



Vietnam National University of HCMC  
International University  
School of Computer Science and Engineering



# UI/UX Design & Evaluation

## ★ Designing for Diversity ★

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SCAN ME

# Course Overview

1. Introduction to HCI
2. Needfinding
3. Analyzing and Synthesizing
4. Prototyping
5. Design Theory, Principles, and Guidelines
6. Introduction to Prototyping
7. Visual Design
8. Human abilities and theoretical models
9. Human abilities and theoretical models (cont.)
10. Medium-fidelity Prototypes
11. Evaluation: overview. Heuristic evaluation
12. Design Patterns
13. Designing for Diversity
14. Usability Testing & Evaluation Methods
15. Data Collection Techniques & Report  
Usability Test Results

# 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

	Permanent	Temporary	Situational
Touch			
	One arm	Arm injury	New parent
See			
	Blind	Cataract	Distracted driver
Hear			
	Deaf	Ear infection	Bartender
Speak			
	Non-verbal	Laryngitis	Heavy accent

# Designing for Others

- When it comes to people, there is no such thing as “normal.”
- The interactions we design with technology depend heavily on what we can see, hear, say, and touch.
- Assuming all those senses and abilities are fully enabled all the time creates the potential to ignore people with a diverse set of characteristics.
- (Interaction Design Foundation)

# Disability Figures in the UK

- There are **14.6 million disabled people** in the UK.
- 9% of children are disabled
- 21% of working age adults are disabled
- 42% of older adults are disabled
- (Scope UK)

# Principles and Methodologies

Inclusive and Universal Design

# What is Accessibility?

- ***"Accessibility is the concept of whether a product or service can be used by everyone—however they encounter it. Accessibility laws exist to aid people with disabilities, but designers should try to accommodate all potential users in many contexts of use anyway".***

(Interaction Design Foundation)

# Universal Design

- Universal Design is the concept of an environment, product, or service that can be accessed, understood and used to the greatest extent possible by **all people** regardless of their age, size, ability or disability.
- By considering the diverse needs and abilities of **all users** throughout the design process, universal design creates products, services and environments that meet peoples' needs.

