Inclusive Design for People with Disabilities

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Designing to the Average

- Cooper et al. talk about designing to the average
  - Average ability, average training, average age etc.
- However, what Cooper et al are not saying is that you should *only* design for the average
- In design you need to account for a wide variety of issues relating to ability, expertise, experience, age and more
- We need to be inclusive in our designs – providing options and adaptations for a wide variety of individuals

Inclusive Design

- While the term inclusive design is usually meant to encompass all users it is often used to refer to two key groups:
  - People with disabilities (which is actually a lot more groups)
  - Older adults
- Each of these groups has particular needs and preferences that are important to understand
- In this lecture we will touch on some of the key ideas

Individual Differences

- When people use technology, they are applying a *user agent* to web content to access it
  - Web browser (desktop, mobile, tablet)
  - Mobile/Tablet apps
  - Soon wearables, your car, your kitchen sink
- Some people will apply specific *assistive technologies* that allow them to interact with user agents differently – it must be the case that our technology does not conflict with those ATs
- Some people require *alternative* or *enhanced* content to perceive and understand the information contained on a website – we must produce these alternatives and enhancements and provide options at the right time

Inclusion: Key Concepts

- Accessibility, like any other field, has its own language that it uses
- We used to apply a *medical model* - a glaucoma patient, someone with a "condition" that needed to be rehabilitated
- We now apply a more *social model* – where we describe an individual and their needs and preferences independently of whatever their physical or cognitive state is at any particular time

Inclusion: Key Concepts (2)

- Impairment – where someone has some functional limitation in comparison to the average
  - Example: A person with a severe visual impairment is someone who below 3/60 on the Snellen Test for Visual Acuity in the UK
- Disability – where the person and the context in which they are working are mismatched
  - Examples:
    - Physical World – A wheel-chair user cannot reach the second floor as it is only accessible by stairs
    - Digital World – The contrast of two colours on a website is too low, meaning the person cannot see the two different colours

Inclusion: Key Concepts (3)

- In accessibility, people often worry about what language to use when working with user groups
- In the UK the two commonly used terms are:
  - People/Users with disabilities
  - Disabled People/Users
- There will always be some discussion when working with a new group of people – usually disabled users will quite openly discuss it

Key User Groups

- The list of user groups with which web accessibility is concerned is always expanding
- The most common disabled user groups discussed are:
  - People who are blind
  - People who are partially sighted
  - People who are hard of hearing
  - People who are Deaf
  - People who have physical disabilities
  - People who have learning difficulties (usually discuss dyslexia)
- Many definitions also include older adults who may have a variety of issues – however, many do not use the types of techniques and technologies we talk about in this lecture – require a more *universal design* approach
- Currently there is a lot of investigation about broader people with cognitive disabilities and people with autism and how technology can be used to adapt environments

Screen Reader Users

- People who are blind either have no vision, or have very limited visual perception
- A minority of people are *congenitally blind*, while most are *adventitiously blind*, losing their sight due to accident, illness or aging (see why medical models don't work well!)
- Most commonly mentioned group in inclusive design
- People with no useful vision use screen readers to access computer applications
- Most common of these are JAWS, WindowEyes and NVDA on Windows; VoiceOver for Mac
- Most Windows screen readers are very expensive (NVDA is trying to fix that), VoiceOver comes free with every Mac

Screen Readers

- How do screen readers work?
  - Users seldom read from the top left hand corner to the lower-right hand corner
  - Users apply a variety of keyboard shortcuts to drive powerful interaction dialogues for navigating by headings or links, for completing forms etc.
  - Users apply robust strategies when looking for content on the page – some evidence that they work bottom up constructing sections of the page to build a working mental model (Power et al., 2013)
- Screen readers allow users to access visual content through an *audio modality*

Adapting for People who are Blind

- Modality?
  - We receive content from or put content into the computer through *modalities*
  - For output the most common are visual, auditory and haptic modalities
- In the case of a screen reader user, things that are purely in a visual modality will be completely inaccessible to them
- What types of content can you think of that have this quality?
- We often provide *alternative content* (e.g. text for pictures) or in some cases *enhance content* (e.g. audio description)
- As part of our designs, we need to identify those things that are purely visual and provide these different types of content

