FHV
Vorarlberg University
of Applied Sciences

Beyond the Screen: HCI and Accessibility in the Immersive Web

(Dr. Peter Hoffmann, November 2026,
Workshop 1 (ICT, undergraduate))

WhoAmI?

BERGISCHE UNIVERSITÄT WUPPERTAL

Fraunhofer IGD

UNIVERSITÄT ZU LÜBECK

Universität Bremen TZI

Story telling | Multi media | Hyper media

FOM Die Hochschule. Für Berufstätige.

Vorarlberg University of Applied Sciences



invisible-cow.de/lehre

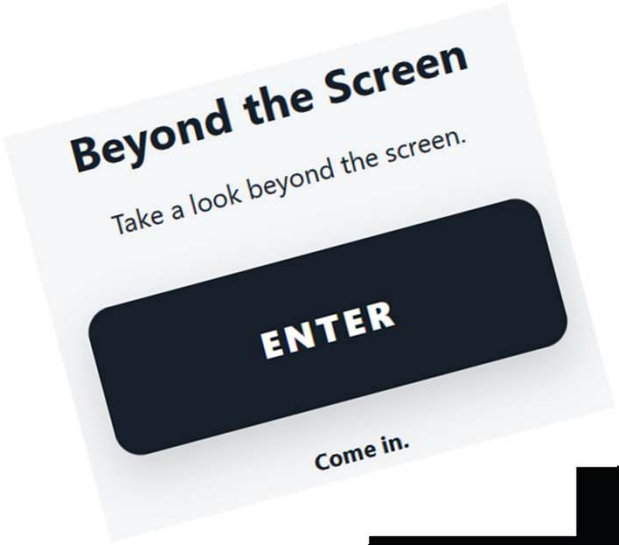
peter.hoffmann@fhv.at

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1 - Can you use it?

Exmple A: „The Button“

https://invisible-cow.de/lehre/immersive-workshops/beyond-the-screen/example-button.html



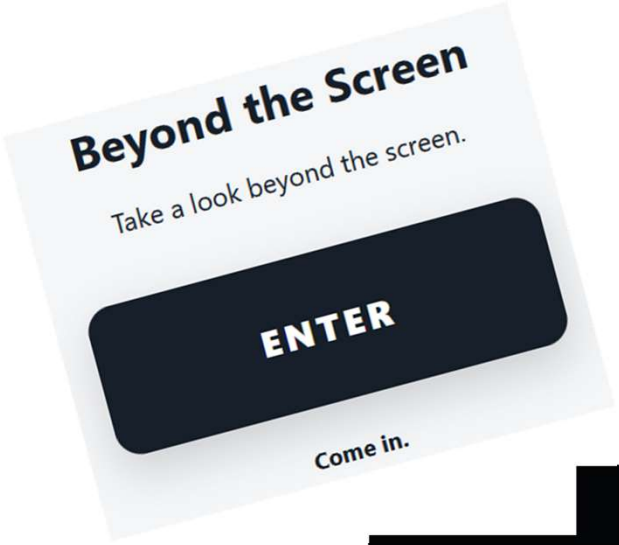
1 - Can you use it?

Example A: „The impossible Button“

→ What did you expect to happen ?

→ What actually happened ?

→ Who made the mistake - you or the interface ?



1 - Can you use it?

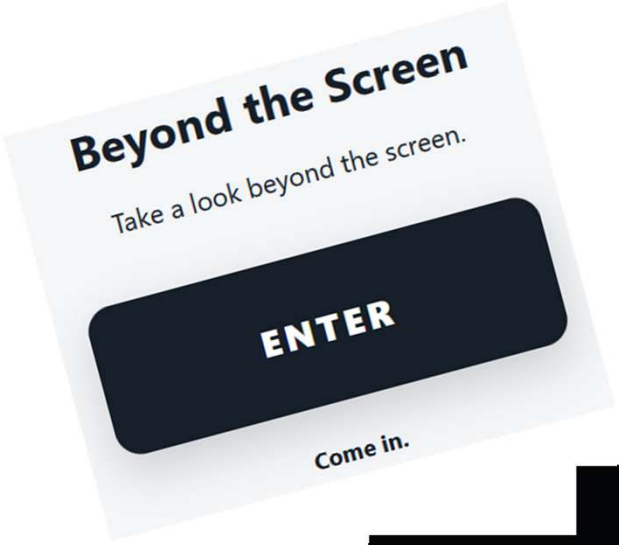
Example A: „The impossible Button“

→ Affordance: ?

