

Considering Ability in the Design of Interactive Systems

Martez E. Mott

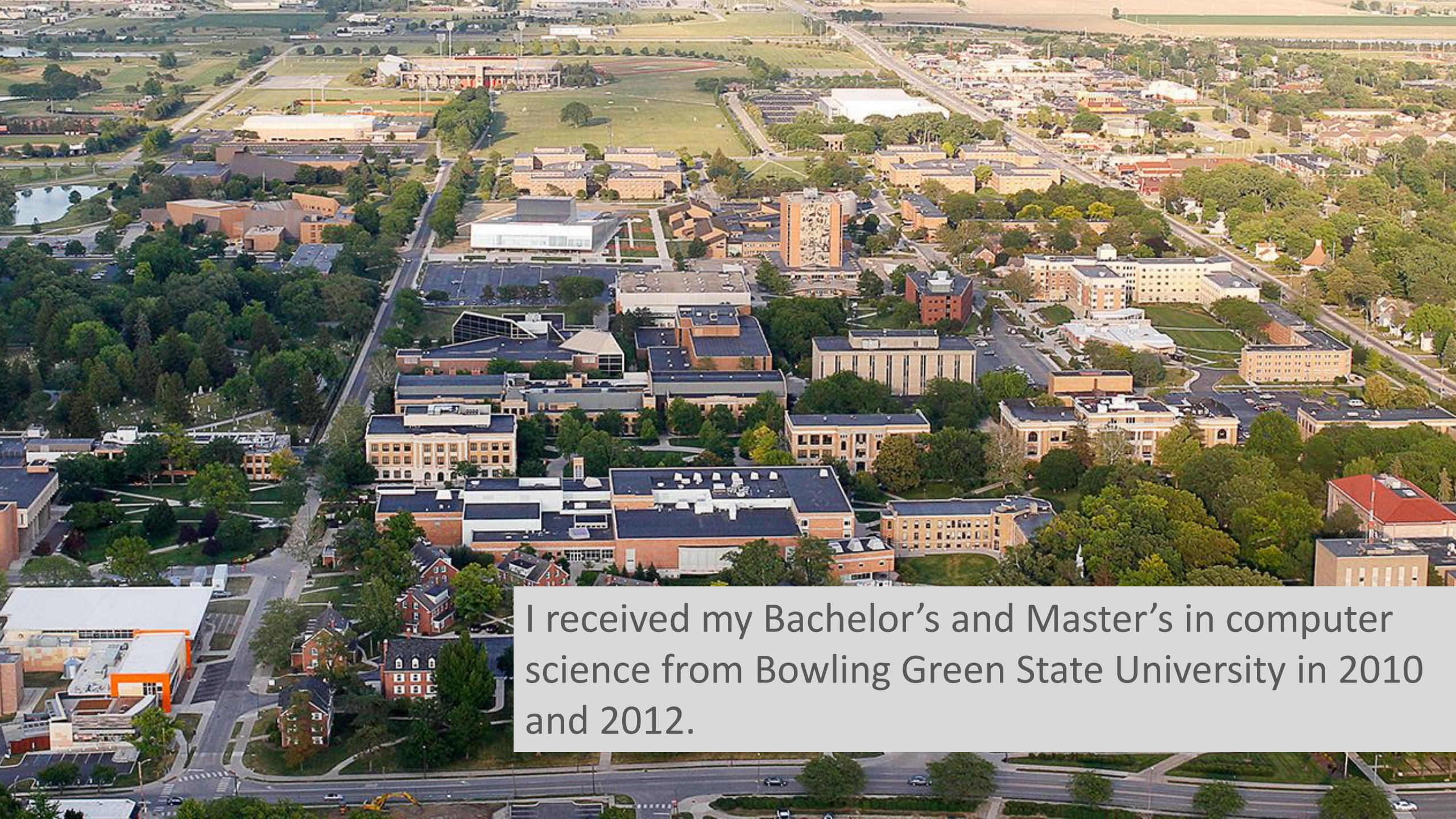
Ability Group | Microsoft Research

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Home





I received my Bachelor's and Master's in computer science from Bowling Green State University in 2010 and 2012.

I received my Ph.D. in Information Science from the University of Washington in Dec. 2018





Currently a Postdoctoral Researcher in the Ability Group at Microsoft Research.

Accessible computing

*Designing computing devices and services to be **usable** by **all people**, and using computing to make the **world more accessible** to people with disabilities.*

Universal design

*The design of **products** and **environments** that can be used and experienced by people of all **ages** and **abilities**, to the greatest extent possible, without adaptation.*

(Center for Accessible Housing, 1995)

Curb cuts



Closed captioning



Wow, they have done it!
The last moments of the game and they did it!



Universal design

*The design of **products** and **environments** that can be used and experienced by people of all **ages** and **abilities**, to the greatest extent possible, without adaptation.*

(Center for Accessible Housing, 1995)

What is ability?

*Possession of the means or skill to **do** something.*

What is disability?

