

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

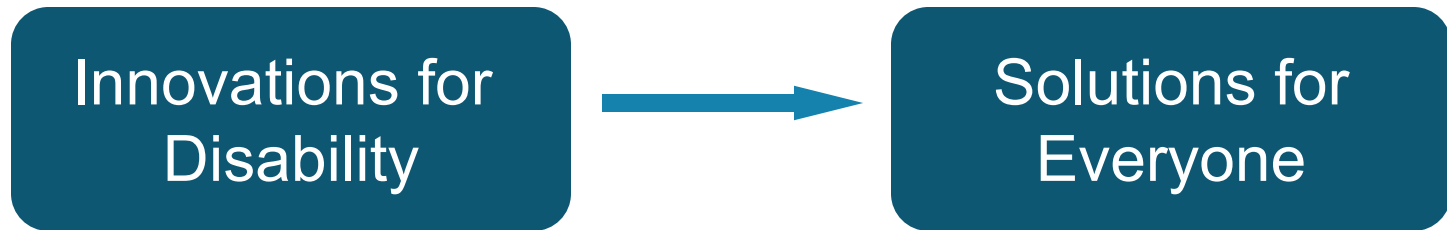
- Allows an activity that would be difficult to impossible to achieve without it. Emphasis not on restoring function, but on achieving an end goal by whatever means possible.
- Examples: Screen readers, video phones, wheel chairs.

Argument

Disability and technology innovation are intertwined.

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

Accessibility Innovations Matter



- ❖ Telephone
- ❖ Personal texting
- ❖ Optical Character Recognition
- ❖ Speech synthesis
- ❖ Speech recognition
- ❖ Personal 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)

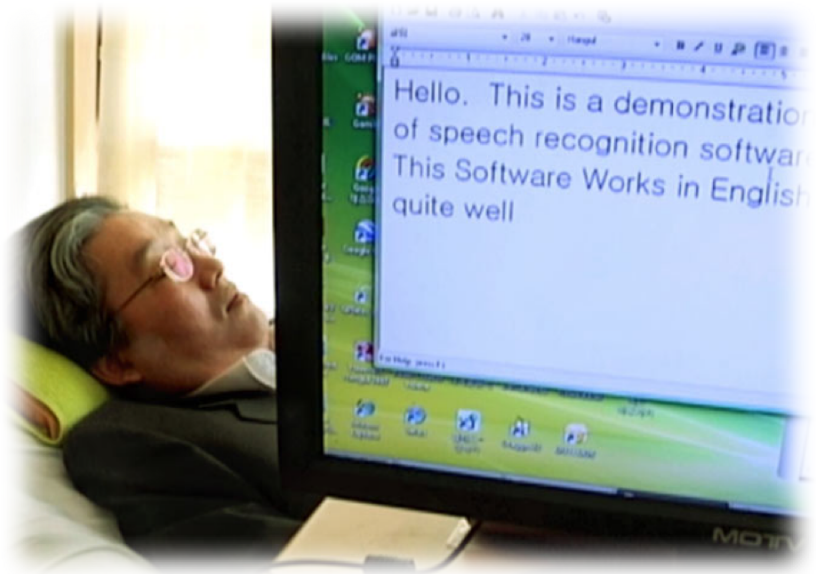


A.G. Bell
1880

Speech Recognition for Hands Free Access



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



Sang-Mook Lee


Speech for Eyes Free Access

amazon echo



Picturephone

Western Electric
is crossing a telephone
with a TV set.



Someday you'll be
a star!

What you'll use is called, simply enough, a Picturephone® set. Someday it will let you see who you are talking to, and let them see you.

The Picturephone set is just one of the communications of the future. Western Electric is working on with Bell Telephone Laboratories.

Western Electric builds regular phones & equipment for your Bell telephone company. But we also build for the future.

