Embedded Ethics:

CSC207 (module 2) Disability and Accessible Software

One set of users whose needs may differ from the average user are those with disabilities.

The WHO estimates that 15% of users have disabilities

From Module 1

When we fail to design appropriately for users with disabilities, we risk causing both:

- tangible harms and
- harm to relational equality

Examples of disabilities:

Paraplegia (paralysis of lower limbs)

Deafness

Blindness

Mental illness

Speech impairment

What do disabilities have in common with each other?

Wasserman *et al* 2006: a disability is a **physical or mental impairment** that is associated with a **personal or social limitation** on the activities one can perform.

Physical or mental impairment

e.g. paraplegia

Personal / social limitation

e.g. not being able to access public spaces

Normally we think of the "cause" of an event as another specific event that occurred before it.

Other factors are simply "background conditions" - required for the event to happen, but not part of the "cause"
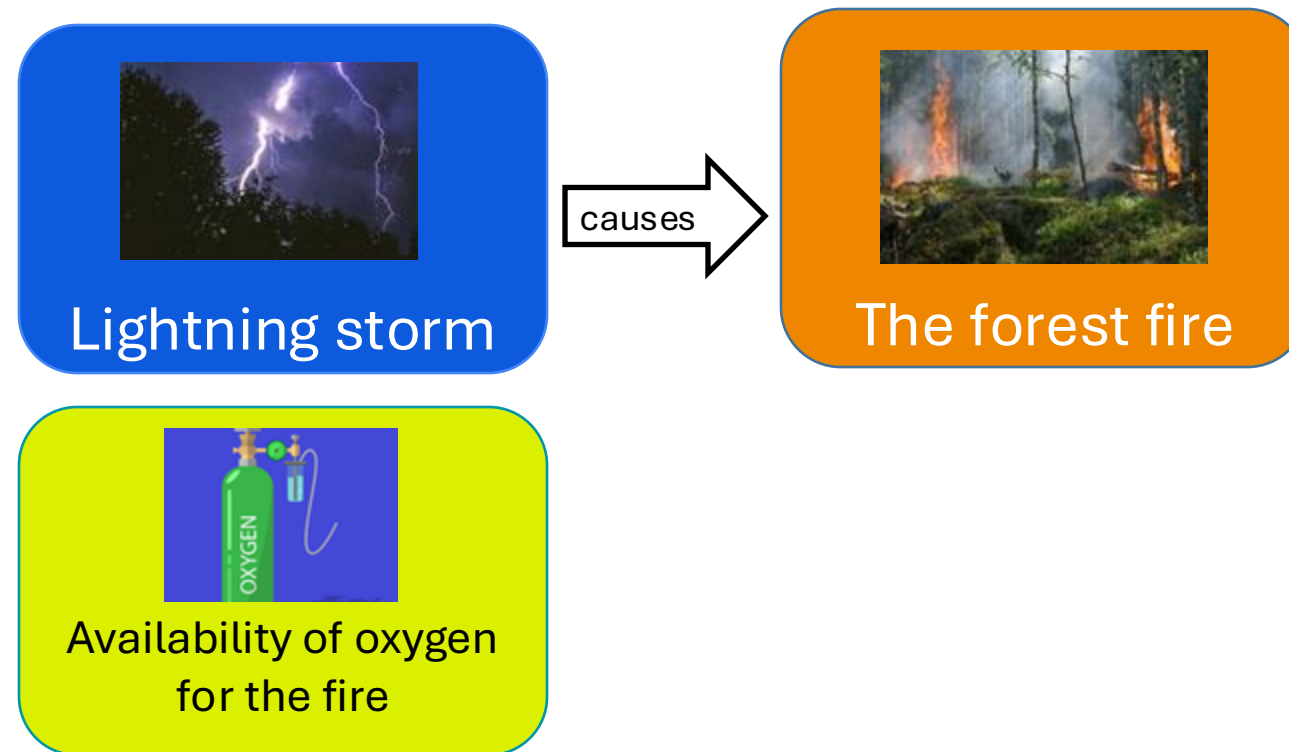
Lightning storm

causes

The forest fire

Availability of oxygen for the fire

The Medical Model of Disability

Physical or mental impairment

→ causes →

Personal / social limitation

Human world

In some disabilities, the limitations are caused by the physical or mental impairment.

The human world is a background condition.