→ Mapping: ?

→ Feedback: ?

→ Error prevention: ?



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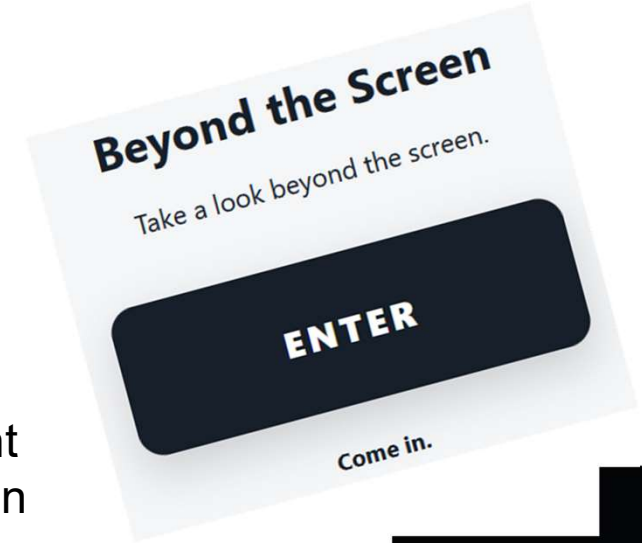
Example A: „The impossible Button“

→ Affordance: The design of a control element should suggest how it can be used or interacted with.

→ Mapping: The relationship between a user action and the resulting system response should be clear and intuitive.

→ Feedback: The system should respond to a user action immediately and in an understandable way.

→ Error prevention: The user interface should be designed to prevent errors from occurring in the first place, rather than merely assisting the user in fixing errors after they have happened.



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1 - Can you use it?

Example B: „The Objekt“

Select the red cube.

https://invisible-cow.de/lehre/immersive-workshops/beyond-the-screen/ example-object.html



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1 - Can you use it?

Example B: „The Objekt“

Select the red cube.

A rather trivial task ;)

… but: The cube is located behind the user and thus outside their initial field of view.

→ Actually still a trivial problem ;)

→ … yet it highlights a fundamental difference:

→ On a screen, we only have two dimensions.



1 - Can you use it?

Example B: „The Objekt“

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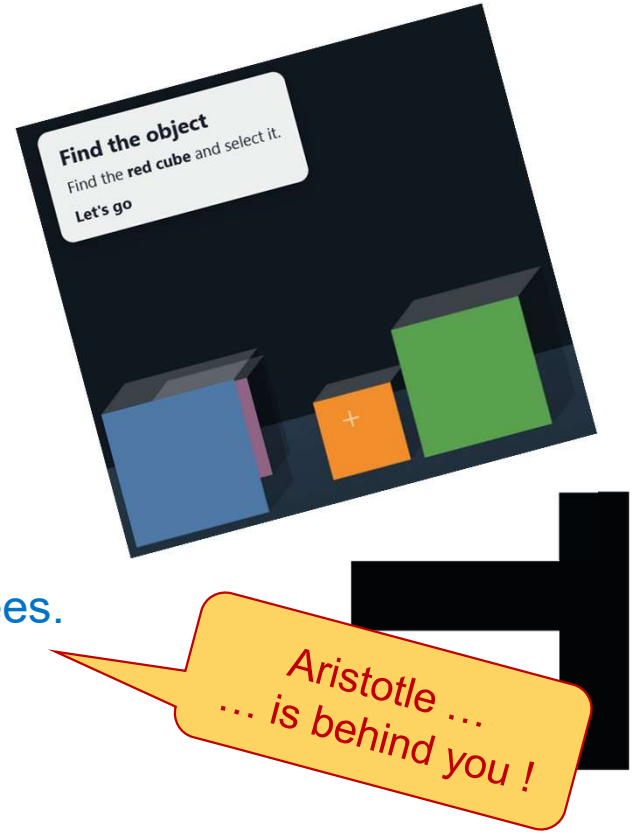
… but: The cube is located behind the user and thus outside their initial field of view.

