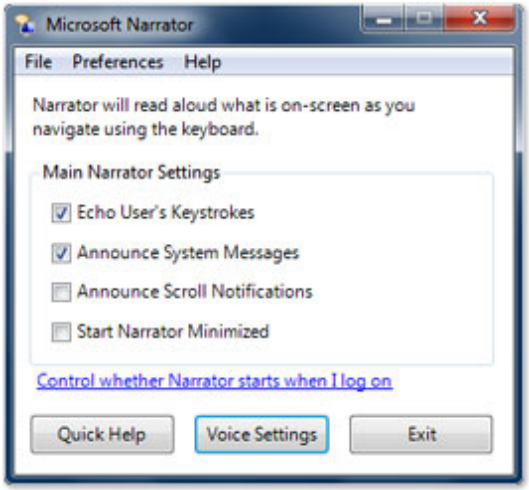


Windows Accessibility

- Tools
  - » Magnifier: magnifies part of screen
    - University machines also provide QuickRes



Windows Accessibility



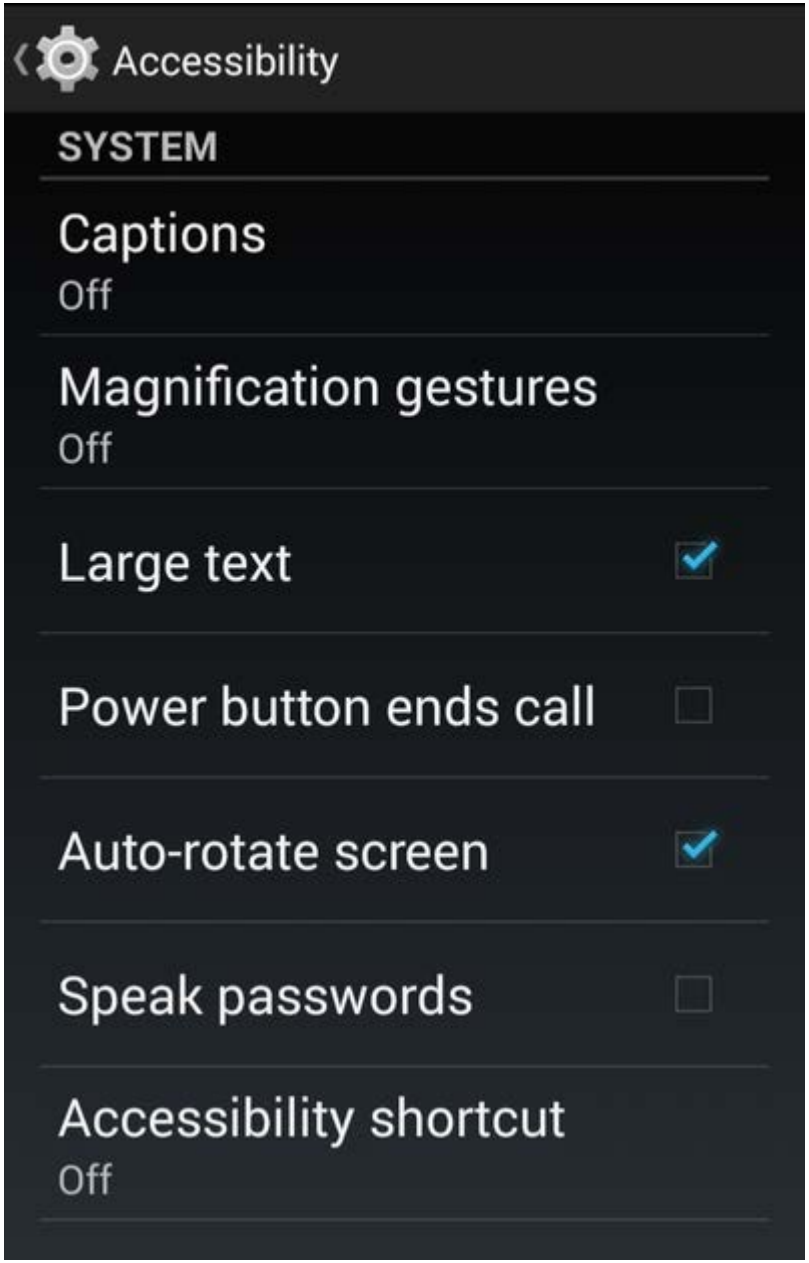
- Tools
  - » Narrator: reads text as speech

    University machines also provide:

