XR for All

Accessibility and Privacy for Disabled Users

DEFCON - August 10, 2024

XRAccess.org

Speaker



Dylan R. Fox

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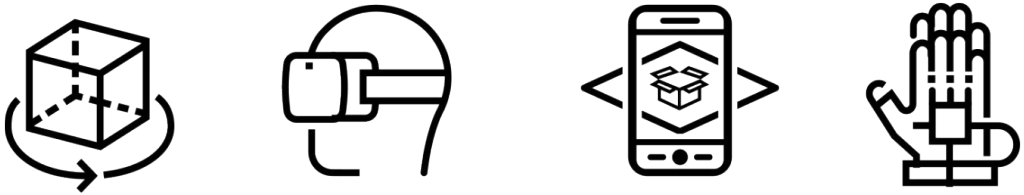
Agenda

- The XR Access Initiative
- Accessibility-Focused XR
- Privacy Risks
- Best Practices for Mitigating Privacy Risks
- Q&A

The XR Access Initiative

XR Access

A community committed to making virtual, augmented, and mixed reality (XR) accessible to disabled people.



Our History

Founded in 2019 to engage & connect XR creators.

Now a research initiative at Cornell Tech.



Photo Credit: Verizon Media

What We Do

Research Accessibility





Provide Resources

Connect Communities





Advocate & Educate

2024 XR Access Symposium

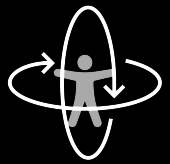
Insights from
XR Assistive Technology

June 6-7, 2024

Verizon Executive Education Center
at Cornell Tech, New York City

xraccess.org/symposium





Accessibility-Focused XR

Defining XR (eXtended Reality)

Virtual Reality (VR)



Augmented Reality (AR)



Mixed Reality (MR)

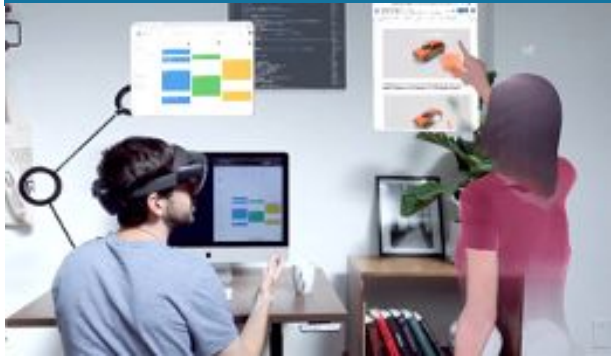


Image credits: Glue (Virtual Reality), Global Foundries / PTC (Augmented Reality), Spatial.io (Mixed Reality)

Defining Accessibility

Our **abilities** can be hampered permanently, temporarily, or situationally.

Accessible products **adapt** to what we can do at any given moment.

“We’re all just temporarily abled.”
-Cindy Li, CSS expert & accessibility advocate

