Universal Usability

Ethical, good business, the law

SWEN-444

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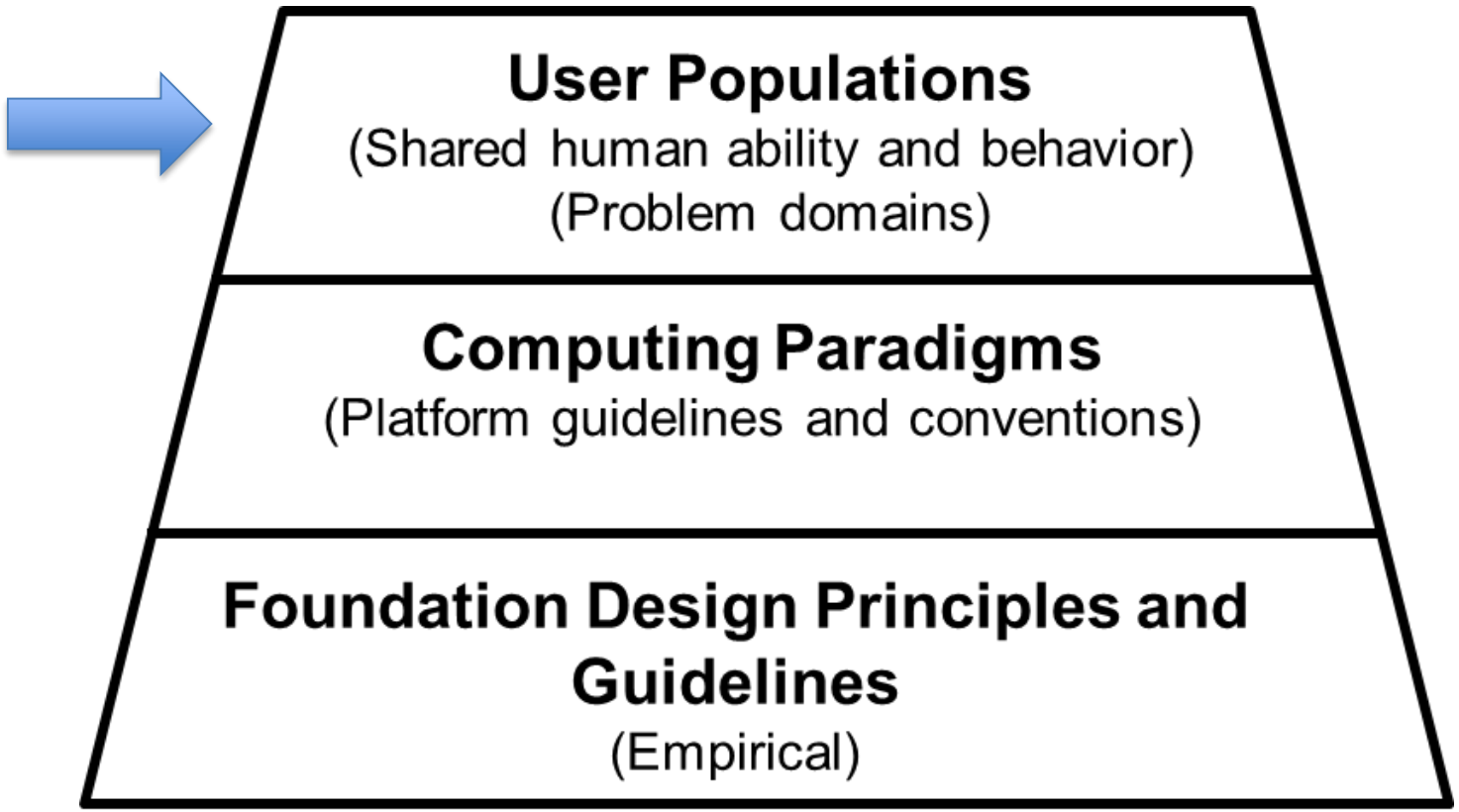
User Populations
(Shared human ability and behavior)
(Problem domains)
Computing Paradigms
(Platform guidelines and conventions)
Foundation Design Principles and Guidelines
(Empirical)

Universal Usability – a Case of Software Ethics

“Universal usability can be defined as having more than 90% of all households as successful users of information and communications services at least once a week.”

