HCI 2022

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Designing for Diversity

Human Computer Interaction

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What We (Should) Know…

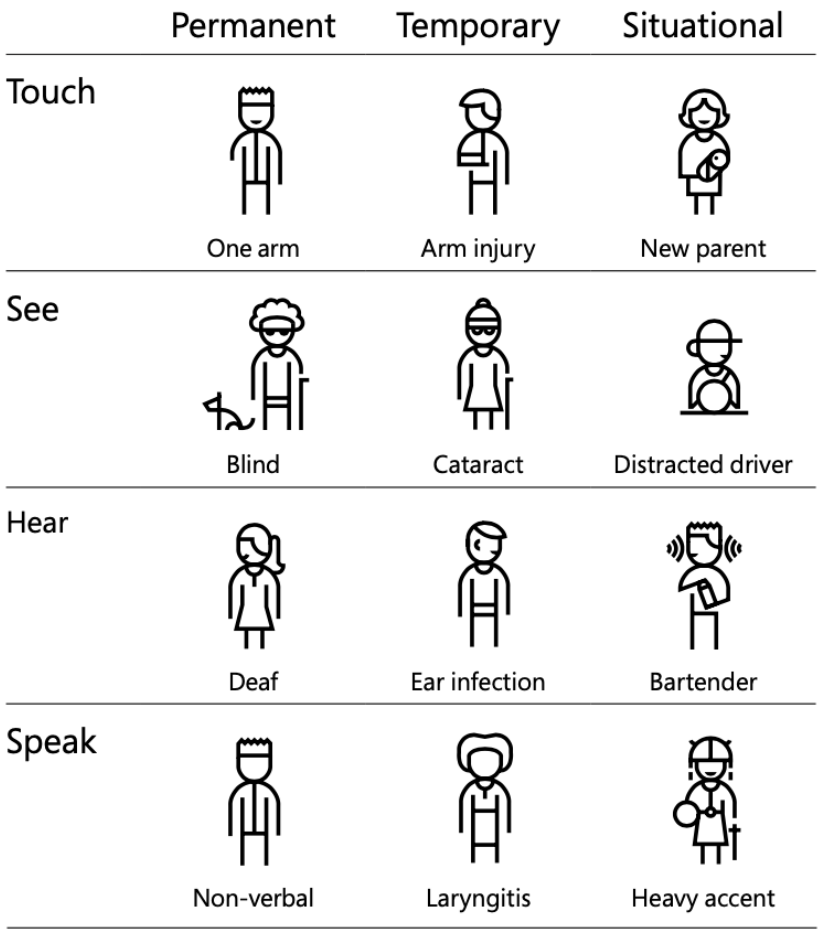
- It is important to design for the user, to follow a human-centered process
- "*People are a mess*"
  - they have different abilities and weaknesses
  - they come from different backgrounds and cultures
  - they have different interests, viewpoints, and experiences
  - they are of different ages and sizes
  - …
- All these things have an impact on the way in which a person use a software application and, indeed, on whether they can use it at all

Are We Designing For People Like Us?

- If we use our own abilities as a starting point…
- … we make things that are easy for some people to use, but difficult for everyone else
- … we end up with systems designed for people like us
  - specific gender, age, language ability, tech literacy, physical ability, specific access to money, time, etc.

“Normal”… Who?

- The interactions we design with technology depend heavily on what we can understand/remember, see, hear, say, and touch
- Assuming all those senses and abilities are fully enabled all the time means ignoring several people
  - it also reflects how people really are, as “life happens”
- We want our designs to reflect that diversity



Principles and Methodologies

Inclusive and Universal Design

Inclusive Design

- A design methodology that enables and draws on the full range of human diversity
  - i.e., including and learning from people with a range of perspectives
- Designing a diversity of ways to participate so that everyone has a sense of belonging
- It not a "one size fits all" approach, but a "*one size fits one*"
  - it is more designing a system, a portion of it, or an application for a specific use case and extending this to others
- **Beware**: there is no "standard" and shared definitions, principles, and practices
  - here, we rely on a recent definition and practices by Microsoft Design (https://www.microsoft.com/design/inclusive/)