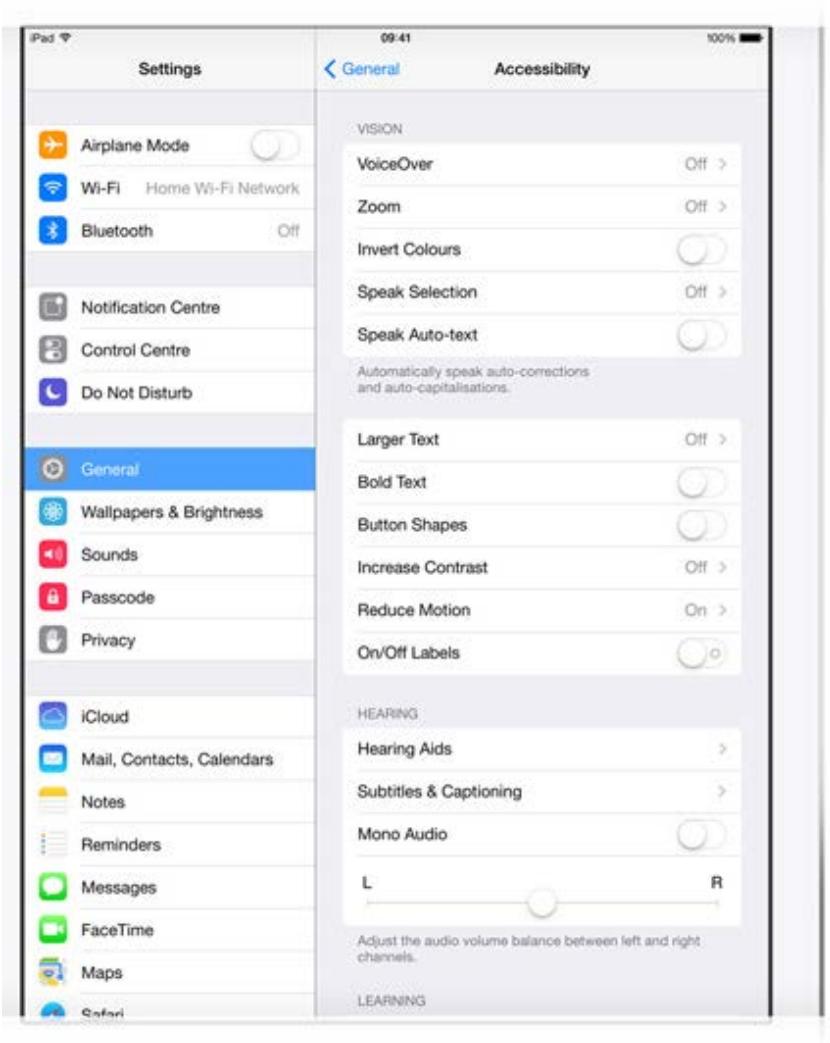
    – NVDA

    – ClaroRead; also provides coloured screen overlays, enhanced spell-checking and grammar-checking
  - » On-screen keyboard

Android



IPad



IBM Guidelines: Keyboard

- www-03.ibm.com/able/guidelines/software/accesssoftware.html
- Allow keyboard-only operation
  - » Try to use your app without a mouse!
- Don’t interfere with OS’s use of keyboard for accessibility
  - » Eg, don’t rely on numeric keypad, this is used for mouse simulation
- Ensure a component is always in focus
  - » focus traversal order is reasonable

IBM Guidelines: Multimedia

- Provide visual cues when sound is used
- Provide text transcripts for important audios and videos

IBM Guidelines: Display

- Don’t rely on users recognising colours and fonts
  - » use colour as an enhancement
- Ensure system works when colours are set for high contrast, etc
  - » use look-and-feel for colours, fonts, etc
- Provide text desc of graphics, animation
  - » for blind users

IBM Guidelines: Other

- Avoid quick time-outs
  - » Some users may require a lot of time
- Don’t make things blink
  - » can cause epileptic seizures!
  - » rapidly changing graphics a danger as well
- Test!

Reading Level

- Many people have poor reading skills
  - » 20% of UK adults have a reading age of 11 or less
- Use simple texts
  - » common words, short sentences

www.plainenglish.co.uk

Web-Page Accessibility

- Similar rules to interface accessibility
- Other points
  - » Don’t hard-code fonts, colours!!
  - » Semantically meaningful HTML markups
- General rule: keep page simple
  - » So screen readers, etc, can understand it

Web Page Accessibility

- W3C Guidelines
  - » Three priority levels
  - » University pages supposed to comply with priority 2
- Checking Tools (see previous lecture)

Key Point: Don't Fight the OS

- Use colours, fonts, etc from the Operating System (or Web Browser)
  - » User can set according to prefs, abilities
  - » Don't hard-code!
- Don't get in the way of the OS
- Keep things simple

Seven principles for Inclusive Design

Accessibility - appropriate size and space is provided for approach and use

For example:

- Computer desk with space for wheelchair;
- Lift controls at wheelchair height;
- On/off switch at front of machine;
- Space for assistive devices;
- Don’t make user reach far;
- Device within disabled user’s budget;
- Service available at time required

Usability - there is simple and intuitive quality of interaction

For example:

- Immediately understandable icons;
- Information in task order;
- Language not over-complex

Flexibility in use - users can use design in their own ways

For example:

- Left handed mouse;
- On-line tutorial adaptable to user's own pace;
- Choice of interaction methods such as menu or direct manipulation.

Perceptible information display - design communicates information clearly and effectively as possible, accounting for possible perceptual difficulties or ambient conditions

For example:

- No use of same-hue colours together, or red/green combinations;
- Ability to set font size;
- Use different modes together for maximum redundancy

Tolerance for error - design minimises unwanted results of unintended actions

For example:

- Grey out menu items that are not currently valid;
- Hide data-dangerous operations where they can’t be carried out unintentionally

Low physical effort - design makes for minimum effort and fatigue

For example:

- Use key combinations from same part of keyboard;
- Enable “sticky” control keys;
- Minimise mouse movement;
- Cut down on repetitive actions;
- Make sure documentation lies flat or is displayed in holder

Acceptability - not embarrassing or uncomfortable to use in real world context

For example:

- ATM sited outside bank may make people with disabilities or older people feel vulnerable;
- Voice activated mobile devices may be embarrassing to use in public;
- Head-mounted pointers may be embarrassing or uncomfortable to wear

How to achieve inclusive design?

<--->

inadvertent exclusion

infeasible inclusion

Aim to maximise participation within resources available

Summary

- Many people have disabilities
  - » vision, hearing, motor, cognitive
- Software should be usable by them
  - » our social responsibility!
- Be aware of problems, guidelines
  - » Stick to standards and “usual” way of doing things

Summary

- Easy to make a system usable by people with no problems who know computers
- Much harder to make systems usable for people with disabilities, especially if they don’t have computer experience
- Increasingly a legal obligation
- The real challenge of HCI?