



# Privacy Concerns of People with Visual Impairments while using Camera based Assistive Tools



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## Cameras are helping people with visual impairments to achieve independence

Various artificial and human intelligence based assistive technologies are using the camera to assist people with visual impairments, such as Aira, Microsoft's Seeing AI, Be My Eyes.

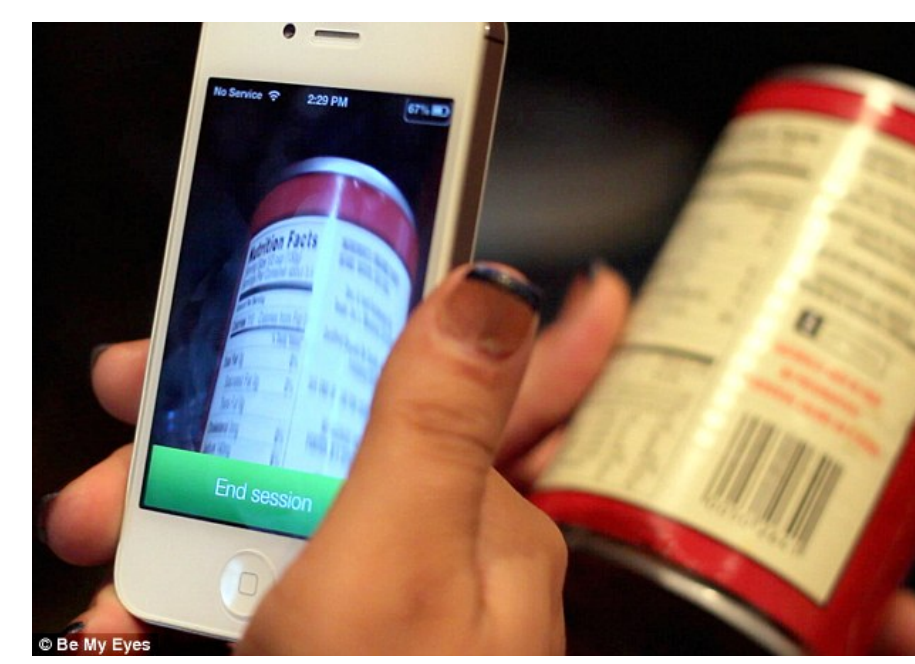
Human-assisted technologies are becoming popular for better quality and accuracy.



BeSpecular identifying objects



Aira recognizing people



Be My Eyes identifying objects

## There can be privacy and security risks associated with cameras

People with visual impairments often capture **sensitive** content and **unintentionally** share it with the human-assistant.

Sensitive objects can be present either as **foreground** (primary) object or **background** object.

### Privacy and security risks of foreground objects



Credit card



Medicine

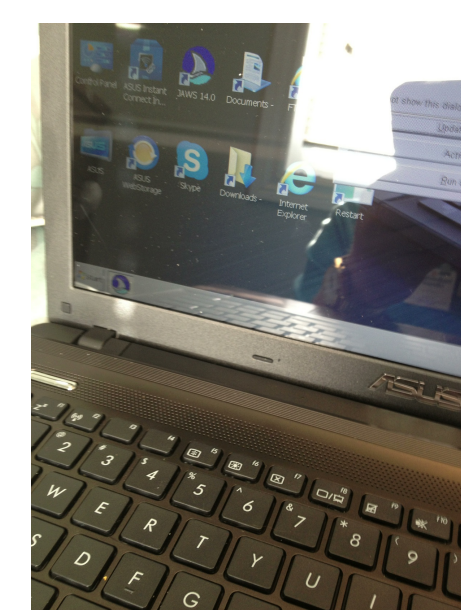


Face or body part

### Privacy and security risks of background objects



Photo frame



Self



Bystander

Pictures collected from the public VizWiz [2] dataset

## We conducted a survey with 150 people with visual impairments

We asked for their comfort level on 5-point Likert scale.