The Social Model of Disability

Human world

causes →

Personal / social limitation

Physical or mental impairment
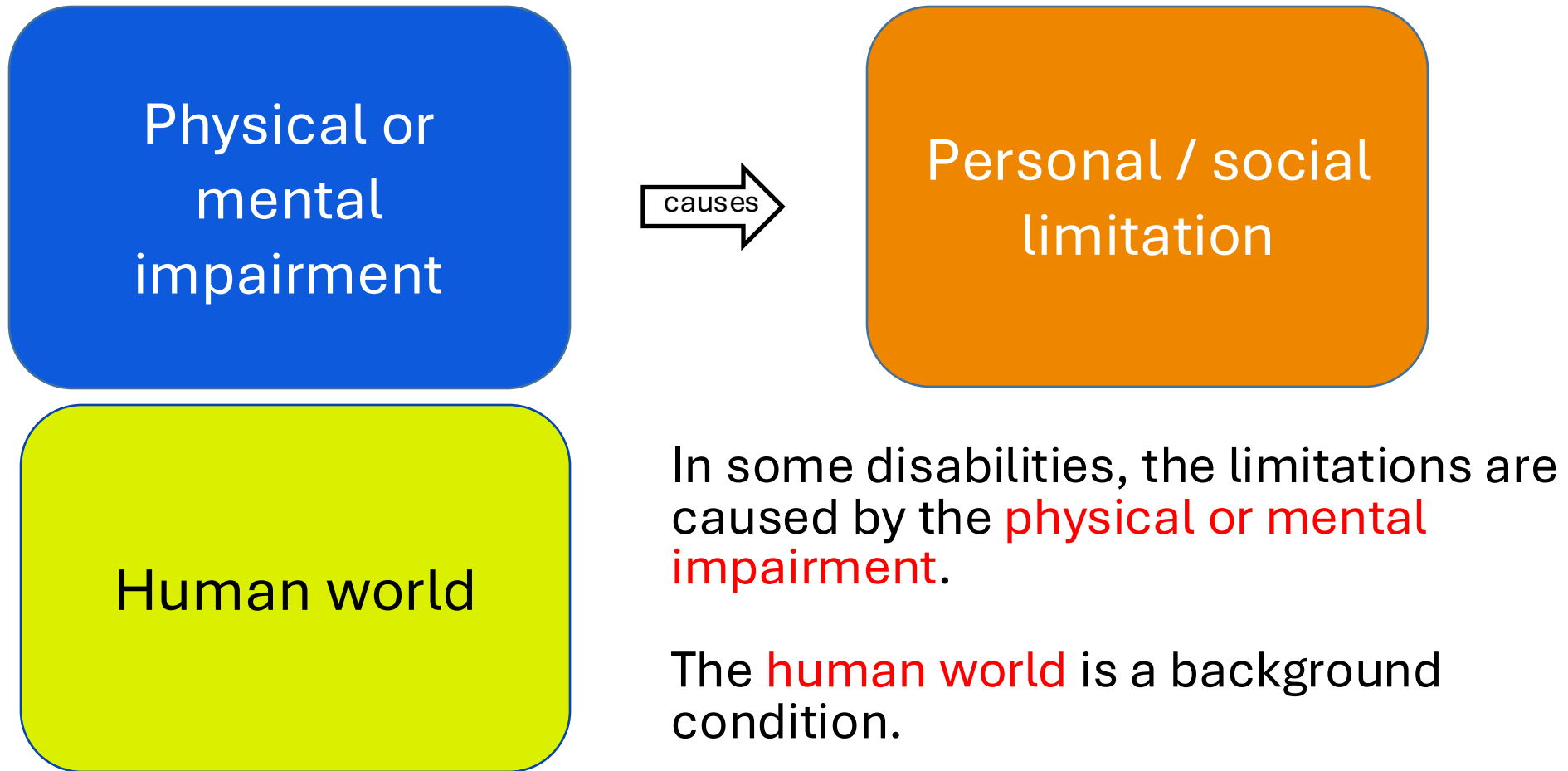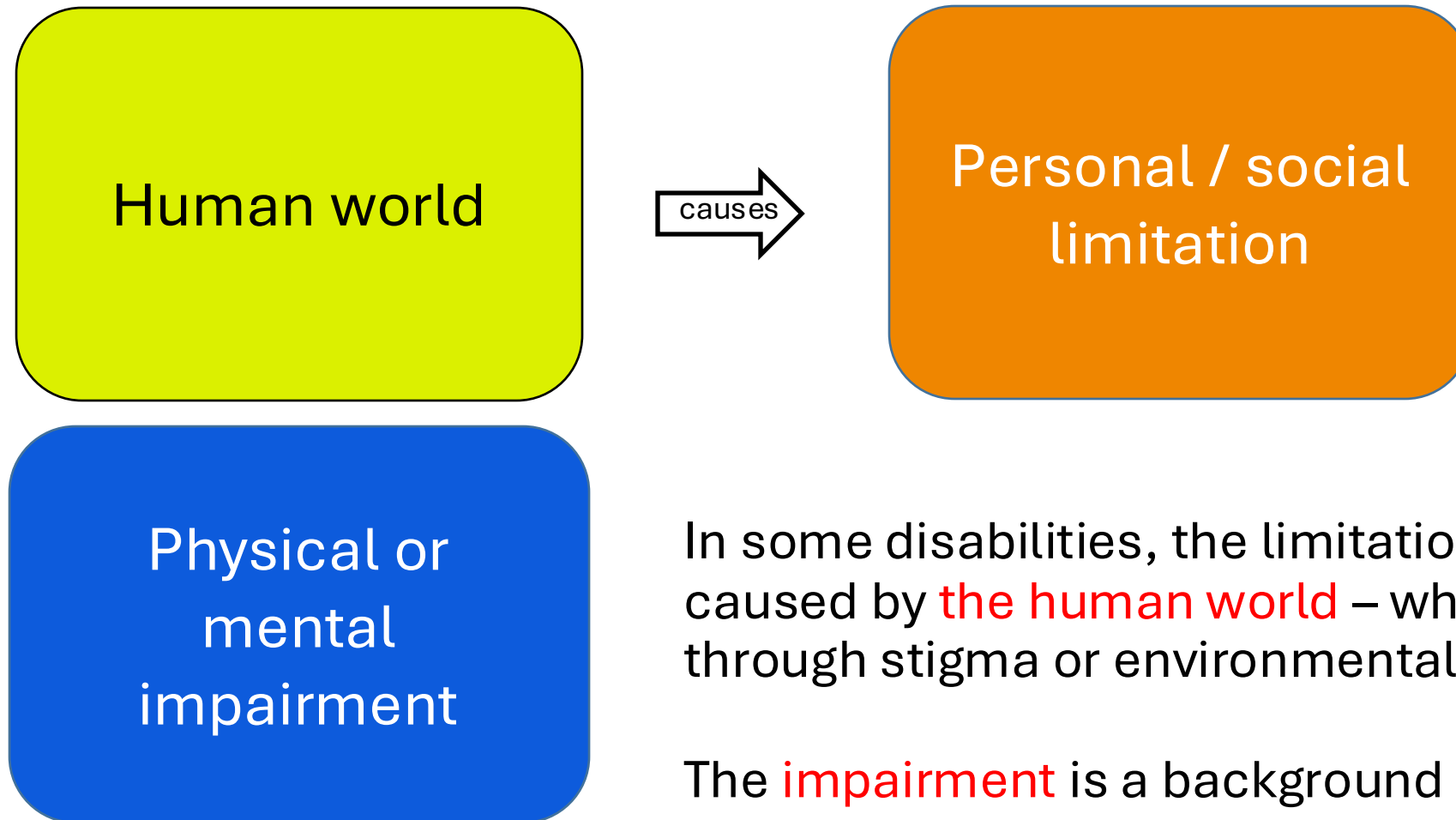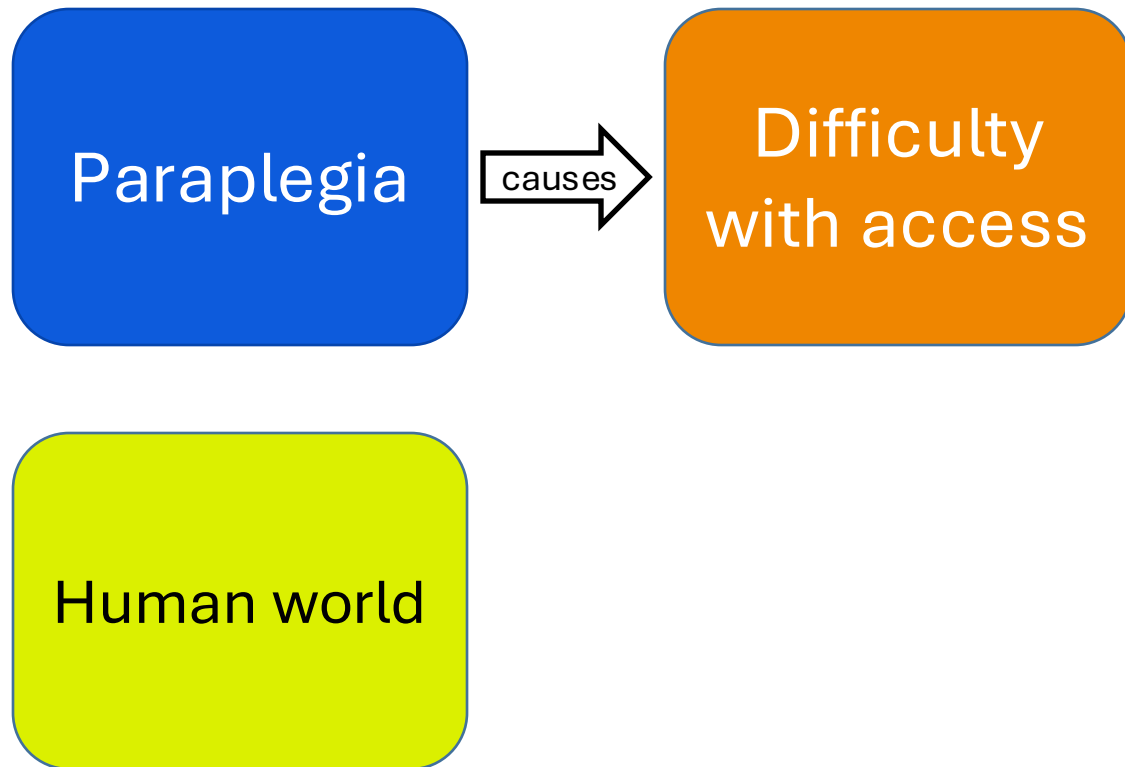
In some disabilities, the limitations are caused by the human world – whether through stigma or environmental design.