» -Ben Schneiderman

“In a fair society, all individuals would have equal opportunity to participate in, or benefit from, the use of computer resources regardless of race, sex, religion, age, disability, national origin or other such similar factors.”

» -ACM Code of Ethics

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Universal Usability for the Web

“The power of the Web is in its universality. Access by everyone regardless of disability is an essential aspect.”

>> -Tim Berners-Lee, W3C Director and inventor of the World Wide Web

The UN Convention on the Rights of Persons with Disabilities recognizes access to information and communications technologies, including the Web, as a **basic human right.**

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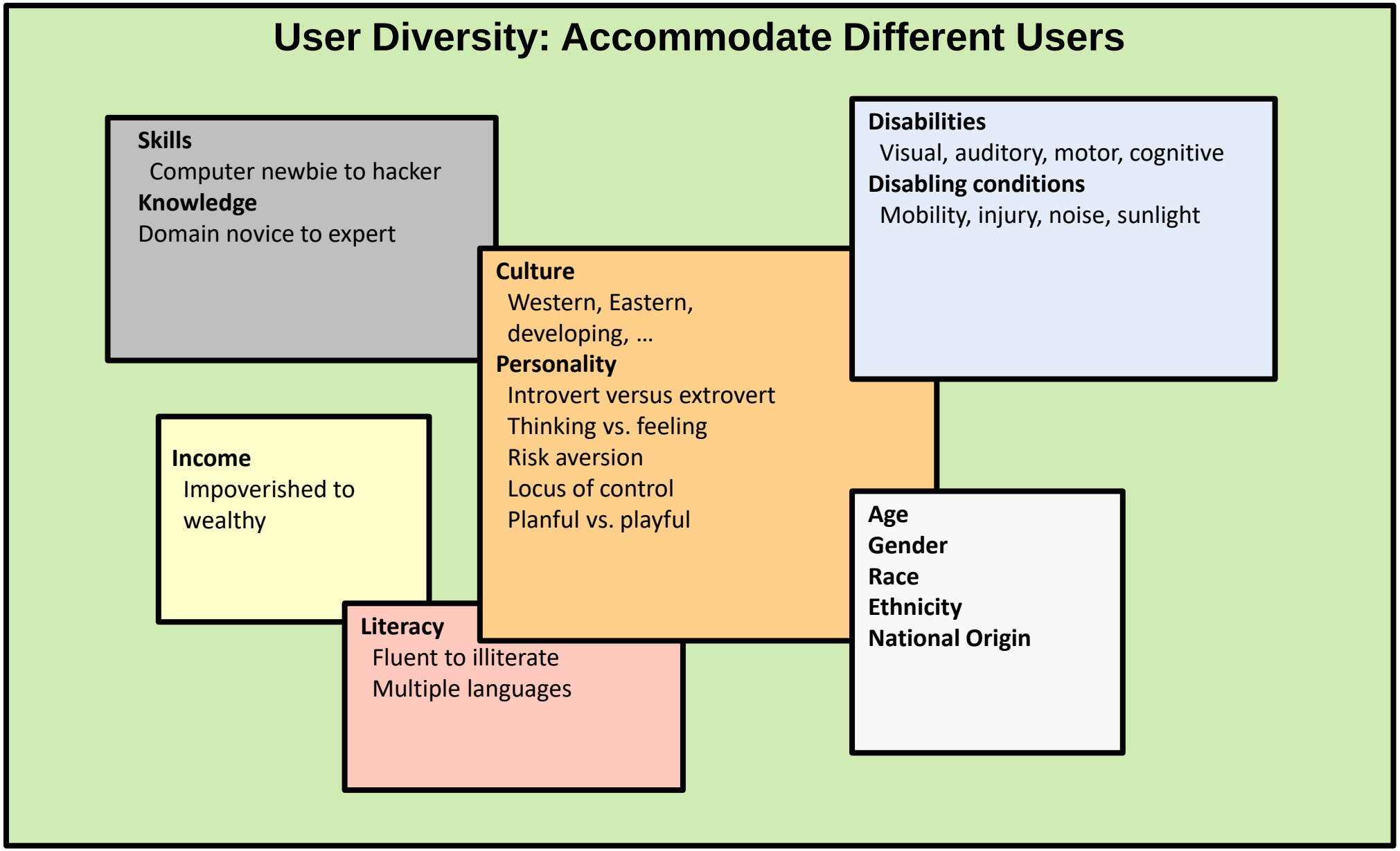
User Diversity: Accommodate Different Users



Accessibility Definition Has Changed.