Demonstration: Screen Reader

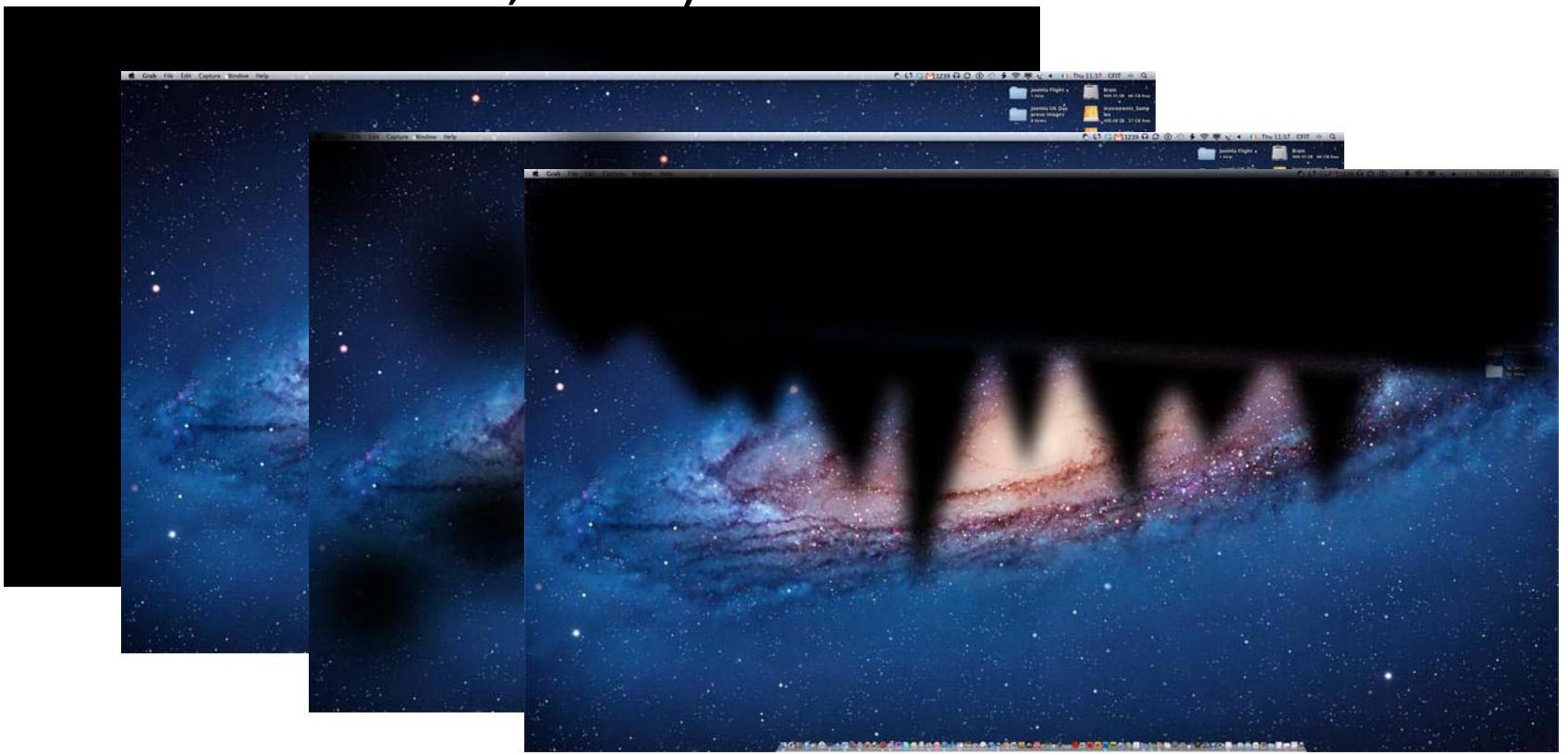
https://www.youtube.com/watch?v=2PMuBQ7LyOw

