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.

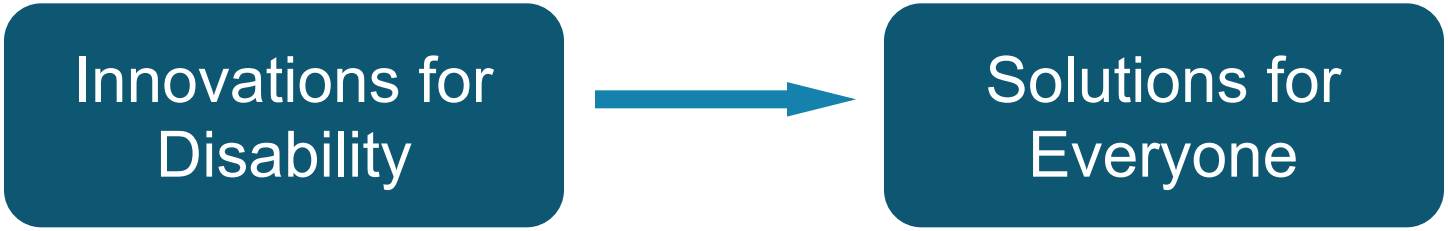
Access technology

- 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.

Disabilities Drive Innovation

Disability and technology innovation are intertwined.

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



Telephone
Texting
Optical Character Recognition
Speech synthesis
Speech recognition
Video chat

The Telephone

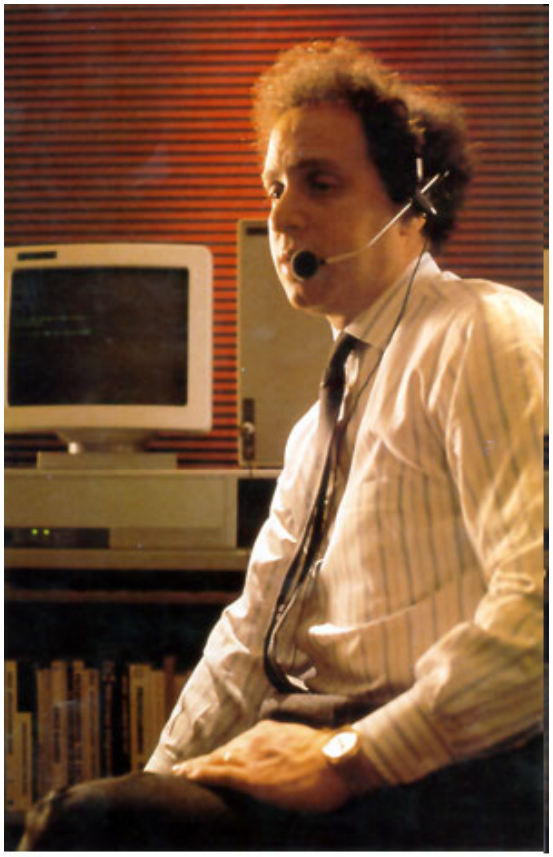
The telephone was invented by A.G. Bell in his efforts

"of devising methods of exhibiting the vibrations of sound optically, for use in teaching the deaf and dumb"

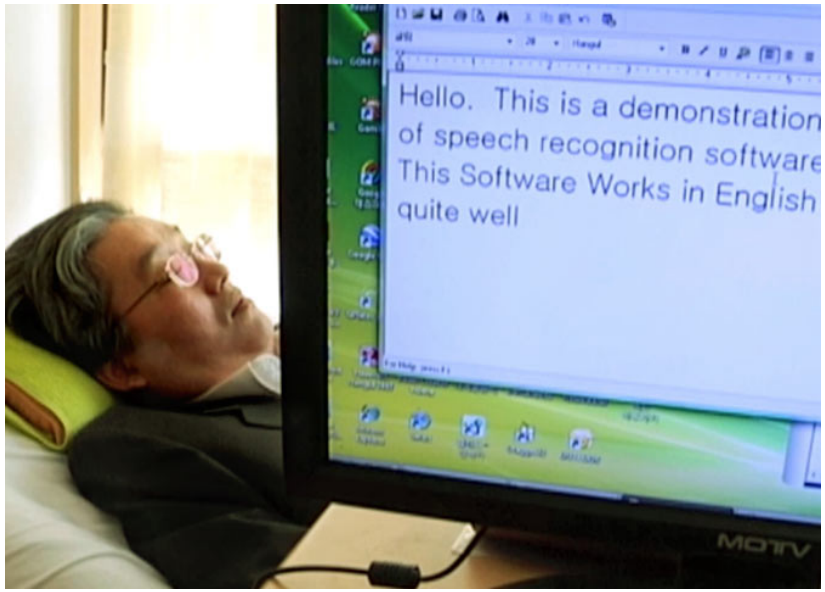
(Fay, American Annals of the Deaf, 1887)

