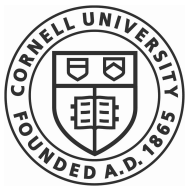
Reimagining Video Accessibility:

Exploring Immersive and Context-Aware Access with and for Blind and Low Vision People

Lucy Jiang

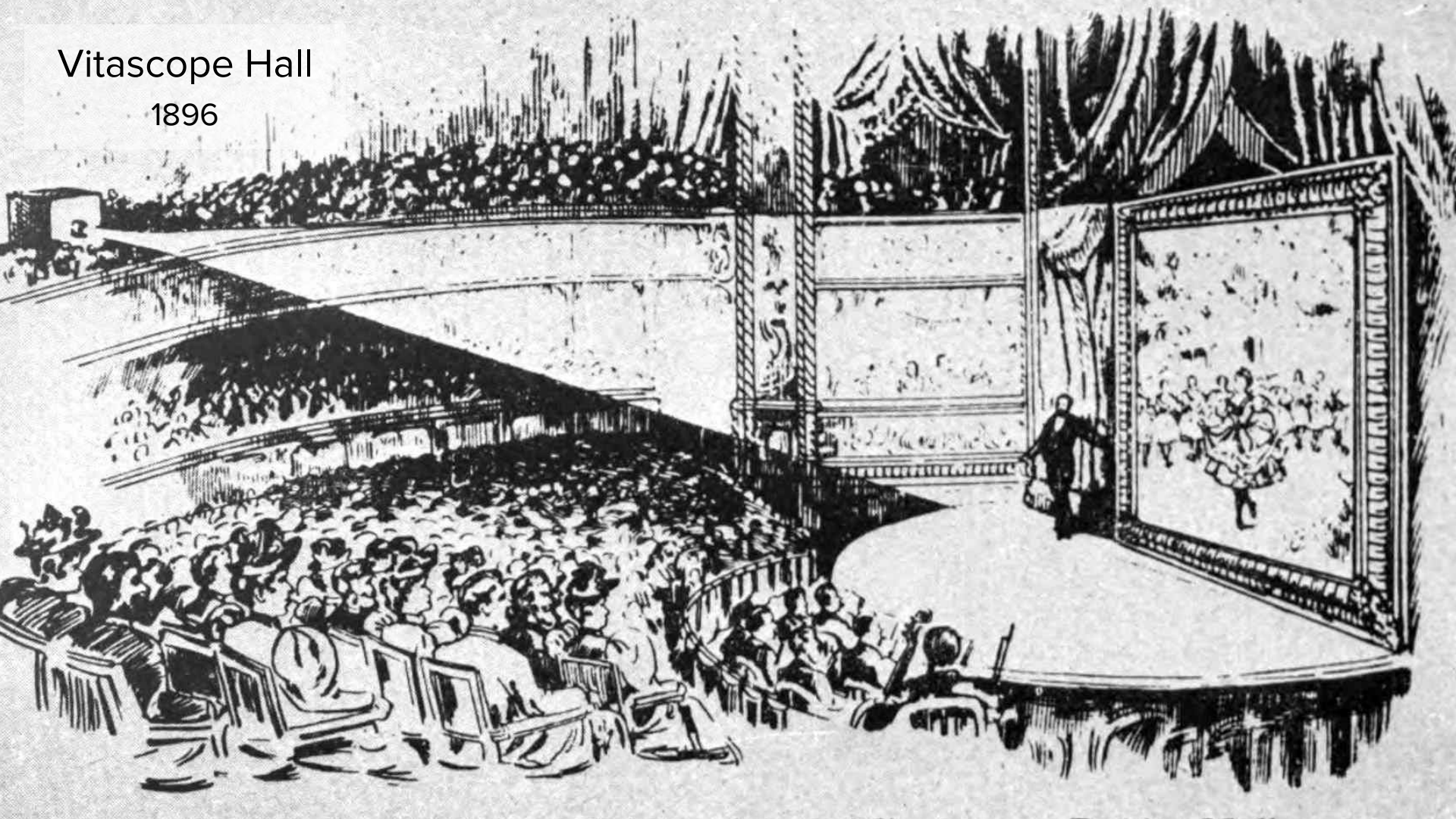
A Exam Presentation, Computer Science, Cornell University

Committee: Shiri Azenkot (chair), Aditya Vashistha, Emma Pierson



Vitascope Hall

1896




prime
video
Disney+
hulu

BLV people remain excluded from engaging with video content

How are videos currently made accessible?