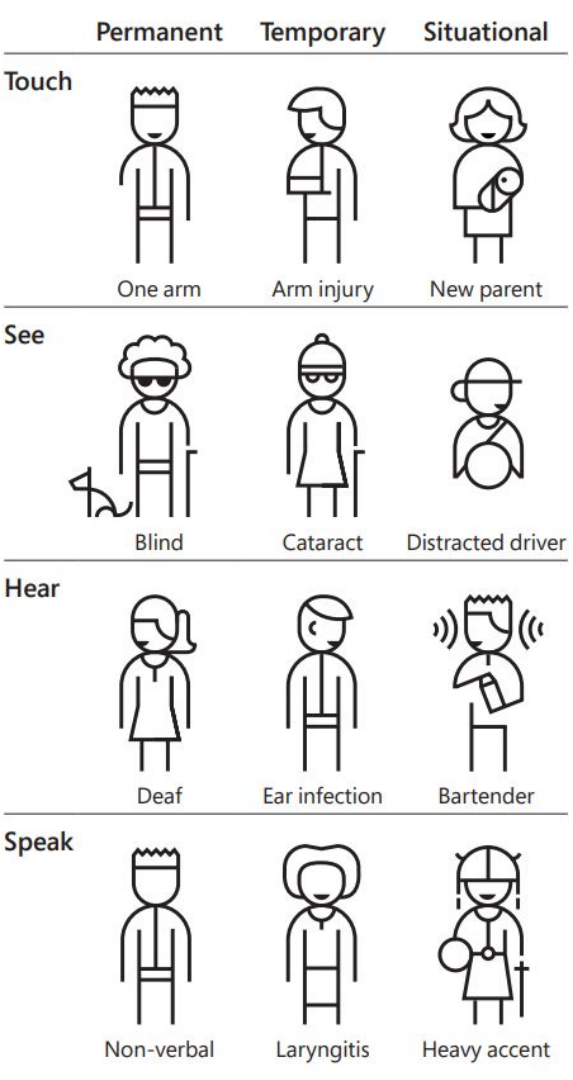


Image credit: Microsoft Inclusive Design

Perspectives on XR Accessibility

Core XR Platform Accessibility

Making every XR platform and app accessible to everyone

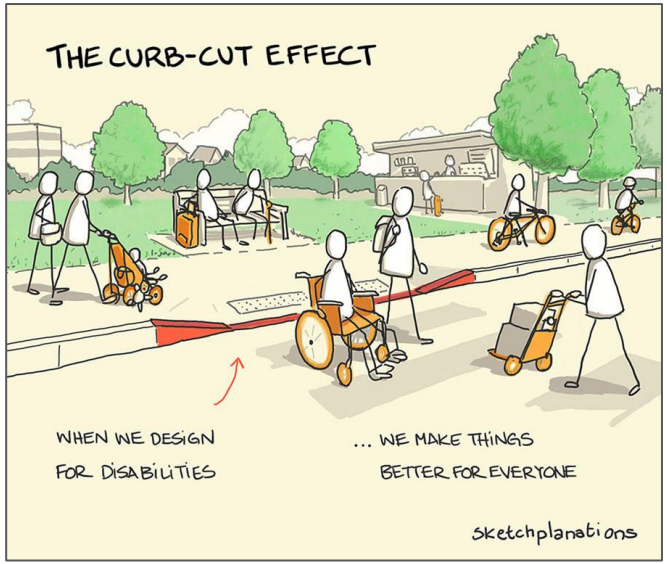


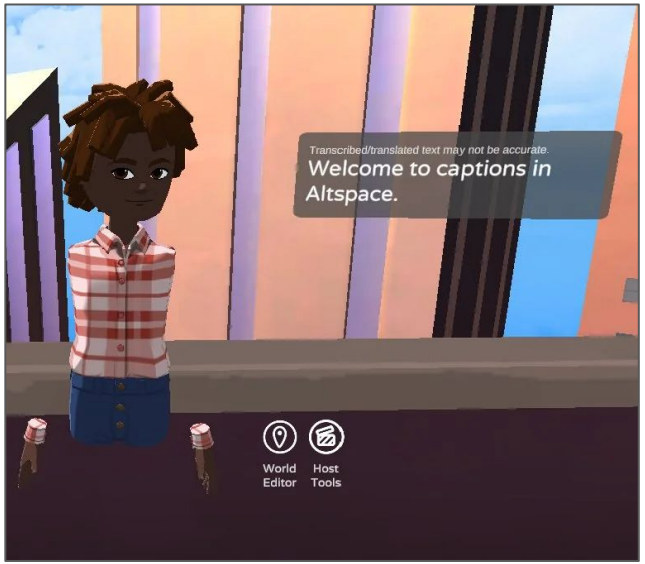


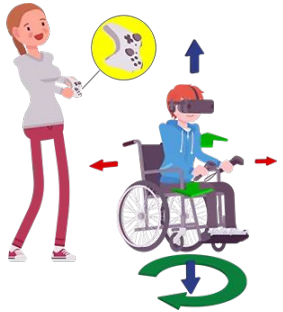
XR As Assistive Technology

Creating XR-powered technology to support disabled people

Core Platform Accessibility

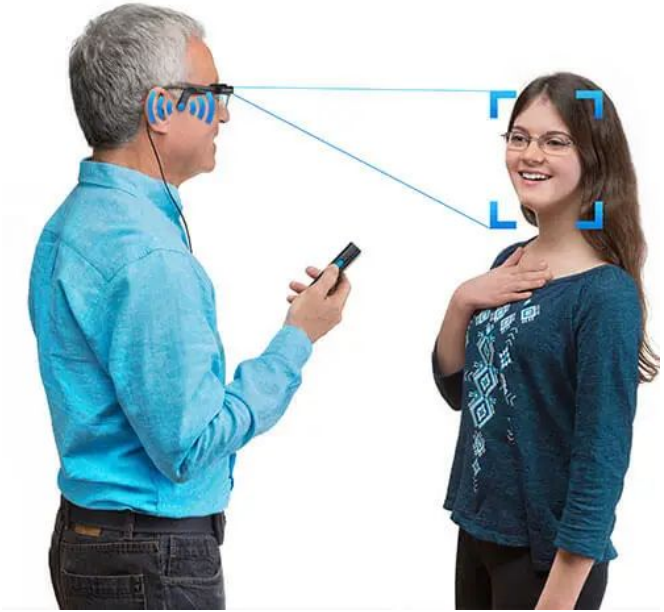








XR Assistive Technology - Machine Vision

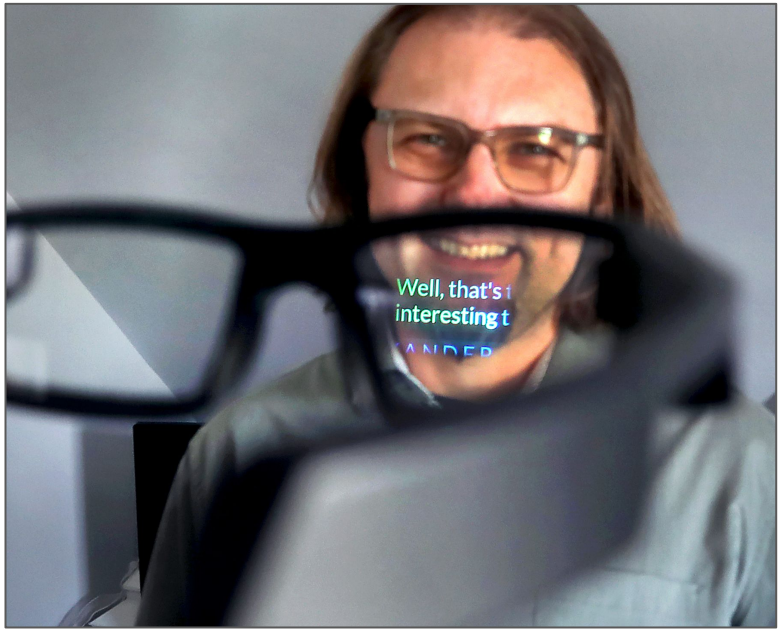


OrCam



Be My AI

XR Assistive Technology - Captioning

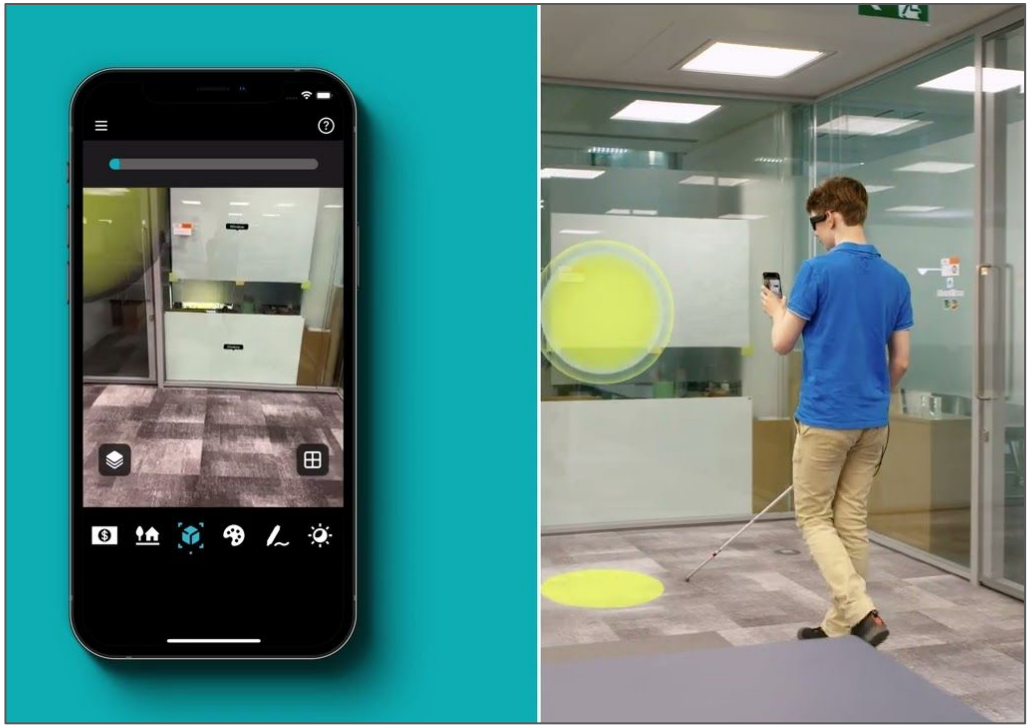


Xander Glasses



XRAI

XR Assistive Technology - Navigation



Seeing AI





AR for VIPs

Privacy Risks

The Data Vacuum



Discrete or continuous gathering of:

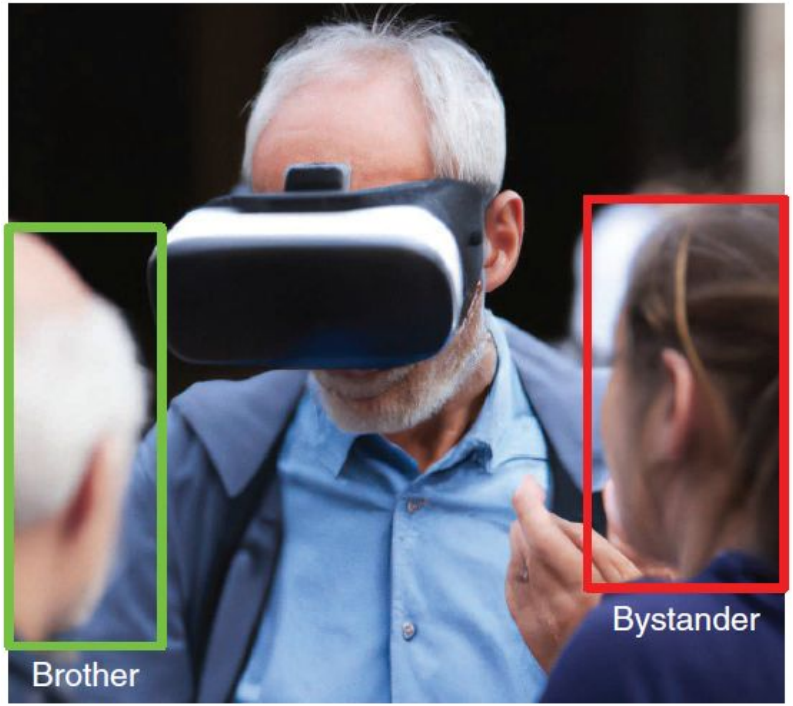
Data about **you:**

a. Gaze
b. Motion
c. Biometric
d. Location

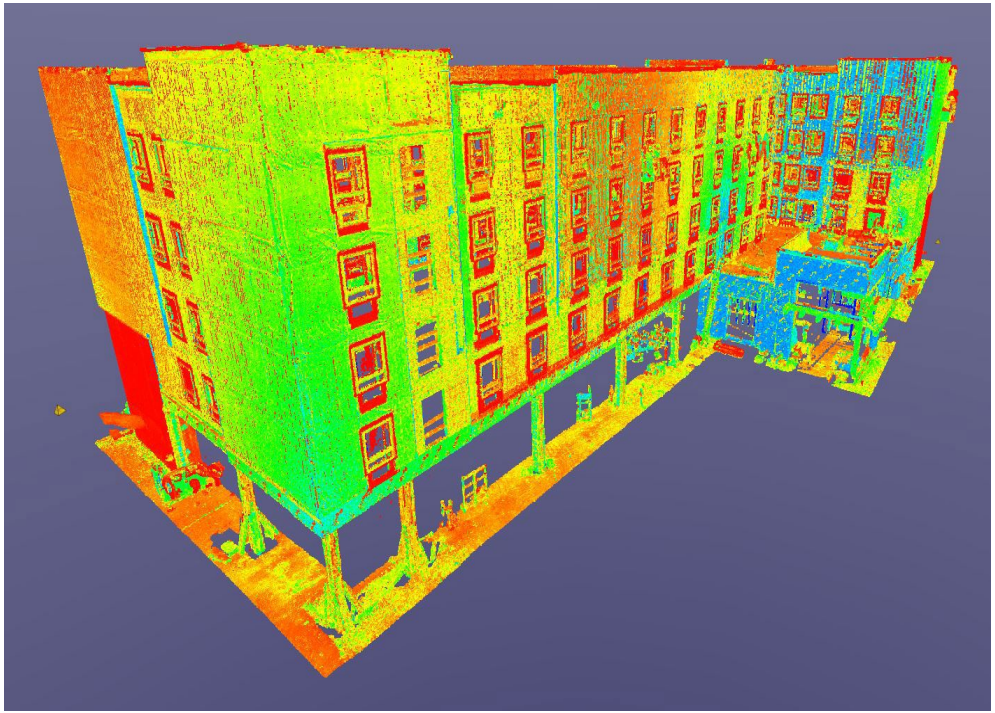
Data about **your surroundings:**

a. Visual
b. Auditory
c. Spatial
d. Temporal

Nonconsensual Recording



Bystanders *(Corbett et al)*



Private Places

Data Retention



Meta’s arctic server farm

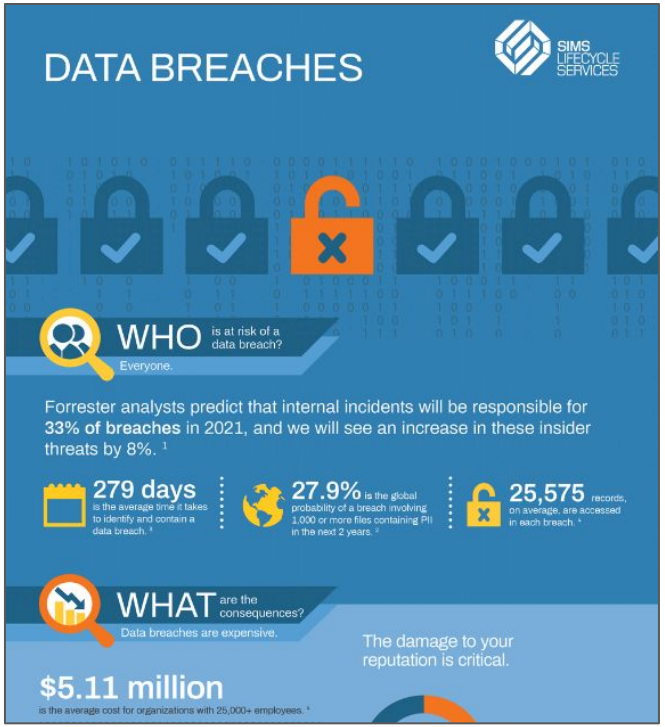


Image source: Sims Lifecycle Services

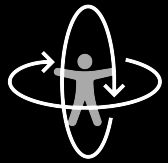
Perception Hacking



Ghost in the Shell: Laughing Man



Black Mirror: Men Against FIre

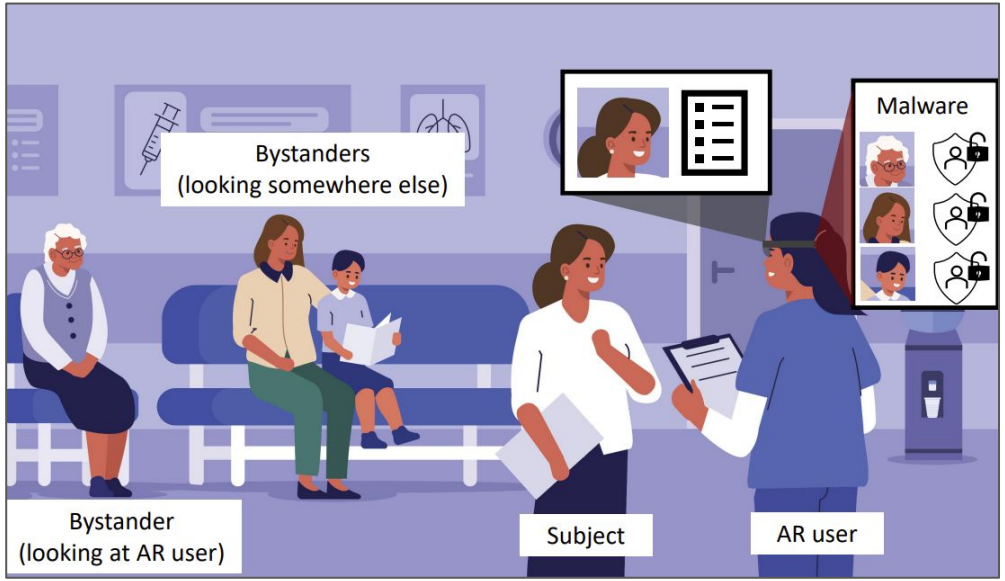


How to Have Your Cake (and Eat It Too)

On-Device Processing



Vision Pro



BystandAR *(Corbett et al)*

Data Transparency & Control

Your right to:

1. Know what data is being collected and transmitted, and for what purposes
2. Control access to your data
3. Delete data that is no longer needed



Image source: Zuar

Consent

Requesting consent

- Public disclaimers
- Recording indicators

Giving consent

- Verbal communication
- Physical or digital token
- Registration in a database

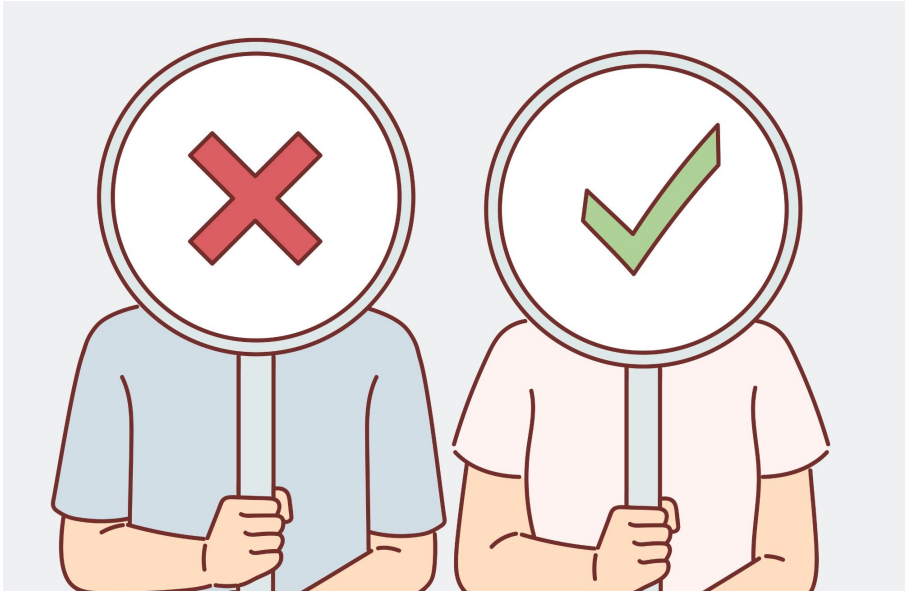


Image source: Boston University

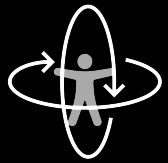
The Choice Is Ours!