# 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/>)

# 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



# 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
  - 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?

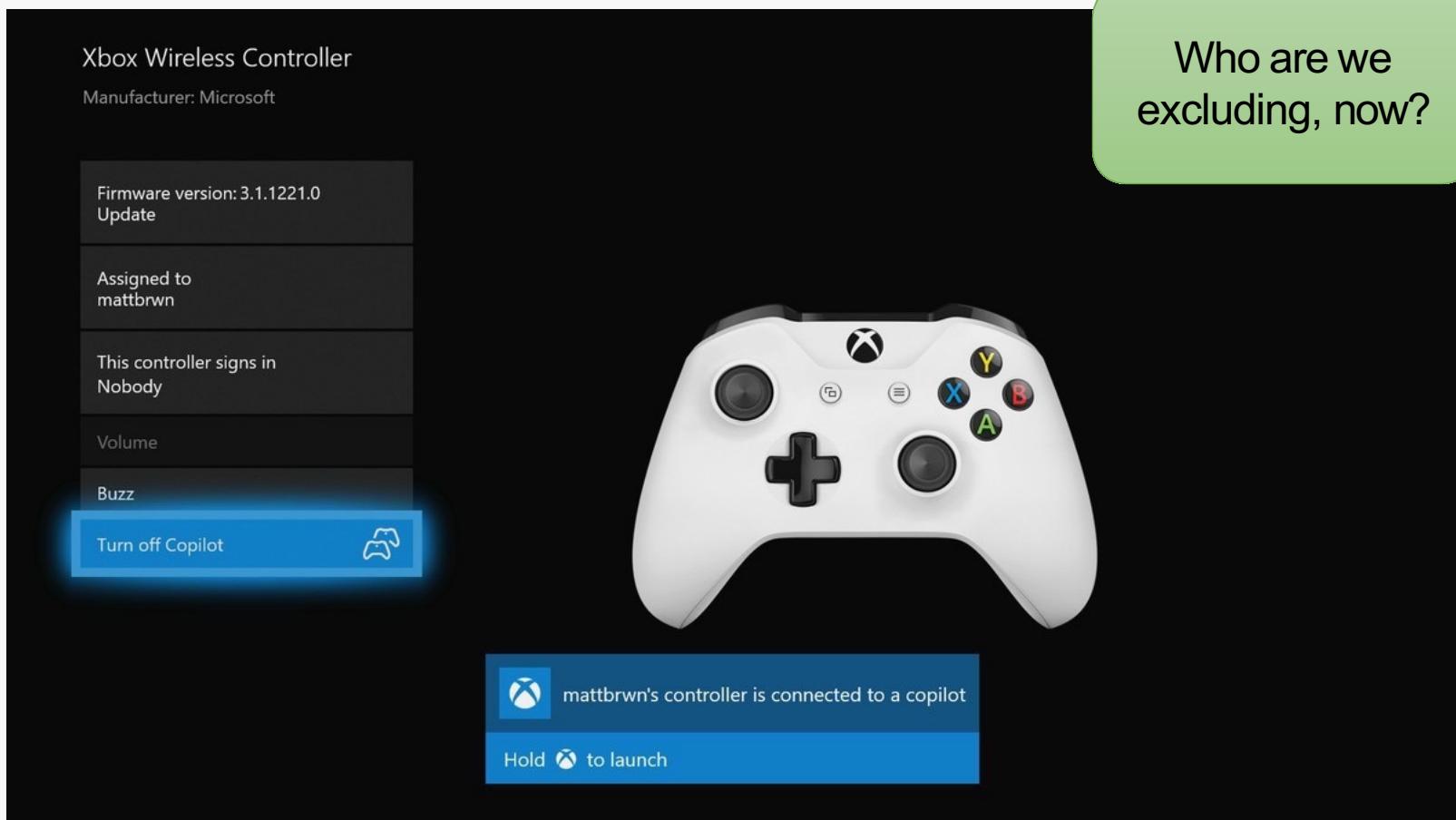
# Example: Creating a Video Game

- 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



# Xbox 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

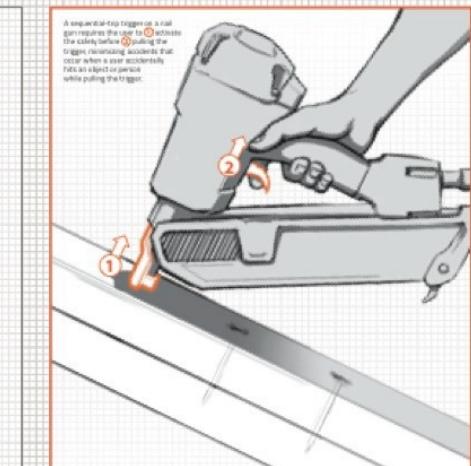
- Designing interactive systems that are usable by anyone, with any range of abilities, using any technology platform
- A "one size fits all" approach, less prone to consider very specific cases
  - it is strongest at describing the qualities and nature of a final design
  - it might not involve the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