9 JUN 1964

Western Electric
MANUFACTURING & SERVICE DIV. OF BELL SYSTEM

“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

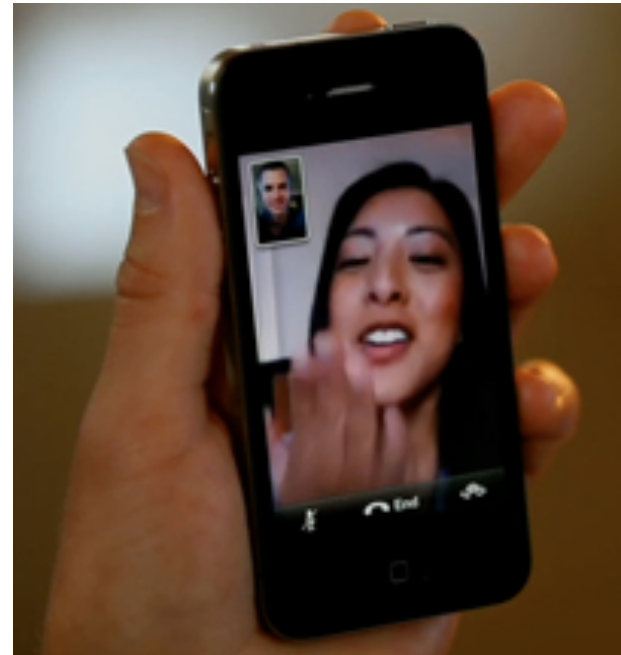


Set top box
Sorenson 2002



Purple 2010

Ubiquitous Video Phone



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

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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	təpəpə
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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.



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

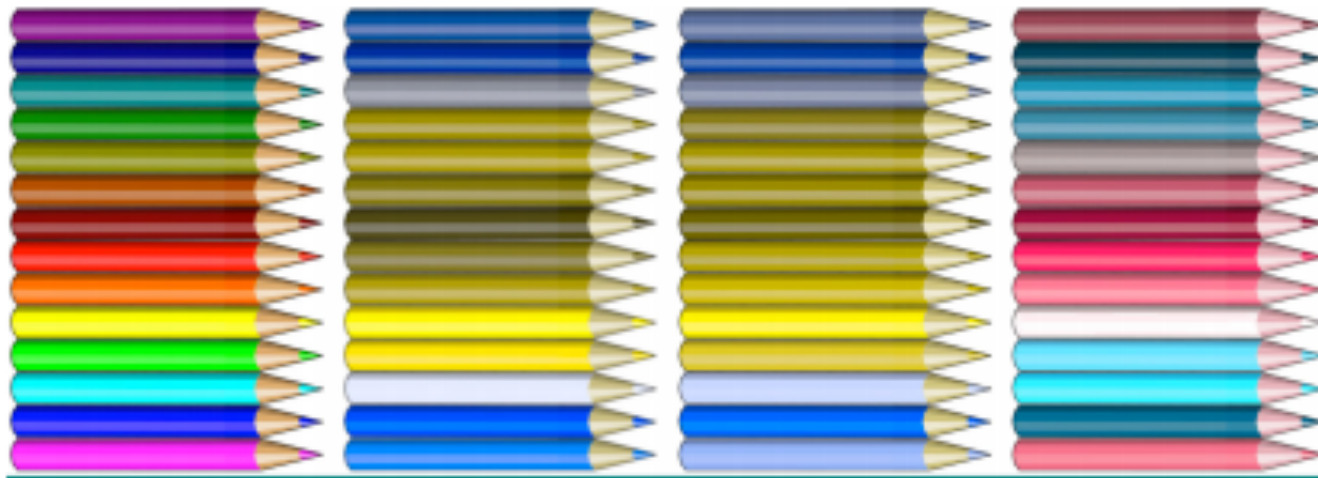


Fig. 2. Simulations of dichromatic color vision. From left to right: original image, simulation of protanopia, simulation of deuteranopia, and simulation of tritanopia. Simulations generated at www.vischeck.org.