Three Principles of Inclusive Design

1. **Recognize exclusion**
   - it means examining what you are building, and recognizing who would be excluded from using it
   - sometimes exclusion happens when we do not pay attention to our biases, and it could be temporary or situational
2. **Learn from diversity**
   - put people at the center of the design process from day zero
   - we can try to imagine how a person with a given set of abilities would use a system
   - we cannot imagine her various contexts, being them situational, emotional, or what gives her joy or frustration
3. **Solve for one, extend to many**

The Beauty of Constraints

- Designing for people with permanent disabilities can seem like a significant constraint…
- …but the resulting designs can benefit a much larger number of people
- Examples?

Hard of hearing

The Beauty of Constraints

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- …but the resulting designs can benefit a much larger number of people
- Examples
  - closed captioning was created for the hard of hearing community, but they are useful for reading in a crowded airport or to teach children how to read
  - remote controls, automatic door openers, audiobooks, …

Example: Creating a Video Game

- You are creating a video game for **console**
- A **competitive** game, with characters who needs to jump, run, … maybe even drive, at a certain stage.
- Who are you excluding?
  - Be sure to include various contexts/situations, not just "edge cases".
  - Which of them can you observe, and how?
- Which 1-2 solution(s) can we come to, then?

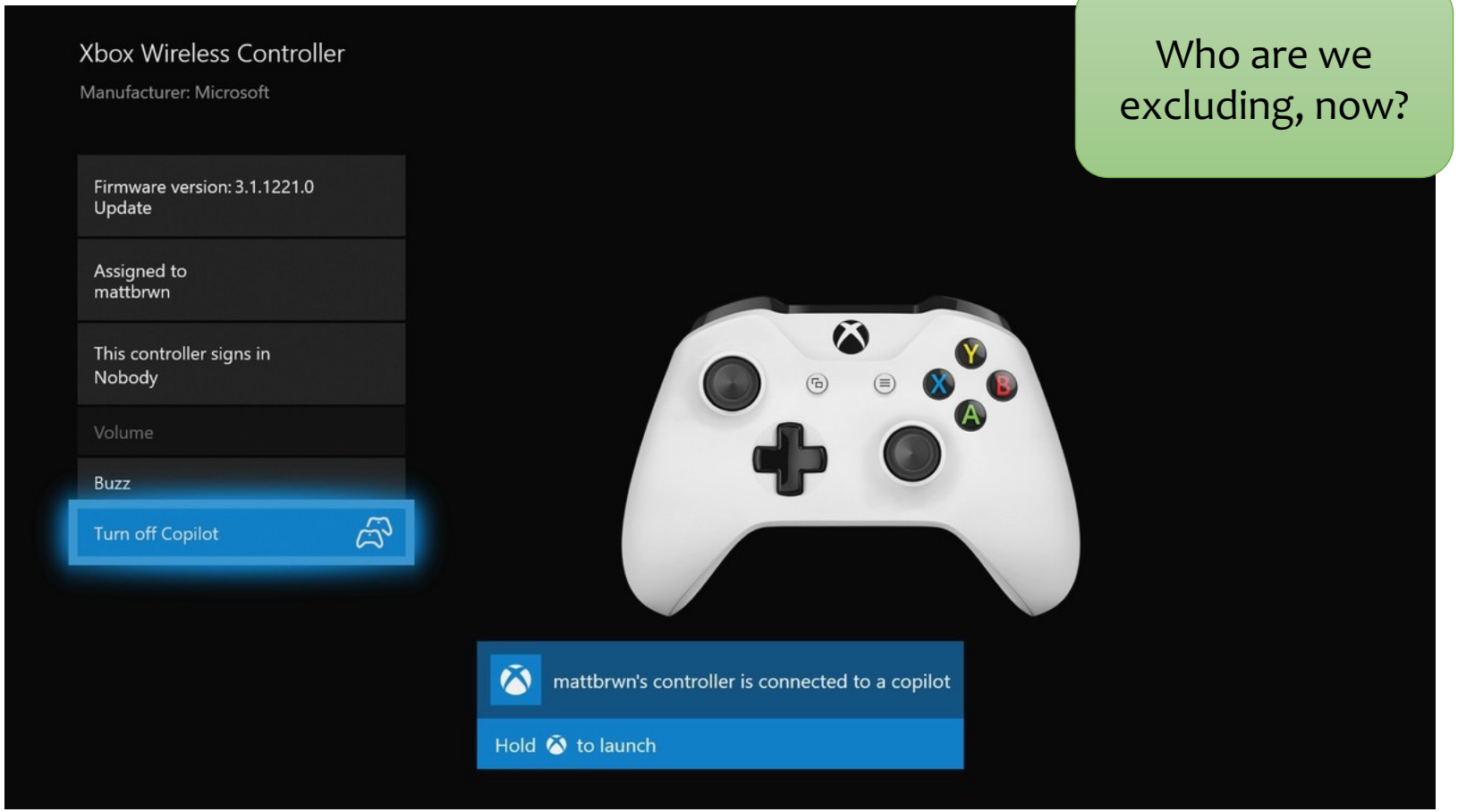
Example: Creating a Video Game

- Jumping, running, driving, … will require fine motor skills to compete.
- Possible factors to consider:
  - what if you have limited mobility?
  - or if you never played a video game before?
  - …

Example: Creating a Video Game

- A possible solution: a co-pilot mode
  - allows two game controllers to work together, so that two people can control the same character, or car, or…
  - in this way, an advanced or skilled player can play alongside someone who might need more assistance
- This opens gaming to various kinds of people
  - people with disabilities or temporary injuries
  - novice gamers
  - kids
  - people who just want to play together without competing