# The Principles of Universal Design



## 1 Equitable Use

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

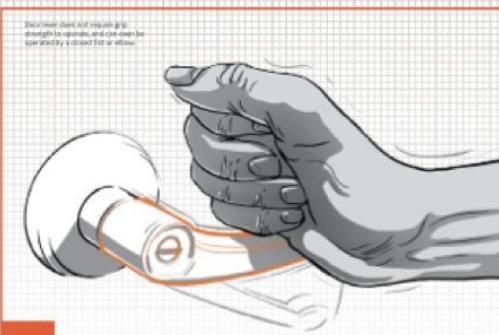
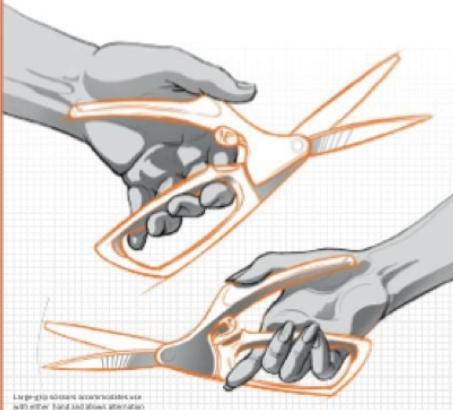


## 5 Tolerance for Error

The design minimizes hazards and the adverse consequences of accidental or unintended actions.

## 2 Flexibility in Use

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

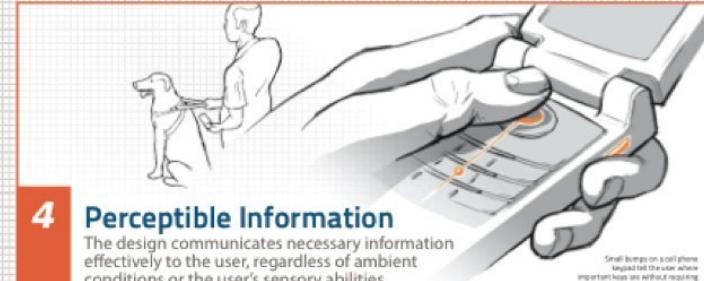


## 6 Low Physical Effort

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

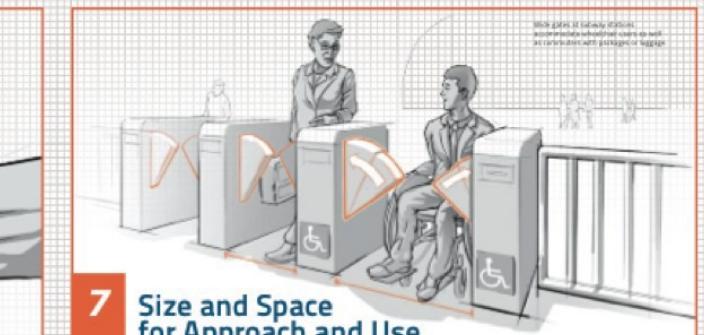
## 3 Simple and Intuitive Use

Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or education level.



## 4 Perceptible Information

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



## 7 Size and Space for Approach and Use

Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility.

# Principles of Universal Design

## • **Equitable Use**

- Products should be equally helpful and usable to people of diverse abilities.
- It should provide similar experiences to everyone if not identical.



# Principles of Universal Design

- **Flexibility of use**

- Products should accommodate a wide range of preferences and abilities.
- The designs should provide a choice in how they can be used. The user has full control of the pace of use and the accuracy of the use.



# Principles of Universal Design

- **Simple and intuitive use**

- Products should be easy to understand regardless of experience, knowledge, language skills, or current concentration level.
- The use of the product should be self-explanatory.



# Principles of Universal Design

- **Perceptible information**

- The product design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.
- The information is communicated to the users in multiple cues (pictorial, verbal and tactile) which is easy to understand.



# Principles of Universal Design

## • **Tolerance for error**

- Products should have a certain level of error tolerance
- This is done to reduce the harms and adverse consequences caused due to unintended actions.



# Principles of Universal Design

- **Low physical effort**

- Products should be used effectively and comfortably without the need of extensive physical action.



# Principles of Universal Design

- **Size and space for approach and use**

- Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility.
- The additional spaces are provided around things for comfortable use.