Image generated by Microsoft Designer

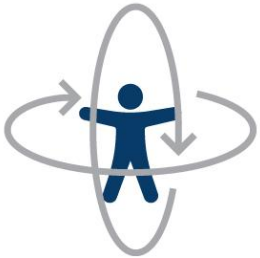
References

- M. Corbett, B. David-John, J. Shang, Y. C. Hu and B. Ji, **"Securing Bystander Privacy in Mixed Reality While Protecting the User Experience,"** in IEEE Security & Privacy, vol. 22, no. 1, pp. 33-42, Jan.-Feb. 2024, doi: 10.1109/MSEC.2023.3331649.
- Matthew Corbett, Brendan David-John, Jiacheng Shang, Y. Charlie Hu, and Bo Ji. 2023. **“BystandAR: Protecting Bystander Visual Data in Augmented Reality Systems.”** In Proceedings of the 21st Annual International Conference on Mobile Systems, Applications and Services (MobiSys '23). Association for Computing Machinery, New York, NY, USA, 370–382. https://doi.org/10.1145/3581791.3596830
- Ellysse Dick. **“How to Address Privacy Questions Raised by the Expansion of Augmented Reality in Public Spaces.”** Information Technology & Innovation Foundation, December 14, 2020.
- McGill; Mark, **"The IEEE Global Initiative on Ethics of Extended Reality (XR) Report--Extended Reality (XR) and the Erosion of Anonymity and Privacy,"** in Extended Reality (XR) and the Erosion of Anonymity and Privacy - White Paper , vol., no., pp.1-24, 18 Nov. 2021.
- **“Apple Vision Pro Privacy Overview.”** Apple, Feb 2024.



Q&A

Stay in Touch!