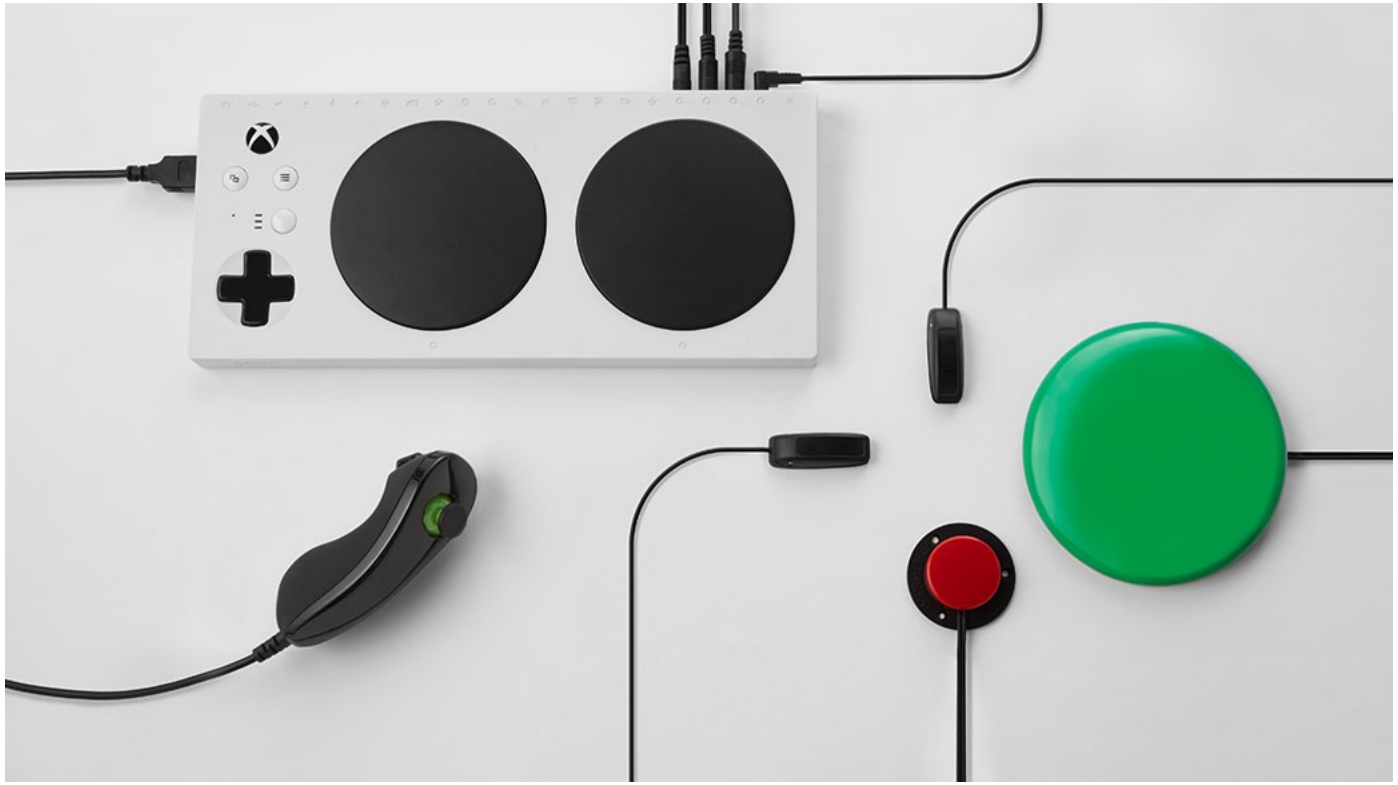
Copilot Mode – Xbox One



Who are we excluding, now?

image from https://www.windowscentral.com