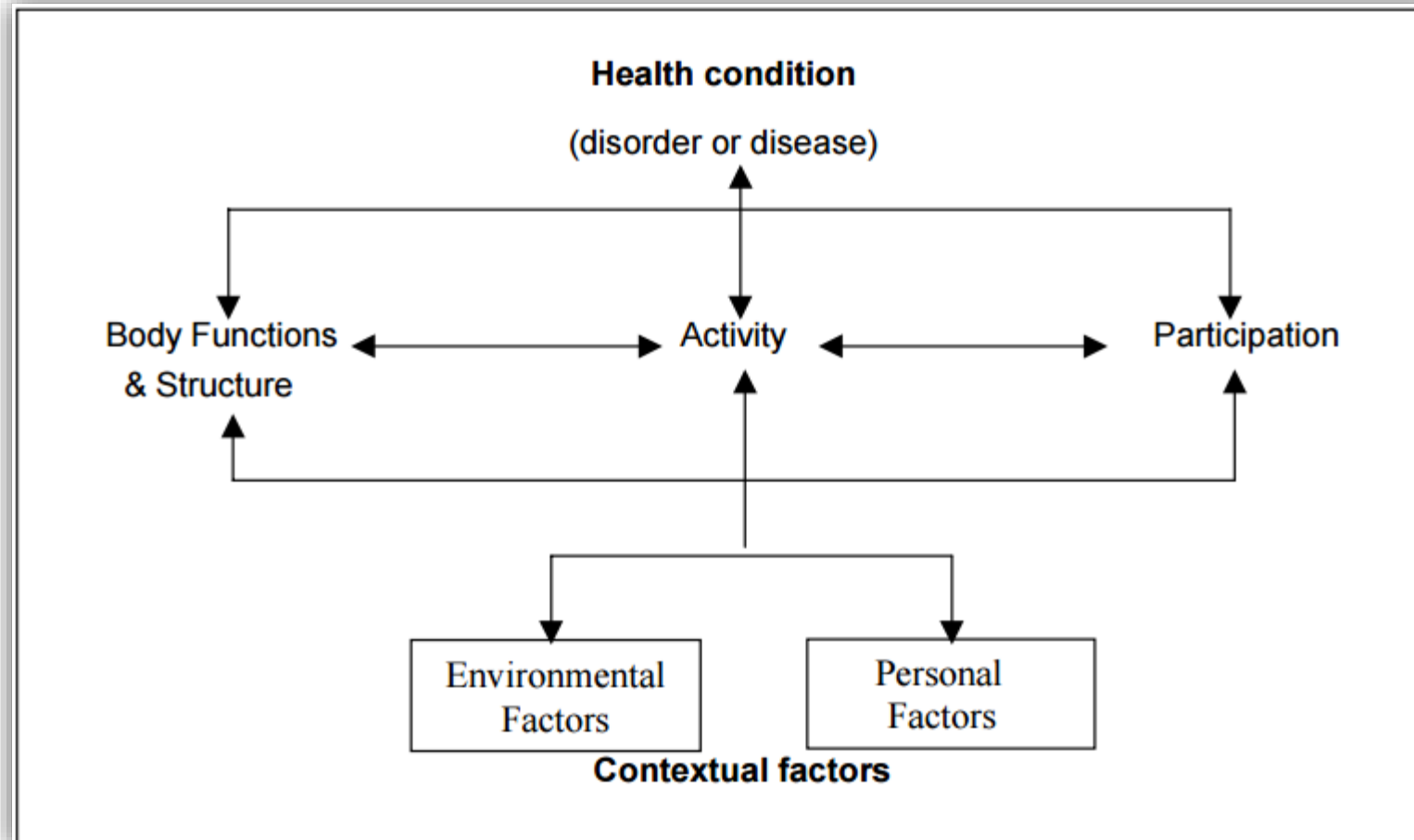
Any restriction or lack...of ability to perform an activity in the manner or within the range considered normal for a human being.

(World Health Organization, 1976)

Any issues with this definition?

What is disability?

WHO 2001



What is dis-ability?

What is dis-ability?

Not being in

^ *possession of the means or skill to do something.*

Dis-weight? Dis-height?



Positive affirmation of ability

*Everyone has abilities, some people more than others. We need to design for people with **abilities of all types**.*

Do abilities change?

Interacting while walking

Consider walking while interacting with a smartphone. Are your abilities different?