A.G. Bell
1880

Speech Recognition for Hands Free Access



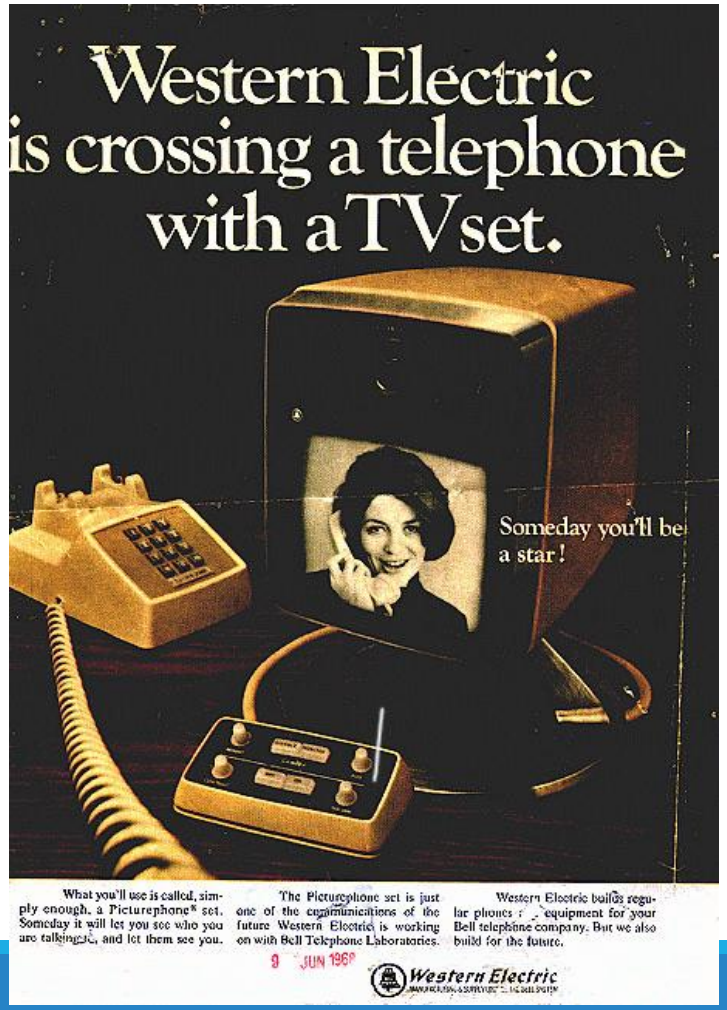
Ray Kurzweil introduced the first commercial large-vocabulary speech recognition software in 1987



Sang-Mook Lee

amazon echo

Picturephone



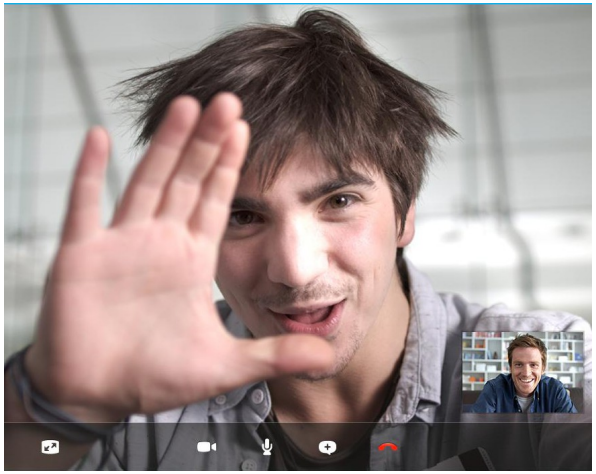
"Picturephone" demonstrated by AT&T at the 1964 World's Fair

