HCI and Design
Today

Technology and disabilities
- Who is affected
- Models of disability
- Categories of impairments
- Universal design
Who is affected?

16% of US population to ages 15 to 64 is disabled.
10% of the workforce is disabled
5% of the STEM workforce is disabled
1% of PhDs in STEM are disabled
Who is affected?

People with disabilities
- Visual, hearing, motor, cognitive, reading
- About 1 in 5 adults (webaim.org/intro)

Older adults
- up to 50% of computer users may benefit from accessibility features
  (http://www.microsoft.com/enable/research/)

“Situational impairments”
- mobile device users, temporarily injured people

Sometimes it’s just convenient
- reading transcripts vs. watching a video
Models of Disability

**Medical Model**
- Disabled people are patients who need treatment and/or cure.

**Rehabilitation Model**
- Disabled people need assistive technology for employment and everyday life.

**Legal Model**
- Disabled people are citizens who have rights and responsibilities like other citizens. Accessibility to public buildings and spaces, voting, television, and telephone are some of those rights.

**Social Model**
- Disabled people are part of the diversity of life, not necessarily in need of treatment and cure. They do need access when possible.
Technology and Disabilities

Prosthesis
- Augmentation to restore lost function. Call it a “cure.”

Assistive technology
- Popular in rehabilitation literature.
- Emphasis on the need for assistance.

Access technology
- Allows an activity that would be difficult to impossible to achieve without it. Emphasis not on restoring function, but on achieving an end goal by whatever means possible.
- Examples: Screen readers, video phones, wheel chairs.
Disability and technology innovation are intertwined.

Information technology fields need more people with disabilities because their expertise and perspectives spark innovation.

Disabilities Drive Innovation

Innovations for Disability

Solutions for Everyone

- Telephone
- Texting
- Optical Character Recognition
- Speech synthesis
- Speech recognition
- Video chat
The Telephone

The telephone was invented by A.G. Bell in his efforts “of devising methods of exhibiting the vibrations of sound optically, for use in teaching the deaf and dumb”

(Fay, American Annals of the Deaf, 1887)
Speech Recognition for Hands Free Access

Ray Kurzweil introduced the first commercial large-vocabulary speech recognition software in 1987.

Sang-Mook Lee
“Picturephone” demonstrated by AT&T at the 1964 World’s Fair

- Required too much bandwidth for phone system
- Deaf world excited then disappointed
Video Phone

Set top box
Sorenson 2002

Purple 2010
Accessibility is Becoming Mainstream

Accessibility concerns lead to major innovations
Accessibility is built into products and services
Companies are focusing on accessibility
  ◦ Microsoft Chief Accessibility Officer
  ◦ Teach Access
Accessibility is becoming part of the curriculum
Categories of Impairments

Cognitive (learning disabilities, memory, reading)
Mobility (Physical)
Hearing
Speech
Visual
Cognitive Impairments

Memory
- Working memory, short term memory, long term memory

Reading
- dyslexia

Social
- e.g. autism

Learning disabilities
- ADHD, etc.

Memory storage
- Don’t rely on users remembering large amounts of information

Distraction / Task Decomposition
- Consider users who have difficulty focusing
- Make tasks shorter, simplify designs

Socialization
- Some children with autism may not be comfortable looking at faces
Challenges: Physical/mobility

Diverse array of physical disabilities
Little or no control of hands
Temporary injury
Permanent condition

Keyboard accessibility
- Users can access and activate everything with only the keyboard

Speech recognition compatibility

Provide ample time for tasks

Provide shortcuts
- “Skip Navigation” links
Challenges: Hearing

Obstacles include videos, mp3s, podcasts
Often not essential to web content
  ◦ Becoming more essential with things like Siri, Echo.
Closed-captioning, transcripts
Sign language
Hearing aids

Use structure
  ◦ Use headings and subheadings
  ◦ Use bulleted lists

Write clearly
  ◦ Keep language short, simple, and to the point
  ◦ Write in active voice
  ◦ Avoid jargon and/or provide definitions

Provide alternatives to audio
  ◦ Text, captions, and/or sign language interpreters
  ◦ TTY-enabled customer service
Challenges: Vision

Many different kinds of vision impairment
- Blind
- Low vision
- Color blind
- Etc.

Profoundly affected by web content
- Web is extremely visual

Web developers need to accommodate needs more than for any other group

Use text instead of images of text
- Use CSS to style text (Logos are exceptions)

Keyboard accessibility
- Don’t override keystrokes
- Users can access and activate everything on the page with solely the keyboard

Skip navigation links

Have alternatives to color
- Required fields in red
- * denotes required fields

Provide sufficient color contrast
Color blindness

Affects 10% of males

Multiple variations

Fig. 2. Simulations of dichromatic color vision. From left to right: original image, simulation of protanopia, simulation of deuteranopia, and simulation of tritanopia. Simulations generated at www.vischeck.org.
Universal Design

Design for as many users as possible, not just the average user
Seven Principles for Universal Design

Principle 1: Equitable Use

The design is useful and marketable to people with diverse abilities.
Principle 2: Flexibility in Use

The design accommodates a wide range of individual preferences and abilities.

e.g., Many reading apps (iBooks, Kindle) enable users to personalize font size and background color.
Principle 3: Simple and Intuitive Use

Use of the design is easy to understand, regardless of the user’s experience, knowledge, language skills, or education level.
Principle 4: Perceptible Information

The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.
Principle 5: Tolerance for Error

The design minimizes hazards and the adverse consequences of accidental or unintended actions.

e.g., Always having an undo or reset button to get back to a familiar state
Principle 6: Low Physical Effort

The design can be used efficiently and comfortably and with a minimum of fatigue.

e.g. Adding appropriate amounts of white space decreases the physical cognitive effort.
Principle 7: Size and Space for Approach and Use

Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user’s body size, posture, or mobility.

Example: The size and spacing of hotspots or buttons on widgets and other interactive elements enable users with low vision or poor fine motor skills to discriminate and control the elements.
Summary

Technology and disabilities
- About 1 in 5 people affected
- Many more, depending on how you count...
- There are different models of disability

You need to:
- Understand categories of impairments
- Design for accessibility
- Practice Universal design
Activity: Work in Pairs

Explore and analyze your device’s accessibility features
1. Choose one of your laptops/phones
2. Locate the device’s built-in accessibility features
3. Make a list of features. For each feature:
   - Turn it on and try it out yourselves. What does it do?
   - What category(s) of impairment is it targeting?
   - How good is it? Does it work well? Could it be improved?

Upload a pdf showing your work/comments/answers
https://drive.google.com/drive/folders/1B1m3udWlrW-d1oW7lfEQag_Lckbm4UCK?usp=sharing

If time: Explore different kinds of color blindness tests:
http://www.color-blindness.com/color-blindness-tests/