/xbox-one-copilot

Xbox Adaptive Controller



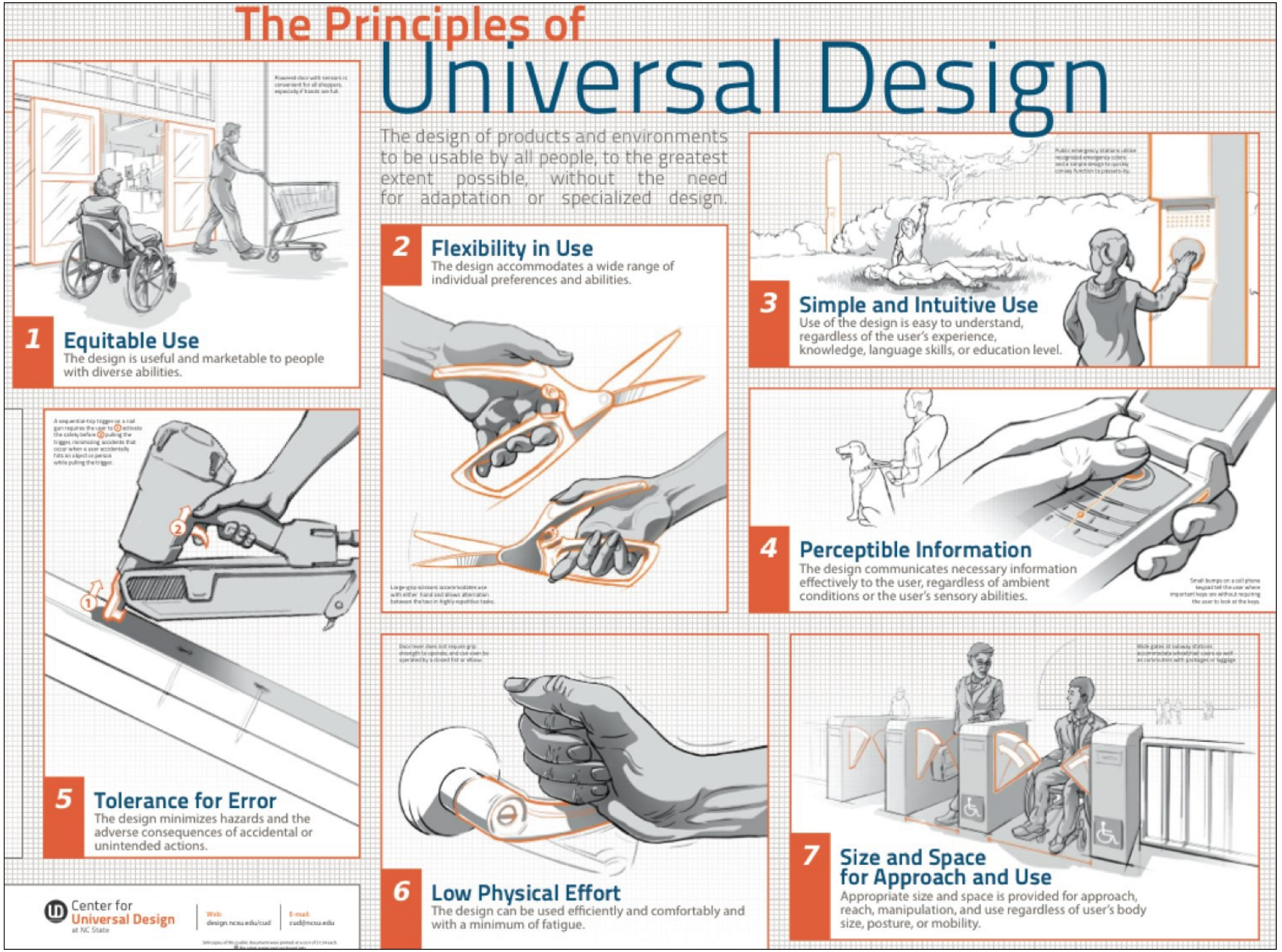
source: https://xbox.com/adaptive-controller