Interacting while walking

Reduced reading
speed

Reduced motor
accuracy

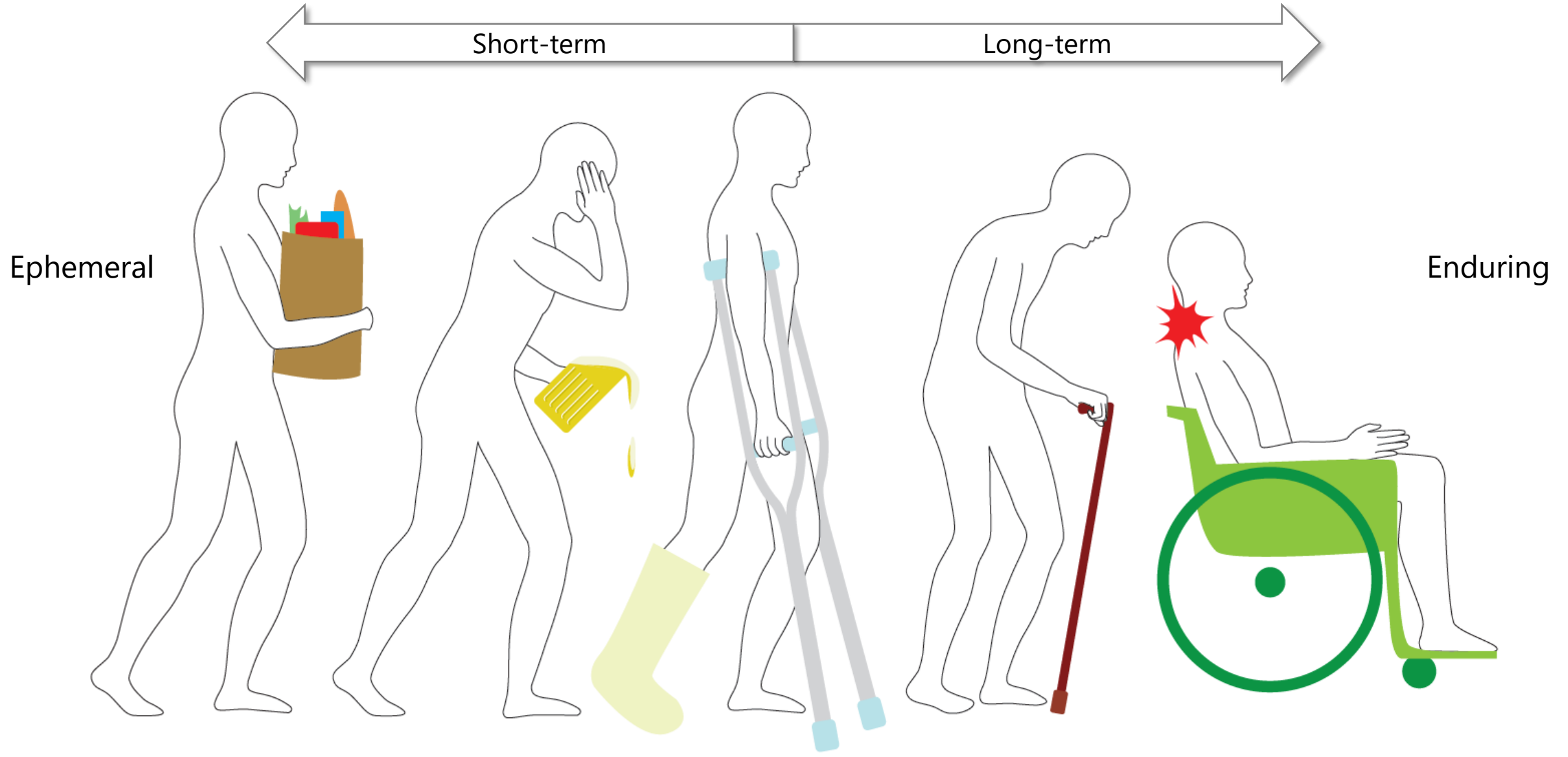
Divided attention
(4 seconds)

Reduced ability to
maneuver



How does context change our ability to perform everyday interactions?

Duration



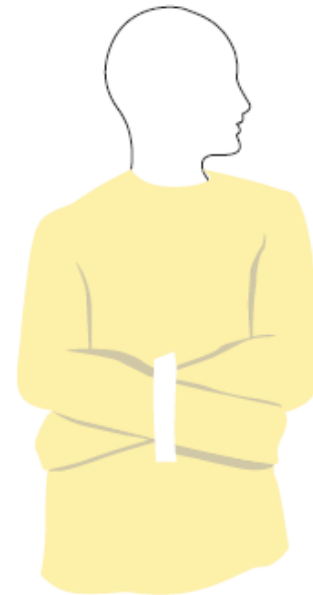
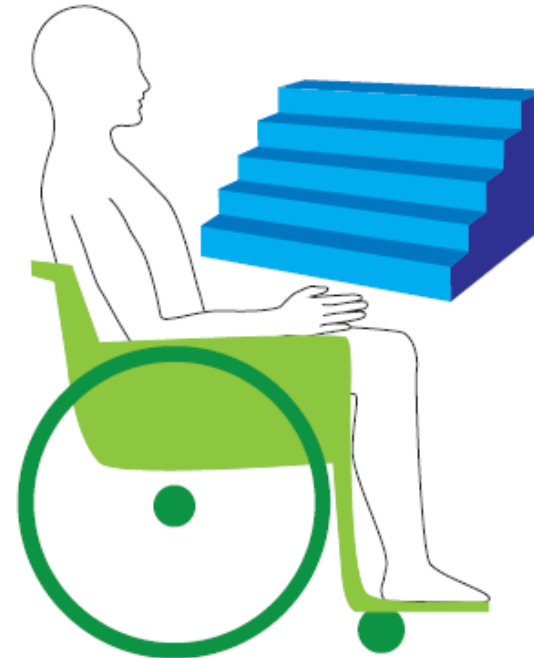
Location