1980

Disability as personal attribute

“In the contest of health experience, a disability is any restriction or lack of ability (resulting from an impairment) to perform an activity in the manner or within the range considered normal for a human being.”

-World Health Organization

Today

Disability as context dependent

“Disability is not just a health problem. It is a complex phenomenon, reflecting the interaction between features of a person’s body and features of the society in which he or she lives”.

-World Health Organization

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Accessibility – Accommodate Abilities

- **Ability** – (Oxford dictionary): “Possession of the means or skill to do something” …
- Therefore, **disability** means being **unable to do something**
  - Something **experienced** rather than something someone has or is
  - A **more positive** view
- So **everyone experiences disabilities** in some circumstances
  - E.g., situational in the environment

Ability Based Design, Wobbrock, Gajos, Kane, Vanderheiden, CACM 6/18, P. 62

Situational Factors That Impact Ability

Vibration	Cold temperatures
Divided attention	Impeding clothing (such as gloves)
Distraction	Encumbering baggage
Diverted gaze	Rainwater
Device out-of-view	Light levels (such as darkness and glare)
Intervening objects	Ambient noise
Bodily motion (such as walking)	Social behaviors (such as interruptions)
Vehicular motion	Multitasking
Uneven terrain	Stress
Physical obstacles	Fatigue
Awkward postures or grips	Haste
Occupied hands	Intoxication

Ability Based Design, Wobbrock, Gajos, Kane, Vanderheiden, CACM 6/18, P. 62

Design for Universal Usability

- **Equitable** - focus on tasks that apply to everyone
- **Adaptable** – configuration and usage patterns
- Intuitive, **minimalist design**; mental models and metaphors
- Avoid **design bias** based on your abilities or the average user
- **Perceptible** information
- **Error prevention** and tolerance
- **Low physical effort**
- **Size and space** for approach and use
- **Evolutionary learning** via help and tutorials
- Be **conscious** of the “stigma problem” – **user sensitivity** to their condition

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Adaptable Design

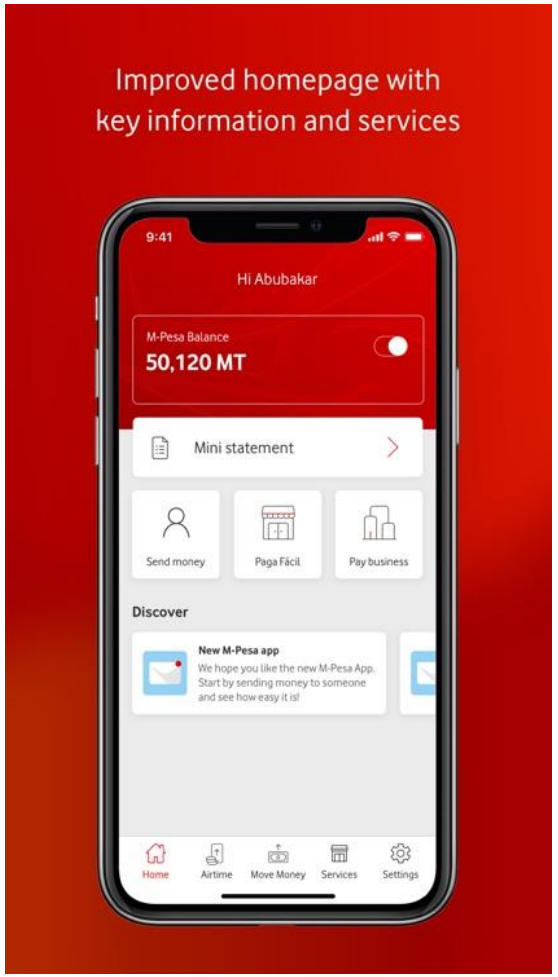
- **Technology variety**
  - Innovate to **exploit new technology** but make interfaces more **adaptable** and malleable
  - E.g., use plug-ins, sense screen size and other device capabilities, factor network performance
- **User diversity**
  - Profile sub-categories of users to understand diverse needs; e.g. kids versus seniors
  - **Segment and accessorize** the design accordingly
  - E.g., provide baseline and accelerated options, auto localization

MultiPoint-PC is an innovative solution from Microsoft Research India: Multiple Mice, One PC.