Are We Speaking About Accessibility?

- Not only
  - accessibility is an attribute, inclusive design is a method
- Accessibility focuses primarily on people with disabilities
  - ensuring that there are no barriers to serving them
  - via testable accommodations able to solve a technical, design, physical, or cognitive barrier to engaging with a system or product
- Inclusive design will make your systems and products more accessible, but it is not a process for meeting all accessibility standards
- Accessibility and inclusive design work together to make experiences that are not only compliant with some standards, but usable and open to all

Universal Design

- Designing interactive systems that are usable by anyone, with any range of abilities, using any technology platform
- A "one size fits all" approach, less prone to consider very specific cases
  - it is strongest at describing the qualities and nature of a final design
  - it might not involve the participation of some excluded communities
- Born for the physical world, then adopted in the digital one



https://www.interaction-design.org/literature/article/learn-to-create-accessible-websites-with-the-principles-of-universal-design

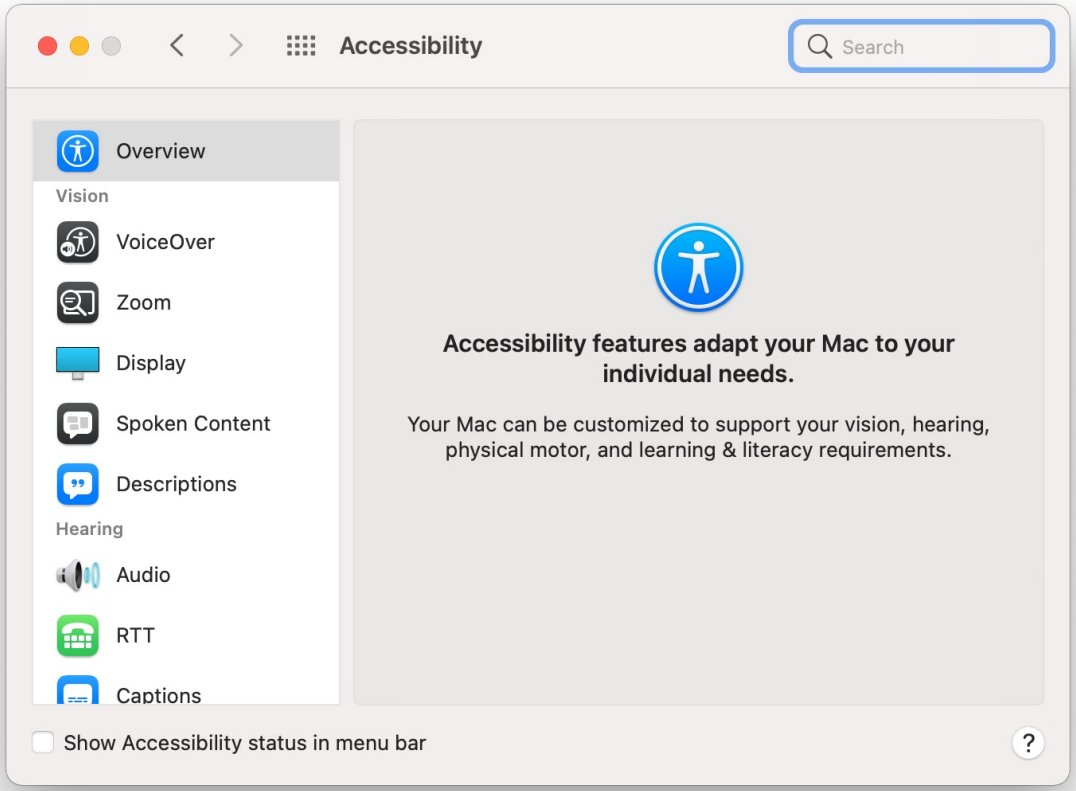
Universal and Inclusive Design: Examples

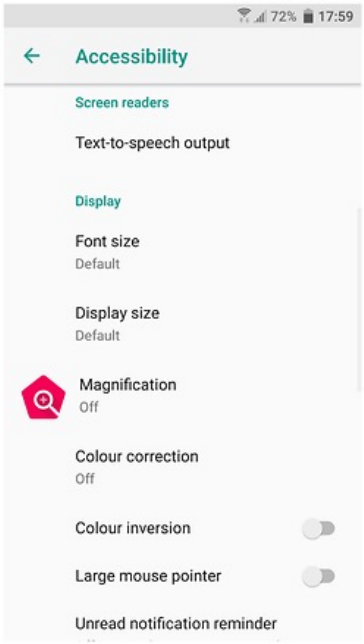
https://www.youtube.com/watch?v=pqdbabk-0hk

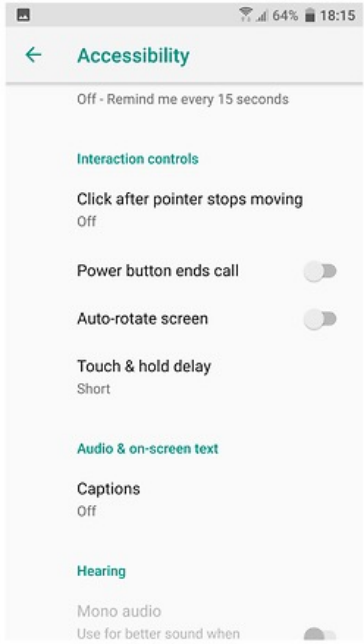
Multiple Senses and Abilities

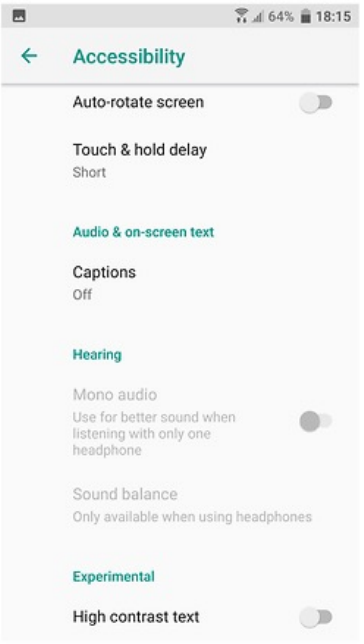
- Can we design an application or a system that leverages on multiple senses and abilities at the same time?
- Maybe providing different input/output mechanisms in different contexts and for different people?
- How?
  - redundancy
  - compatibility with assistive technologies
  - …