AD


AD
?

Talk Outline

- 💬 **Background & Related Work**
- 💬 **360° Video Accessibility**
  - 📄 *Beyond Audio Description: Exploring 360° Video Accessibility with Blind and Low Vision Users Through Collaborative Creation*
- 💬 **Contextual Video Accessibility**
  - 📄 *“It’s Kind of Context Dependent”: Understanding Blind and Low Vision People’s Video Accessibility Preferences Across Viewing Scenarios*
- 💬 **Discussion**
- 💬 **Next Steps**

Background & Related Work

360° Videos

Orion Nebula - Google Arts and Culture

Short-Form Videos

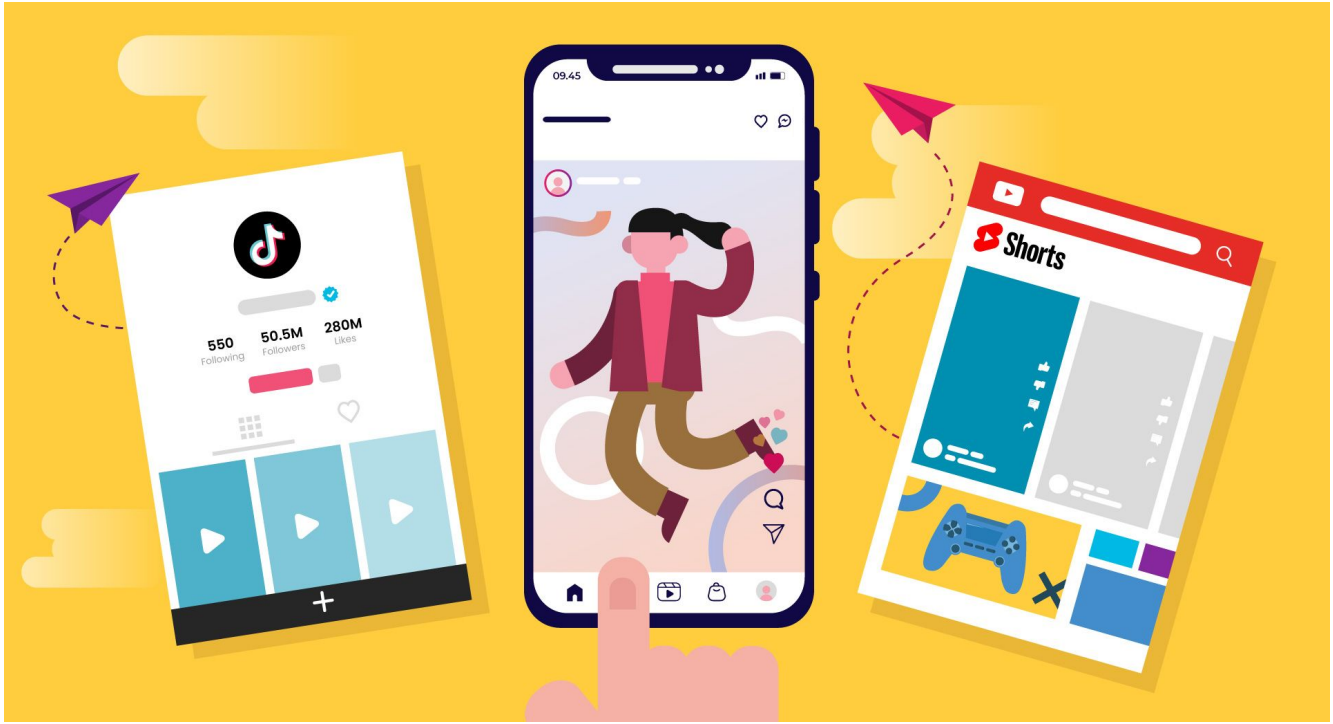


Image and Video Accessibility Research

- **Image and social media content** (e.g., Morris et al. 2018, Gleason et al. 2019)