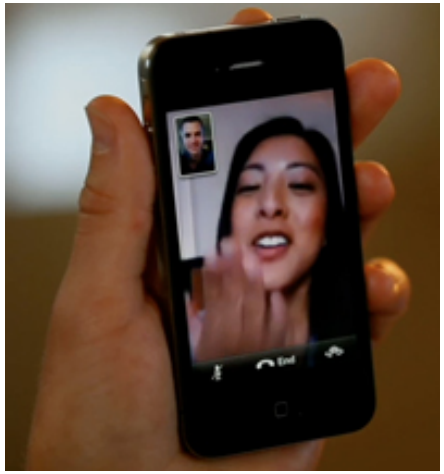
- Required too much bandwidth for phone system
- Deaf world excited then disappointed

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

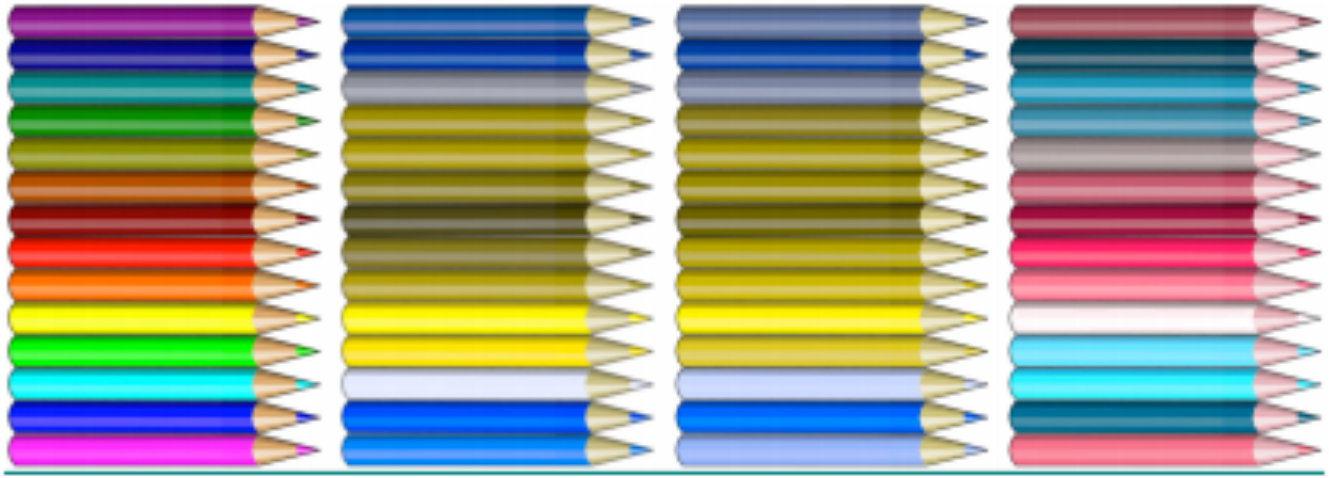


Fig. 2. Simulations of dichromatic color vision. From left to right: original image, simulation of protanopia, simulation of deuteranopia, and simulation of tritanopia. Simulations generated at www.vischeck.org.