The impairment is a background condition.
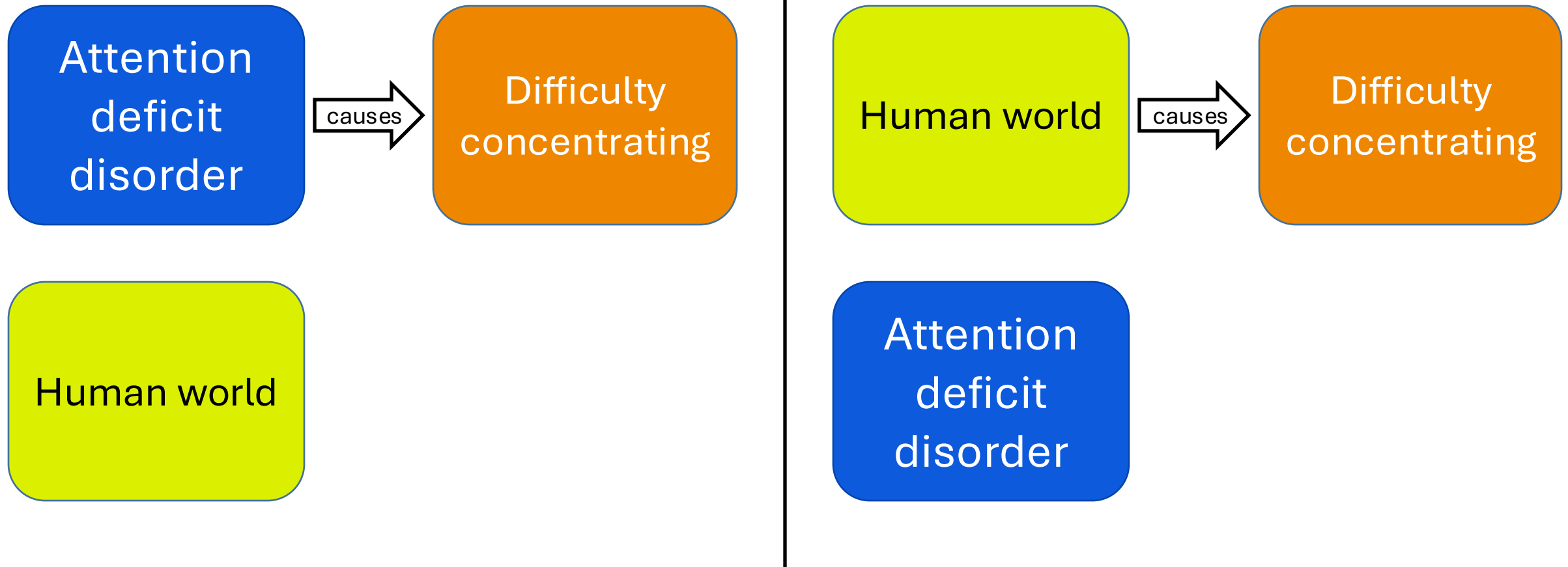
For some impairments, and some limitations, the medical model will seem more appropriate.