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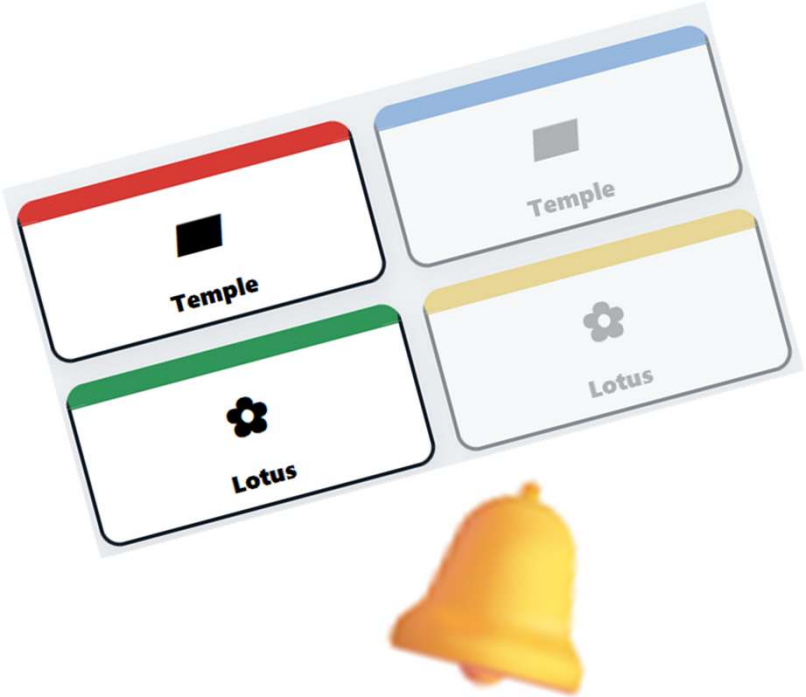
→ On a screen, the designer generally controls what the user sees. In an immersive environment, that is not the case.



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1 - Can you use it?

Example C-1: What now ?



https://invisible-cow.de/lehre/immersive-workshops/beyond-the-screen/ example-and-now.html

1 - Can you use it?

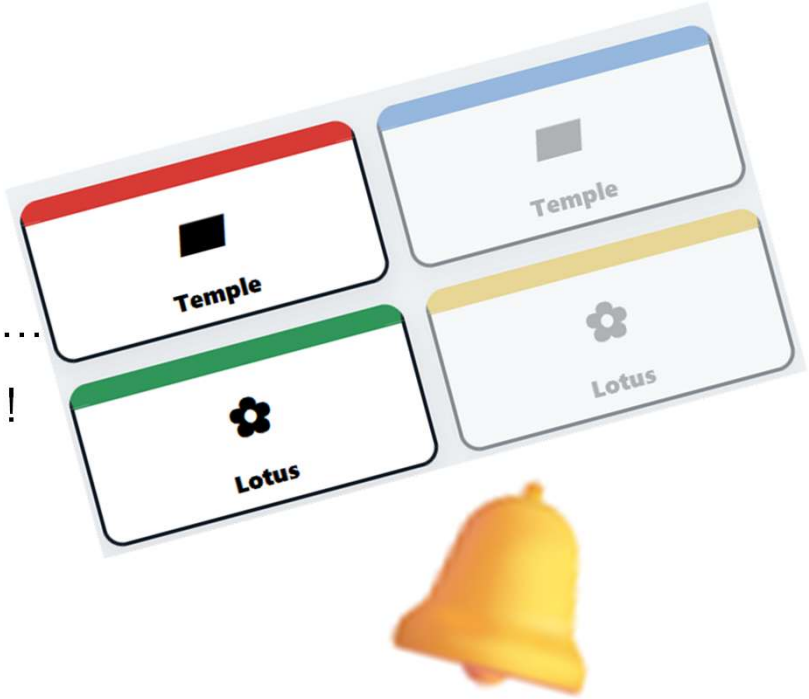
Example C-2: What now ?

→ The problem here is NOT the design!

→ The challenges here are…

… first and foremost, the different modality, and…

… getting accustomed to this different modality !



https://invisible-cow.de/lehre/immersive-workshops/accessories/ws01-example-und-nun.html

2 - What makes an interface usable?

A bit of theory

→ The classic system:



→ Basic HCI principles:

?

2 - What makes an interface usable?

A bit of theory

→ The classic system:



→ Basic HCI principles:

Visibility	Do I recognize what I can do?
Affordance	Do I understand what I can do?
Feedback	Do I know what is happening?
Consistency	Does the system behave the way I expect it to?
Error prevention	Does the system help me avoid errors?
Control	Can I undo, stop, or exit?