Try Windows – Control Panel -> Ease of Access Center

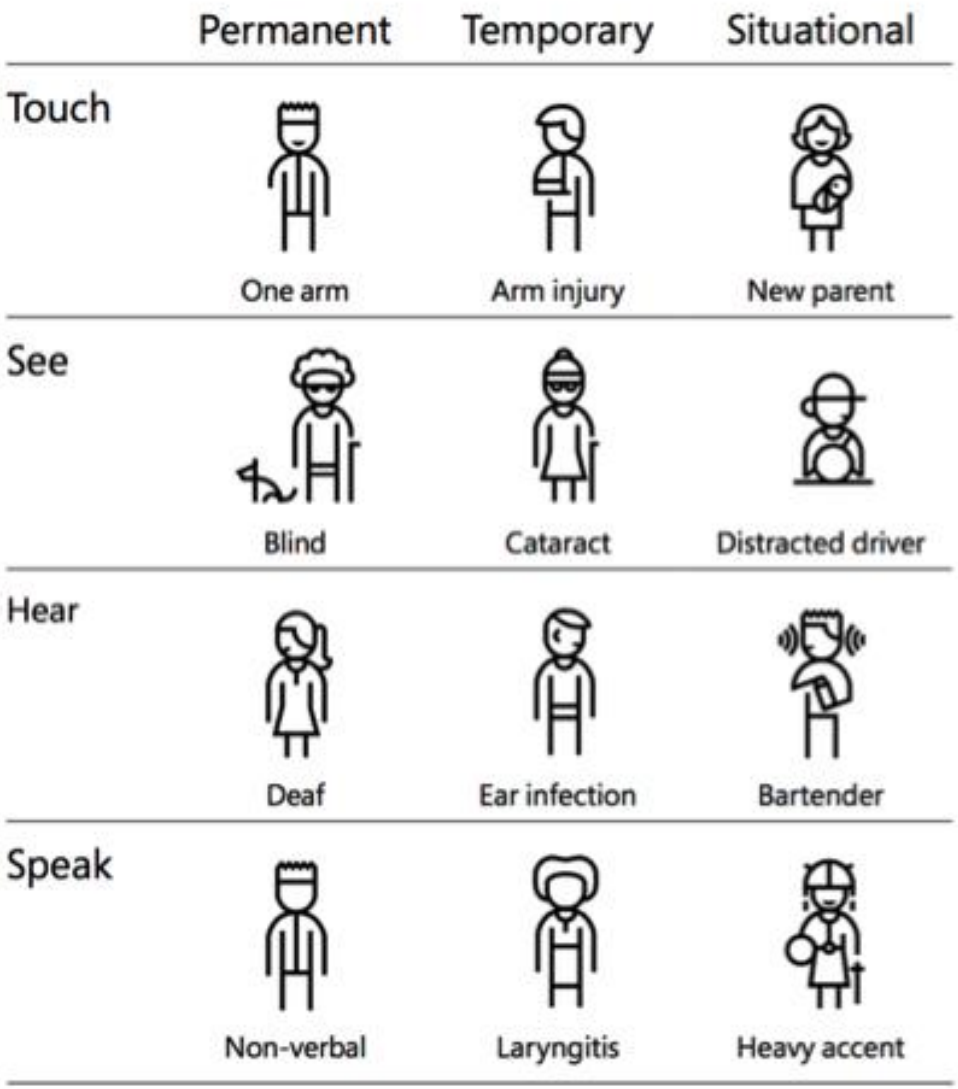
Progress

- Modern technology is removing usage barriers; literacy, accessibility, applicability
- More people have access to and can use technology
  - The worldwide ubiquitous availability of affordable **mobile devices** and **wireless networks**
  - Improved UX design
  - Global reach of the **Internet**



M-PESA App for financial services

Accessibility Benefits Multiple Personas



Let's Discuss Some Accessibility Situations

- Visually impaired
- Deaf and hard of hearing
- Dexterity and mobility impairments

Visual Impairments

- Low vision, and total blindness
  - Tunnel vision, cataracts, peripheral visual field restrictions and loss of visual acuity.
  - Some visual impairments may cause difficulty seeing in low light levels, problems judging speed and distance, or painful irritation in bright light.
  - Only about 4% of people who have visual impairments are totally blind.
- Color blindness
  - 8% of male individuals
  - 0.4% of female individuals

Visual Impairments

- Research shows that most partially sighted people are able to read clear large print comfortably.
  - Large print size - 14 point or above
  - So a simple way to increase accessibility to the visually impaired.
- When print is not suitable, Braille or voice is an option.
  - The actual number of fluent Braille users is small (less than 10% of the blind)
  - But it is a useful medium and can also be used by deaf blind people.