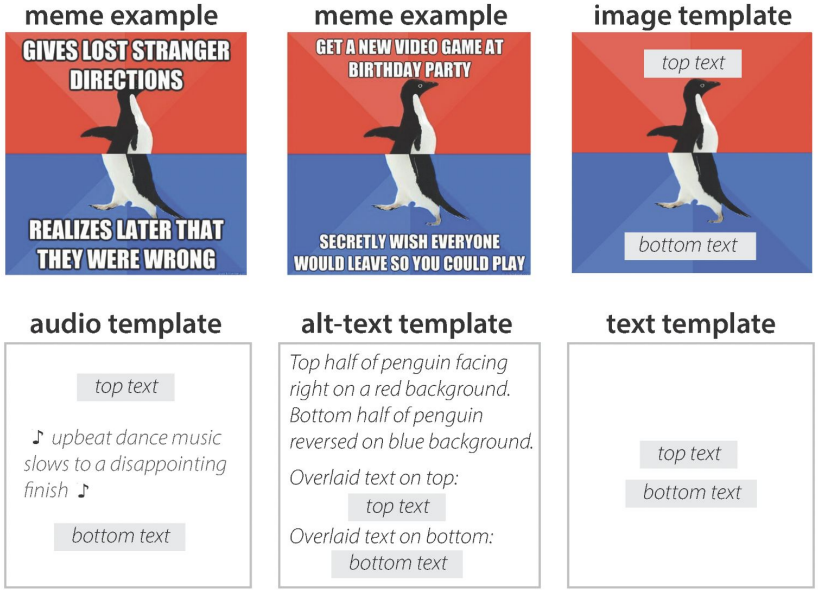


Image and Video Accessibility Research

- **Adjustments to video output** (e.g., Sackl et al. 2020)

Image and Video Accessibility Research

- **360° videos** (e.g., Fleet & Herndon 2020, Fidyka et al. 2021, Chang et al. 2022)

Image and Video Accessibility Research

- **Diverse content preferences** (e.g., Stangl et al. 2021, Wang et al. 2021)

Image and Video Accessibility Research

- **BLV description co-creation** (e.g., Muehlbradt & Kane 2021, Jiang & Ladner 2022)

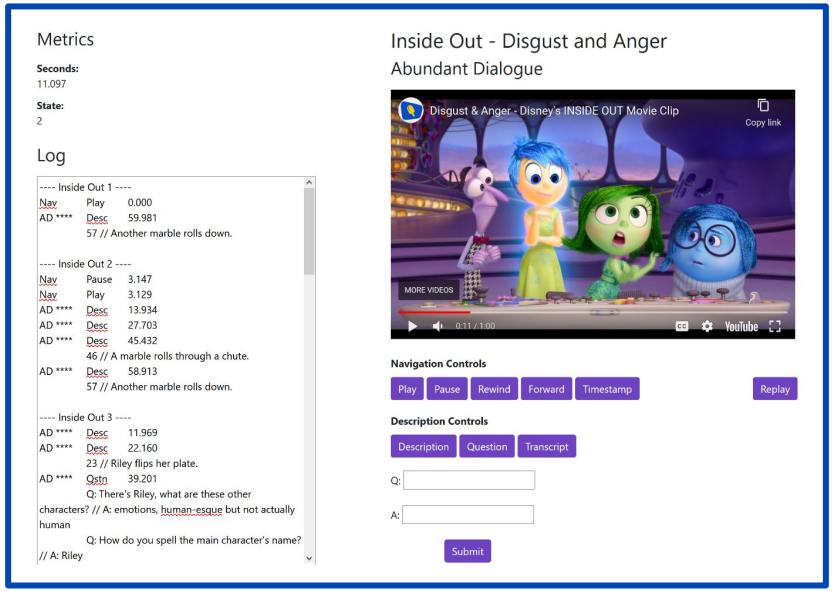


Image and Video Accessibility Research

- **Image and social media content** (e.g., Morris et al. 2018, Gleason et al. 2019)
- **Multimodal video output** (e.g., Sackl et al. 2021)
- **360° videos** (e.g., Fleet & Herndon 2020, Fidyka et al. 2021, Chang et al. 2022)
- **Diverse content preferences** (e.g., Stangl et al. 2021, Wang et al. 2021)
- **BLV description co-creation** (e.g., Muehlbradt & Kane 2021, Jiang & Ladner 2022)

However...