We considered 3 human assistants: a family member, friend, or volunteer.

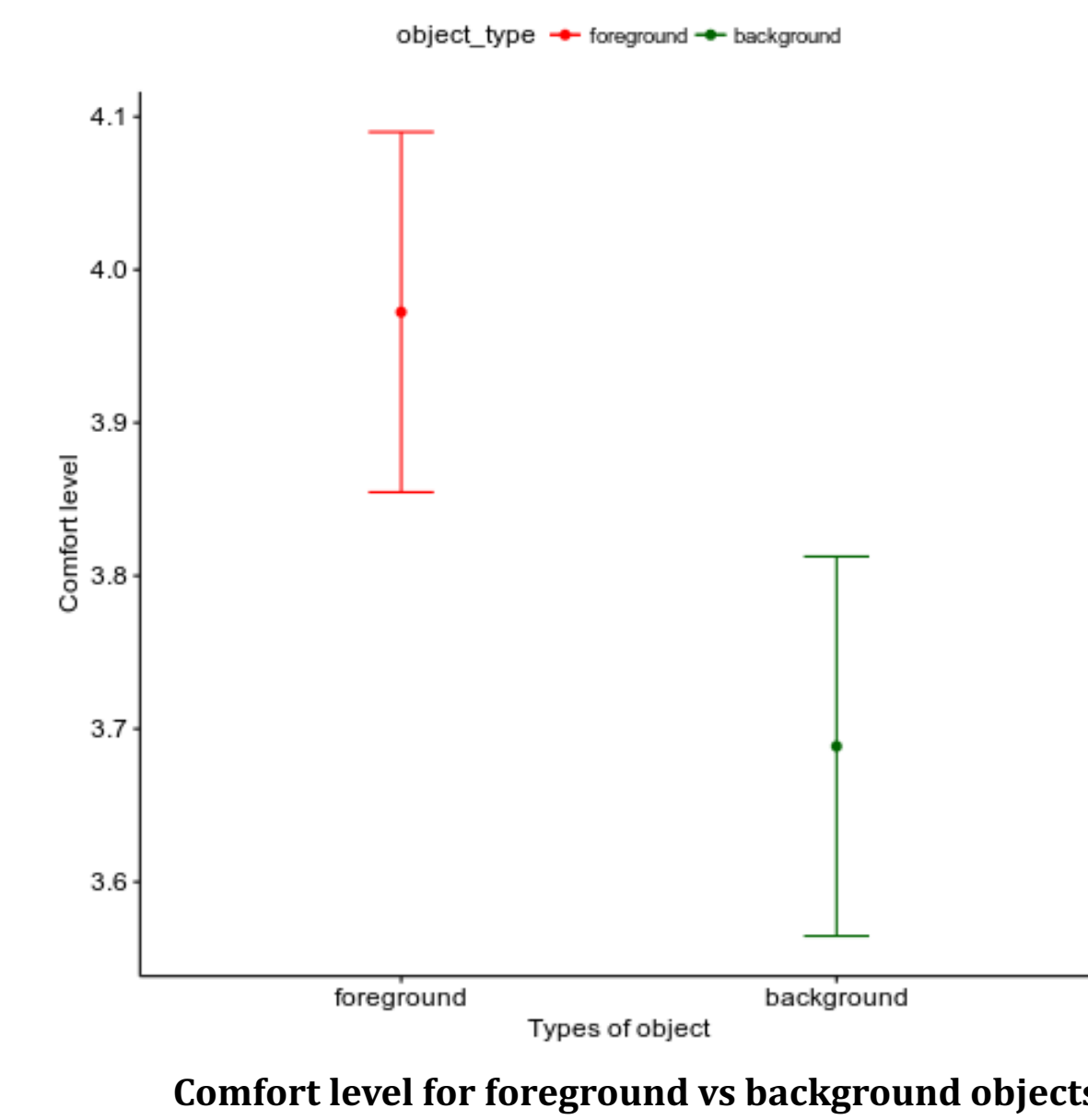
We considered 3 scenarios: **home, restaurant, and office.**

## People with visual impairments are more concerned about background objects

Visually impaired people are more **concerned** about **background** objects than **foreground** objects.