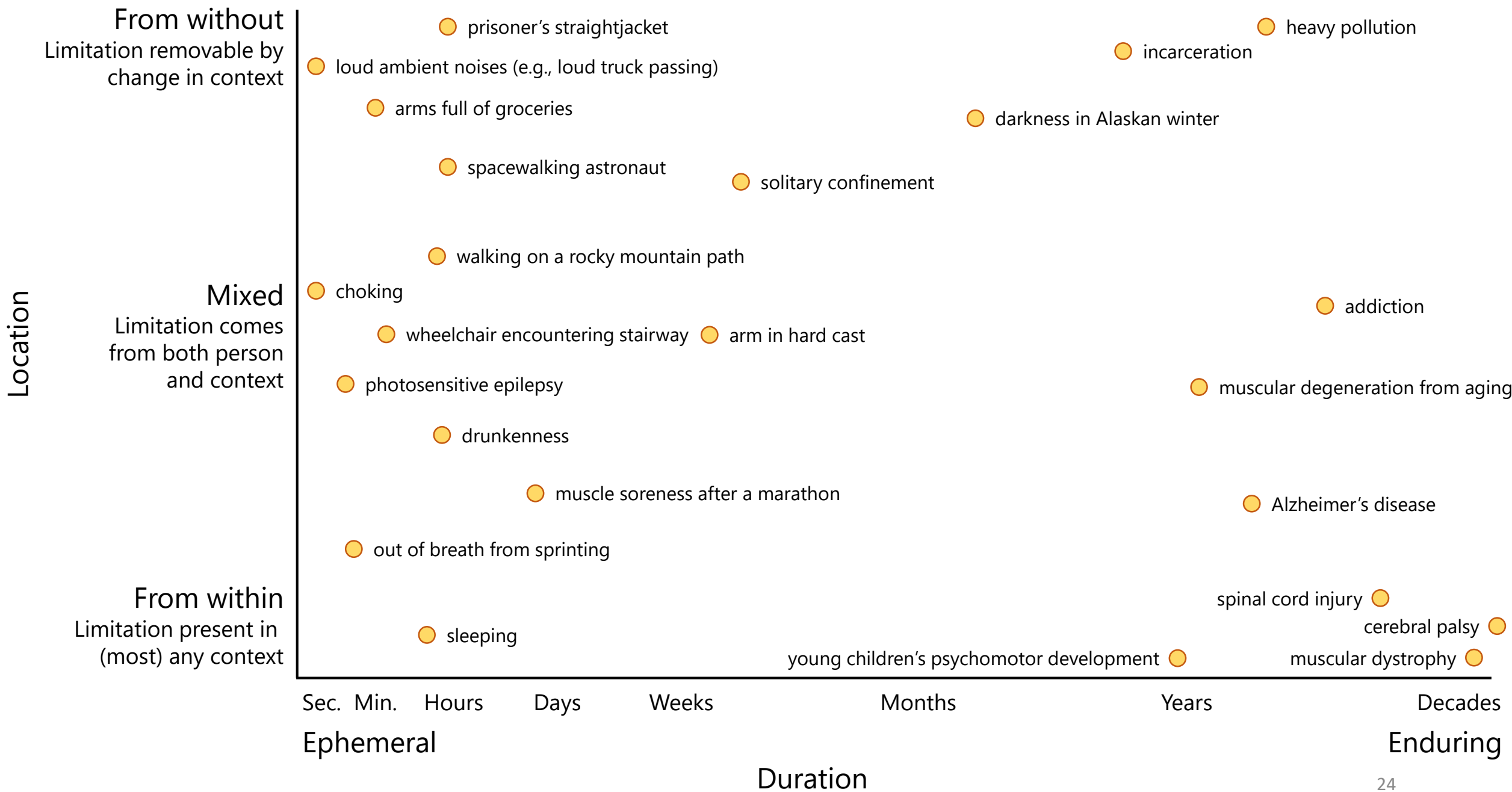
From within
Limitation present in
(most) any context



Mixed
Limitation comes
from both person
and context



From without
Limitation removable by
change in context



Many sources of SIIDs

- vibration
- divided attention
- distraction
- diverted gaze
- device out-of-sight
- intervening objects
- body motion
- vehicle motion
- uneven terrain
- physical obstacles
- awkward postures or grips
- occupied hands
- cold temperatures
- impeding clothing (e.g., gloves)
- encumbering baggage
- rainwater
- light levels (e.g., darkness, glare)
- ambient noise
- social interactions (e.g., interruptions)
- multitasking
- stress
- fatigue
- haste
- intoxication



Recap

Ability: possession of the means or skill to **do** something

Dis-ability: **Not being** in possession of the means or skill to **do** something

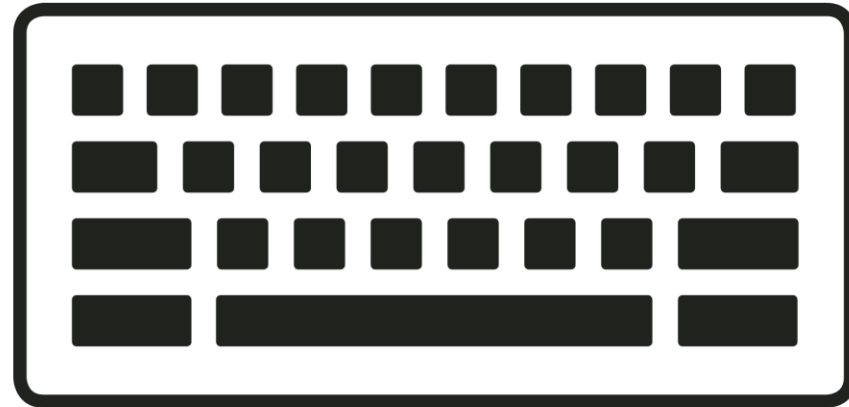
Our abilities are altered by our current **context**.

Ability assumptions

*All **human-operated** technologies contain embedded “**ability assumptions**,” whether explicit or implicit.*

Ability assumptions

What ability assumptions are embedded in the design of a keyboard?



Ability assumptions

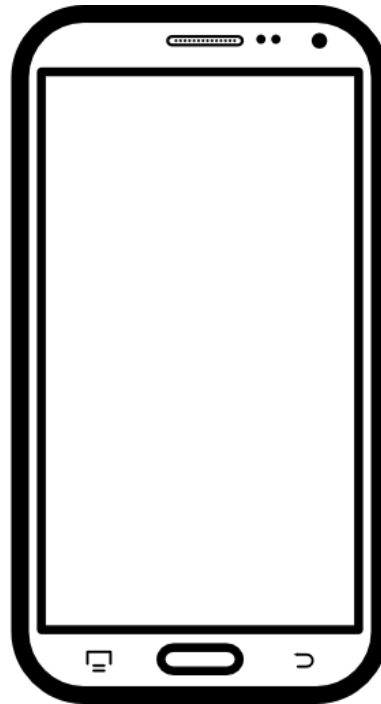
What ability assumptions are violated?