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

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Universal Design

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



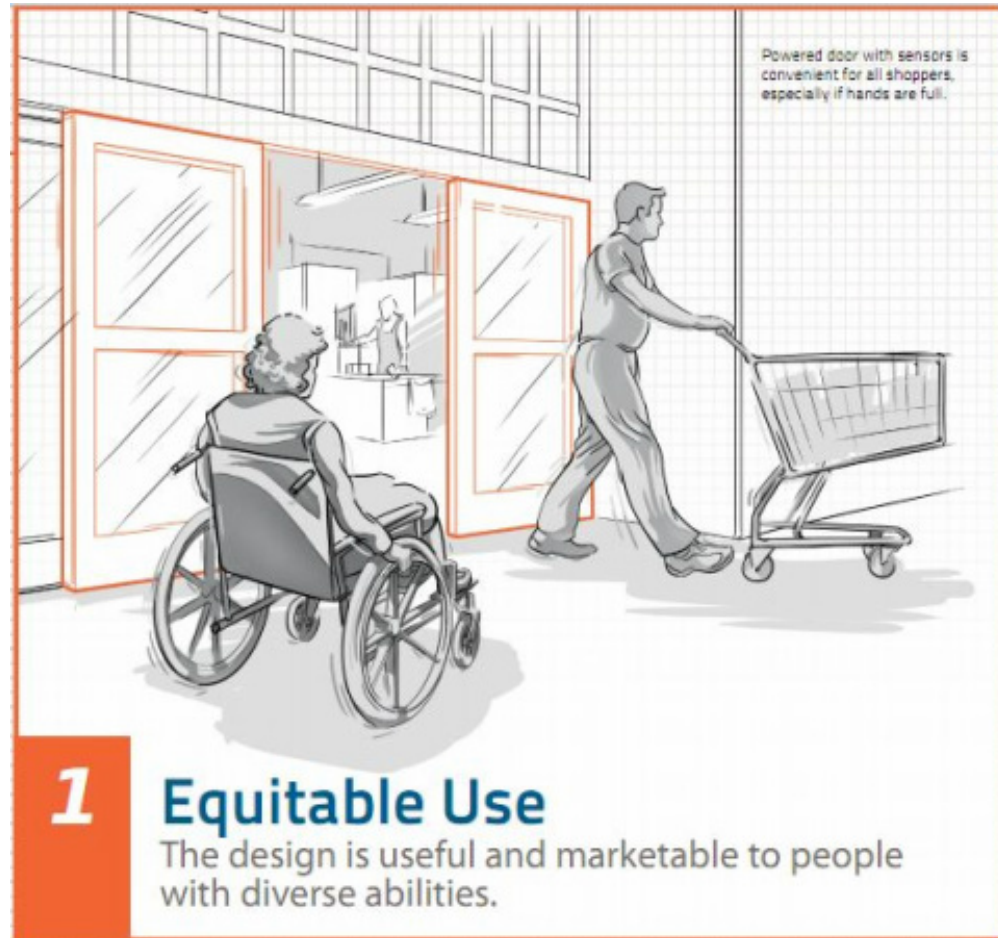
Universal Design – Example



Seven Principles for Universal Design

Principle 1: Equitable Use

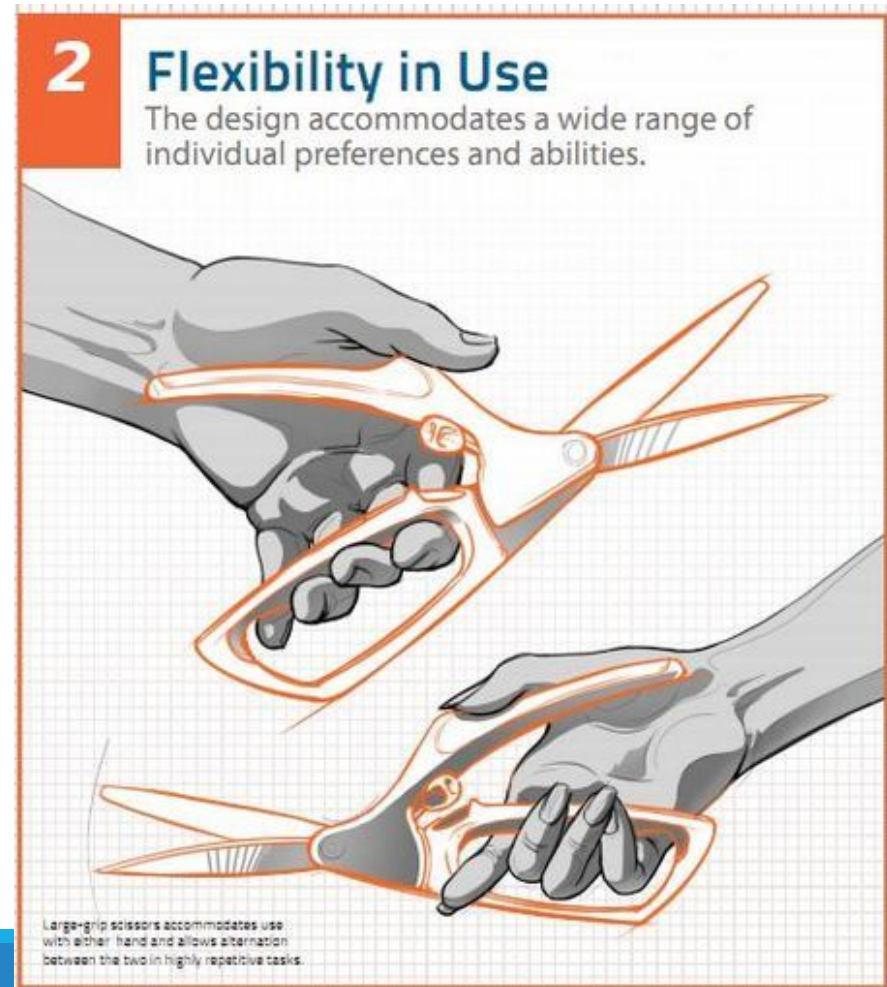
The design is useful and marketable to people with diverse abilities.