# Designing for users with dyslexia

## Other resources:

- [British Dyslexia Association Style Friendly Guide \(Link 1\)](#)
- [British Dyslexia Association Style Friendly Guide \(Link 2\)](#)

## Designing for users with dyslexia



### Do...

use images and diagrams to support text



align text to the left and keep a consistent layout



consider producing materials in other formats (for example audio or video)



keep content short, clear and simple



let users change the contrast between background and text



### Don't...

use large blocks of heavy text



underline words, use italics or write in capitals

**DON'T DO THIS**

force users to remember things from previous pages - give reminders and prompts



rely on accurate spelling - use autocorrect or provide suggestions



put too much information in one place



# Designing for autistic users

## Designing for users on the autistic spectrum



**Do...**

use simple colours



write in plain language

**Do this**

use simple sentences and bullets



make buttons descriptive

Attach files

build simple and consistent layouts



**Don't...**

use bright contrasting colours



use figures of speech and idioms



create a wall of text



make buttons vague and unpredictable

Click here!



# Designing for users with physical impairments

## Designing for users with physical or motor disabilities

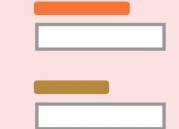


### Do...

make large clickable actions



give clickable elements space



design for keyboard or speech only use



design with mobile and touchscreen in mind



provide shortcuts



### Don't...

demand precision



bunch interactions together



make dynamic content that requires a lot of mouse movement



have short time out windows



tire users with lots of typing and scrolling



# Designing for users with low vision

## Designing for users with low vision



### Do...

use good colour contrasts and a readable font size

Aa

publish all information on web pages



use a combination of colour, shapes and text

Start

follow a linear, logical layout



put buttons and notifications in context



### Don't...

use low colour contrasts and small font size

Aa

bury information in downloads



only use colour to convey meaning



200% magnification



spread content all over a page



separate actions from their context

# Designing for screen reader users

## Designing for users of screen readers



### Do...

describe images and provide transcripts for video

`<alt>`

follow a linear logical layout



structure content using HTML5

`<h1>` `<nav>` `<label>`

build for keyboard use only



write descriptive links and headings

[Contact us](#)

### Don't...

only show information in an image or video



spread content all over a page



rely on text size and placement for structure

`36pt, bold`  
`Header`

force mouse or screen use



write uninformative links and headings

[Click here](#)

# Designing for users with hearing impairments

## Designing for users who are deaf or hard of hearing



**Do...**

write in plain language

**Do this**

use subtitles or provide transcripts for videos



use a linear, logical layout



break up content with sub-headings, images and videos



let users ask for their preferred communication support when booking appointments