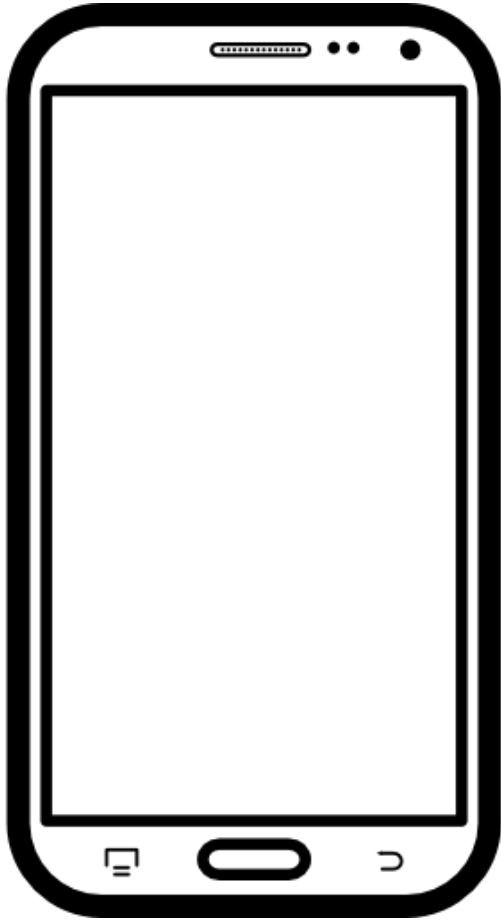
What are the ability assumptions of objects in this room or devices you brought with you?

Ability assumptions

What ability assumptions are embedded in the design of a touch screen?



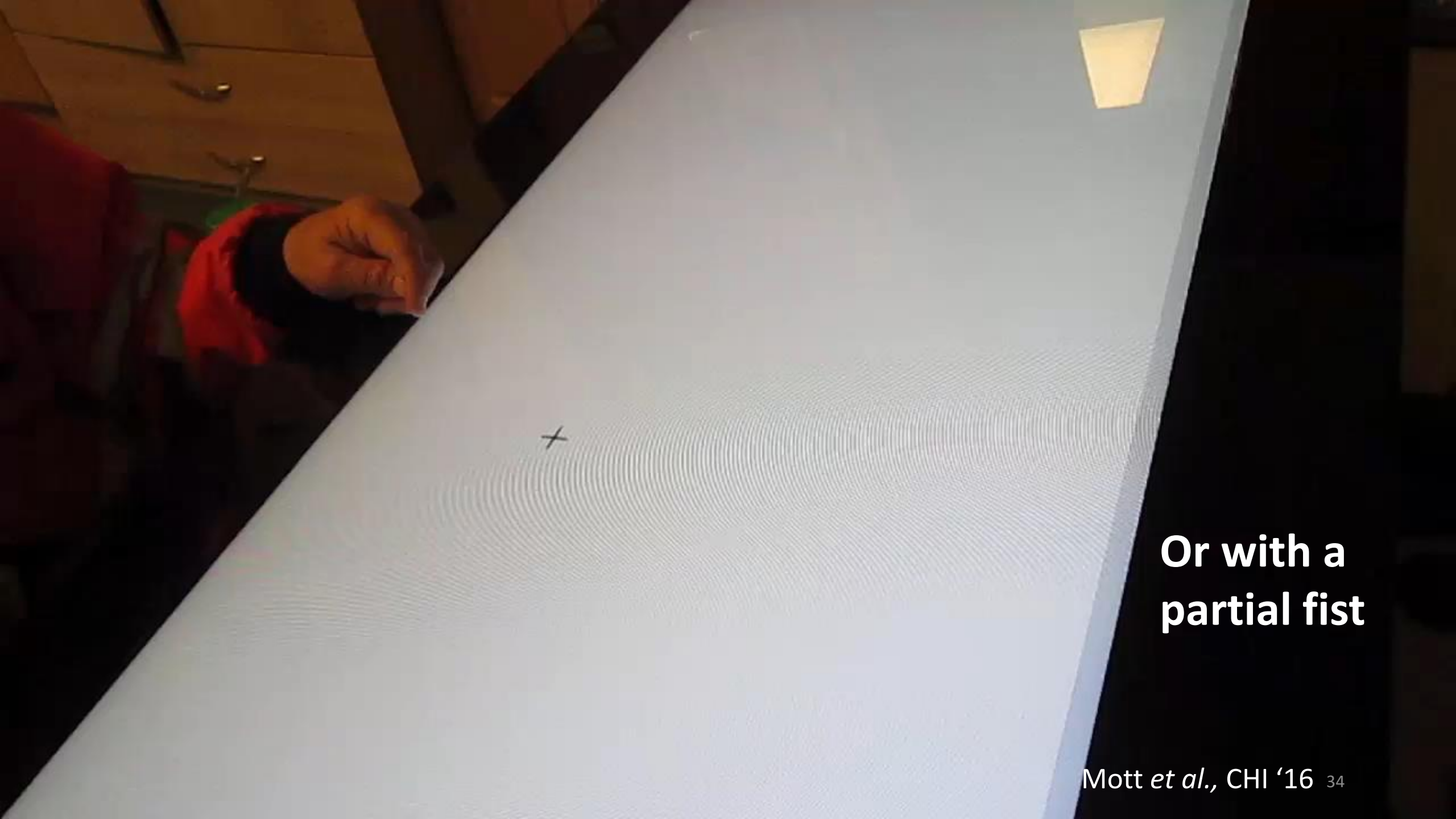
Ability assumptions



- Can tap with a single finger
- Can land and lift inside a target (e.g., button, check box)
- Can gesture with a single finger (e.g., swipe)
- Can use two fingers to gesture (e.g., pinch to zoom)



**People may touch
with multiple
fingers**



**Or with a
partial fist**

Ability assumptions

What ability assumptions are embedded in the design of a smartphone camera?



