



HCI and Design

SPRING 2016

Today

Technology and disabilities

- Who is affected
- Models of disability
- Why care?
- Categories of impairments
- Designing for accessibility

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.

Why make things accessible?

Good for business

- Reach a large audience

Support social inclusion

- Participation from a diverse group is good

Follow the law

- Access to information is a basic human right

Assistive tech improves quality of life

Enables a person to function at his or her own pace.

Fosters independent living.

Maintains or improves daily function

Reduces stress-related injuries

Eases integration into society (levels the “playing field”)

Modifies the environment instead of the person

Legal support for accessibility

1990: Americans with Disabilities Act (ADA)

1998: Rehabilitation Act (section 508)

2006: Individuals with Disabilities Education Act (IDEA)

<http://webaim.org/articles/laws/usa/>

Legal Cases

1996 ADA complaint vs. City of San Jose, CA

- Use of PDF inaccessible to city commissioner
- Web sites are a “service” and thus subject to the ADA
- Led to *S. J. Web Page Disability Access Standard*

1999 National Federation of the Blind vs. AOL

- Based on the interpretation of the Web as a place of public accommodation (ADA)
- Settled out of court
- 2000: AOL agreed to make its browser accessible

2006 NFB vs. Target

- ADA as applied to Target’s web site
- Settled for US \$6 million

Categories of Impairments

Cognitive (learning disabilities, memory, reading)

Mobility (Physical)

Hearing

Speech

Visual

Challenges: Cognitive Impairments

Memory

- Working memory, short term memory, long term memory

Reading

- dyslexia

Social

- e.g. autism

Wide variety of learning disabilities

- ADHD, etc.

teapot təpɒt
təpɒt təpɒt
tepɒt tɛpɒt
təpɒt teapot
təpɒt tɛadɒt

Considerations for Cognitive Impairments

Memory storage

- Don't rely on your user to remember large amounts of information, or complex steps

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



Considerations for Mobility Impairments

Keyboard accessibility

- Users can access and activate everything on the page with solely the keyboard

Speech recognition compatibility

Provide ample time for tasks

Provide shortcuts

- [“Skip Navigation”](#) links



Adaptive keyboards

Keyguards allow hands to rest on keys

Mini-keyboards minimize hand motion

Datahand uses finger movement only...

orbitTouch needs no fine movement at all.



Adaptive pointing devices

Many alternatives to the standard mouse

Also can help prevent RSI

Trackball

Trackpad

Graphics tablet



Hands-free computing

Voice recognition software

On-screen keyboard

Head-tracking mouse

Foot mouse



Challenges: Hearing

Obstacles include videos, mp3s, podcasts

Often not essential to web content

- Becoming more essential with things like Siri, Amazon Echo, etc.

Closed-captioning, transcripts

Sign language

Hearing aids



Considerations for Hearing Impairments

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, or even sign language interpreters
- TTY-enabled customer service lines

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

Color blindness

Affects 10% of males

Multiple variations

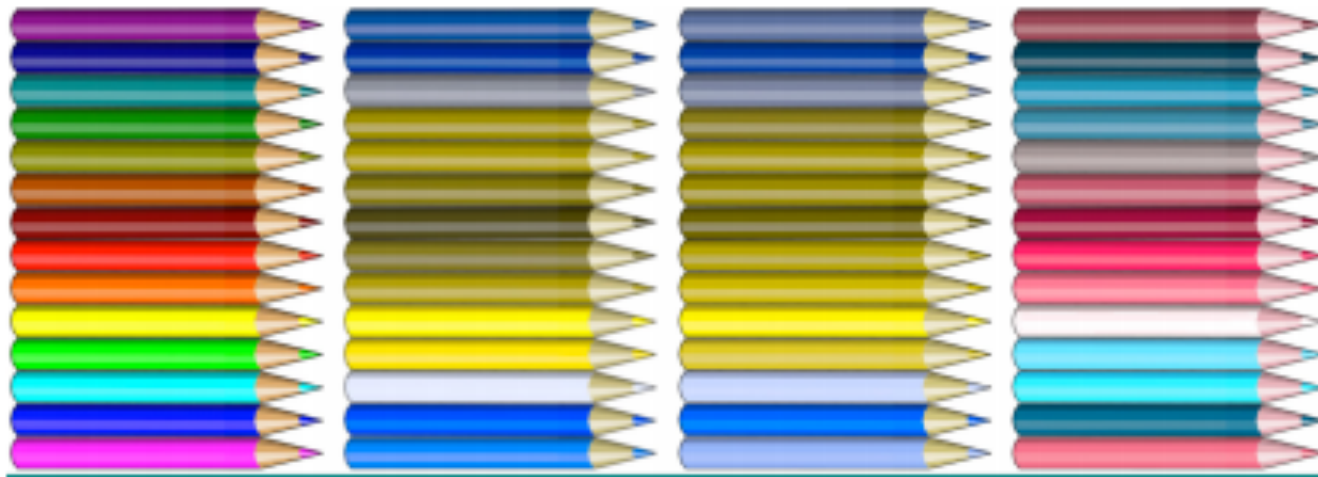


Fig. 2. Simulations of dichromatic color vision. From left to right: original image, simulation of protanopia, simulation of deuteranopia, and simulation of tritanopia. Simulations generated at www.vischeck.org.