Universal Design

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

Seven Principles for Universal Design

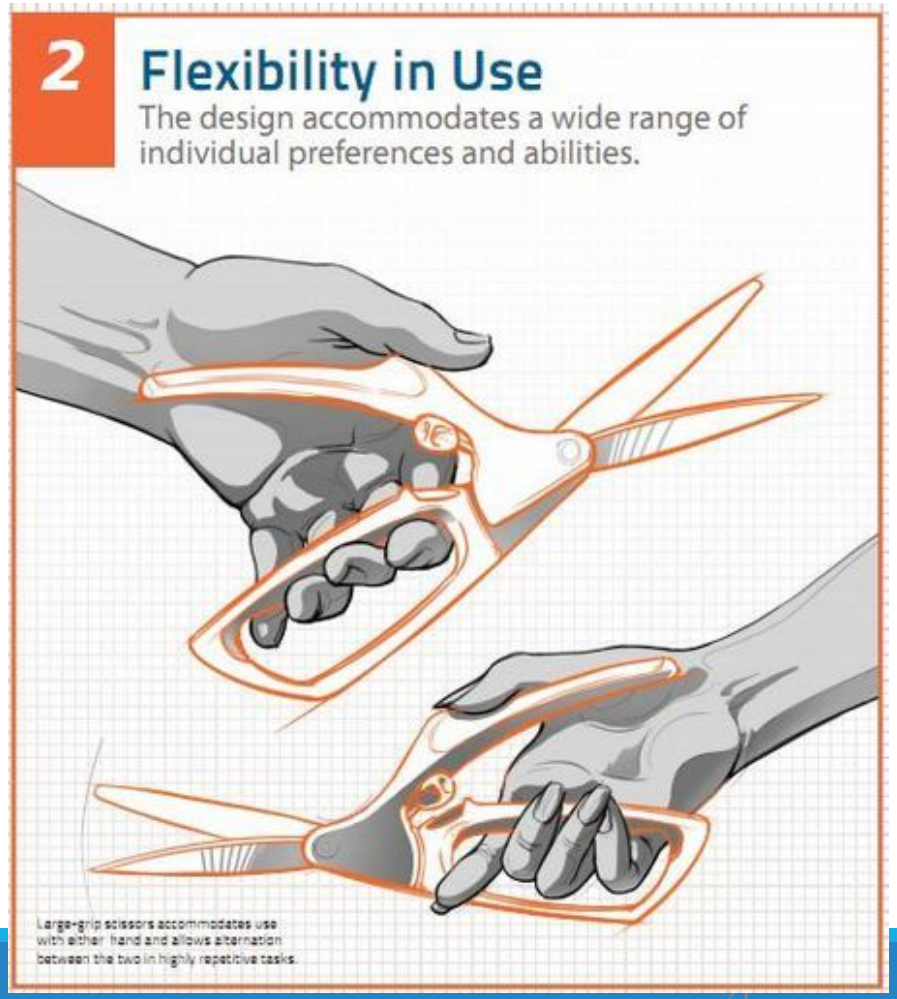
Principle 1: Equitable Use

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