Demonstration: Audio Description

http://main.wgbh.org/wgbh/pages/mag/description.html

People with Partial Sight

- This is a broad group of users who have a variety of different needs and preferences (Examples in images from O'Conner, 2013)



People with Partial Sight (2)

- Partially sighted users are some of the most common users, but also the most poorly supported by technology, standards and research
- Partially sighted people with low residual vision will often use a *screen magnifier*
- There are basic magnifiers in Windows, but more powerful versions are available for purchase or built into other operating systems
- Common ATs are: SuperNova, WindowEyes – these come with screen readers built in as well
- A screen magnifier creates a viewport that focuses a user in on a specific area that is blown up to many times its normal size
- Advanced versions include highlighting of text as screen readers move through text, and most importantly contrast adjustments (negative view)

Adapting for People with Partial Sight

- Many of the same ideas apply – textual content that can be picked up by screen readers is helpful
- Need to ensure that interface not fall apart even when font styles/size changes, under zooming conditions and other transformations users might do – common problem is contrast problems when screen colours are reversed or moved to greyscale
- There is also some evidence that consistency plays a huge role for these users (Power et al. 2013)

People who are Deaf and People who are Hard of Hearing

- There are about 9 million deaf and hard of hearing people in the UK (source: Royal National Institute of Deaf People)
- 8.8 million have an acquired hearing loss - they have become hard of hearing usually through aging
- 120,000 people are prelingually deaf - born deaf or became deaf early in life; may have difficulty with written English
- 50,000 people use a sign language as their preferred language; see themselves as a linguistic and cultural minority, rather than a disability group; English is a second language for them

Adaptations for People who are Deaf and People who are Hard of Hearing

- Currently unlikely to use any assistive technology – most assistive technologies relate to vision loss
- Most commonly, the key thing to support this user group is *enhanced content*, especially audio and video streams
- Options for enhancing content:
  - Captioning
    - Open Captioning
    - Closed Captioning
- Example of captioning:
  - http://main.wgbh.org/wgbh/pages/mag/description.html (CC button on the player)
- Now widely available on YouTube – with some automated help to provide captioning

Demonstration: Sign Language

https://www.youtube.com/watch?v=997hElUcoCw

People with Dyslexia

- Dyslexia causes difficulties in learning to read, write and spell.
- Short-term memory, mathematics, concentration, personal organisation and sequencing may also be affected – but often not directly due to dyslexia
- Dyslexia can occur at any level of intellectual ability
- It is not the result of poor motivation, emotional disturbance, sensory impairment or lack of opportunities, but it may occur alongside any of these

Adaptations for People with Dyslexia

- People may use software such as SpeakOut and textHELP!
- Text-to-speech synthesis can help people with severe dyslexia - but often don't use assistive technology for the Web, so need to be able to adapt appearance presentation
- Similar to people with partial sight, we need to make sure that contrast and colour changes don't make particular parts of the website unreadable
- From a point of view of designing inclusively from the start - short lines of text, different colour combinations and highlighting of text can help deal with some of these problems

People with physical disabilities

- People who have difficulty using a keyboard and particularly a mouse or other pointing device such as touchscreens have problems using the Web
- These physical impairments can result from many conditions from RSI to spinal injuries

Adaptations for People with physical disabilities

- People may use special keyboard and pointing devices
- People may use switch access and head mounted pointing devices
  - This leads to alternate forms of input where you signal an on/off signal to change behaviour
- People may use voice input technology such as Dragon Dictate to provide text input to the computer
- Rely on targets being salient in the interface and being large enough to target

Demonstration: Joust 2 Sip and Puff Interface

https://www.youtube.com/watch?v=nXBsDrCb54g

Summary

- This was a (very) quick tour of some of the adaptations, enhancements and assistive technologies that people use
- Each of these impact what we do with out designs
- A lot of this comes down to designs being flexible – and permitting people to change options if they need them
- In some cases, it is the case that we need to prepare alternative or enhanced content, which may have costs that need to be considered in time/money