Can steady a phone



Can zoom effectively



Can take selfies



Ability assumptions

What ability assumptions are embedded in the design of a voice assistant?



Deaf speech

What is being said?



Deaf speech

The pie was on the table for supper.



ASR

The pie was on the table for tub stopper



Individual

The pie was on the table for supper.

Deaf speech

What is being said?



Deaf speech

Everyone went shopping for the picnic.



ASR

ever onward shopping for panic



Individual

every one will slap you for the picnic

Ability-based design

*A design approach in which the human **abilities** required to operate an interactive system are **questioned**, and systems **adapt** or can be **adapted** to **alternative abilities**.*

(Wobbrock *et al.*, 2018)

Principles v.3 (Updated from Wobbrock et al. 2011, 2014, 2018)

	Principle	Description
Designer Stance (required)	1. Ability	Designers will focus on users' abilities, not <i>dis</i> -abilities, striving to leverage all that users <i>can</i> do in a given situation, context, or environment.
	2. Accountability	Designers will respond to poor usability by changing systems, not users, leaving users as they are.
	3. Availability	Designers will use affordable and available software, hardware, or other components that are acquirable through accessible means.
Adaptive or Adaptable Interface (optional)	4. Adaptation	Interfaces might be adaptive or adaptable to provide the best possible match to users' abilities.
	5. Transparency	Interfaces might give users awareness of adaptive behaviors and what governs them, and the means to inspect, override, discard, revert, store, retrieve, preview, alter, or test those behaviors.
Sensing and Modeling (optional)	6. Performance	Systems might monitor, measure, model, display, predict, or otherwise utilize users' performance to provide the best possible match between systems and users' abilities.
	7. Context	Systems might sense, measure, model, portray, or otherwise utilize users' situation, context, or environment to anticipate and accommodate effects on users' abilities.

Principles v.3 (Updated from Wobbrock et al. 2011, 2014)

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Recap

All technology is created with **implicit** ability assumptions. As designers, engineers, and scientists, it is important to be aware of these assumptions and to **broaden** them when possible.

Burden of adaptation

*Because systems are **oblivious**, the **burden** is on the user to **adapt** to the **ability-demands** of interactive systems.*