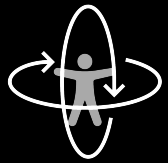
XR Access

Virtual, Augmented, & Mixed Reality for People with Disabilities

Website	Email	Resources
xraccess.org	info@xraccess.org	xraccess.org/github

Join the XR Access Research Network:

xraccess.org/research-network



Accessible Design

Curb Cut Effect

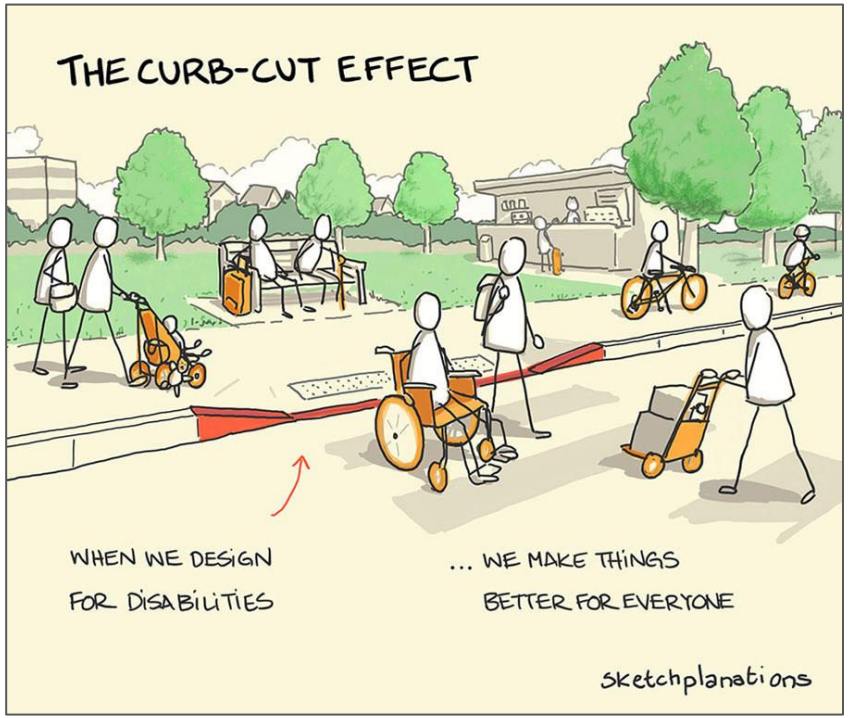




Image credit: Sketchplanations (left), PC Gamer "We love Half-Life: Alyx's Gravity Gloves (right)