Sometimes, they share **sensitive** objects **intentionally**.

Would like to know **what** is in the **background** before sharing photos.

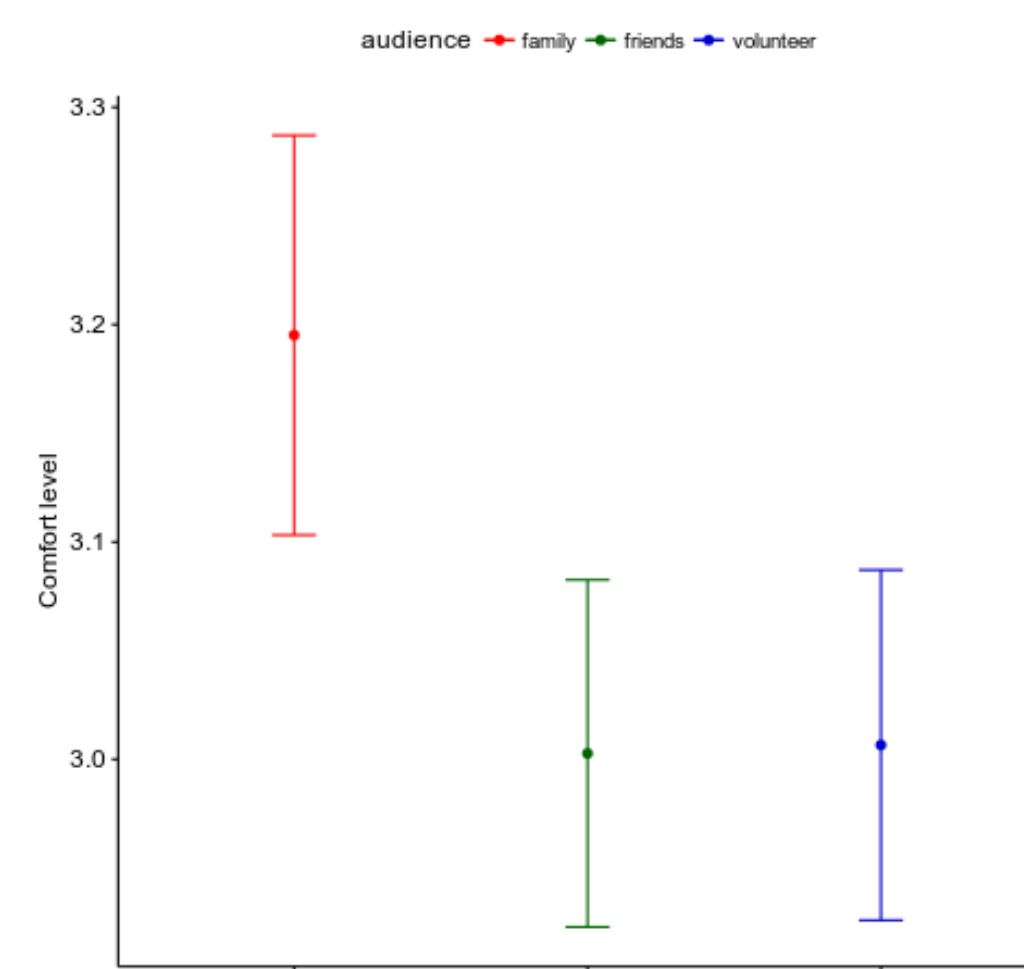


## Privacy concerns vary depending on the