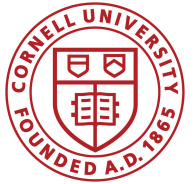
How can we make videos accessible to BLV audiences in an immersive and context-aware way?

Beyond Audio Description:

Exploring 360° Video Accessibility with Blind and Low Vision Users Through Collaborative Creation

Lucy Jiang, Mahika Phutane, and Shiri Azenkot

ASSETS 2023



Research Questions

How can we make 360° videos accessible?

Research Questions

How can we make 360° videos accessible?

- How can audio descriptions best support **accessible and immersive** 360° video viewing experiences?
- What **additional feedback** can improve accessibility and immersion for 360° videos?
- How and why should **BLV people engage in AD creation**?

Methodology

Participants

BLV AD Users	Sighted AD Creators
9	**5**

Participants

BLV AD Users	BLV AD Creators	Sighted AD Creators
4	**5**	**5**

Interviews

- Individual and virtual
- Presented 360° video probes
- Brainstormed AD styles and interactions

Design Workshops

- Collaborative and in person
- Focused on one 360° video probe
- Wrote AD script prototypes with audio cues in mixed-ability groups

Design Workshop 1
@ CSUN
5 participants

Design Workshop 2
@ Cornell Tech & Zoom
4 participants

Data Analysis

	Individual	Group	Group Interaction
Who			
What			
How			How was the group dynamic and how did that shape the outcome?

Findings

Linguistic Preferences

- Changing the AD point of view
  - First-person-plural
  - Second-person
- Characters could serve as AD narrators

“The describer is in it with me, rather than sucking me out of the show.”

(Aaron, BLV AD Creator)

Aural Preferences & Sound Design

- Spatialized AD
- Audio effects helped with exploration and agency
  - Sound and speech
  - Augmentative earcons and prompts

“Having the person be like, ‘Hey!’ … That’s really helpful, just in terms of knowing which direction to face… It’s not audio description, so you’re still in the moment.”

– Amber, blind AD narrator

As Mario, we watch Luigi, a tall thin plumber with a large mustache in a green hat, in a tub plunging a bathtub drain.

Suction cup plunging and ***spatialized AD***

Multisensory Interactions

- Haptic / tactile feedback
  - Touch tours
  - Inspired by video games
  - Access for deafblind users
- Smell / taste were not critical

“Haptics are a great way to imply very loud sounds... being ducked or slightly sacrificed for the sake of narration.”

(Stacy, Sighted AD Creator)

Including BLV AD Creators

- BLV experts contributed unique insights
  - Detailed questions about characters
  - Discussions about the inaccessibility of existing media
- AD creation is a collaborative effort

“What is the coloring, or what is the style like, visually? … Is it 3D? Is it claymation? Is it cartoons? Is it live action? Is it neon video gamey surreal? … Even if we’re not seeing it visually, that can give some context.”

– Annie, blind AD creator

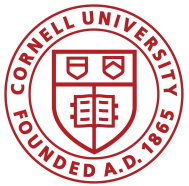
Contributions

- Proposed **multisensory design considerations** (linguistic, aural, smell, and taste) to make 360° videos more **accessible and immersive**
- Explored the importance of **including BLV experts in creating / designing** access technologies
- Utilized a **co-design framework** featuring mixed-ability groups

“It’s Kind of Context Dependent”:

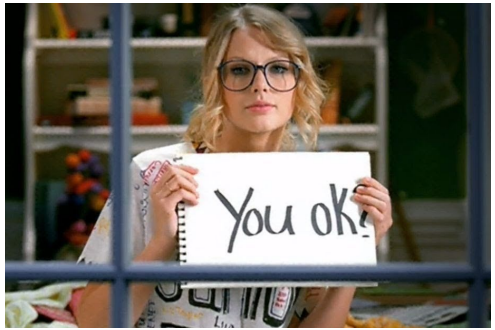
Understanding Blind and Low Vision People’s Video Accessibility Preferences Across Viewing Scenarios