Visual Impairments: Assistive Technology

- Screen enlargers/magnifiers
- Screen readers are software programs that present graphics and text as speech.
- Talking / large print word processors
- Speech/Voice recognition systems to give commands and enter data using voice.
- Refreshable Braille displays provide Braille output of information represented on the computer screen one line at a time.
- Braille embossers transfer computer generated text into embossed Braille output.

Visual Impairments: Assistive Technology

Screen enlarger

Braille display

Braille embosser

Experience It

- Browse the list of accessibility related links under Accessibility Resources in myCourses
- Try the distraction and dyslexia simulations
- Try Narrator (Control Panel → Ease of Access)
- What did you learn?

- Note: this is just a sampling of accessibility design resources

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Deaf and Hard of Hearing

- Hearing difficulties range from slight hearing loss to deafness
- Hearing impaired might be able to hear some sound, but might not be able to distinguish words
- People born profoundly deaf may have difficulty in acquiring a clear understanding of spoken and written language
- Many hearing impaired people can lip read to some extent
- Requires concentration and is tiring over long periods.
- More popular with people who lost hearing later in life, or who have some residual hearing.
- Sign Language is a common communication method

https://www.youtube.com/watch?v=33krnU_juFE

Deaf and Hard of Hearing

- Hearing aids are often used in addition to other forms of communication
  - Hearing aids amplify all sounds, including background noise, and may not be suitable in some circumstances
- Technology considerations:
  - Communicate information visually, e.g., …
    - Flash when beep occurs
    - Video sign language
  - Sound amplification
    - Adjust sound options and volume
  - Translate speech to text
  - Research – ASL to and from speech using gesture recognition technology

Dexterity and Mobility Impairments

- Difficult to use a standard keyboard, mouse, or other peripherals
- Individuals experience pain, discomfort, loss of feeling
- Individuals may also have a reduced range of physical movement or complete loss of physical capability
  - In their fingers, hands, wrists, or arms,
- Difficulties / impairments can be caused by a wide range of common illnesses and accidents such as carpal tunnel, arthritis, stroke, cerebral palsy, Parkinson's disease, multiple sclerosis, loss of limbs or digits, and spinal cord injuries, among others
- Can be stable, degenerative or intermittent, depending on the cause
- Manual dexterity impairments result in the loss of fine control of movement, affecting typing and the use of the mouse/peripherals

