Accessibility

CSC 326



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© NC State Software Engineering Faculty

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Universal Software Accessibility

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Universal Design

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Universal Design



Universal design is the design of products and environments to be ***usable by all people***, to the greatest extent possible, ***without*** *the need for* ***adaptation or specialized design***.

–Ron Mace

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Ron Mace (1941 – 1998)

- **Bachelor Degree in Architecture, NC State, 1966**
- **Founded North Carolina State University Center for Accessible Housing**
  - **Now Center for Universal Design** (https://projects.ncsu.edu/ncsu/design/cud/)
- **North Carolina Accessible Building Code, 1973**
- **Fair Housing Amendments Act, 1988**
- **Americans with Disabilities Act (ADA), 1990**



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Universal Design Helps Everyone!



CLEARING A PATH
FOR PEOPLE WITH SPECIAL NEEDS
CLEARS THE PATH FOR EVERYONE!

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Legal Mandates

- Rehabilitation Act of 1973, as amended in 1998
  - Section 504
    - **requires universities receiving federal assistance to provide equal access to students with disabilities.**
  - Section 508
    - requires Federal agencies to make their electronic and information technology (EIT) accessible to people with disabilities.
    - mandates that most purchases of EIT by the federal government be accessible to disabled federal employees.
- Americans with Disabilities Act of 1990 (ADA)
  - outlaws discrimination in the private sector.
  - applied to National Federation of the Blind (NFB) vs. Target lawsuit. (Aug '08)

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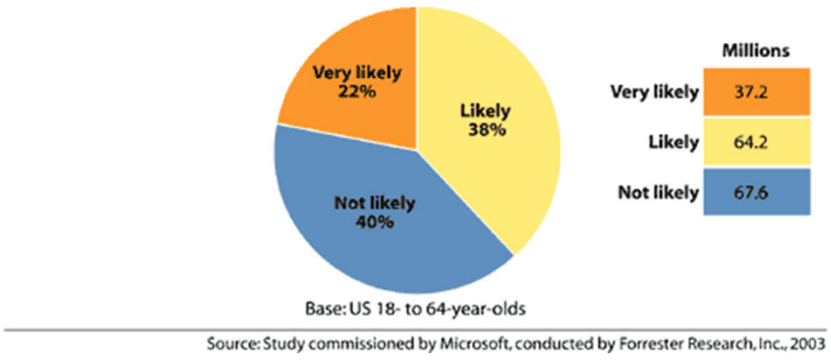
Economic Justification

Microsoft -- The majority of US working-age adults (18 – 64 year olds) are likely to benefit from the use of assistive technology:



(http://www.microsoft.com/enable/research/workingage.aspx)

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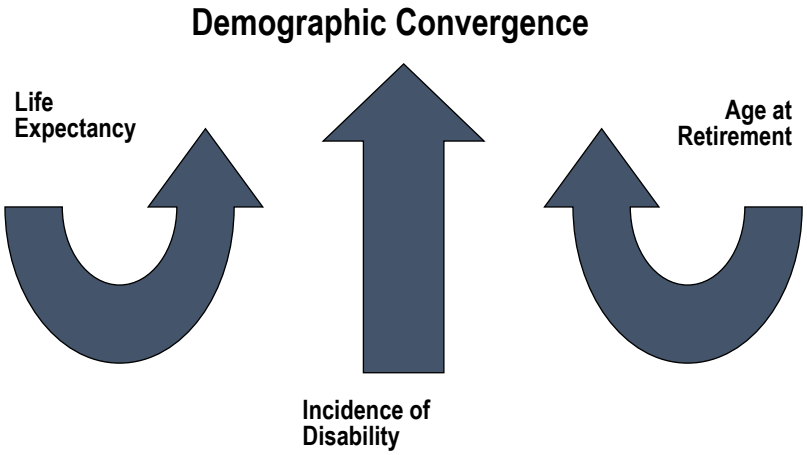
My Soapbox Has a Ramp

--Lisa Cook, former Accessibility Analyst, SAS Institute



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Background and Motivation

Software for the visually or hearing impaired—populations who have historically been neglected in terms of tech products—should be developed as a societal effort. This is just one of many research innovations that you are going to see...and not just for people with disabilities. With aging baby boomers in the U.S. at about 76 million, who will have vision or hearing deterioration, we think applications of the future need to take these users into consideration [16].

Frances West, Director Worldwide Accessibility Center for IBM

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Section 508 Requirements

https://www.section508.gov/develop/software-websites/

- ***The Section 508 standards are requirements. The standards include functional performance criteria and technical standards. It is not necessary to understand disabilities or any assistive technology. The functional performance criteria serve to ensure that software works for users with disabilities, while the technical standards define specific technical requirements to ensure that the functional performance criteria are generally met.***

- Quick Reference Guide to Section 508 Requirements and Standards
  https://www.section508.gov

