Universal Software Accessibility
Computer Use for Everyone

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Computer Science
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Computer users have a wide range of abilities…

- Hearing
- Mobility
- Vision
  - Blind
  - Visually Impaired
  - Color Vision Deficiency
Color Blindness

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

Normal | Deuteranopia | Protanopia | Tritanopia
CAPTCHA: Completely Automated Public Turing test to tell Computers and Humans Apart
Assistive Technology

• Hearing Impairment
  – Closed Captioning

• Mobility Impairments
  – Switch
  – On-screen Keyboard
  – Speech Recognition

• Visual Impairments
  – Screen Magnifier
  – Screen Reader (JAWS, NVDA, VoiceOver)
    • Speech Synthesizer
    • Braille Display
Refreshable Braille Display

Screen Reader Demo (DO-IT Center, U. Washington)
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
Universal Design Helps Everyone!

CLEARING A PATH
FOR PEOPLE WITH SPECIAL NEEDS
CLEAR THE PATH FOR EVERYONE!
Ron Mace (1941 – 1998)

• Bachelors 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
CSC 333 Student, Fall 2004

Sina Bahram
Accessibility Consultant
B.S. Computer Science, 2007
M.S. Computer Science, 2011
ProofChecker

SAS® Enterprise Miner
CSC 116 Student, Spring 2010

Sean Mealin
Ph.D. Student
B.S. Computer Science, 2013
M.S. Computer Science, 2015
Accessible Battleship Game
Graph SKetching Tool (GSK)

Java Accessibility
C# Accessibility

Engineering Software for Accessibility
GSK#

http://go.ncsu.edu/gsk

(multiplatform version under development by Matthew Meeks)
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)
Economic Justification

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

![Pie chart showing the likelihood of benefit from assistive technology]

- Very likely: 37.2 millions
- Likely: 64.2 millions
- Not likely: 67.6 millions

Base: US 18- to 64-year-olds

Source: Study commissioned by Microsoft, conducted by Forrester Research, Inc., 2003

(http://www.microsoft.com/enable/research/workingage.aspx)
My Soapbox Has a Ramp
--Lisa Cook, former Accessibility Analyst, SAS Institute

Demographic Convergence

Life Expectancy

Incidence of Disability

Age at Retirement
Chapter 2

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
Section 508 Requirements

• 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.

https://section508.gov/content/software-development-life-cycle

• Quick Reference Guide to Section 508 Requirements and Standards
  https://section508.gov/content/learn/standards/quick-reference-guide
Designing for Accessibility

• Web Development
  – https://a11yproject.com/
  – https://getbootstrap.com/docs/4.0/getting-started/accessibility/

• Engineering Software for Accessibility

• AngularJS
  – https://docs.angularjs.org/guide/accessibility
  – http://marcysutton.github.io/a11y-testing-with-angular/#/
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/
Accessibility Testing

• Color
  – Is there enough contrast between foreground and background colors?
  – Is color used as the sole indication of a condition?
  – How do colors appear to someone who is color blind?
  – Are system preferences (e.g., High Contrast) respected?

• Keyboard Accessible
  – Are all components accessible and operational solely through use of the keyboard?
  – Is there a visible focus indicator when a component has programmatic focus?
  – Does tabbing from component to component proceed in a way that makes sense, typically top to bottom, left to right?