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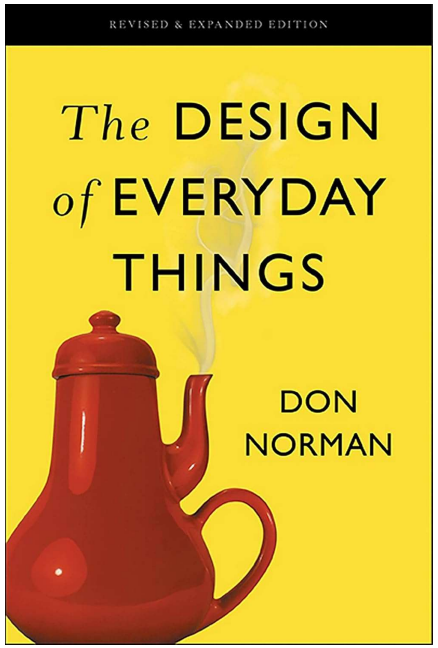
2 - What makes an interface usable?

A bit of theory

→ The classic system: Human ↔ Interface ↔ System

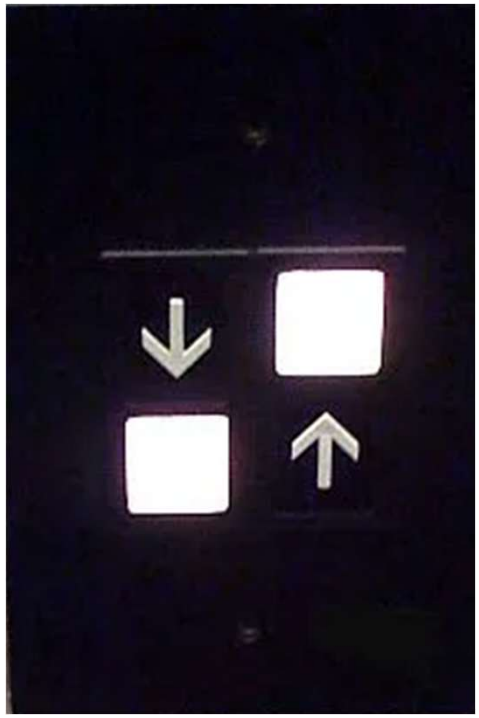
→ Don Norman: The Design of Everyday Things (1988)

„Good design makes it clear what users can do,
how they can do it,
and what happened after they did it.“



2 - What makes an interface usable?

Discussion (i / ii)



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2 - What makes an interface usable?

Discussion (ii / ii)



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3 - From GUI to Spatial UI !

History: Desktop → Mobile → 3D → Spatial

→ With each step, not only does the presentation change, but so does the form of interaction.

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3 - From GUI to Spatial UI !

History: Desktop → Mobile → 3D → Spatial

→ With each step, not only does the presentation change, but so does the form of interaction.

→ Desktop: Keyboard, mouse (pointer, windows, buttons)
→ The user sits in front of a clearly defined interface (a window or screen)

→ Mobile: Touch (gestures), device sensors (e.g., camera)
→ The physical context becomes part of the interaction

→ 3D Web: Virtual Camera → Scene → Objects → Raycasting Raytracing → Navigation
→ The user moves a virtual camera through a space

→ VR/ AR: Head, hands, body, voice, physical environment
→ In immersive HCI, the user's body as well as the "real" environment become part of the interface.

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4a - What is an Immersive Environment ?

Immersive Environments are … ?

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4a - What is an Immersive Environment ?

Immersive Environments are digital or digitally enhanced spaces
in which users experience information spatially and interact with it,
rather than doing so solely via a 2D interface.

Characteristics:

- → Spatial: Objects and information have a position in 3D space
- → Interactive: Users can navigate, as well as select and manipulate objects
- → Embodied: Head, hands, gaze direction, voice, or body movements can serve as input
- → Responsive: The environment reacts to the user's actions and position