For some impairments, and some limitations, the social model will seem more appropriate.
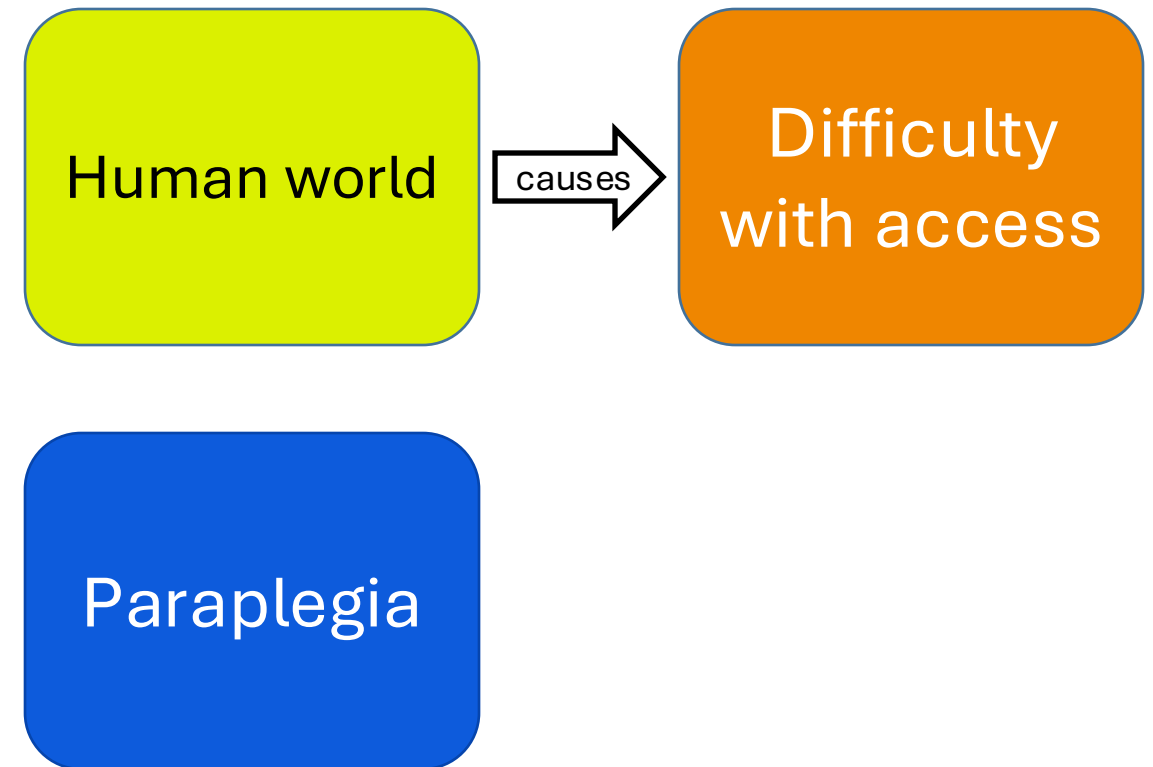
Impairment: Paraplegia
Limitation: Not being able to access public spaces

Impairment: Attention Deficit Disorder
Limitation: Difficulty concentrating on schoolwork

"Well, I was born with a rare visual condition called achromatopsia, which is total color blindness, so I've never seen color, and I don't know what color looks like, because I come from a grayscale world...

...But, since the age of 21, instead of seeing color, I can hear color... it's a color sensor that detects the color frequency in front of me — (Frequency sounds) — and sends this frequency to a chip installed at the back of my head, and I hear the color in front of me through the bone, through bone conduction."

Neil Harbisson, "I Listen to Color"
(TED Talk)

"Hearing people assume that the Deaf live in a perpetual state of wanting to hear, because they can't imagine any other way. But I've never once wished to be hearing. I just wanted to be part of a community like me."

