Universal Usability

Ethical, good business, the law

SWEN-444
Topics

• Universal usability and software ethics
• Visually impaired
• Deaf and hard of hearing
• Dexterity and mobility impairments
• Section 508 – the law
Universal Usability – a Case of Software Ethics

“Universal usability can be defined as having more than 90% of all households as successful users of information and communications services at least once a week.”
- Ben Schneiderman

“In a fair society, all individuals would have equal opportunity to participate in, or benefit from, the use of computer resources regardless of race, sex, religion, age, disability, national origin or other such similar factors.”
—ACM Code of Ethics
Universal Usability for the Web

“The power of the Web is in its universality. Access by everyone regardless of disability is an essential aspect.”

Tim Berners-Lee, W3C Director and inventor of the World Wide Web

The UN Convention on the Rights of Persons with Disabilities recognizes access to information and communications technologies, including the Web, as a basic human right.
Challenges

- Technology variety
- User diversity
- The digital divide

http://www.internethlivestats.com/internet-users/
Profile

User Diversity: Accommodate Different Users

**Skills**
- Computer newbie to hacker

**Knowledge**
- Domain novice to expert

**Culture**
- Western, Eastern, developing, …

**Personality**
- Introvert versus extrovert
- Thinking vs. feeling
- Risk aversion
- Locus of control
- Planful vs. playful

**Income**
- Impoverished to wealthy

**Literacy**
- Fluent to illiterate
- Multiple languages

**Disabilities**
- Visual, auditory, motor, cognitive

**Disabling conditions**
- Mobility, injury, noise, sunlight

**Age, Gender, Race, Ethnicity, National Origin**

Personal anecdotes of examples, good and bad? **Avoid lowest common denominator design** – less useful to mainstream users, limits innovation
Design for Universal Usability

- Equitable
- Adaptable – configuration and usage patterns
- Simple, intuitive, minimalist design
- Metaphors and mental models
- Perceptible information
- Error prevention and tolerance
- Low physical effort
- Size and space for approach and use
- Evolutionary learning via help and tutorials
- ...
Constraints, Solutions, Innovation

• Technology variety
  • Innovate to exploit new technology but ….
  • Make interfaces more adaptable and malleable
  • E.g., use plug-ins, sense screen size and other device capabilities, factor network performance

• User diversity
  • Profile sub-categories of users to understand diverse needs; e.g. kids versus seniors
  • Segment and accessorize the design accordingly
  • E.g., provide baseline and accelerated options, auto localization, disability accessibility

Try Windows – Control Panel -> Ease of Access Center
W3C Accessibility Design Guidelines

- Web Content Accessibility Guidelines (WCAG)
  [http://www.w3.org/WAI/intro/wcag](http://www.w3.org/WAI/intro/wcag)
  - “explain how to make web content more accessible to people with disabilities”; principles …
  - **Perceivable** objects and content
  - **Operable** objects and navigation
  - **Understandable** content and interactive operation
  - **Robust** – reliably interpretable by assistive technologies

- Accessible Rich Internet Applications (ARIA)
  [http://www.w3.org/WAI/intro/aria](http://www.w3.org/WAI/intro/aria)
  - Guidelines for how to make dynamic web app functionality available to assistive technologies
Accessible Web Design Approaches

- Alternate Text
- Table Headings
- Forms
- Meaningful Link Text
- Captions and Transcripts
- Other File Formats
- Using Headings for Semantic Structure

- Keyboard & Navigation
- Never Rely on Color-Coding Only
- Readability Level of Text
- Cognitive Disabilities
- Conforming to Standards
- Site Maps, Site Search
Accessibility

• **Situational disabilities** – temporary conditions of the person or their environment that effectively cause impairment
  • Driving a car
  • Walking down the street
  • Noisy event
  • Sun glare

• **Physical disabilities**
  • Visually impaired
  • Deaf and hard of hearing
  • Dexterity and mobility impairments
Visually Impaired

- Visual impairments - low vision, color blindness, and total blindness
  - Tunnel vision, cataracts, peripheral visual field restrictions and loss of visual acuity.
  - Some visual impairments may cause difficulty seeing in low light levels, problems judging speed and distance, or painful irritation in bright light.
  - Only about 4% of people who have visual impairments are totally blind.
Visually Impaired

• Research shows that most partially sighted people are able to read clear large print comfortably.
  • Large print size - 14 point or above
  • So a simple way to increase accessibility to the visually impaired.
• When print is not suitable, Braille or voice is an option.
  • The actual number of fluent Braille users is small (less than 10% of the blind)
  • But it is a useful medium and can also be used by deaf blind people.
Visually Impaired: Assistive Technology

- Screen enlargers/magnifiers
- Screen readers are software programs that present graphics and text as speech.
- Talking / large print word processors
- Speech/Voice recognition systems to give commands and enter data using voice.
- Refreshable Braille displays provide Braille output of information represented on the computer screen one line at a time.
- Braille embossers transfer computer generated text into embossed Braille output.
Visually Impaired: Assistive Technology

Screen enlarger  Braille display  Braille embosser
Experience It

- Browse the list of accessibility related links under Accessibility Resources in myCourses
- Try the distraction and dyslexia simulations
- What did you learn?