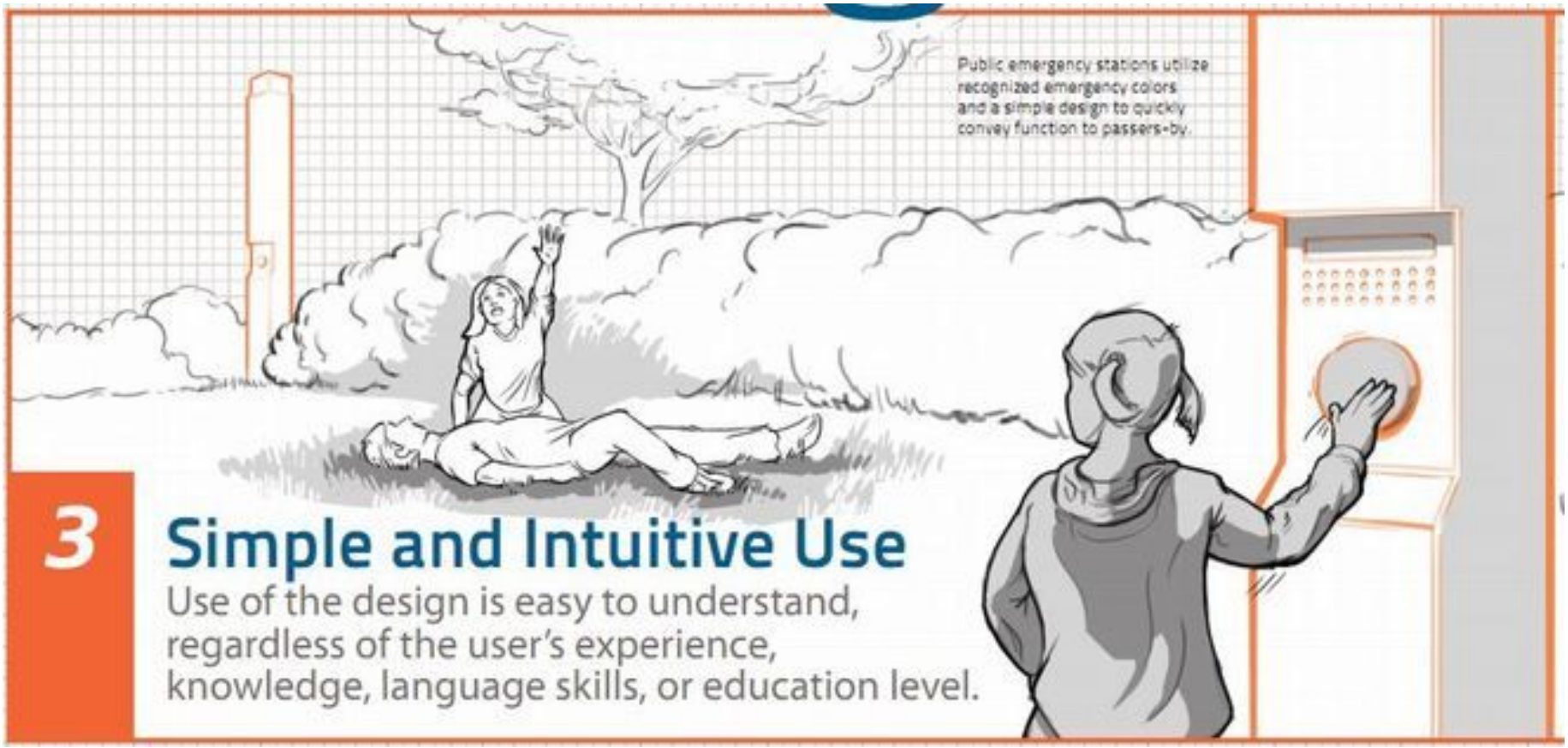
Principle 2: Flexibility in Use

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.

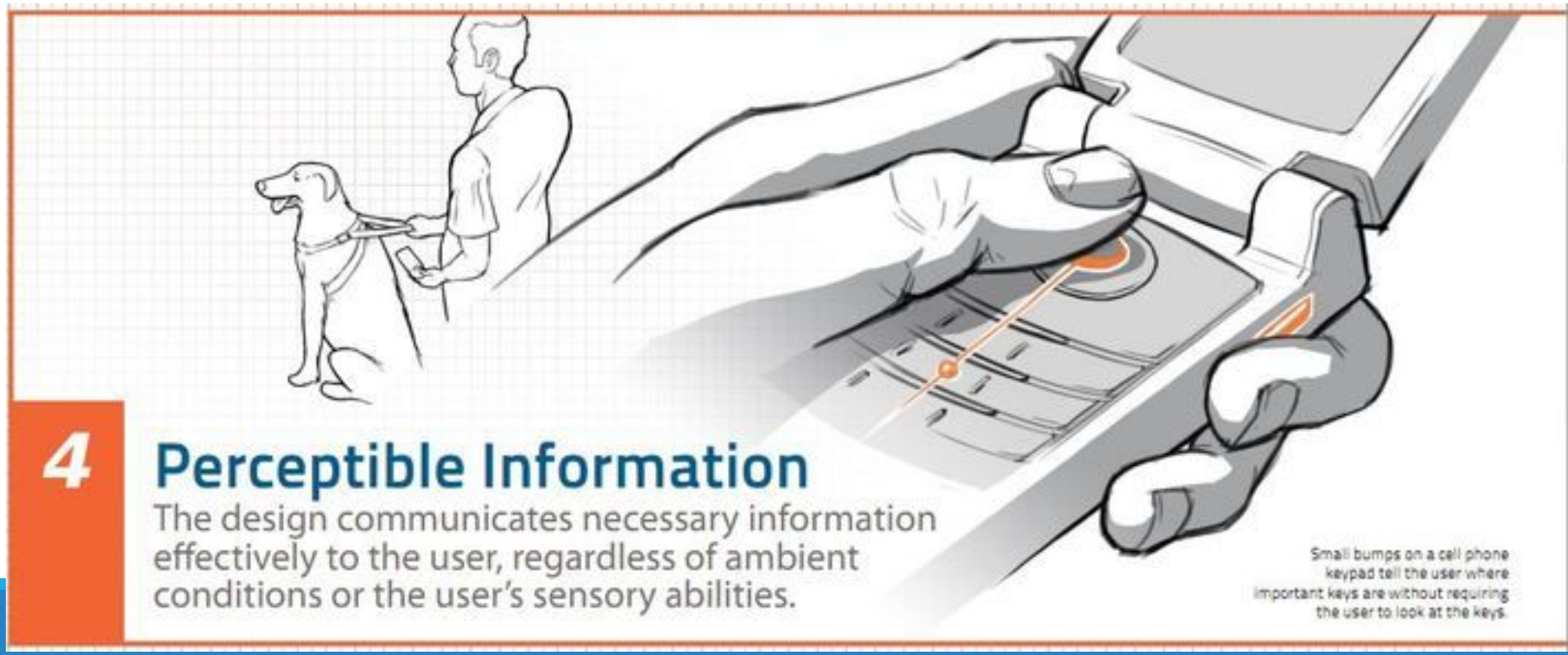


Principle 3: Simple and Intuitive Use



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.