Rebecca Krill, "How Technology has Changed What it's Like to be Deaf" (TED Talk)

So far we have seen how disabilities (impairment + limitation) reflects the medical model or the social model.

We can also use the medical model and social model to think about interventions that address disability.

Medical model: intervention reduces the impairment

Medical model: intervention reduces the impairment

- "closer" to the impairment

- Can work for one person without working for everyone

- Need to do something to trigger

- Designed with a particular impairment in mind

Social model:
intervention prevents impairment
from causing limitations

Social model:
intervention prevents impairment from causing limitations

- "further" from the impairment

- Applies to everyone; cannot apply to just one person

- Requires little work to trigger

- May be designed with a particular impairment in mind or none in particular in mind

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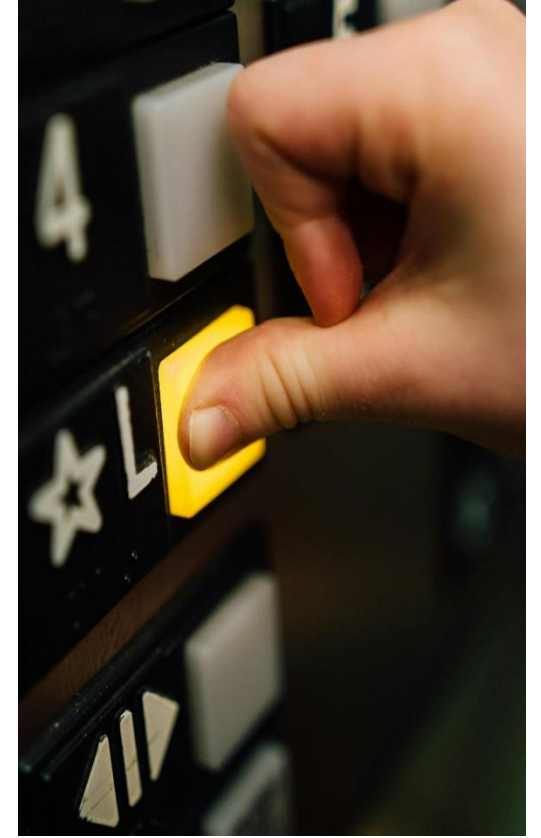
When software is an intervention that helps to address disability, is it more like the prosthetic or the elevator?

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When software is an intervention that helps to address disability, is it more like the prosthetic or the elevator?

- "closer" to the impairment
- Can work for one person without working for everyone
- Need to do something to trigger
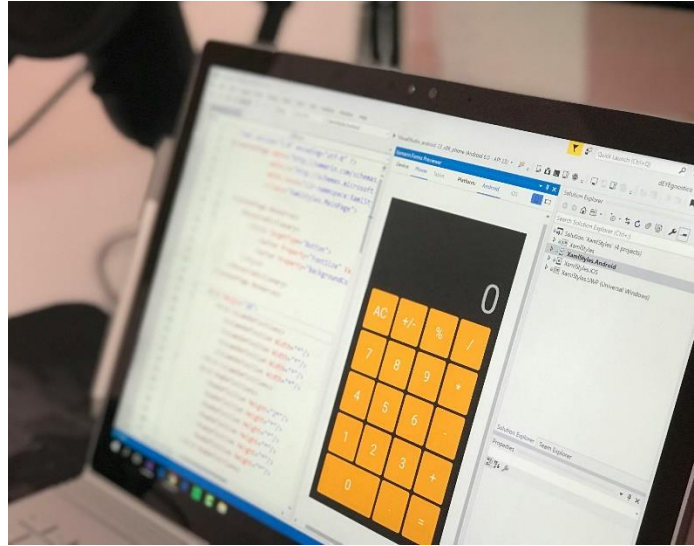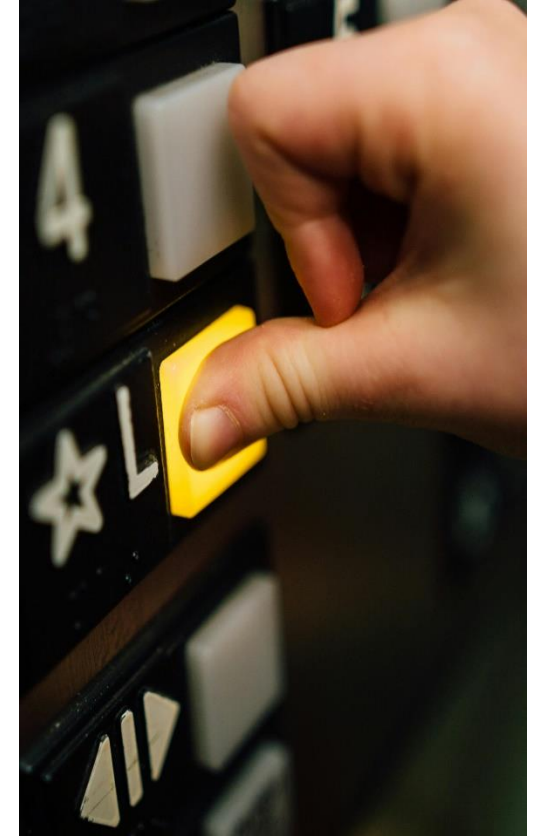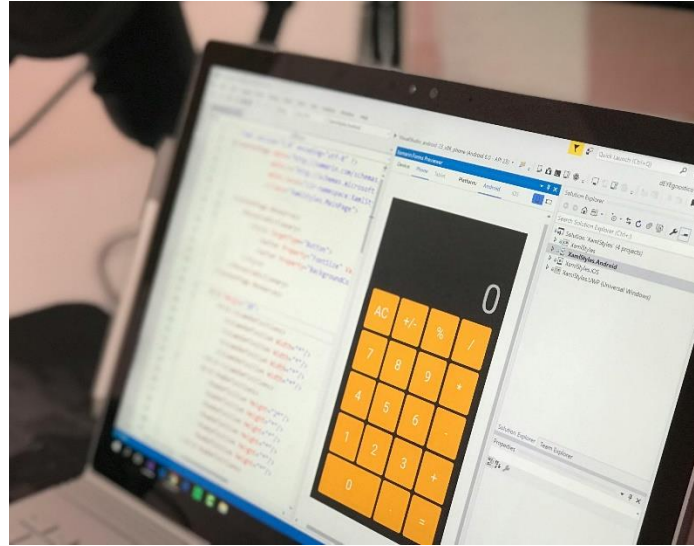- Designed with a particular impairment in mind