Example: Accessibility in OS



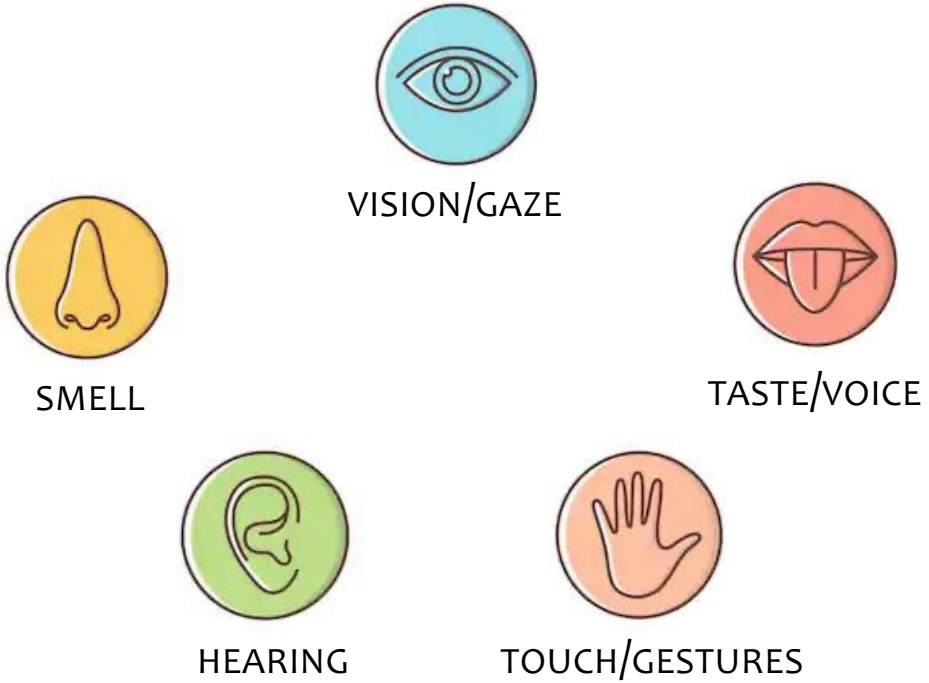






Multimodal Interaction

Definition: To use more than one sensory channel or mode of interaction



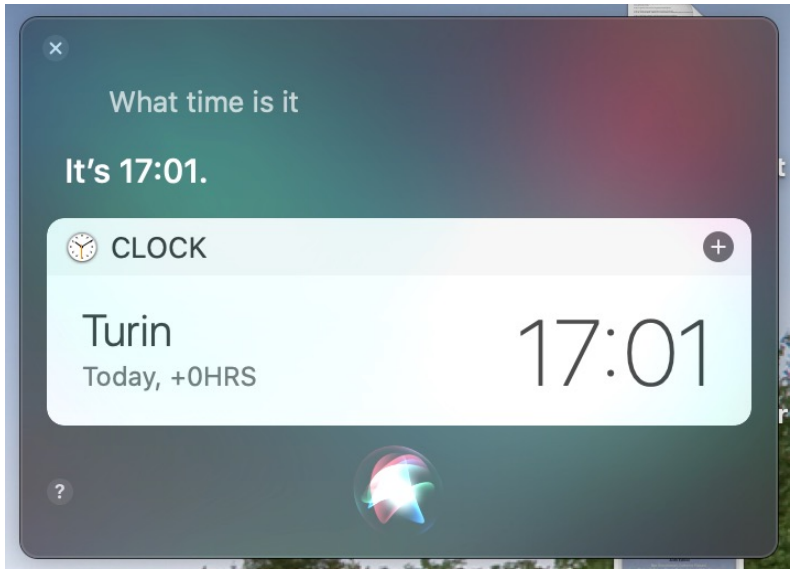
Can we use all of these?