Dexterity Impairments: Assistive Technology

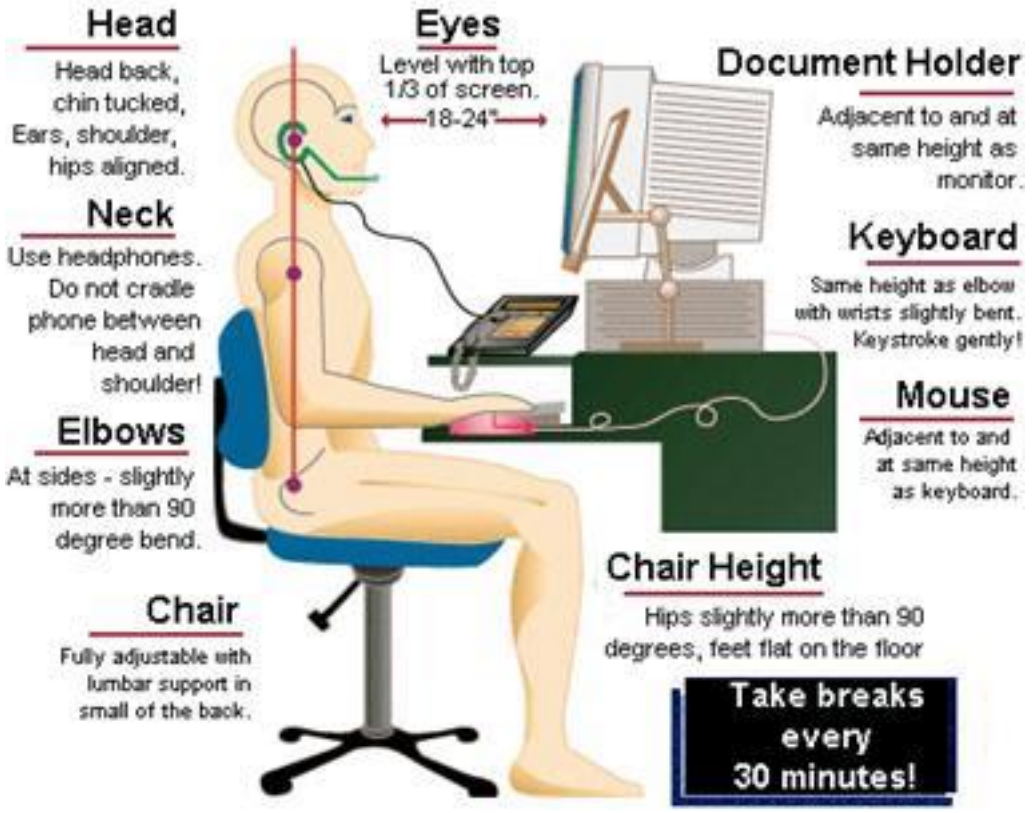
- Keyboards may be altered to make typing with the fingers easier, or can be adapted to be used by a (head) pointer.
- Voice/Speech recognition systems
  - Users can give commands and enter data using voice
- On-screen keyboard programs
  - Provide an image of a standard or modified keyboard on the computer screen.
  - The user selects the keys with a mouse, touch screen, trackball, joystick, switch, or electronic pointing device.
- Keyboard filters
  - Include typing aids, such as word prediction utilities
  - Reduce the required number of keystrokes.
- Alternative input devices
  - Including alternative keyboards, electronic pointing devices, sip-and-puff systems, wands and sticks, joysticks and trackballs

Eye tracker

Sip/puff switch

A Word About Ergonomics

- “Ergonomics is the study of designing equipment and devices that fit the human body, its movements, and its cognitive abilities … two goals of health and productivity… relevant in the design of such things as safe furniture and easy-to-use interfaces”



Section 508

- Section 508 is an amendment to the United States Workforce Rehabilitation Act of 1973
- **Mandates** that all electronic and **information technology** developed, procured, maintained, or used by the federal government be **accessible** to people with disabilities
- Conformance now based on **Web Content Accessibility Guidelines** (WCAG) 2 requirements
- Conformance testing tools available

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W3C Accessibility Design Guidelines

https://www.w3.org/WAI/standards-guidelines/

- Web Content Accessibility Guidelines (WCAG) https://www.w3.org/WAI/standards-guidelines/wcag/
  - "explain how to make web content more accessible to people with disabilities"; principles …
  - **Perceivable** objects and content
  - **Operable** objects and navigation
  - **Understandable** content and interactive operation
  - **Robust** – reliably interpretable by assistive technologies
- Accessible Rich Internet Applications (ARIA) https://www.w3.org/WAI/standards-guidelines/aria/
  - Guidelines for how to make dynamic web app functionality available to assistive technologies
- Mobile Accessibility https://www.w3.org/TR/mobile-accessibility-mapping/
  - "How WCAG 2.0 and Other W3C/WAI Guidelines Apply to Mobile"

Accessible Web Design Guidelines (WCAG)

- Alternate Text
- Table Headings
- Forms
- Meaningful Link Text
- Captions and Transcripts
- Other File Formats
- Using Headings for Semantic Structure
- Keyboard & Navigation
- Never Rely on Color-Coding Only
- Readability Level of Text
- Cognitive Disabilities
- Conforming to Standards
- Site Maps, Site Search

Evaluate 5 Mobile Apps

- Use the checklist in the link below to evaluate the accessibility of one of the mobile apps listed. Specify what OS and app version you evaluated.
  - Google Calendar
  - The Weather Channel
  - Slack
  - Uber
  - Google maps

https://www.w3.org/TR/mobile-accessibility-mapping/

References

- See myCourses for some specific resources
- Ben Schneiderman, “Universal Usability”, CACM, May 2000
- Some overview material from:

  http://www.microsoft.com/enable/guides/default.aspx

  https://www.google.com/accessibility/for-developers/

  https://developer.apple.com/accessibility/
- Read about Learning Disability material at:

  https://ldaamerica.org/
- US Government usability site:

  http://www.usability.gov/index.html