- "further" from the impairment
- Can work for one person without working for everyone
- Requires little work to trigger
- May be designed with a particular impairment in mind or none in particular in mind

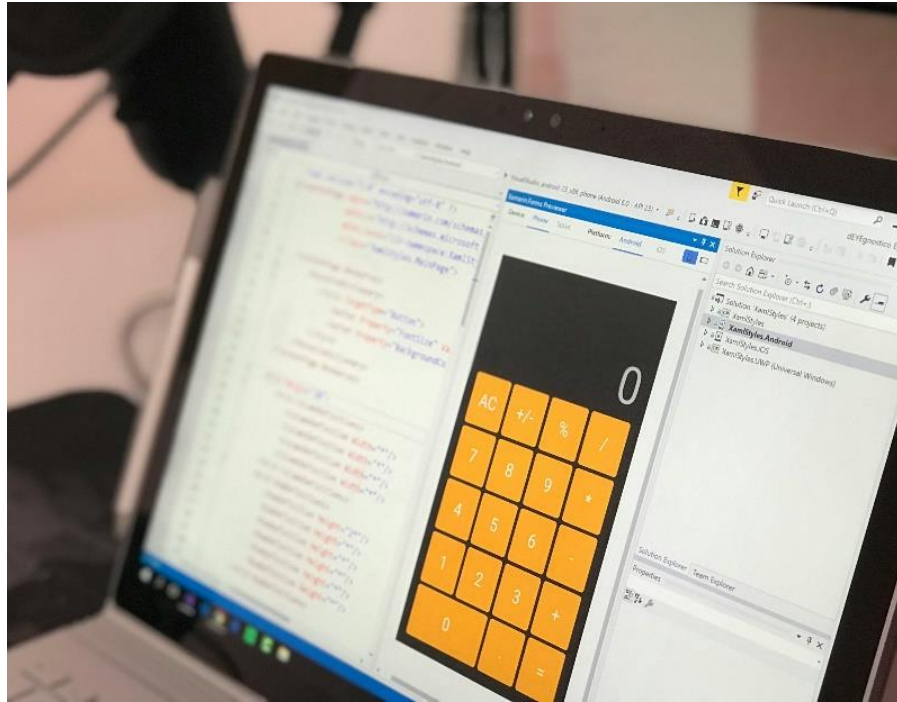1) There are some examples of software that fit the medical model and some examples that fit the social model.

2) It is useful to distinguish between software itself and features within software.