**Don't...**

use complicated words or figures of speech



put content in audio or video only



make complex layouts and menus



make users read long blocks of content



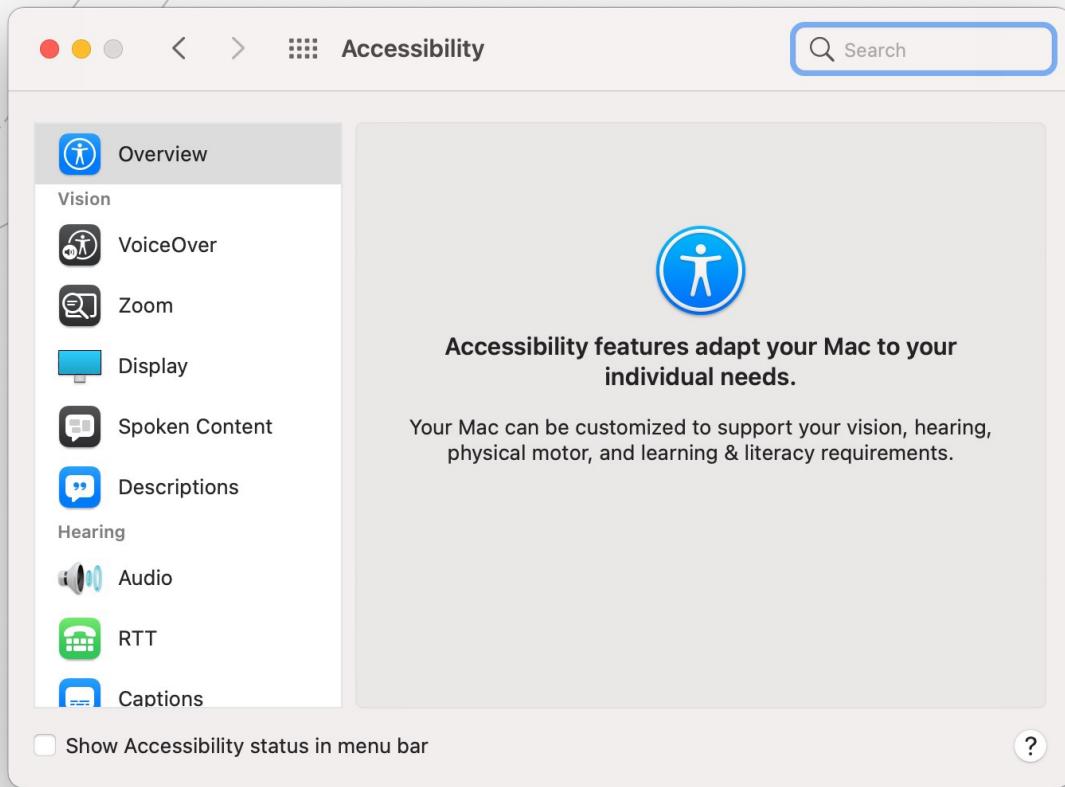
make telephone the only means of contact for users



# 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

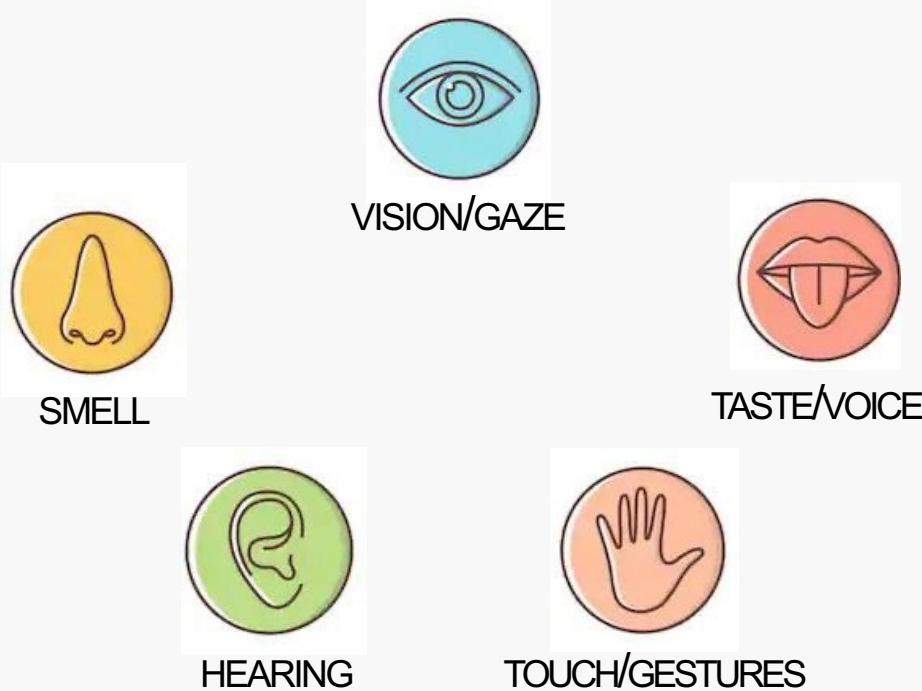


The image contains three side-by-side screenshots of the Mac OS Accessibility settings. Each screenshot shows a different section of the settings:

- Screenshot 1 (Left):** Shows the "Screen readers", "Text-to-speech output", "Display" (Font size, Display size), and "Magnification" (Colour correction, Colour inversion, Large mouse pointer) sections.
- Screenshot 2 (Middle):** Shows the "Interaction controls" (Click after pointer stops moving, Power button ends call, Auto-rotate screen, Touch & hold delay), "Audio & on-screen text" (Captions, Mono audio, Sound balance), and "Hearing" (Mono audio, High contrast text) sections.
- Screenshot 3 (Right):** Shows the "Experimental" section, which includes "Auto-rotate screen", "Touch & hold delay", "Audio & on-screen text", "Hearing", and "Experimental" settings.