Lucy Jiang, Crescentia Jung, Mahika Phutane, Abigale Stangl, and Shiri Azenkot

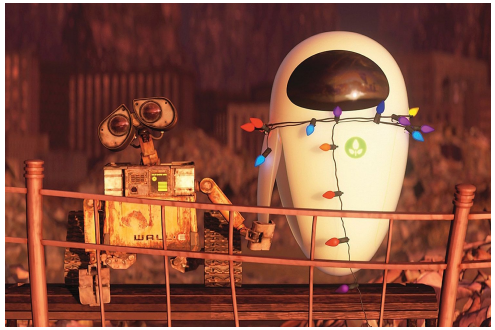


CHI 2024

Music Video



Science Fiction



TikTok / Reel

Research Question

What are BLV people’s needs and preferences for video accessibility across viewing scenarios?

VIEWING SCENARIOS

Video types

+

Viewing platforms

+

Viewing goals

Methodology

Formative Survey Method

- 101 participants
- Asked about **AD usage and types of videos** they wished to watch
  - Allowed us to select relatable and naturalistic videos to co-watch

Video Watching Behaviors

- Popular video types
  - Informational / educational
  - Comedic
  - How-to / DIY
  - Lifestyle
  - News and commentary
- Popular video platforms
  - YouTube
  - Netflix
  - Facebook

90.6% of respondents used a mobile phone to watch videos

AD Usage

- Varied depending on the scenario
- Most used AD for traditional movies and television

Not for *“concerts because I don’t like the audio description talking in the middle of a song [or for] standup comedy because it is hard to hear the comedian talking during the audio description track.”*

Interview Method

- 15 BLV survey respondents
- Reviewed survey responses and recalled **previously watched videos**

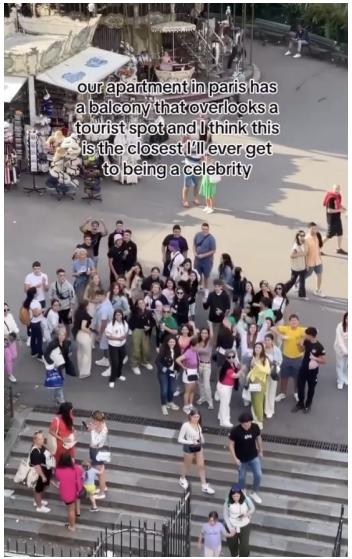
Interview Method

- Co-watching activity
  - Presented participants with different scenarios
    - One of three common scenarios
    - At least one participant-specific scenario
  - **Compared and contrasted** preferences

Examples of Presented Scenarios

Documentary

Comedy Sketch



Short-Form Video

Findings

Scenarios

- **How-to video**: learning how to do something on video sharing sites
- **Informational / educational video**: learning a new concept on a streaming service or video sharing site
- **Short-form video**: engaging with friends and pop culture on a social networking site
- **Music video**: seeking entertainment on a video sharing site
- **Live video**: seeking information or entertainment on a video sharing site or social networking site
- **Personal video**: engaging with friends or family on a social networking site
- **TV show or movie**: seeking entertainment on a streaming service

Scenarios

- **How-to video**: learning how to do something on video sharing sites
- **Informational / educational video**: learning a new concept on a streaming service or video sharing site
- **Short-form video**: engaging with friends and pop culture on a social networking site
- **Music video**: seeking entertainment on a video sharing site
- **Live video**: seeking information or entertainment on a video sharing site or social networking site
- **Personal video**: engaging with friends or family on a social networking site
- **TV show or movie**: seeking entertainment on a streaming service