Case Study: Night Mode

Does Night Mode better illustrate the medical model or the social model?
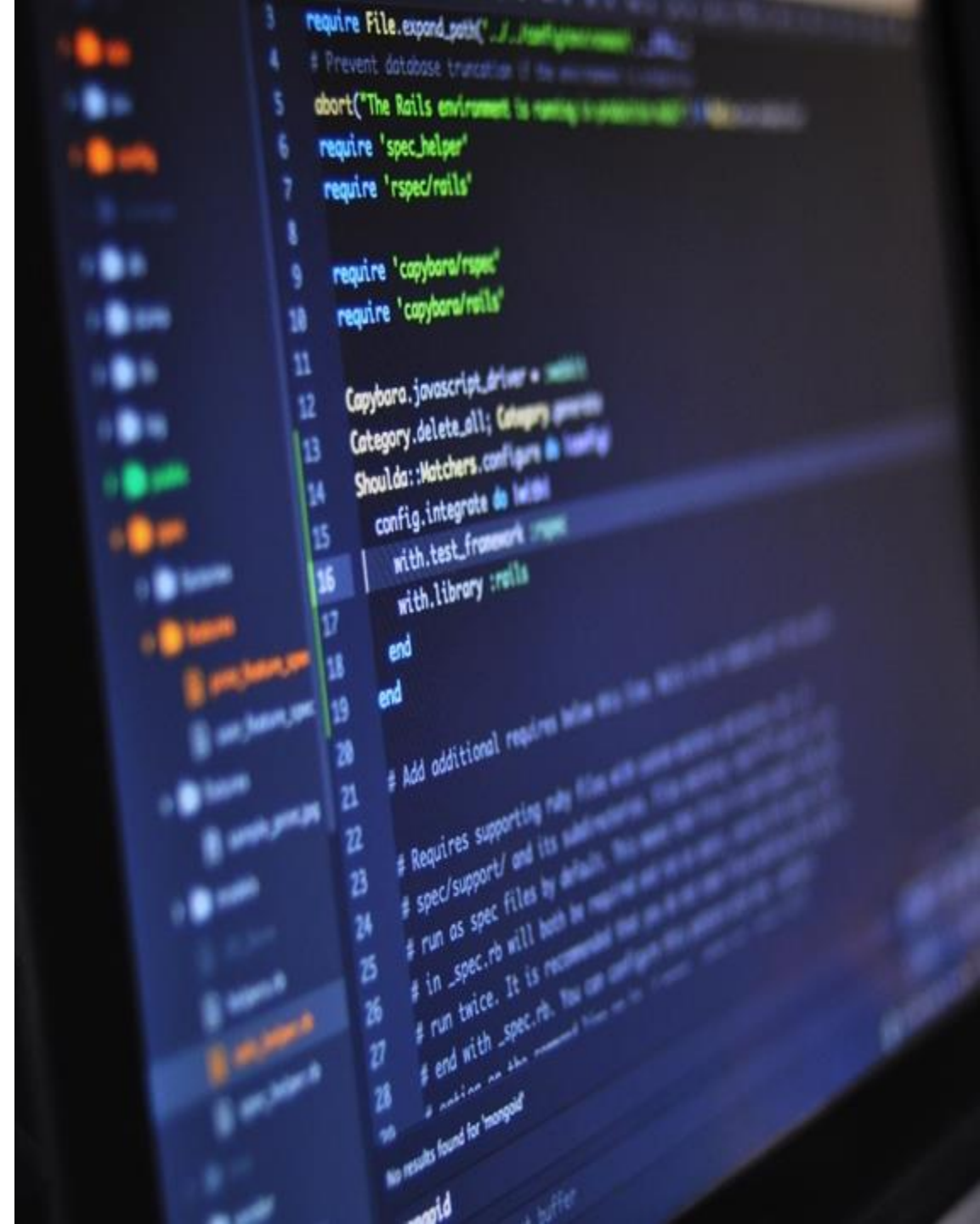
Software and the Medical Model

Here are some examples of software that are specifically designed to be accessible to people with various impairments:

- Braille Translation Software (example: Index BrailleApp) converts text to a document that can be printed by a Braille printer
- Software that runs a simplified phone interface for people with Down Syndrome (example: Simple Smartphone)
- Programs that can learn from users' past mistakes to predict future text and suggest corrections for spelling and grammatical errors, aimed at people with dyslexia (example: Ghotit)

Software and the Medical Model

Here are some more examples of software that are specifically designed to be accessible to people with various impairments:

- Sip-and-puff systems that allow a person to input information into a computer using a joystick that can be manipulated in any direction by their mouth, like a joystick, and sipping or puffing into the controller replacing clicking a mouse (example: Jouse3 for drawing or computer games, Origin instrument products for controlling a mouse, joystick, or keyboard)
- Domain specific voice recognition software that allows people to create text by speaking instead of typing (example for math symbols: MathTalk)

Software and the Social Model

Here are some examples of software features that are aimed to allow programs to reach a wider audience regardless of whether or not users are identified as disabled:

- Automatic Captioning for anyone who might understand better if they see the words being spoken (example: Zoom feature)
- Giving the user the ability to zoom in to see the UI better, or otherwise change the size of icons and text (example: all operating systems)
- Allowing "unlocking" a device using biometrics like fingerprint instead of a pass code (example: Windows 10, Mac OS)
- Text-to-speech features that allow anyone to listen to a text (example: Speechify)

Principles of Universal Design

Principle 1: Equitable Use

Principle 2: Flexibility in Use

Principle 3: Simple and Intuitive Use

Principle 4: Perceptible Information

Principle 5: Tolerance for Error

Principle 6: Low Physical Effort

Principle 7: Size and Space for Approach and Use

Compare the following interfaces to a file system:

BASH:

a text interface to the UNIX file system
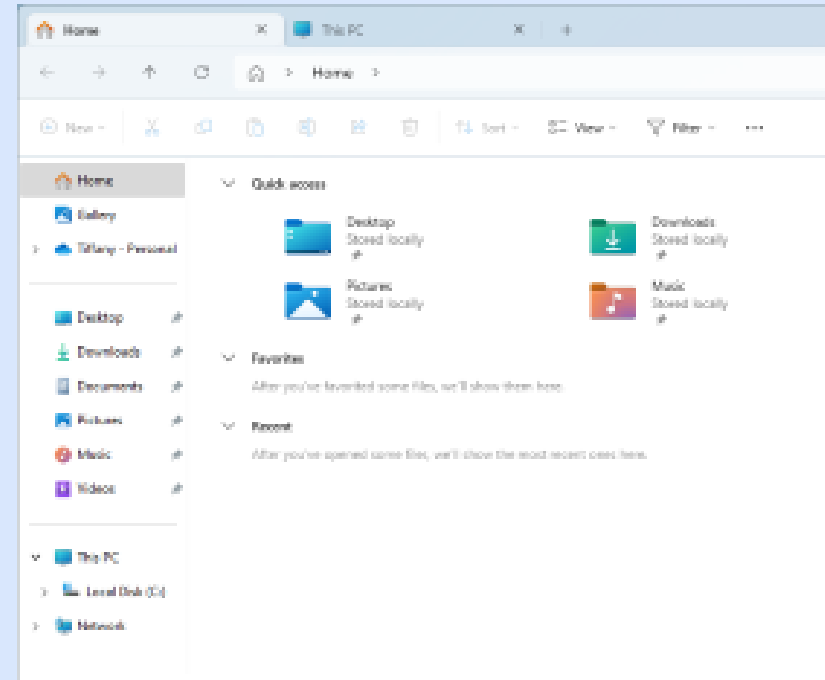
Windows File Explorer:

a graphical interface to the file system

Which of these interfaces better reflects each of the seven principles of universal design?