# Multimodal Interaction

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



Can we use all of these?

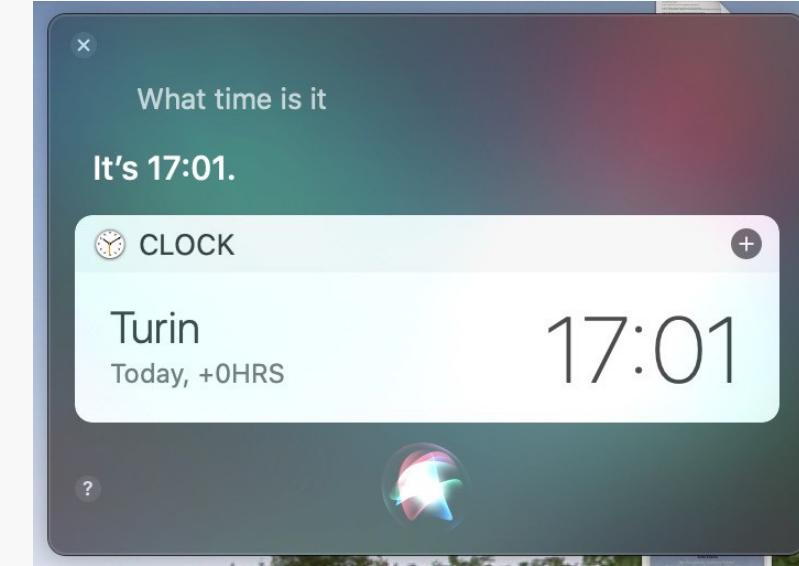
# Multimodal Interfaces Around Us

- Most interactive systems are predominantly visual
  - often WIMP based (*windows, icons, menus, pointer*), 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

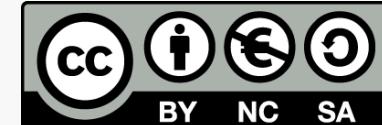
- The W3C Web Accessibility Initiative (WAI) provides a set of **guidelines** that are internationally recognized as standards
  - [Web Content Accessibility Guidelines \(WCAG\)](#)
  - [User Agent Accessibility Guidelines \(UAAG\)](#)
  - [Authoring Tool Accessibility Guidelines \(ATAG\)](#)
  - [Accessible 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 1.2 Time-based Media 1.3 Adaptable 1.4 Distinguishable	1.1.1 1.2.1 – 1.2.3 1.3.1 – 1.3.3 1.4.1 – 1.4.2	1.2.4 – 1.2.5 1.4.3 – 1.4.5	1.2.6 – 1.2.9 1.4.6 – 1.4.9
2. Operable	2.1 Keyboard Accessible 2.2 Enough Time 2.3 Seizures 2.4 Navigable	2.1.1 – 2.1.2 2.2.1 – 2.2.2 2.3.1 2.4.1 – 2.4.4	2.1.3 2.2.3 – 2.2.5 2.3.2 2.4.5 – 2.4.7	2.4.8 – 2.4.10
3. Understandable	3.1 Readable 3.2 Predictable 3.3 Input Assistance	3.1.1 3.2.1 – 3.2.2 3.3.1 – 3.3.2	3.1.2 3.2.3 – 3.2.4 3.3.3 – 3.3.4	3.1.3 – 3.1.6 3.2.5 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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**THANK YOU**

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