- Note: this is just a sampling of web accessibility design resources
Deaf and Hard of Hearing

• Hearing difficulties range from slight hearing loss to deafness.
• Hearing impaired might be able to hear some sound, but might not be able to distinguish words.
• People born profoundly deaf may have difficulty in acquiring a clear understanding of spoken and written language.
• Many hearing impaired people can lip read to some extent.
• Requires concentration and is tiring over long periods.
• More popular with people who lost hearing later in life, or who have some residual hearing.
• Sign Language is a common communication method.
Deaf and Hard of Hearing

- Hearing aids are often used in addition to other forms of communication
  - Hearing aids amplify all sounds, including background noise, and may not be suitable in some circumstances
- Technology considerations:
  - Communicate information visually, e.g., …
    - Flash when beep occurs
    - Video sign language
  - Sound amplification
    - Adjust sound options and volume
  - Translate speech to text
  - Research – ASL to and from speech using gesture recognition technology (e.g., Microsoft’s Kinect)
Dexterity and Mobility Impairments

- Difficult to use a standard keyboard, mouse, or other peripherals
- Individuals experience pain, discomfort, loss of feeling
- Individuals may also have a reduced range of physical movement or complete loss of physical capability

- In their fingers, hands, wrists, or arms,
- Difficulties / impairments can be caused by a wide range of common illnesses and accidents such as carpal tunnel, arthritis, stroke, cerebral palsy, Parkinson's disease, multiple sclerosis, loss of limbs or digits, and spinal cord injuries, among others
- Can be stable, degenerative or intermittent, depending on the cause
- Manual dexterity impairments result in the loss of fine control of movement, affecting typing and the use of the mouse/peripherals
Dexterity Impairments: Assistive Technology

- Keyboards may be altered to make typing with the fingers easier, or can be adapted to be used by a (head) pointer.
- Voice/Speech recognition systems
  - Allow people to give commands and enter data using their voice
- On-screen keyboard programs
  - Provide an image of a standard or modified keyboard on the computer screen.
  - The user selects the keys with a mouse, touch screen, trackball, joystick, switch, or electronic pointing device.
- Keyboard filters
  - Include typing aids, such as word prediction utilities
  - These products reduce the required number of keystrokes.
- Touch screens
  - Devices placed on the computer monitor (or built into it) that allow direct selection or activation of the computer by touching the screen.
- Alternative input devices
  - including alternative keyboards, electronic pointing devices, sip-and-puff systems, wands and sticks, joysticks and trackballs
A Word About Ergonomics

• “Ergonomics is the study of designing equipment and devices that fit the human body, its movements, and its cognitive abilities … two goals of health and productivity… relevant in the design of such things as safe furniture and easy-to-use interfaces”
Section 508

- Section 508 is an amendment to the United States Workforce Rehabilitation Act of 1973
- Mandates that all electronic and information technology developed, procured, maintained, or used by the federal government be accessible to people with disabilities
- Good accessibility design guidelines in general
Section 508

• Technical standards:
  • 1194.21 Software applications and operating systems.
  • 1194.22 Web-based intranet and internet information and applications. 16 rules.
  • 1194.23 Telecommunications products.
  • 1194.24 Video and multimedia products.
  • 1194.25 Self contained, closed products.
  • 1194.26 Desktop and portable computers.

• Section 508 validators available
### Section 508 Mandates

<table>
<thead>
<tr>
<th>Requirement</th>
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<tr>
<td>Use a keyboard for text interaction</td>
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<td>Accessibility features must always be available</td>
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<td>Provide indication of current screen focus</td>
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<td>Sufficient information about user interface element operation should be available</td>
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<td>Image representation of UI elements should also have explanatory text</td>
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<td>The use of images should be consistent</td>
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<td>Minimum text information should include content, input cursor location, attributes</td>
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<td>Don’t override individual display preferences</td>
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<td>Information displayed as animation must also be available without animation</td>
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<td>Color should not be the only means of communicating information</td>
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<td>No flash or blink frequency greater than 2 Hz and lower than 55 Hz</td>
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<td>Form interaction should support accessibility methods</td>
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Evaluate Your Project

• How well does it meet universal usability needs?
• How would you need to change the design to improve it?
References

- See myCourses for some specific resources
- Ben Schneiderman, “Universal Usability”, CACM, May 2000
- Some overview material from:
  - http://www.shef.ac.uk/disability/adtrain/8_support.html
- Read about Learning Disability material at:
- US Government usability site:
Appendix: Section 508
Section 508

- Section 508 is an amendment to the United States Workforce Rehabilitation Act of 1973.
- Requires that when federal agencies develop, procure, maintain, or use electronic and information technology, federal employees with disabilities have access to and use of information technology that is comparable to that of federal employees who do not have disabilities.
- Requires that members of the public with disabilities who seek information/services from a federal agency have access to and use of information that is comparable to that provided to members of the public without disabilities.
Section 508

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  • 1194.26 Desktop and portable computers.

• Section 508 validators available
Section 508 includes:

- Product functions shall be run from a keyboard where the function itself or the result of performing a function can be discerned textually.
- Applications shall not disrupt or disable activated features of other products that are identified as accessibility features.
- A well-defined on-screen indication of the current focus shall be provided that moves among interactive interface elements as the input focus changes.
Section 508 includes:

- Sufficient information about a user interface element including the identity, operation, and state shall be available to assistive technology.
- When an image represents a program element, the information conveyed by the image must also be available in text.
- When bitmap images are used to identify controls, status indicators, or other programmatic elements, they shall be consistent throughout an application's performance.
Section 508 includes:

- Textual information shall be provided through OS functions for displaying text. The minimum information that shall be made available is content, text input cursor location, and text attributes.
- Applications shall not override user selected contrast and color selections and other individual display attributes.
- When animation is displayed, the information shall be displayable in at least one non-animated presentation mode at the option of the user.
Section 508 includes:

• Color coding shall not be used as the only means of conveying information, indicating an action, prompting a response.
• Software shall not use flashing or blinking text, objects having a flash or blink frequency greater than 2 Hz and lower than 55 Hz.
• When forms are used, the form shall allow people using assistive technology to access the information, field elements, and functionality required for completion and submission of the form.