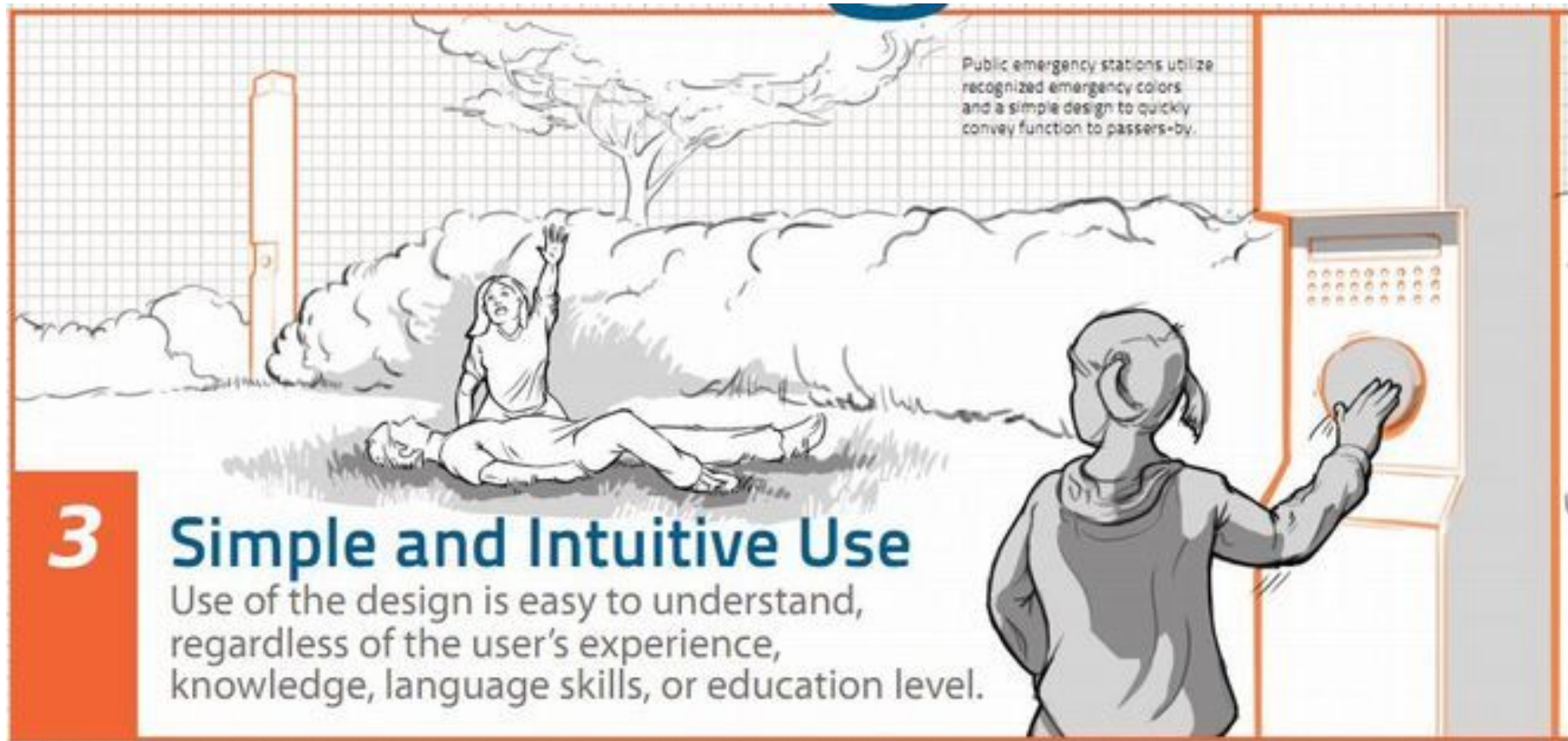
Principle 2: Flexibility in Use

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

Eg: Many reading apps (iBooks, Kindle) enable users to personalize font size and background color.



Principle 3: Simple and Intuitive Use



Principle 4: Perceptible Information