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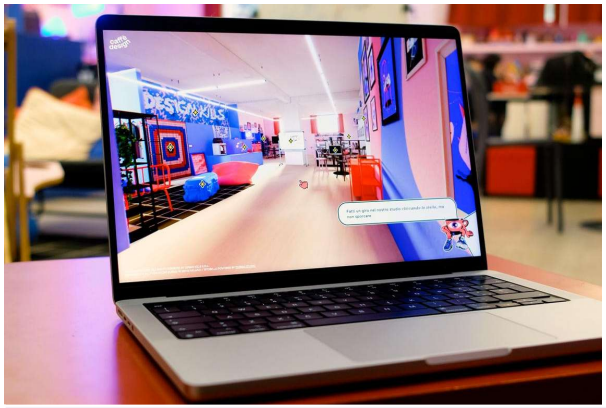
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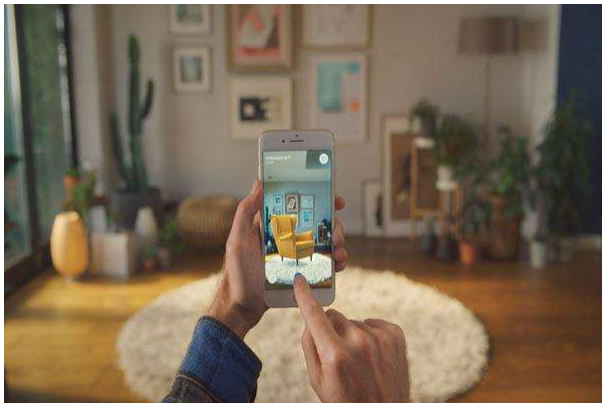
→ Traditional interface: User → On the Screen → 2D Content

→ Immersive environment: User → In the Scene → Spatial Content

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4a - Immersive does not necessarily mean VR







3D / Spatial Web	Augmented Reality	Virtual Reality
Digital 3D environment on the screen	Digital content integrated into the physical environment	User immersed in a virtual environment
Mouse, touch, keyboard, etc.	Smartphone, glasses, gestures, etc.	Headset, controller, hands, etc.
e.g. virtual museum	e.g. virtual object in a real room	e.g. immersive museum

4b - Challenges in immersive environments

?

4b - 5 Challenges in immersive environments

1 Navigation

→ How do I get there?

→ Teleportation, walking, flying, joystick control … ?

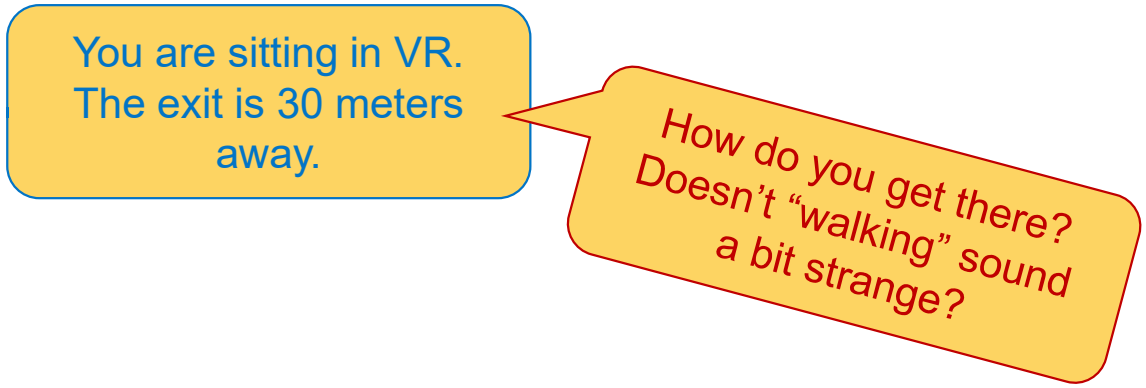
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4b - 5 Challenges in immersive environments

1 Navigation

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4b - 5 Challenges in immersive environments

2 Selecting

→ How do I select something?

→ Mouse clicking no longer works.

→ Touch - Ray - Gaze - Hand Tracking - Voice

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4b - 5 Challenges in immersive environments

2 Selecting

→ How do I select something?

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→ Touch - Ray - Gaze - Hand Tracking - Voice

In VR, select a small virtual button located three meters away.

Which method works?

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4b - 5 Challenges in immersive environments

3 Manipulation

→ How do I change something?

→ Grab, rotate, move, or scale an object.

→ 2D interaction using a mouse vs. 3D interaction using…

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4b - 5 Challenges in immersive environments

4 Feedback

→ Did it work?

→ An object was clicked.

But: → Did I hit it?
→ Is it selected?
→ Is something loading?

→ Options: ?

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4b - 5 Challenges in immersive environments

4 Feedback

→ Did it work?

→ An object was clicked.

But: → Did I hit it?
→ Is it selected?
→ Is something loading?

→ Options: Visual + audio + haptic feedback

Redundant feedback is not only convenient,
but can also help reduce barriers.

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4b - 5 Challenges in immersive environments

5 Orientation

→ Where am I?

→ A classic interface, for example, includes:

Back button – Home page – Menu – Scroll bar

→ What is the equivalent in a virtual space?

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4b - 5 Challenges in immersive environments

5 Orientation

→ Where am I?