Unlock New Capabilities

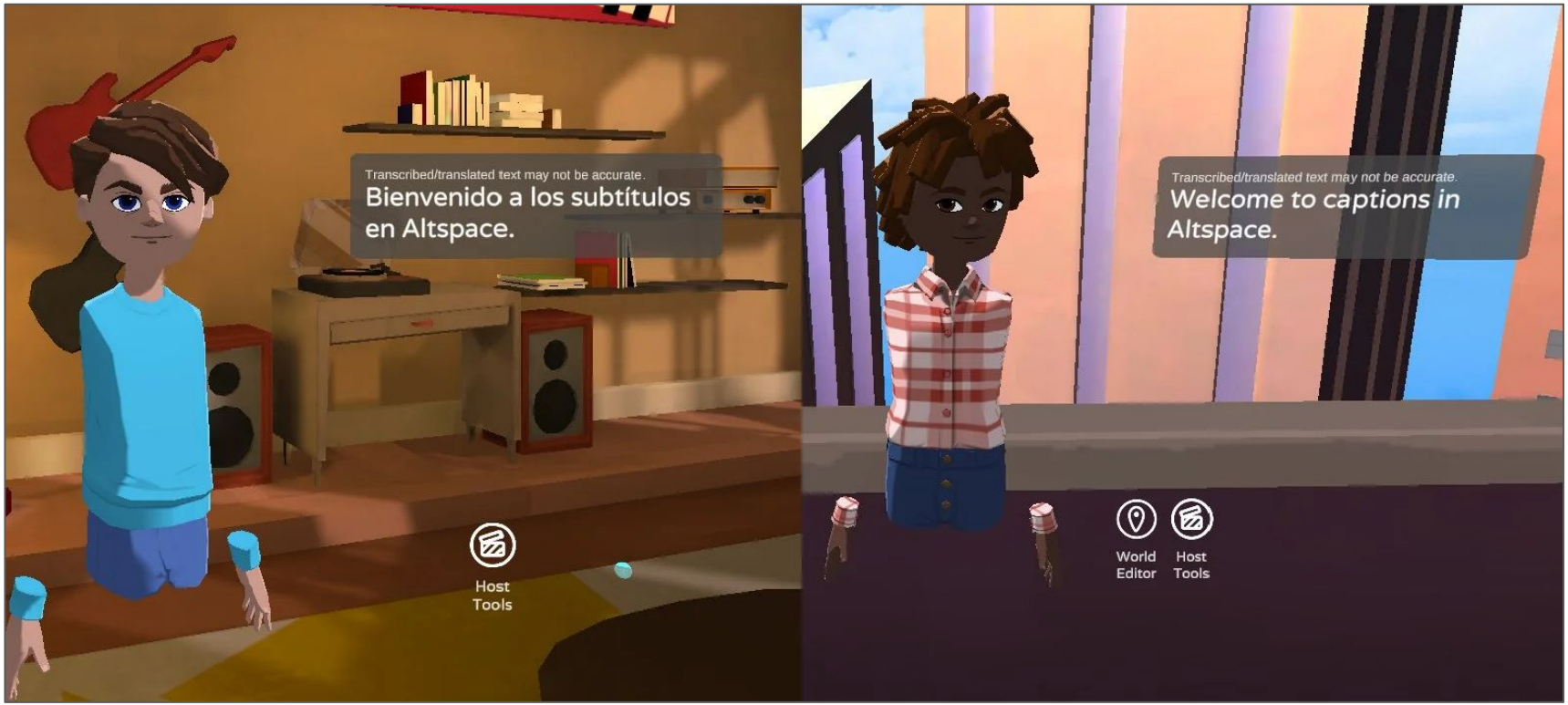


Image Credit: Altspace VR

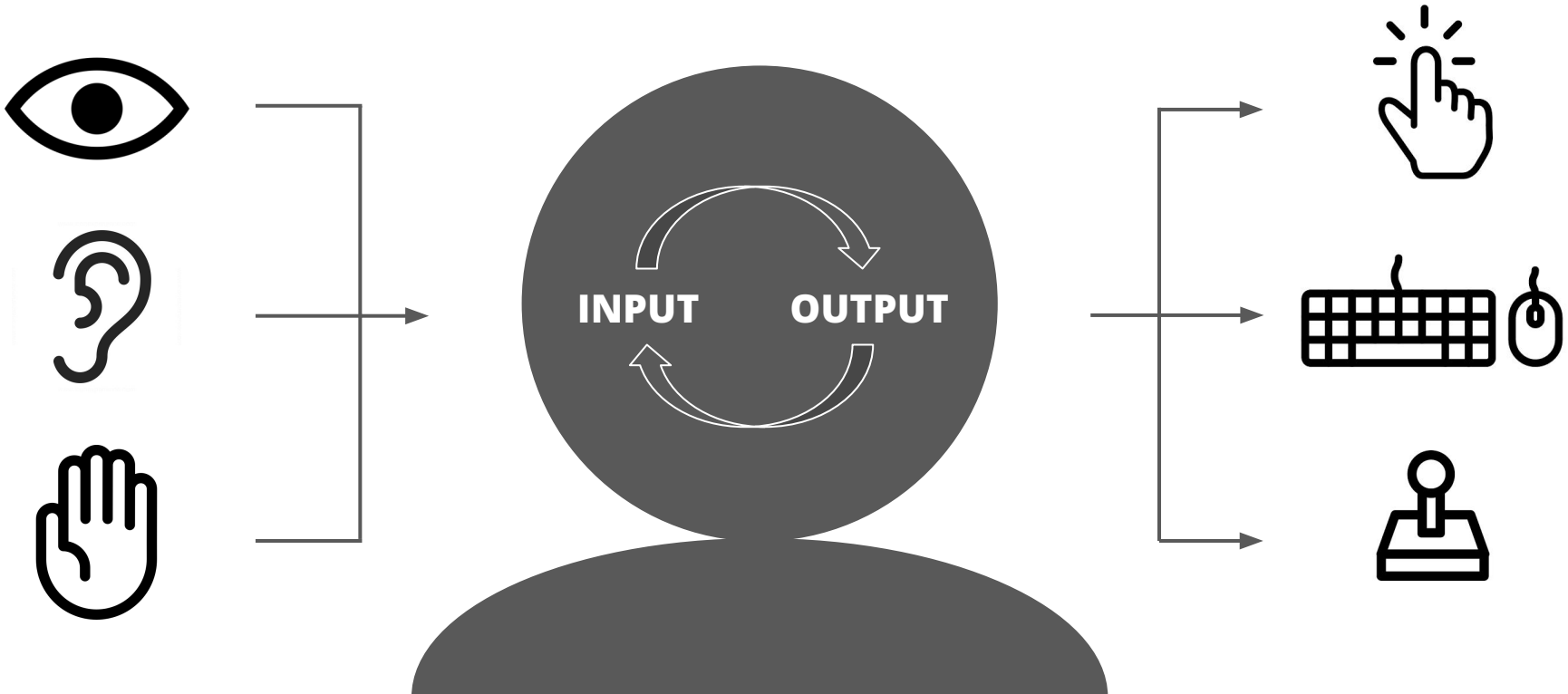
Equitable Access & Representation





Image/Video Credit: “Bringing Virtual Reality Down to Earth,” Claire Levine (left); Mictacular “How to Sign the Alphabet in ASL in VR Chat” (right)

Principle: Modularity



Principle: POUR



Perceivable	Can users perceive the system?
Operable	Can users operate on the system?
Understandable	Can users understand the system?
Robust	Is the system robust to a variety of user agents?


INCLUDOVATE
INNOVATE FOR INCLUSION
The primary commandment of inclusive disability work is
"Nothing About Us Without Us."

Vision - Universal

BAD FONT

Good font

Painful contrast

Unreadable contrast

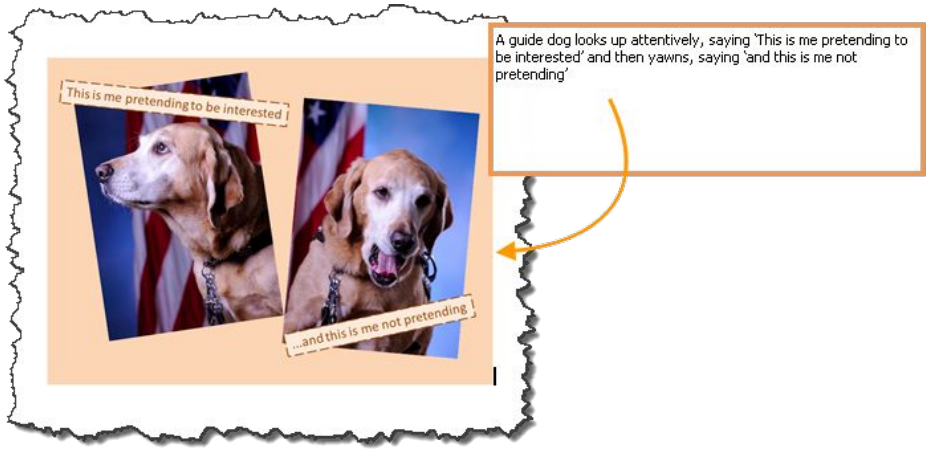


Image credit: "Missing alt text" on Social Security Administration 508 accessibility checklist.

Vision - XR

SeeingVR

Unity Plugin for Visual Accessibility

- Magnification
- Edge enhancement
- Recoloring
- Text augmentation
- Object description
- AI Support

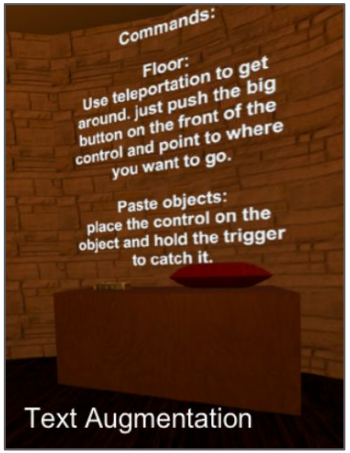
+ 8 more

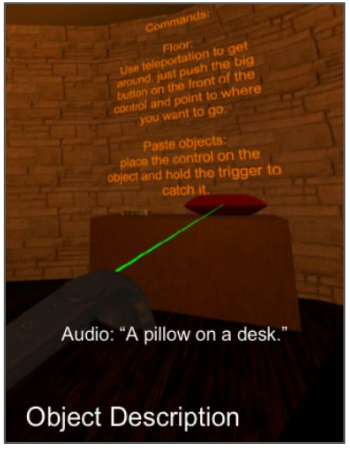
microsoft.com/en-us/research/project/seeingvr