Multimodal Interfaces Around Us

- Most interactive systems are predominantly **visual**
  - often WIMP based, they make use of simple sounds while adding more and more visual information to the screen
- As systems become more complex, the visual channel may be overloaded if too much information is presented at once
  - this may lead to frustration or errors in use
- Using multiple modes increases the *bandwidth* of the interaction
  - we should always remember that multi-modal interaction is not just about enhancing the richness of the interaction, but also about *redundancy*

Multimodal Interfaces Around Us: Examples

Vision + Gesture + Hearing + Speech



Vision + Hearing + Speech

Guidelines

Accessibility… and the Web

Accessibility… and the Web

- Despite the great potential that the Web might have for people with disabilities, this potential is still largely unrealized
  - some sites can only be navigated using a mouse
  - only a very small percentage of video or multimedia content has been captioned
  - very few websites are fully usable by people who are blind
- Web accessibility encompasses all disabilities that affect access to the Web: auditory, cognitive, neurological, physical, speech, visual
  - also situational or temporary impairments

Web Accessibility Relies on Several Components

- Web content
  - text, images, forms, multimedia, scripts, etc.
- User agents
  - browsers, voice browsers, mobile browsers, …, and some assistive technologies
- Authoring tools
  - code editors, content management systems, database scripts, etc.

W3C Web Accessibility Initiative

- The W3C Web Accessibility Initiative (WAI) provides a set of **guidelines** that are internationally recognized as standards
  - Web Content Accessibility Guidelines (WCAG)
  - User Agent Accessibility Guidelines (UAAG)
  - Authoring Tool Accessibility Guidelines (ATAG)
  - Accessible Rich Internet Applications (WAI-ARIA)
- and adopted in laws, e.g., the Italian's Stanca Act that promotes the accessibility of information technology

WCAG 2.0: Example

Principles	Guidelines	Level A	Level AA	Level AAA
1. Perceivable	1.1 Text Alternatives	1.1.1		
	1.2 Time-based Media	1.2.1 – 1.2.3	1.2.4 – 1.2.5	1.2.6 – 1.2.9
	1.3 Adaptable	1.3.1 – 1.3.3		
	1.4 Distinguishable	1.4.1 – 1.4.2	1.4.3 – 1.4.5	1.4.6 – 1.4.9
2. Operable	2.1 Keyboard Accessible	2.1.1 – 2.1.2		2.1.3
	2.2 Enough Time	2.2.1 – 2.2.2		2.2.3 – 2.2.5
	2.3 Seizures	2.3.1		2.3.2
	2.4 Navigable	2.4.1 – 2.4.4	2.4.5 – 2.4.7	2.4.8 – 2.4.10
3. Understandable	3.1 Readable	3.1.1	3.1.2	3.1.3 – 3.1.6
	3.2 Predictable	3.2.1 – 3.2.2	3.2.3 – 3.2.4	3.2.5
	3.3 Input Assistance	3.3.1 – 3.3.2	3.3.3 – 3.3.4	3.3.5 – 3.3.6
4. Robust	4.1 Compatible	4.1.1 – 4.1.2		

References

- Microsoft's Inclusive Design 101 Toolkit
  - https://www.microsoft.com/design/inclusive/
- Blog post on "Inclusive Design Principles"
  - https://medium.com/microsoft-design/inclusive-design-principles-77f7c5f639da
- Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale: Human Computer Interaction, 3rd Edition
  - Chapter 10

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