contents, scenarios, and audiences

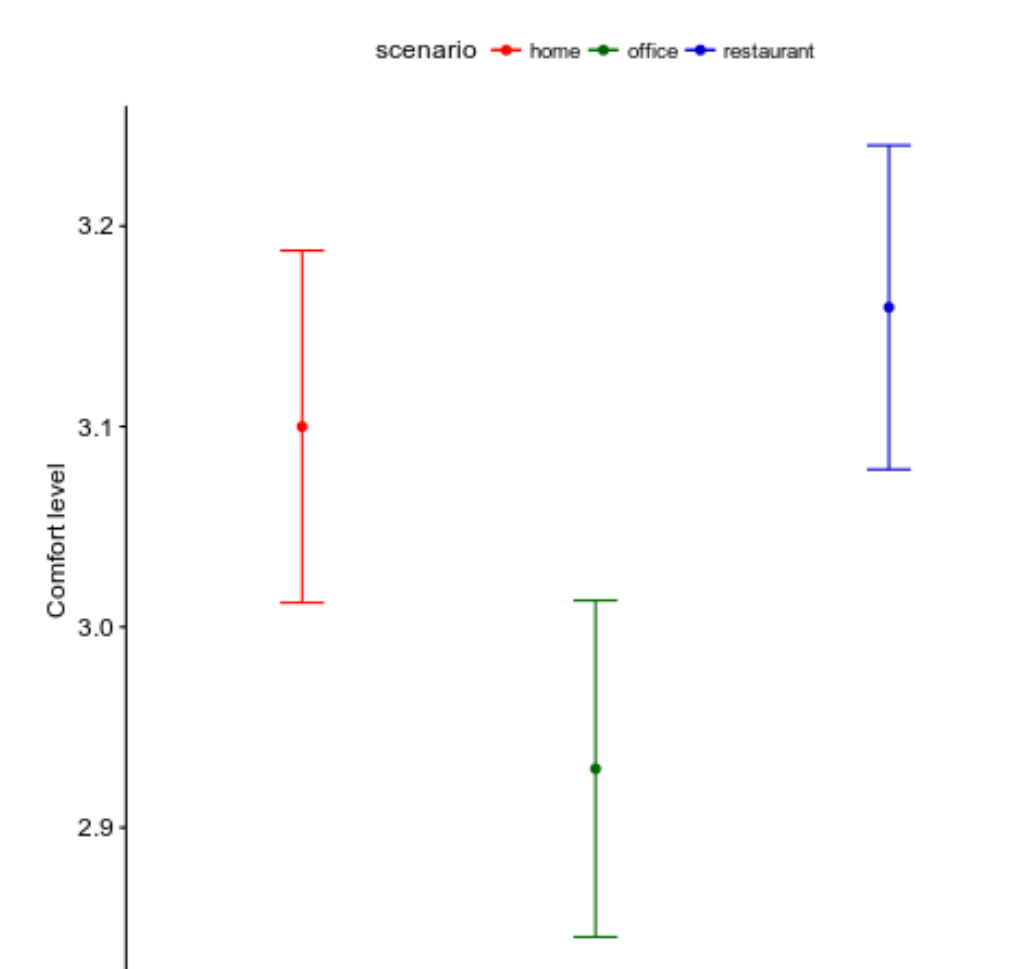
Sharing preference with **friends** and **volunteers** are **similar**.

Visually impaired people are concerned about their **impression with friends**.