Burden of adaptation



Microsoft EasyBall

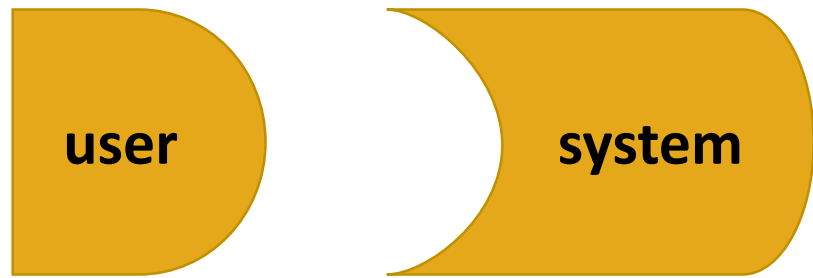


Hand pointing-stick

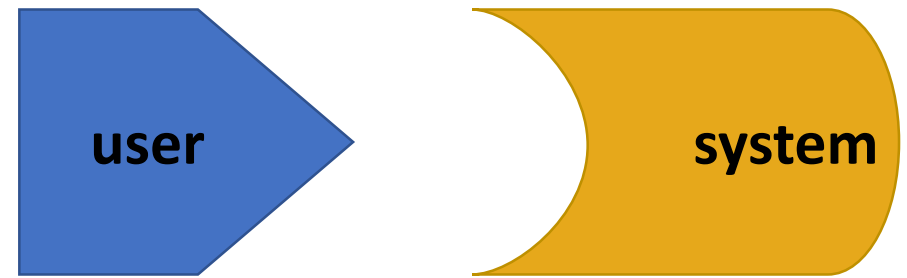


Mouth stylus

Burden of adaptation

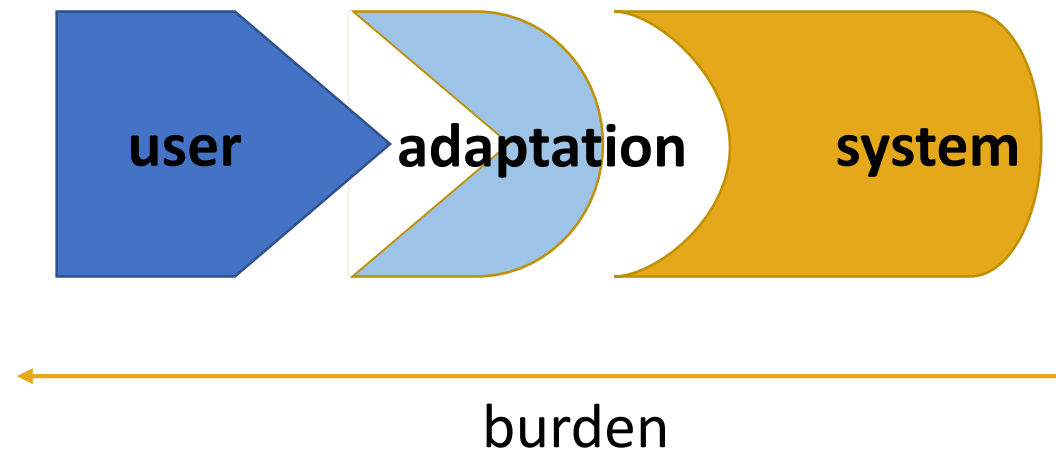


Perfect match

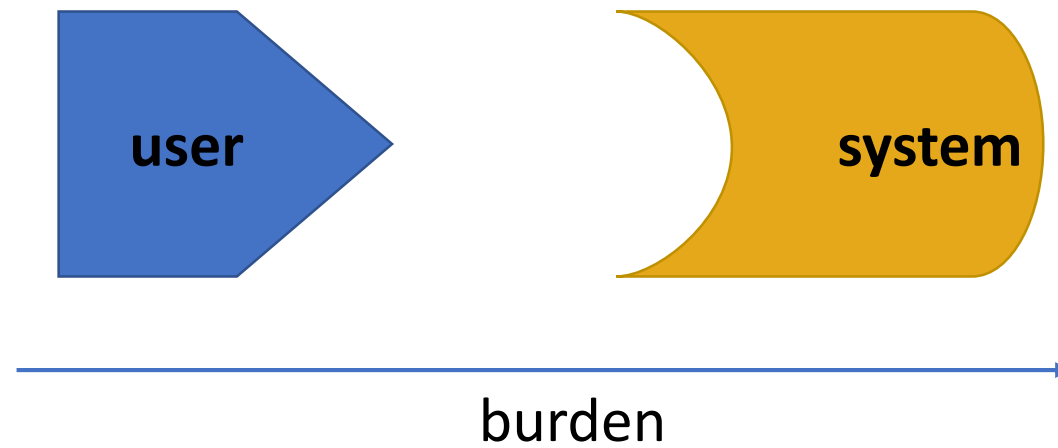


Mismatch

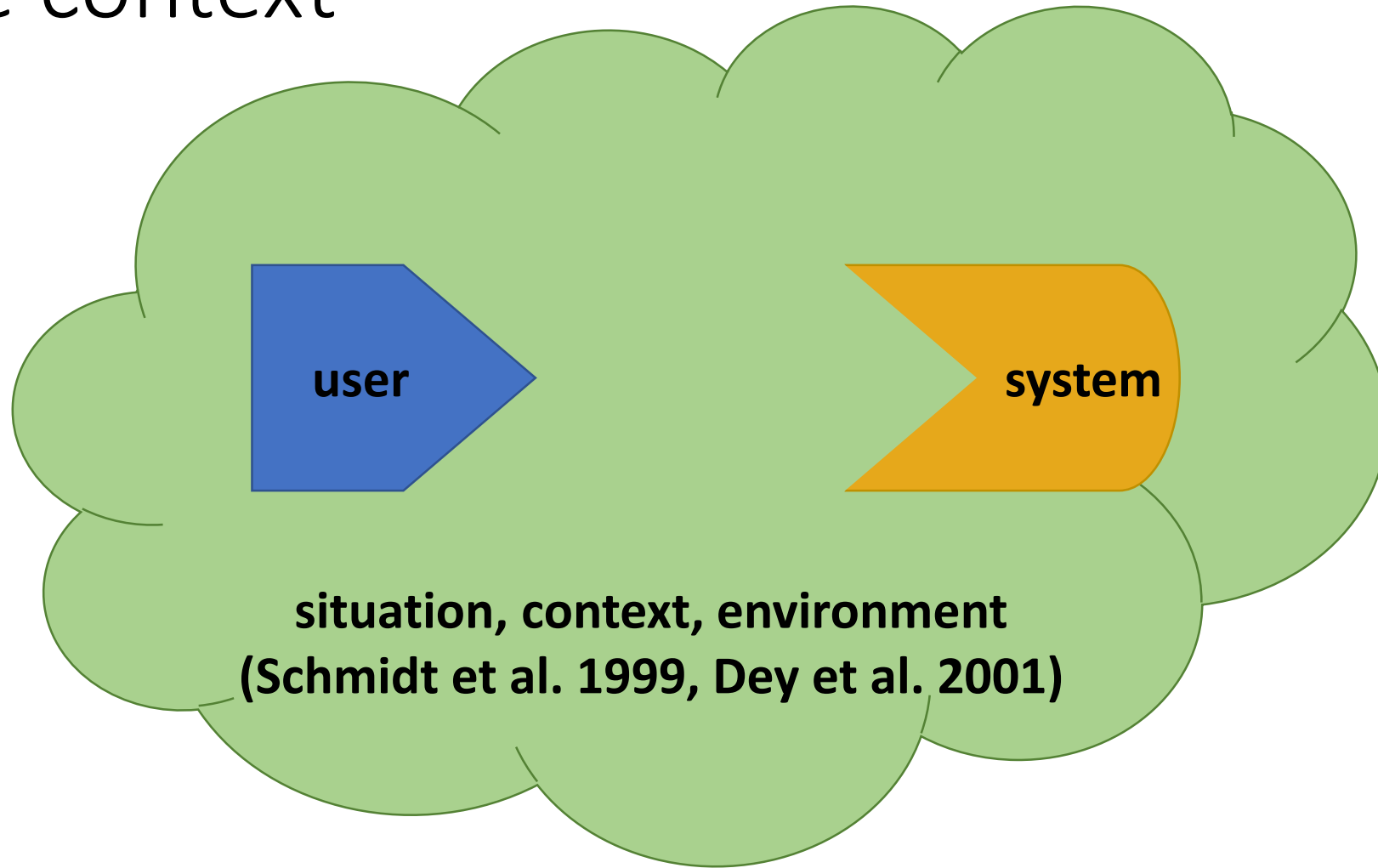
Burden of adaptation



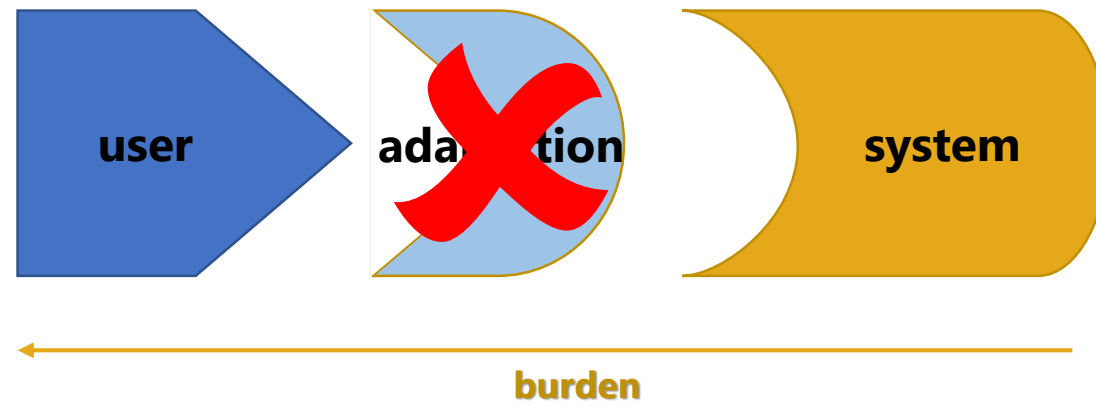
Burden of adaptation