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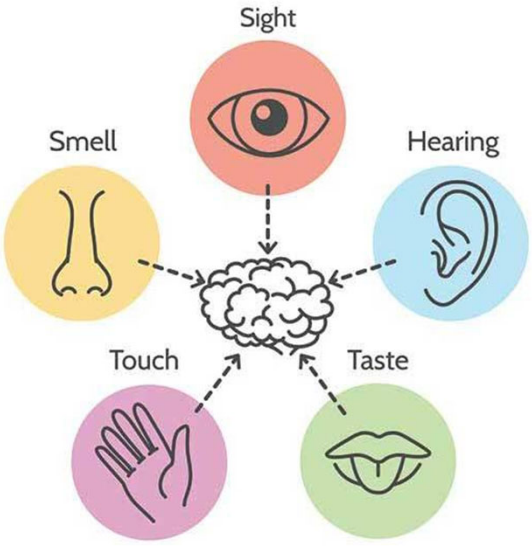
Cognitive computing perspective

Perception



https://marcus-jackson.com/2018/07/31/the-five-senses-and-the-first-day-of-school/

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Perceptual Systems

Thresholds

- Each type of perception has a **threshold** for recognition of percepts
- Sounds that are too quiet or visual stimuli that are too faint cannot be perceived

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Some perceptual thresholds

Vision	A candle flame seen from 50 km (31 mi) on a clear dark night
Audition	The tick of a watch from 6 m (19.6 feet) in very quiet conditions
Taste	One gram of table salt in 500 liters (132 gallons) of water
Smell	One drop of perfume diffused throughout a 3-room apartment
Touch	The wing of a bee falling on your cheek from a height of 1 cm

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Perceptual Thresholds Vary

About 20% of the population has special needs

- 1 in 10 people have a severe impairment or need
- 1 in 2 people over 65 have reduced capabilities

Special needs include blindness, hearing impairments, mobility issues, or any disorders in the body

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Special Needs to Consider

Special Need	Considerations
Visual	• Complete blindness or Color blindness or Poor vision • Visual problems like visual strobe and flashing effect problems
Physical	• Not able to use the mouse or keyboard with one hand • Poor motor skills like hand movements and muscle slowness
Cognitive	• Learning difficulties or Poor memory or not able to understand more complex scenarios
Literacy	• Reading challenges
Hearing	• Auditory problems like deafness and hearing impairments • Not able to hear or not able to hear clearly

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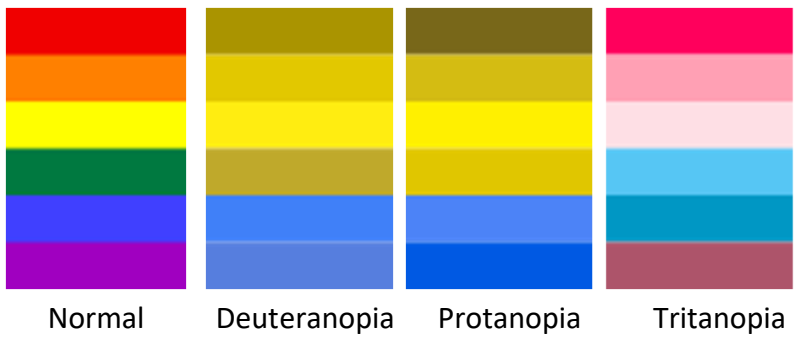
Color Blindness

(http://en.wikipedia.org/wiki/Color_blindness)



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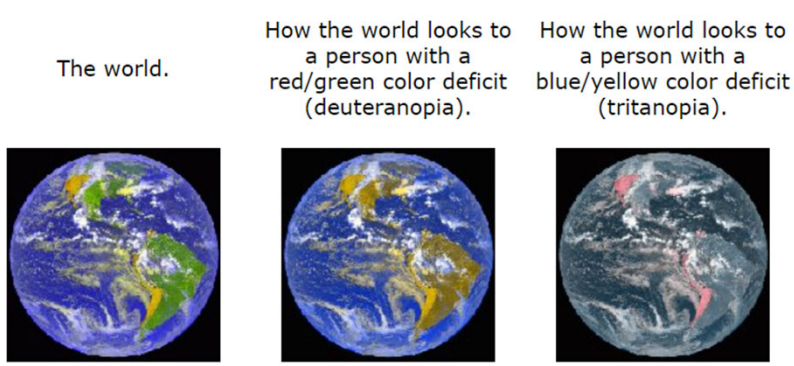

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http://en.wikipedia.org/wiki/Color_blindness

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https://sites.google.com/view/iris-mobile/home

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Accessibility in CoffeeMaker

Exercise 10.01

- What are accessibility considerations for CoffeeMaker?