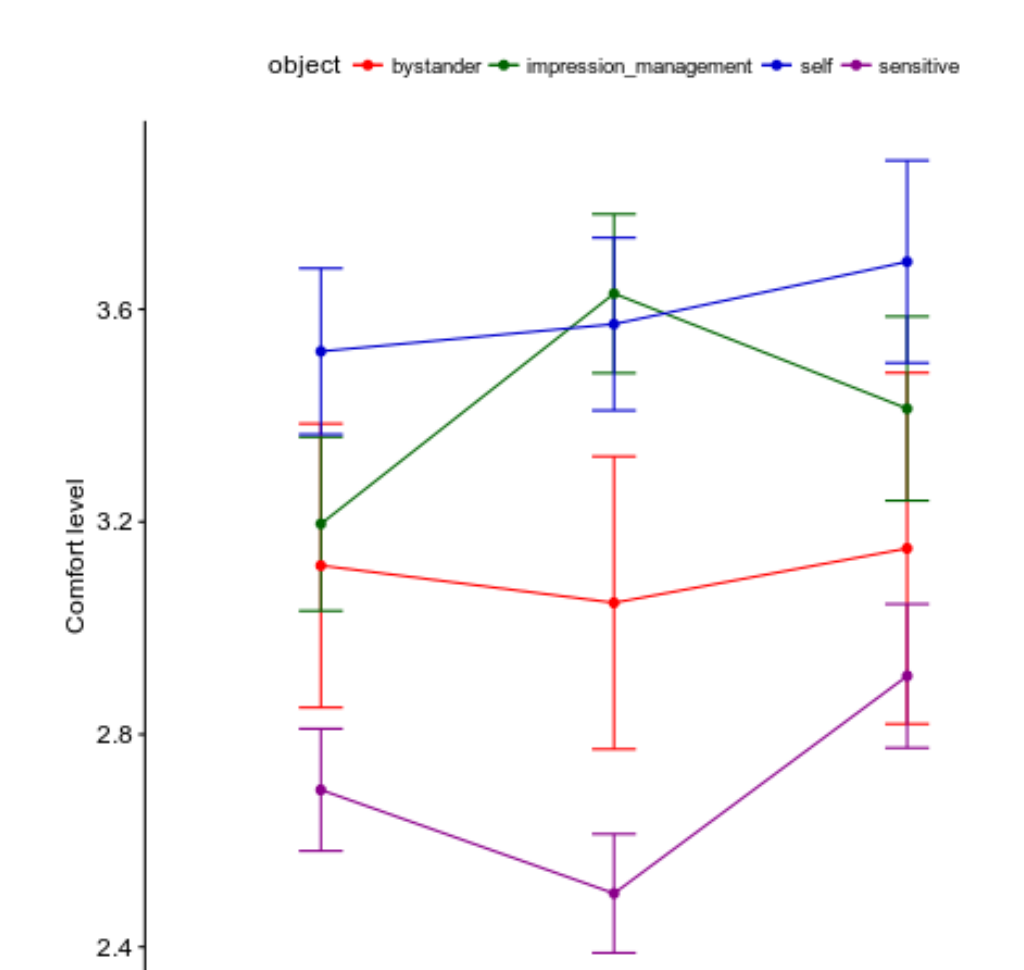
Visually impaired people are more concerned about **bystanders** than **self**.