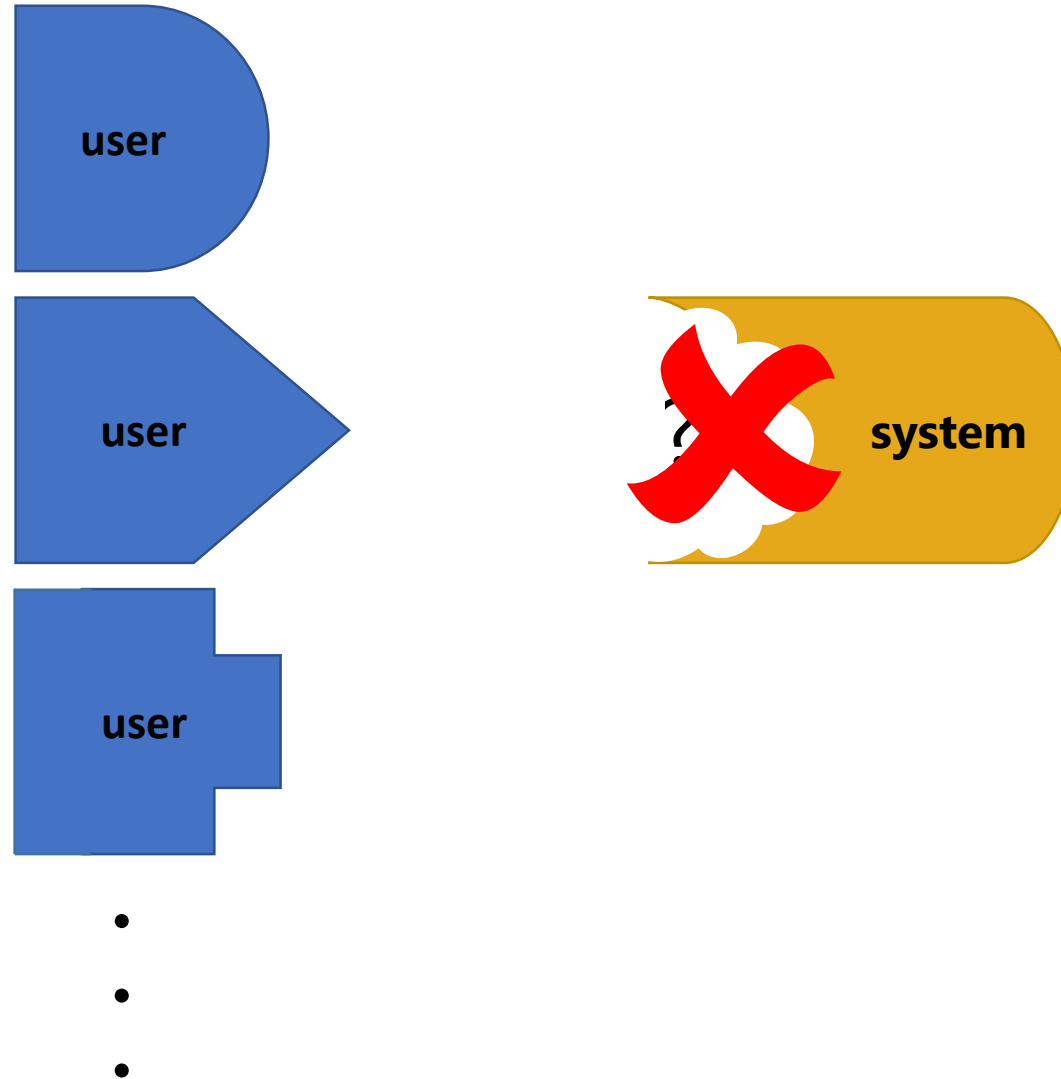
Sense context



Contrast to Assistive Technology



Contrast to Universal Design



Key takeaways

- Focus on **ability** rather than **disability**
- Understand that ability is **always changing** and is influenced by **context**
- Ability assumptions are embedded in **all** technologies
- Try to remove the burden of adaptation from the user

Any questions?

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