How-To Videos

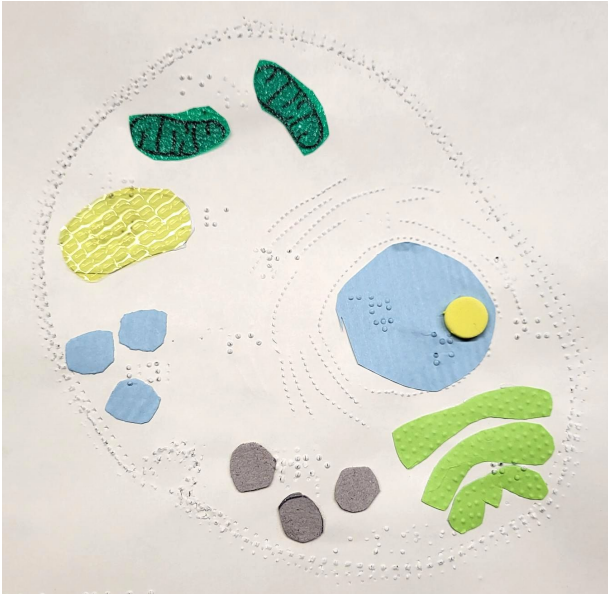
- Details about **actions** and **equipment**
- Explainable audio and tactile cues, including diegetic audio, could give context
- Separate resources could help with preparation, understanding, and execution

“Having a link that you can click, or a list of different workout stuff that they’re going to do, gives you some time to prep...”

(Karla, 24F)

Informational / Educational Videos

- Details about **visual aids**, **settings**, and **subjects**
- Tactile feedback is helpful for learning
  - Specifically for understanding scale or structure
  - Tactile graphics
  - 3D models



“It would be cool to have it be more tactile because that’s how you learn... describing part of a cell is not as good as seeing a picture or feeling it more hands-on.”

– Alice, 30F

Short-Form Videos

- Details about **subjects**, **actions**, **clothing**, and **settings**
- Popular “sounds” / background music used as templates help give context
- Additional context typically found in the video caption

“If the caption is ‘When girls’ night goes terribly wrong,’ you can assume that they were relaxing and then something happened.”

(Karla, 24F)

Music Videos

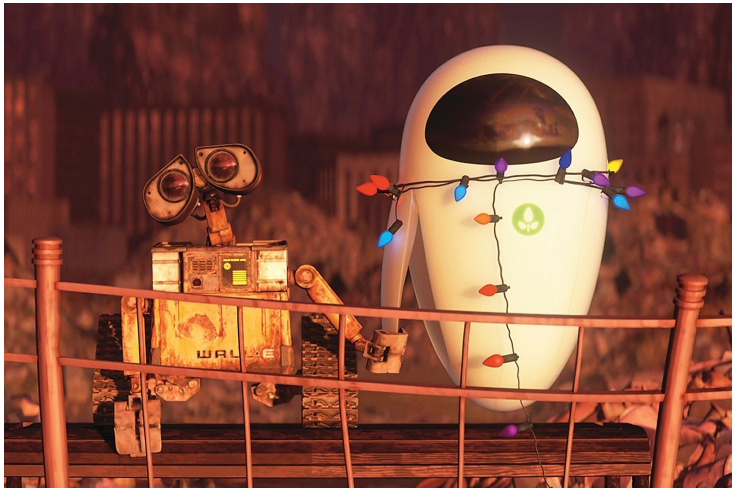
- Details about **people**, **actions**, **settings**, **clothing**, and **visual effects**

Music Videos

- Details about **people**, **actions**, **settings**, **clothing**, and **visual effects**
- Braille and other tactile cues can provide AD without disrupting music

Science Fiction, Fantasy, and Animation Videos

- Details about **characters**, **actions**, **clothing**, **facial expressions**, and **settings**
- Separate resources could include details about characters and clothing
- 3D models could convey unique character designs



“As somebody who could see **Wall-E** *and now cannot, I can tell you that the [AD] just doesn’t have it. … I know we can’t roll a* **Wall-E** *into people’s homes, but I almost wish we could.”*

– Felix, 40M

Similarities Across Scenarios

- Access to text on screen was crucial
- **Adapting a video's visual style** could suit users' differing abilities and vision levels
  - E.g., *"flat and simple"* animation styles

This image was generated with Microsoft Copilot

Video Accessibility Design Space

1. Level of Detail
2. Alteration of Video Time
3. Level of Augmentation
4. Modality of Presentation
5. Synchronicity of Accessible Content
6. Tone and Style of Approach