Clean Architecture and Accessibility

Clean Architecture (or other layered architectures) makes it easier to update the accessibility features of your program.

Why? Because they should mostly be located in the outer layer.

You can get help in designing accessibly!

Accessibility for Ontarians with Disabilities Act (AODA)

Most public and private organizations in Ontario are expected to make their websites compliant with Web Content Accessibility Guidelines 2.0 to the "AA" level

(which includes the lower "A" level, too)

https://www.ontario.ca/page/how-make-websites-accessible

Corporations can be fined up to $100,000 a day for non-compliance.

Individuals can be fined up to $50,000 a day for non-compliance.

Some of Our Legal Responsibilities

https://www.ontario.ca/page/how-make-websites-accessible

These guidelines are based on https://www.w3.org/WAI/standards-guidelines/wcag/

1.4.1 Use of Color — Level A

Color is not used as the only visual means of conveying information, indicating an action, prompting a response, or distinguishing a visual element.

Note 1: This success criterion addresses color perception specifically. Other forms of perception are covered in Guideline 1.3 including programmatic access to color and other visual presentation coding.

ⓘ Understanding 1.4.1

❯ Show techniques and failures for 1.4.1

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2.3.1 Three Flashes or Below Threshold — Level A

Web pages do not contain anything that flashes more than three times in any one second period, or the flash is below the general flash and red flash thresholds.

Note 1: Since any content that does not meet this success criterion can interfere with a user's ability to use the whole page, all content on the Web page (whether it is used to meet other success criteria or not) must meet this success criterion. See Conformance Requirement 5: Non-Interference.

ⓘ Understanding 2.3.1

❯ Show techniques and failures for 2.3.1

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1.4.2 Audio Control — Level A

If any audio on a Web page plays automatically for more than 3 seconds, either a mechanism is available to pause or stop the audio, or a mechanism is available to control audio volume independently from the overall system volume level.

Note 1: Since any content that does not meet this success criterion can interfere with a user's ability to use the whole page, all content on the Web page (whether or not it is used to meet other success criteria) must meet this success criterion. See Conformance Requirement 5: Non-Interference.

ⓘ Understanding 1.4.2

❯ Show techniques and failures for 1.4.2

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Companies often hire consultants and/or beta testers.

An excellent way to learn about someone's experience of using your software is to ask them. This is especially true if they have a disability that you have not experienced.

- Example of a consulting company that specializes in testing, including for accessibility purposes: https://www.ibeta.com/accessibility -testing/"

- Other independent testers (e.g. SightlessKombat on Youtube)

Accessibility checkers are automated systems that perform tests to check whether programs or files are accessible.

Many major app stores have mandatory in-house accessibility checkers.

Powerpoint has an accessibility checker.

Summary

It is important to design for a diverse range of users, including users with disabilities.

The concepts we use to think about disability matter.

According to the medical model of disability, a physical or mental impairment causes a personal or social limitation.

According to the social model of disability, the human world causes a personal or social limitation.

Depending on which model we have in mind, we may design software in different ways.

Other Resources

If you want to learn more about accessibility and the human aspects of software design, see:	• A wealth of companies, links on slides 38, 39! • CSC318 (The Design of Interactive Computational Media) • CSC428 (Human-Computer Interaction)
If you want to learn more about the ethics of software design, consider taking:	• CSC300 (Computers and Society) • Various HPS courses • PHL277 (Ethics of Big Data)
If you liked the more abstract philosophy, understanding and debating about concepts like *relational equality* and *causes vs. background conditions*, consider taking:	• PHL233 (Philosophy for Scientists) – includes causation • PHL265 (Introduction to Political Philosophy) – about equality and justice • PHL275 (Introduction to Ethics) – about the nature and theories of ethical right and wrong

Acknowledgements

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References

- Wasserman, David, Adrienne Asch, Jeffrey Blustein, and Daniel Putnam, "Disability: Definitions, Models, Experience", *The Stanford Encyclopedia of Philosophy* (Summer 2016 Edition), Edward N. Zalta (ed.), URL = https://plato.stanford.edu/archives/sum2016/entries/disability/

Companies in the Accessibility Space

- Index BrailleApp -- https://www.indexbraille.com/
- Simple Smartphone -- http://simplesmartphone.com
- Ghotit -- https://www.ghotit.com/
- Jouse3 -- https://www.enablingtech.ca/products/jouse-3
- MathTalk -- https://mathtalk.com/
- Zoom -- https://zoom.us
- Biometrics -- Linux, Mac, Window
  - https://itsfoss.com/fingerprint-login-ubuntu/
  - https://support.apple.com/en-ca/guide/mac-help/mchl16fbf90a/mac
  - https://www.computerworld.com/article/3244347/what-is-windows-hello-microsofts-biometrics-security-system-explained.html
- IntelliJ -- https://www.jetbrains.com/idea/

Designing for Accessibility

- <u>World Wide Web Consortium on Accessibility in Web Design</u>
- <u>Google accessibility pages for Android and web design</u>
- <u>General Google Accessibility Guidelines</u>
- <u>Apple Accessibility Guidelines</u>