

Designing Privacy Enhancing Technology for Blind and Low-Vision (BLV) People

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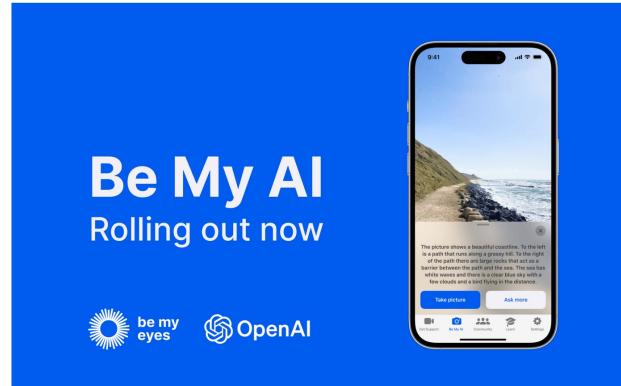
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Camera based Assistive Tools

Both **AI-based** and **Human-assisted** tools are offering new opportunities

Announcing 'Be My AI,' Soon Available for Hundreds of Thousands of Be My Eyes Users

Be My Eyes' AI assistant, powered by GPT-4, is rolling out to hundreds of thousands of iOS and Android users over the next several weeks.



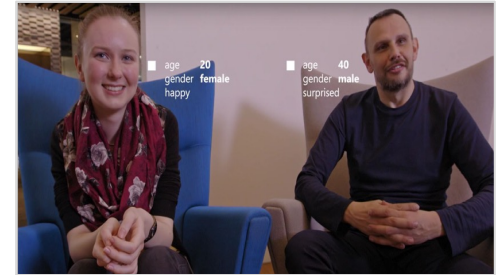
Source: <https://www.bemyeyes.com/blog/announcing-be-my-ai>

Be My AI



Source: [qws.amazon.com](https://aws.amazon.com)

OrCam MyEye helping reading newspaper



Source: seeingai.com

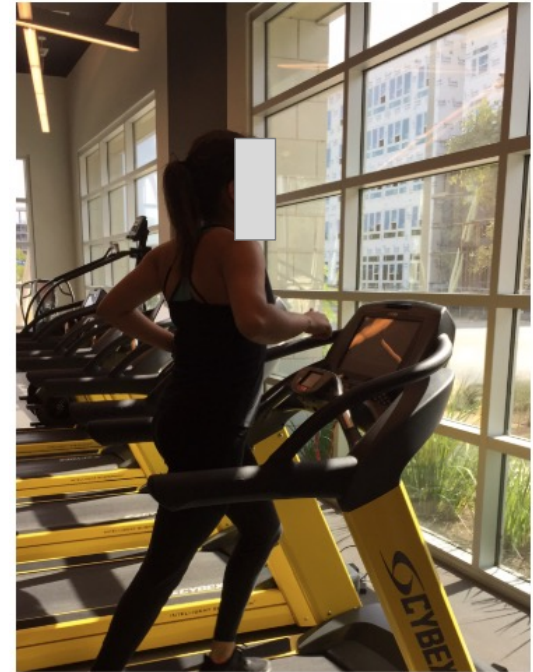
Microsoft's Seeing AI describing people

Fallibility of AI

AI-based tools can not always **infer** human-intent



probably a sign on a sidewalk



probably a woman sitting on a bench in front of a window

Inaccurate and **insufficient** responses by Microsoft's Seeing AI

Reliability of Human-assisted Technologies

More than **600,000** BLV users are using different forms of human assisted technology

The screenshot shows the 'Community' page of the Be My Eyes website. At the top left is the 'be my eyes' logo. Navigation links include 'Business', 'Community', 'About', and 'Download'. The main heading is 'Discover our community'. Below this is a paragraph: 'Be My Eyes' goal is to make the world more accessible to people who are blind or have a low level of vision. We couldn't do this without the help and dedication of our community.' This is followed by another paragraph: 'Read our blog, listen to our podcasts or read about stories from real users from all around the world.' and a link 'Explore Community'. On the right side, there is a grid of 12 circular profile pictures of diverse individuals. At the bottom, four statistics are displayed: '7,114,876 Volunteers' with a 'Live' indicator, '570,588 Blind & low-vision' with a 'Live' indicator, '150+ Countries', and '180+ Languages'.