Contributions

- Empirical insights capturing the **diversity of BLV users' video accessibility preferences** across a wide range of viewing scenarios
- A six-dimensional **video accessibility design space** to guide developers and designers
- Formative considerations of the **ethical and societal impacts of AI** for video and content accessibility

Discussion

Modality of Presentation

- Additional audio elements can improve video access
- Tactile feedback was helpful, but required Braille literacy or tactile graphicacy

Tone and Style of Approach

- E.g., excited, sad, first-person, cartoonish
- Some wanted subjective and judgmental descriptions for reality TV

AD The contestant is wearing a *“ridiculous bathing suit.”*

BLV Involvement Can Improve Video Accessibility

- BLV AD creators often drove discourse on key points due to their **rich expertise as narrators, audio engineers, and writers**
- It is important to consider BLV users' prior cultural context
- We encourage future work to include disabled people as both creators and users of access technologies

Generative AI for Video Accessibility

- Personalized AI video a11y → risks of misinformation and echo chambers
- Future work: intersections between **media accessibility**, **artificial intelligence**, **and misinformation**

Implications for Accessible Media & Future Work

- Insights can be generalized across many types of media
  - Traditional videos
  - Images
  - Video games
  - Extended reality
- Prior works have taken a utilitarian approach to media accessibility
- We recommend exploring creative methods of providing access that go **beyond audio descriptions**

Takeaways

Video accessibility is much **more than just AD quality or quantity**

Our **six-dimensional design space** can be applied for video (and other content) a11y

What’s Next?

ADHD & Video Accessibility Project

- **RQs:** What makes videos inaccessible to people with ADHD? How can we make videos more accessible to support **attention**, **engagement**, **enjoyment**, and **information retention**?
- So far, have interviewed **16 participants**
- Aiming for CHI 2025
- Working with Woojin Ko, Shirley Yuan, Tanisha Shende, and Shiri Azenkot

PiTech Fellowship @ Design Trust for Public Space

- Exploring digital strategies to evaluate and enhance **neurodiversity accessibility in public spaces**
- Working with Design Trust for Public Space, Verona Carpenter Architects, and WIP Collaborative

Additional Research Projects

- Understanding **disability disclosure practices and self-representation preferences** of people with invisible disabilities on social VR platforms
  - Paper accepted to ASSETS 2024
  - With Ria Gualano, Kexin Zhang, Tanisha Shende, Andrea Stevenson Won, and Shiri Azenkot
- Investigating and addressing the **ableist hate and harassment** faced by disabled content creators and users on social media
  - Paper accepted to CHI 2024, follow-up work aiming for CHI 2025
  - With Sharon Heung, Shiri Azenkot, and Aditya Vashistha

After wrapping things up this summer, I'll be heading to...

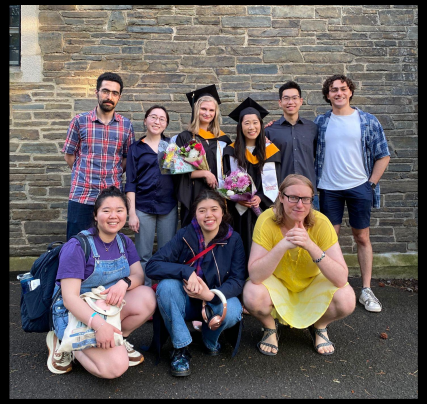
UW HCDE!

Thank you!

Thank you for attending my A Exam 🤗

And thank you to my **committee**, **mentors**, **friends**, **family**, **peers**, **lab mates**, and everyone else for your support 💜


CHI 2024
EXHIBIT HALL SCHEDULE
CHI 2024




WAITRESS—THE MUSICAL
LIVE ON BROADWAY!


EXECUTIVE EDUCATION


5K 99
5K 98

Reimagining Video Accessibility:

Exploring Immersive and Context-Aware Access with and for Blind and Low Vision People

Lucy Jiang

A Exam Presentation, Computer Science, Cornell University

Committee: Shiri Azenkot (chair), Aditya Vashistha, Emma Pierson