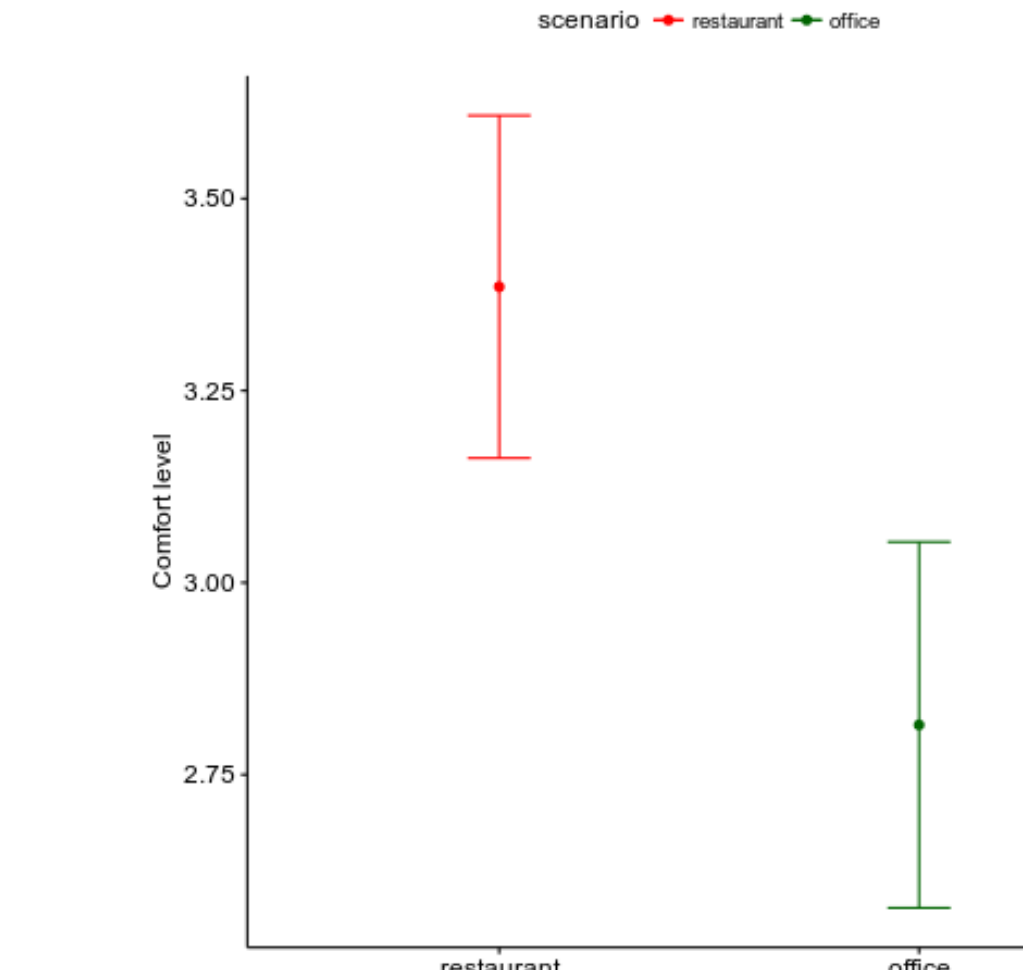
Comfort level for different audiences



Comfort level for different scenarios



Interaction plot between audiences and contents



Comfort level for bystander vs scenario

## Acknowledgement

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## Why do they Prefer Human Intelligence?

We conducted a **semi-structured interview** with 6 people with visual impairments.

Participants prefer interacting with a human.

*"I actually prefer Be My Eyes the best out of all of them [AI and Human], and that's only because I actually get to talk to a real person." [P6]*

Prefer a detail description of a product or scene.

*"TapTapSee is a good product, but I've found that a lot of times when you want a description of something, you're not getting the full description. You're just getting a general couple of sentence description, and sometimes, I want more information than that. I think I want as much information as I would have if I could see. So having a sighted volunteer really is the best." [P6]*

Inaccurate answers by AI-based technologies.

*"Some of the time it [AI] has definitely been inaccurate, that I've noticed. It's obviously the wave of the future, but it does have a long way to go in terms of its limits. I think in a few years it'll be much better than it is now." [P5]*

## Challenges & Future work

Automatically identifying foreground and background objects is still difficult.

Contents of the image should be described to the user before sharing it.

OpenCV applications like scanner darkly [3] can be used to add a privacy layer by removing unimportant details.

## References

1. Tousif Ahmed, Roberto Hoyle, Kay Connelly, David Crandall, Apu Kapadia. "Privacy Concerns and Behaviors of People with Visual Impairments". In CHI 2015
2. J.P. Bigham, C. Jayant, Ji, H., G. Little, A. Miller, R. C. Miller, R. Miller, A. Tatarowicz, B. White, S. White and T. Yeh. VizWiz: nearly real-time answers to visual questions. In UIST 2010.
3. S. Jana, A. Narayanan, and V. Shmatikov. "A scanner darkly: Protecting user privacy from perceptual applications". In Security and Privacy (SP) 2013
4. Tousif Ahmed, Patrick Shaffer, Kay Connelly, David Crandall, Apu Kapadia. "Addressing Physical Safety, Security, and Privacy for People with Visual Impairments". In SOUPS 2016