This screenshot shows the Be My Eyes app interface overlaid on a photo of an airport terminal. A user's smartphone is visible on the left, displaying the name 'Kristie'. A black speech bubble from the app says 'Thanks for calling Aira! How can I help you?'. A blue speech bubble from the user says 'I just landed at the San Diego Airport and need to get to my connecting flight at gate B14.' The Aira logo is visible in the top right corner of the app interface.

This screenshot shows two instances of the Be My Eyes app interface. The left instance shows a query: 'Has the milk expired?' with a response: 'No, you have two more days.' The background image is a carton of Arla Harmonie Øko Minimal milk. The right instance shows a user profile for 'Sara', a 'Trusted Helper'. It displays '13 People Helped' and '345 Points Total'. A progress bar shows '155 points until next level'. Below this, it lists 'Helped a blind person' (+30 points, 2 minutes ago) and 'Attempted to help' (+5 points, 3 hours ago). At the bottom, it shows the 'The Be My Eyes Network' statistics: 361 Sighted, 121 Blind, and 554 Helped.

Privacy Risks with Assistive Tools

Sensitive information can be shared either **intentionally** or **unintentionally**

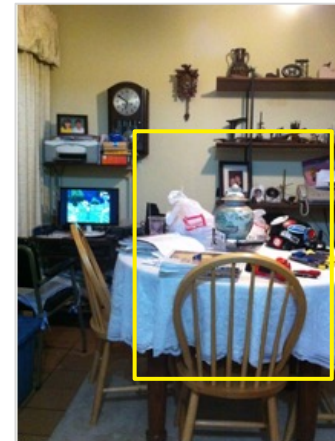
Bigham et al., "Vizwiz: nearly real-time answers to visual questions." Proceedings of the 23rd annual ACM symposium on User interface software and technology. 2010.



Financial information



Medical information



Messy area



Self Reflection



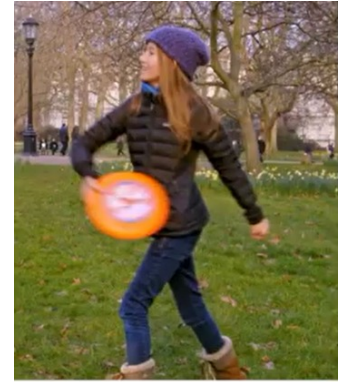
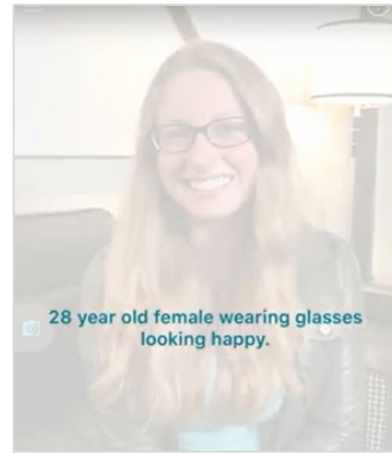
Bystanders



Digital Screen

Bystander Privacy Concerns

Camera-based assistive tools provide **demographic** and **activity** information of people



A young girl throwing a Frisbee in the park.

Ethical concerns of receiving information about **bystanders**. (Hoyle et al., 2014)

Bystanders have **privacy concerns** of augmented reality glasses. (Denning et al., 2014; Profita et al., 2017; Ahmed et al., 2018)

What are the visual privacy preferences of BLV people about sharing information unintentionally with human assistants?