→ A classic interface, for example, includes:

Back button – Home page – Menu – Scroll bar

→ What is the equivalent in a virtual space?

→ Where am I ?
→ Where did I come from ?
→ Where can I go ?
→ How do I get back ?

The „Back“ dilemma

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5 - When Immersion Goes Wrong

- → Cybersickness
  - → artificial movement conflicts with physical perception
- → Disorientation
  - → the user no longer knows where they are located
- → Interaction and information overload
  - → too many objects, gestures, or interaction options
- → Physical fatigue
  - → the “gorilla arm” effect during prolonged spatial interaction
- → Lack of feedback
  - → the user does not know whether their action has been recognized



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5 - When Immersion Goes Wrong

- → Cybersickness
- → Disorientation
- → Interaction and information overload
- → Physical fatigue
- → Lack of feedback

➔ greater immersion does not automatically mean better usability.

➔ **immersion ≠ good interaction**

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6 - What if …

What if the user …

… cannot see ?

… cannot hear ?

… cannot use both hands ?

… cannot move their head ?

… cannot stand ?

… cannot speak ?

… cannot use a VR headset ?

6 - What if …

Reducing issues related to …

… visual accessibility:
→ contrast, colors, text size, depth perception, screen readers, alternative descriptions

… auditory accessibility:
→ subtitles, visual cues, transcription

… motor accessibility:
→ alternative input methods, one-handed interaction, eye tracking, voice, reduced physical movement requirements

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6 - What if …

Reducing issues related to …

… cognitive accessibility:
→ simple navigation, reduced complexity, clear language, orientation aids

… technical accessibility:
→ What happens in the absence of a headset, a high-end PC, a controller, or a fast internet c…nection?

→ Accessibili…

A WebXR …
with a spec… potential !

➔ Accessibility is also about access to technology !

A WebXR application that can only be used effectively with a specific VR headset squanders a large part of its potential !

7 - Accessibility Challenge: The Bad Museum

Take a look at the following example
(feel free to do so in groups).

https://invisible-cow.de/lehre/immersive-workshops/beyond-the-screen/ example-bad-museum.html

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7 - Accessibility Challenge: The Bad Museum

Take a look at the following example
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→ What did you notice in the process ?

→ What would you improve ?

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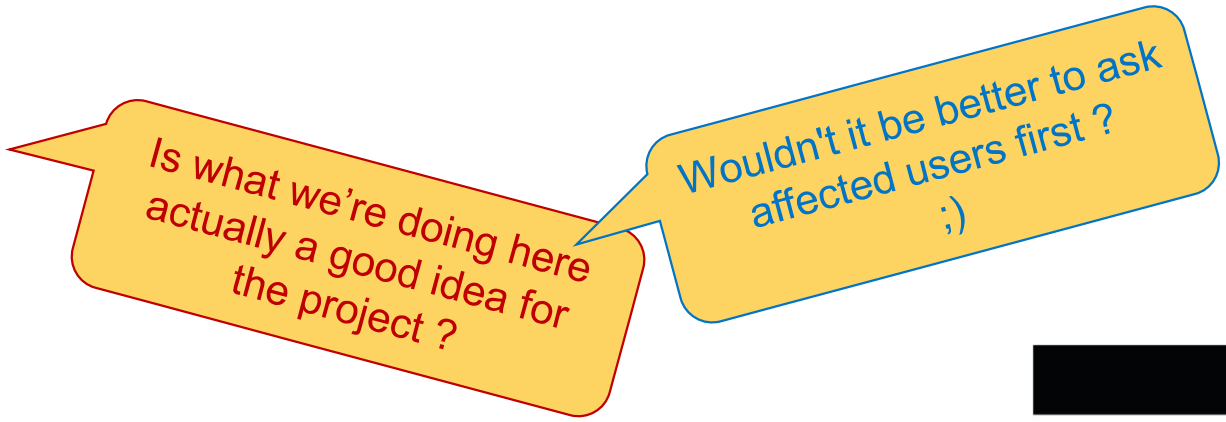
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7 - Accessibility Challenge

Don't fix it !

➔ Understand it !

The first step should be to try and understand what the problem actually is !

→ While this applies to any problem or project, …

… it is absolutely essential when it comes to accessibility !

8 - A little self-reflection

What would you take with you as most important in Accessibility in XR ?

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9 - Usable Immersion

Immersion ≠ Good Interaction

Good immersive design is not about using as much XR technology as possible.

It is about empowering people to understand, interact, and participate !

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That‘s IT

☺