The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.



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Perceptible Information

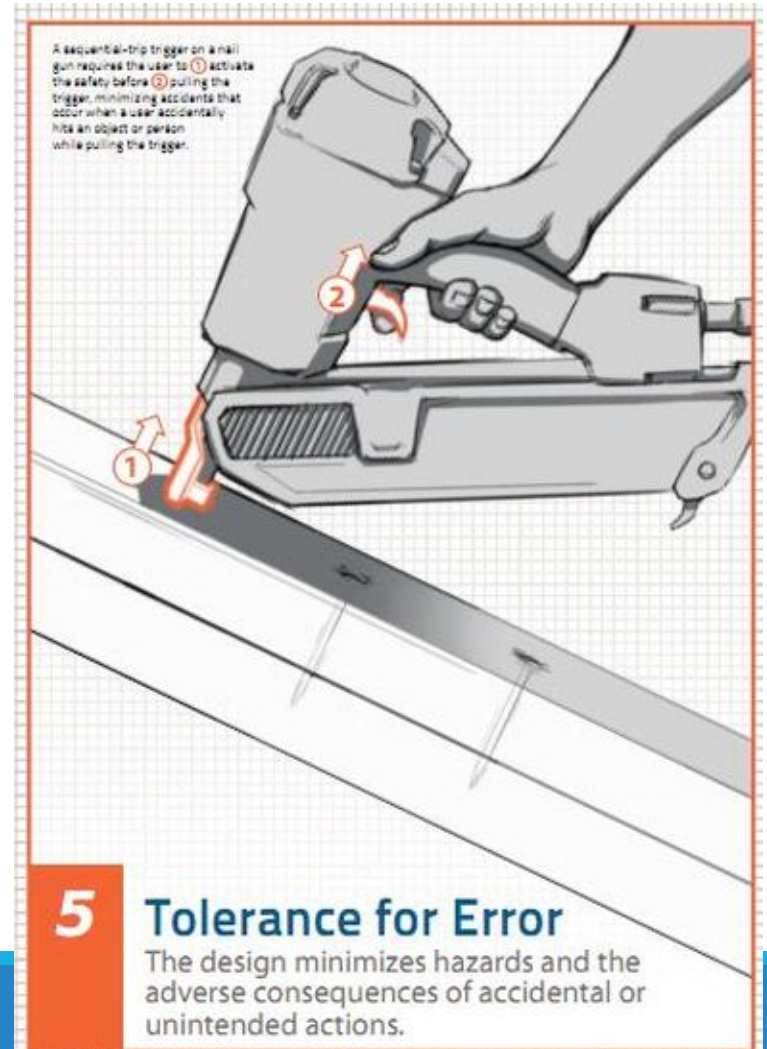
The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.

Small bumps on a cell phone keypad tell the user where important keys are without requiring the user to look at the keys.