Human Assistants:

- Family members
- Friends
- Agent or Volunteers

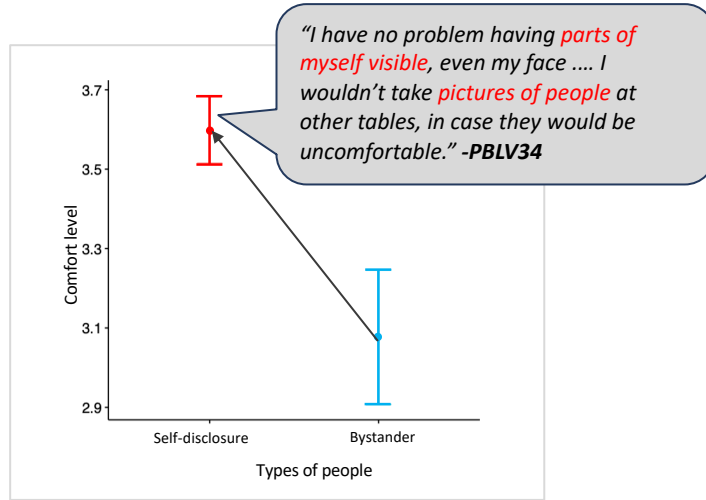


Background Objects:

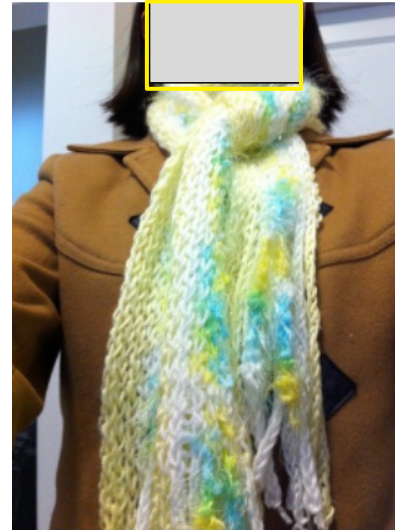
- Credit cards
- Medicine
- People
- Messy area
- Foods
- Laptop screen

Taslina Akter, Bryan Dosono, Tousif Ahmed, Apu Kapadia, and Bryan Semaan, **"I am uncomfortable sharing what I can't see": Privacy Concerns of the Visually Impaired with Camera Based Assistive Applications** (*Usenix Security 2020*).

Bystander Privacy Concerns



Comfort levels for self and bystander

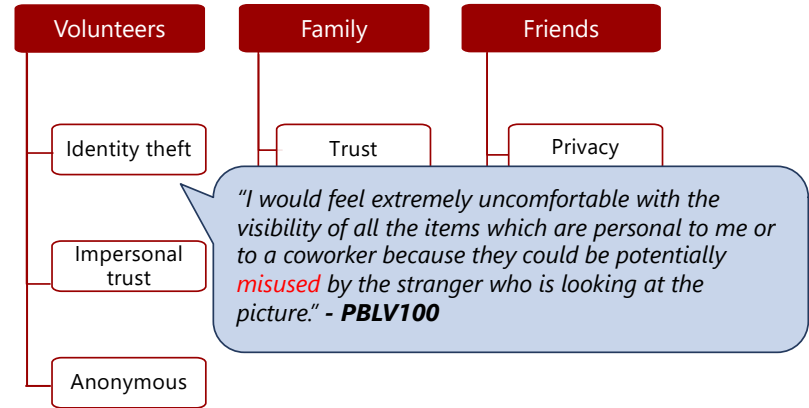
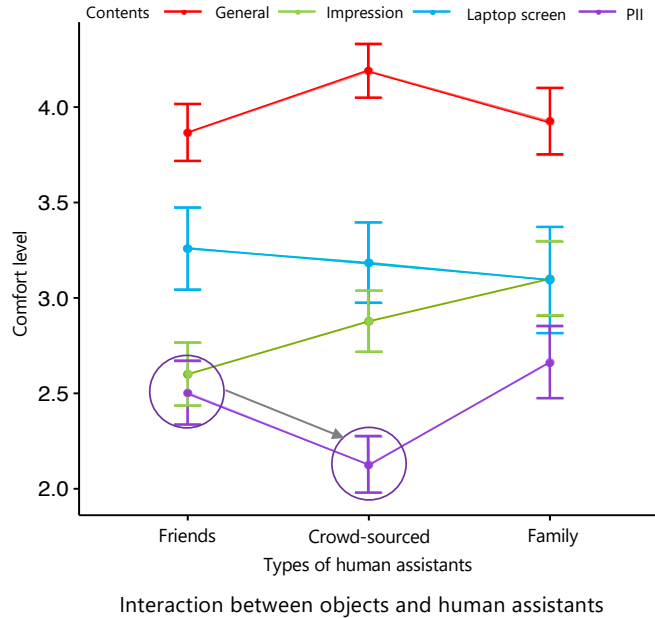