Considerations for Visual Impairments

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

Designing for accessibility

User Centered Design

- Involve the user at every step

Universal Design

- Design for all users, if possible

Design for User Empowerment

- Design to enable people to solve their own accessibility problems, if possible

Follow [known design guidelines](#) for specific disabilities

Assistive Tech can be simple

A magnifying glass

A straw

Anti-glare screen for the monitor

Door handles instead of door knobs

Calculators/clocks with extra large digits

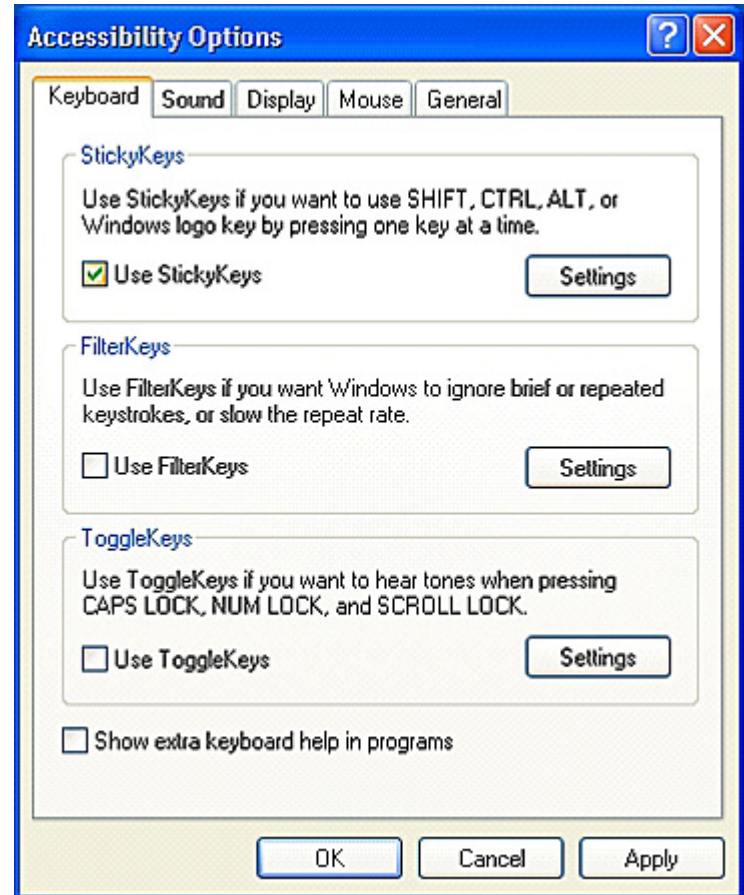
Assistive Tech can be complex

Alternative keyboards or switches
Braille and refreshable braille
Scanning software
Screen magnifiers
Screen readers
Speech recognition
Speech synthesis
Tabbing through structural elements
Text browsers
Visual notification
Voice browsers



Accessibility features in OS

- Sticky keys / filter keys
- Screen magnifiers
- Mouse & cursor control
- Keyboard navigation
- Visual alert
- On-screen keyboard
- Speech recognition for specific commands



Web Content Accessibility Guidelines

Perceivable

Operable

Understandable

Robust

Web Content Accessibility Guidelines

Perceivable

- Provide text alternatives for non-text content and provide captions and alternatives for audio and video content.
- Make content adaptable; and make it available to assistive technologies.
- Use sufficient contrast to make things easy to see and hear.

Web Content Accessibility Guidelines

Operable

- Help users find content and make everything keyboard accessible.
- Give users enough time to read and use content.
- Do not use content that causes seizures.

Web Content Accessibility Guidelines

Understandable

- Make text and content understandable, and readable
- Make content operate in predictable ways and help users avoid and correct mistakes.

Robust

- Maximize compatibility with current and future technologies.

10 Quick Tips

1. Images & animations: Use the alt attribute to describe the function of each visual.
2. Image maps. Use the client-side map and text for hotspots.
3. Multimedia. Provide captioning and transcripts of audio, and descriptions of video.

10 Quick Tips (cont)

4. Hypertext links. Use text that makes sense when read out of context. For example, avoid "click here."
5. Page organization. Use headings, lists, and consistent structure. Use CSS for layout and style where possible.
6. Graphs & charts. Summarize or use the longdesc attribute.

10 Quick Tips (cont)

7. Scripts, applets, & plug-ins. Provide alternative content in case active features are inaccessible or unsupported.

8. Frames. Use the noframes element and meaningful titles.

9. Tables. Make line-by-line reading sensible. Summarize.

10. Check your work. Validate. Use tools, checklist, and guidelines at <http://www.w3.org/TR/WCAG>

Verifying accessibility

Testing with real users is the best way

Heuristic evaluation can help

- <http://webaim.org/intro/#principles>
- <http://webaim.org/standards/wcag/checklist>

Simulating disability

- <http://vischeck.com/>
- <http://firevox.clcworld.net/>
- <http://www.chromevox.com/>

Summary

Technology and disabilities

- About 1 in 5 people affected
- There are different models of disability
- You should care!
- Understand categories of impairments
- How to design for accessibility

Make your software/apps/tools/projects accessible!

Activity

Consider the following types of impairments:

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

For your project (HCI or another one):

- What challenges would a person with EACH type of impairment face accessing your “thing”?
- What things could you do to make your project accessible to people with EACH type of impairment?