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Assistive Technology Examples

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Assistive Technology

People with special needs use assistive technology to help them operate software products

- **Speech Recognition Software** converts spoken word to text, which serves as input to the computer
- **Screen Reader Software** reads out the text that is displayed on the screen
- **Screen Magnification Software** enlarges the monitor to make reading easy for vision-impaired users
- **Carefully designed input devices** can make typing or other input tasks easier for people with motor control difficulties

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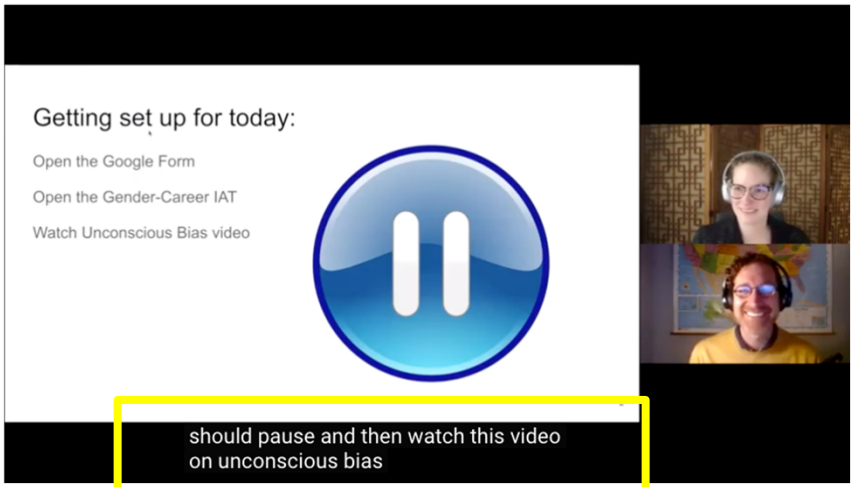

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[rlhh2wr2Yh}w



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Yh}w2wr2[rlhh?#H2shq#Whdghu

The C-Pen Reader is a portable, pocket-sized device that reads text out aloud with an English, human-like digital voice



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OF\ V#Vhuhhq#Whdghu

Fvvlvwl{h#whhmqrorl|#iru#{lvxdo|#lp sdlung



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Refreshable Braille Display



Screen Reader Demo (DO-IT Center, U. Washington)

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Software Engineering: Accessible Software

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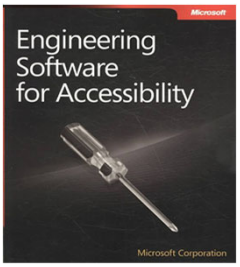
Designing for Accessibility



- Web Development
  - https://a11yproject.com/
  - https://getbootstrap.com/docs/4.0/getting-started/accessibility/
- Engineering Software for Accessibility
  - https://download.microsoft.com/download/5/0/1/501FF941-E93D-423F-868B-C7BB2EC08C56/engineering_for_accessibility_eBook.pdf

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Accessibility Resources

- Guidelines
  - Web Content Accessibility Guidelines (WCAG) 2.0
    W3C Recommendation 11 December 2008
    https://www.w3.org/TR/2008/REC-WCAG20-20081211/
  - Quick Reference Guide to Section 508 Requirements and Standards
    https://section508.gov/content/learn/standards/quick-reference-guide
  - Web Content Accessibility Guidelines
    https://en.wikipedia.org/wiki/Web_Content_Accessibility_Guidelines
- Colour Contrast Analyser
  - https://developer.paciellogroup.com/resources/contrastanalyser/

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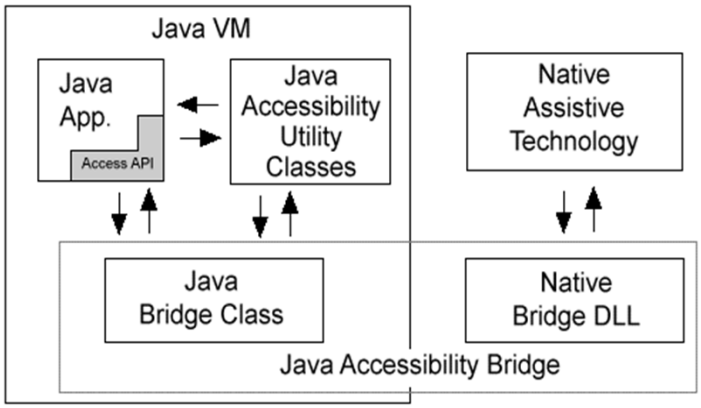
Java Accessibility



Java Accessibility API

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Accessibility Testing

Can be performed in two ways:

1. Manual testing
2. Automated testing

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Accessibility Acceptance Testing

1. Whether an application provides keyboard equivalents for all mouse operations and windows?
2. Whether instructions are provided as a part of user documentation or manual? Is it easy to understand and operate the application using the documentation?
3. Whether tabs are ordered logically to ensure smooth navigation?
4. Whether shortcut keys are provided for menus?
5. Whether application supports all operating systems?
6. Whether response time of each screen or page is clearly mentioned so that End Users know how long to wait?
7. Whether all labels are written correctly in the application?
8. Whether color of the application is flexible for all users?
9. Whether images or icons are used appropriately, so it's easily understood by the end users?

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Accessibility Acceptance Testing

10. Whether an application has audio alerts?
11. Whether a user is able to adjust audio or video controls?
12. Whether a user can override default fonts for printing and text displays?
13. Whether user can adjust or disable flashing, rotating or moving displays?
14. Check to ensure that color-coding is never used as the only means of conveying information or indicating an action
15. Whether highlighting is viewable with inverted colors? Testing of color in the application by changing the contrast ratio
16. Whether audio and video related content are properly heard by users? Test all multimedia pages with no speakers in websites
17. Whether training is provided for users with disabilities that will enable them to become familiar with the software or application?

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