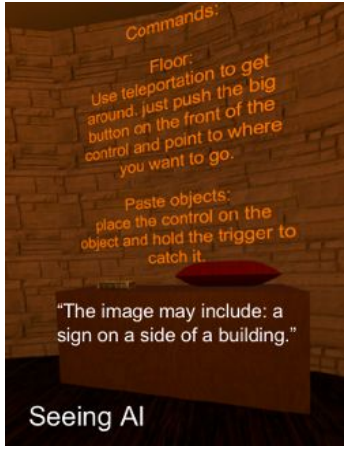












Hearing - Universal



Image credit: "[Idea] Volume sliders for sound effects & music..." from /u/Jigoku on reddit.com/r/brawlstars, Jan 2021



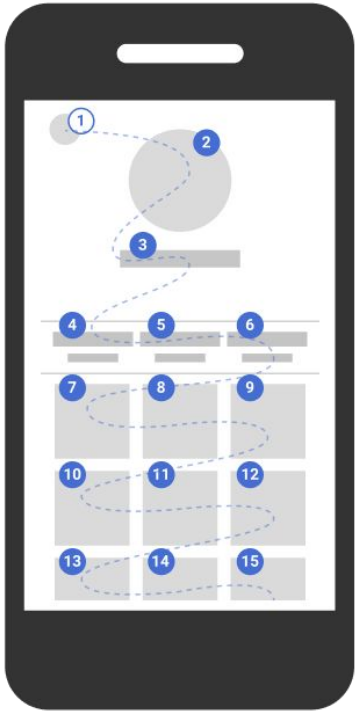
Image credit: Wistia, "Enhance Your Video Marketing Strategy with Captions"

Hearing - XR



Animation Credit: Owlchemy Labs, Vacation Simulator

Motor - Universal



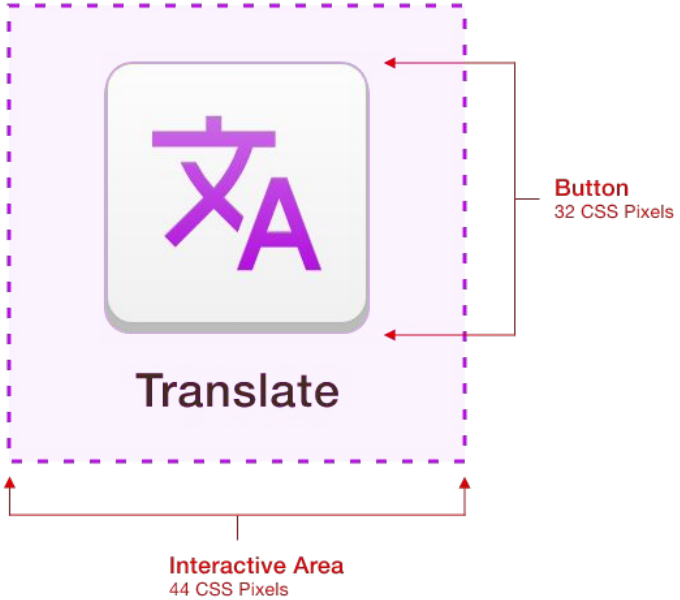




Image credits, left to right:
"Keyboard Navigation," Orange A11y Guidelines, taken May 27, 2021
A11yproject "Large touch targets", November 21, 2018
Microsoft Mixed Reality, accessed 9/23/21

Motor - XR



Animation Credit: WalkinVR

Motor - XR

WalkinVR Driver

SteamVR Plugin for Mobility Accessibility

1. Copiloting w/ able-bodied person
2. Virtual motion & rotation
3. Position adjustment
4. Tracking of disabled/spastic hands

walkinvrdriver.com

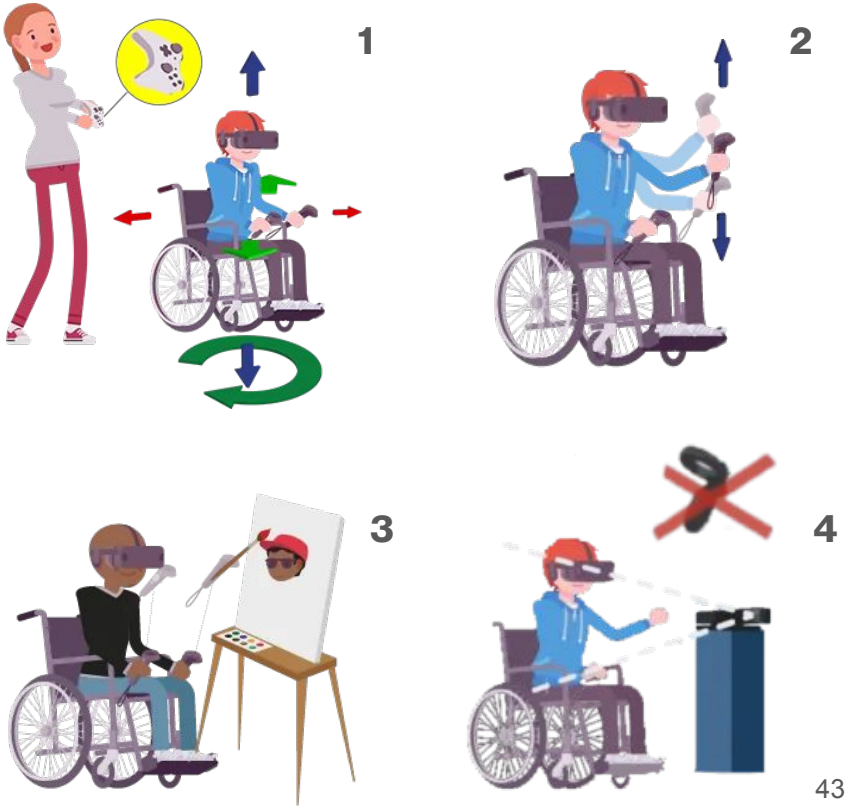
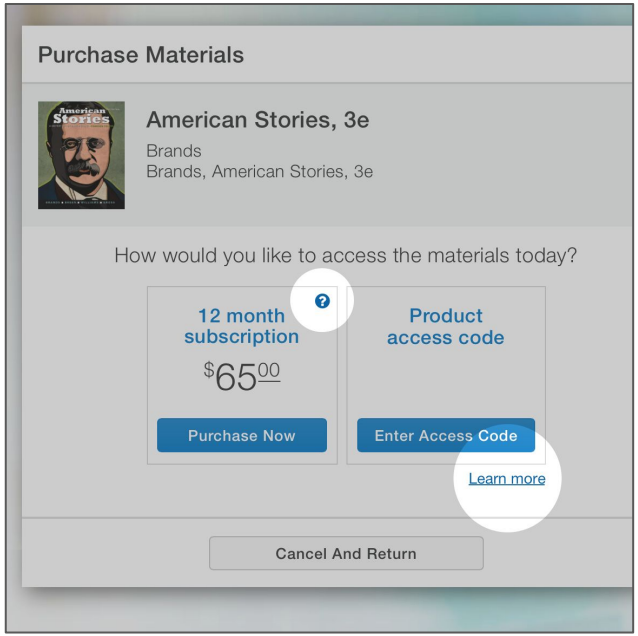