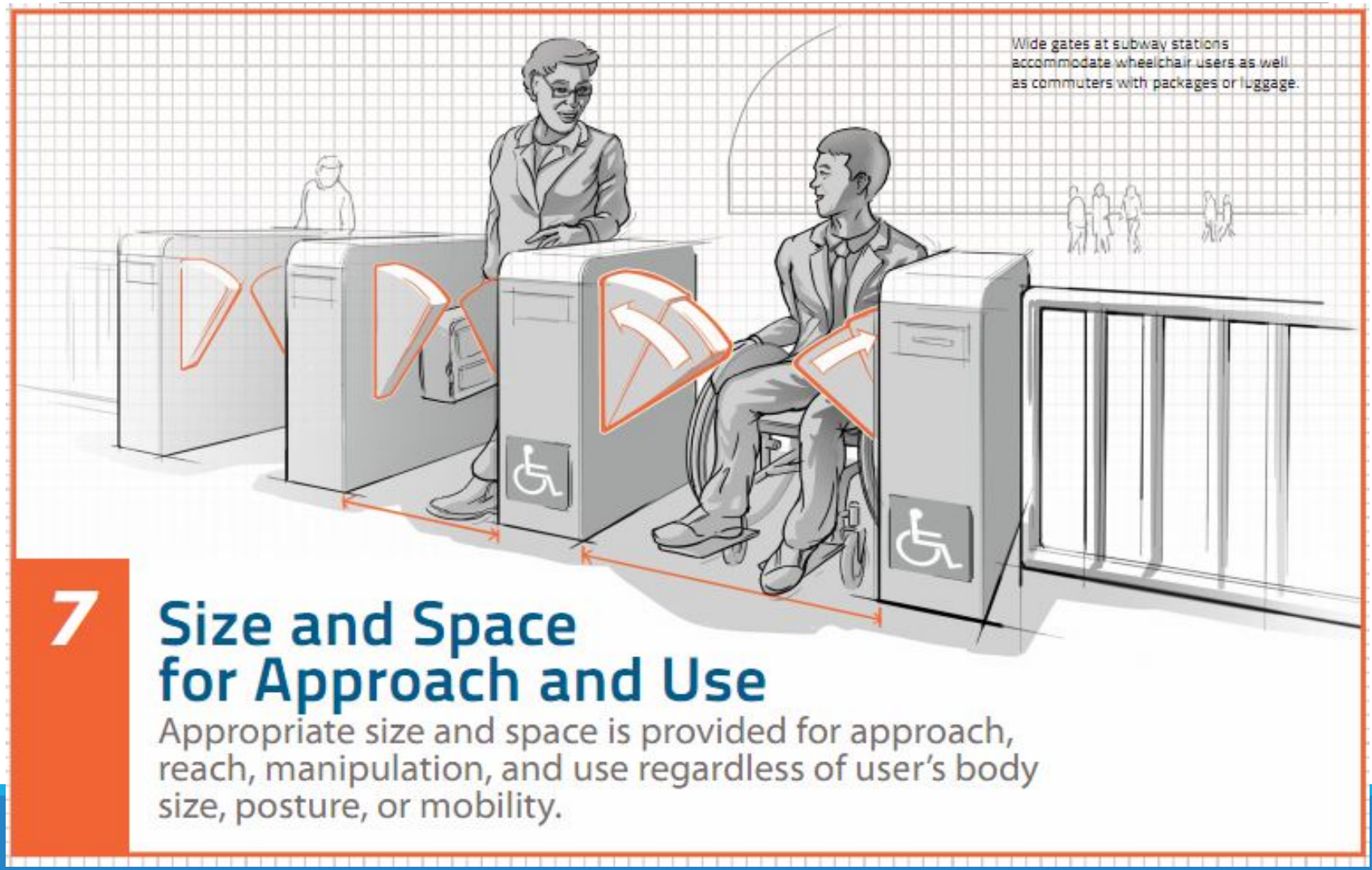
e.g., Always having an undo or reset button to get back to a familiar state

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



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/