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



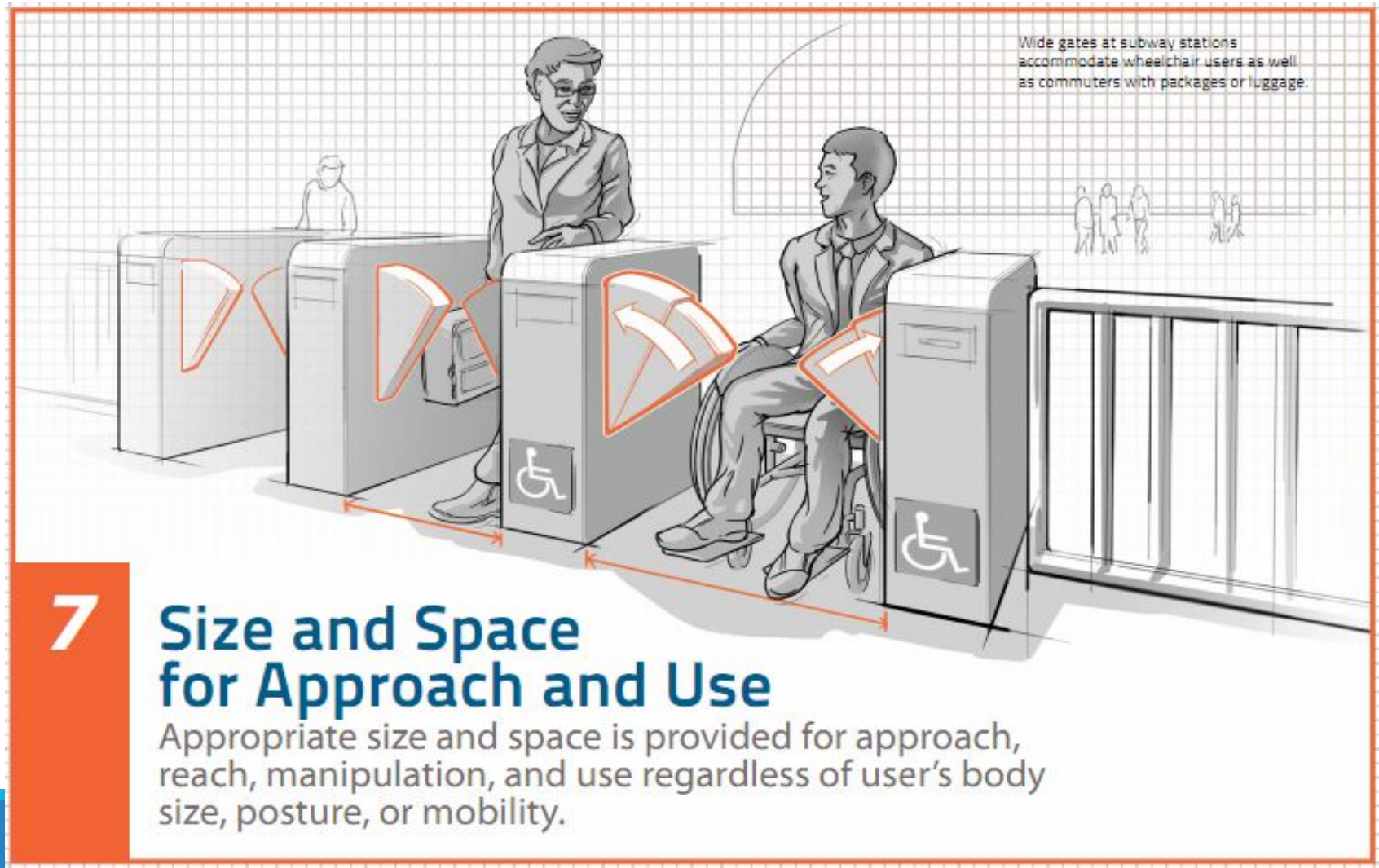
Principle 6: Low Physical Effort

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

Eg: Adding appropriate amounts of white space decreases the physical cognitive effort.



Principle 7: Size and Space for Approach and Use



Summary

Technology and disabilities

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

Make your software/apps/tools/projects accessible!

Activity

Paper prototype a social network website/app for people who can't read

- Think about how to make it “text-free”

Features to think about:

- Adding friends to your network
- Posting content, adding “tags”
- Consuming content
- Commenting, liking, etc.

Do it on paper and turn it in

- Make sure you add annotations and captions to explain your design and thought processes