Body part



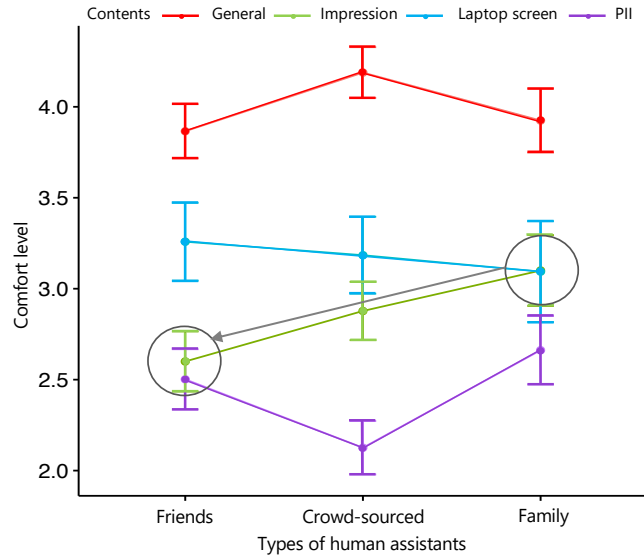
Bystanders

Concerns of Identity Theft

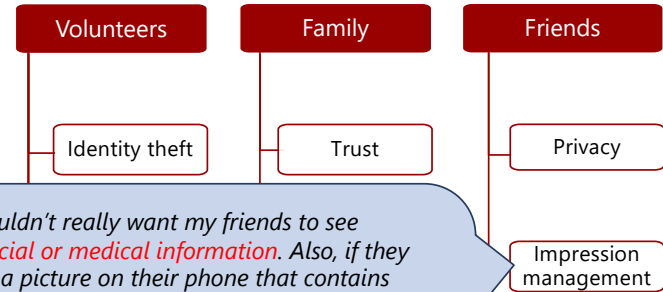


Reasons for selective audience disclosure

Concerns about Impression Management



Interaction between objects and human assistants



"I wouldn't really want my friends to see *financial or medical information*. Also, if they have a picture on their phone that contains personal info about me, this creates an opportunity for someone *other than my friend* to see the picture on my friend's phone (e.g., friend's family members, romantic partner), which would jeopardize the privacy and security of the information." - **PBLV30**

Reasons for selective audience disclosure

What are the shared privacy and ethical concerns of BLV people and bystanders with AI-based assistive tools?



Taslima Akter, Tousif Ahmed, Apu Kapadia, and Manohar Swaminathan, **Privacy Considerations of the Visually Impaired with Camera Based Assistive Technologies: Misrepresentation, Impropropriety, and Fairness** (*ASSETS 2020*).

Taslima Akter, Tousif Ahmed, Apu Kapadia, and Manohar Swaminathan, **Shared Privacy Concerns of the Visually Impaired and Sighted Bystanders with Camera Based Assistive Technologies**, (*TACCESS 2022*).

Impropriety and Social Stigma

“ I might fall into traps of **judging** people by their **appearance**, just as sometimes sighted people do, particularly about **ethnicity, weight, gender** and **expression**. -PBLV48

Misrepresentation of Bystanders

“ I'd be less comfortable with being told a person's **weight** and **gender** because the algorithm's likelihood of being **accurate** varies...Even more **humiliating** would be to talk to a person using a **pronoun** they're uncomfortable. -PBLV26

I'm **uncomfortable** with the gender, cause I'm trans and the glasses would get it wrong at some point, which would give people more reasons to **misgender** me. -PSB17

Summary of Contributions

- Identified BLV users' **information-disclosing** concerns and preferences (e.g., identity theft, impression management, and bystander privacy).
- Investigated the **shared privacy and ethical** concerns of BLV people and bystanders with assistive technologies (e.g., impropriety, and misrepresentation).
- Implications for designing **privacy-enhancing, trustworthy, and responsible** assistive technologies for BLV people.

Thank You!

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