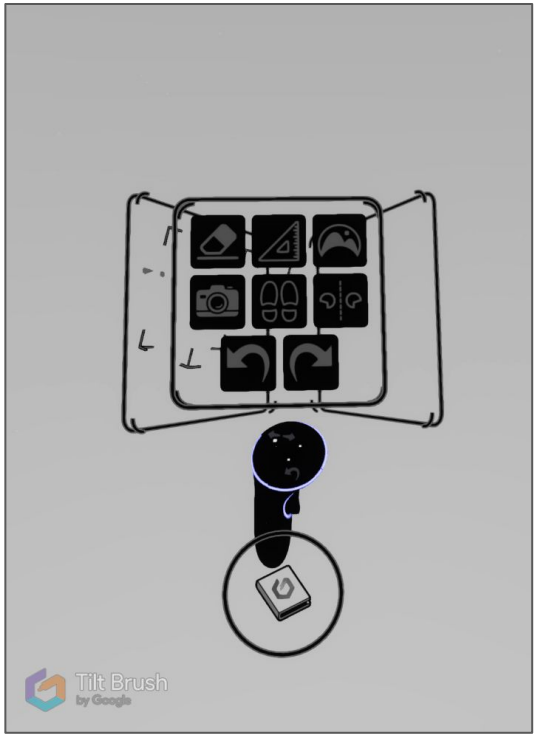
Image Credit: WalkinVR

Cognitive - Universal & XR



Contextual Help Options

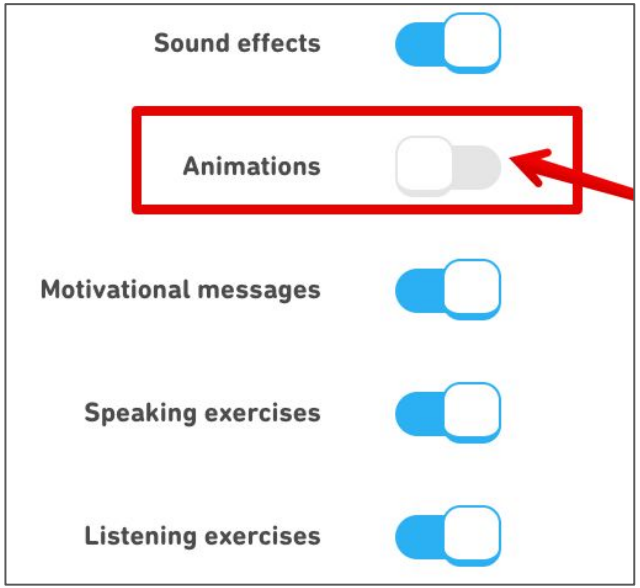
Example from Pearson "UX Framework - Embedded Activation", v2.0.0



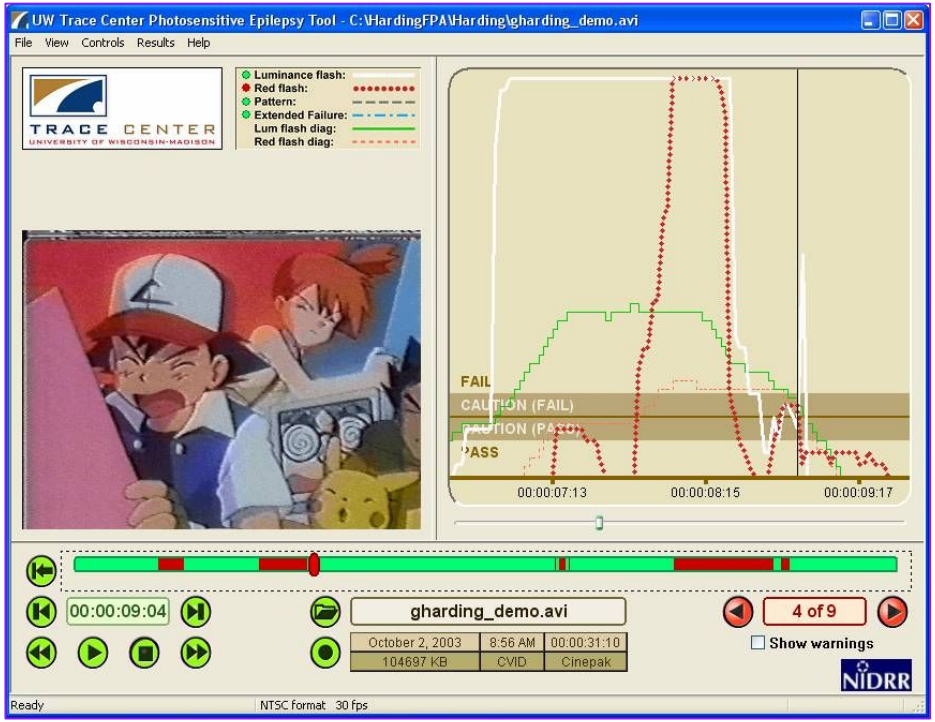
Google Tilt Brush "Beginner Mode"

Example from "Seven New Things You Can Do In Tilt Brush." Google Blog, June 26, 2018.

Sensory - Universal



Example from Duolingo "How do I enable/disable animations?" accessed 3/23/22



Example from "Photosensitive Epilepsy Analysis Tool (PEAT)," Trace Research & Development Center, accessed May 27, 2021.

Sensory - XR



Example: "HYPER-REALITY," Keiichi Matsuda. https://www.youtube.com/watch?v=YJg02ivYzSs&ab_channel=KeiichiMatsuda