

Understanding the Needs and Challenges of Using Conversational Agents for Deaf Older Adults

Motivation



- Older adults (age > 55) are the largest group of conversational agent (CA) **first adopters** – 33%
- Voice interaction modalities **can increase accessibility** for visual impairments and mobility issues
- More than **33%** of adults age 65 or older are affected by hearing loss
- Little work has focused on the unique challenges of CA use for **deaf and hard of hearing** (DHH) users

Research Questions

- What are the **challenges** and **expectations** of using conversational agents for DHH users?
- How can we design a CA that is **more accessible** to deaf and hard of hearing users?

Methods

- 4 semi-structured interviews, conducted through the method most compatible with their hearing needs:



- Interviews were recorded, transcribed, and analyzed using a bottom-up thematic coding process

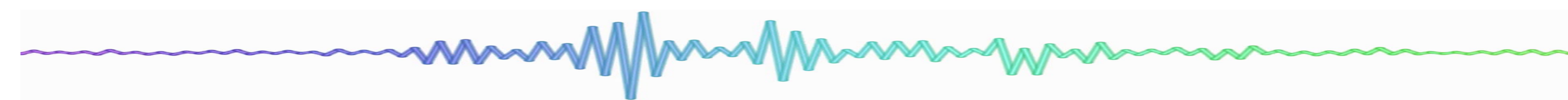
Participants

The following chart describes the demographic information for the participants interviewed

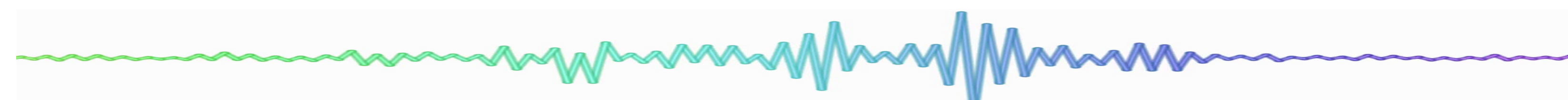
Participant	Age	Gender	Hearing Device	Hearing Status	CA Use
1	53	Female	Cochlear implant	Profoundly Deaf, Childhood hearing loss	Mobile CAs, Daily use
2	56	Female	Hearing aids	Recently Deaf, No prior hearing loss	Mobile CAs, Daily use
3	59	Male	Hearing aids	Profoundly Deaf, Early adulthood loss	Mobile and Smart speaker, Frequent use
4	63	Female	Cochlear implant	Profoundly Deaf, Childhood hearing loss	Mobile and smart speaker, Discontinued

Preliminary Findings

- Used phone-based CAs for tasks common across most CA users
-- *web searches, GPS, weather, reminders, games, etc.*
- Associated home-based smart speakers (e.g. Amazon Echo, Google Home) primarily with **music** and therefore perceived these devices as **less useful**
-- *"...music sounds very different through aids, so it's not something we'd be seeking."* (P2)



- **Higher-pitch** used by the **default** voices -- difficult for hearing aids and cochlear implants
-- *"A male or female voice determines how much I hear..."* (P4)
- **Preferred lower tones** or to change the voice after hearing aids were adjusted
-- *"...a male-sounding voice would be less irritating"* (P4)
- Wished to **change the speed** of their device's verbal response to avoid missing responses or repeating requests



- Developed their own strategies to **avoid errors** or to **simplify complex requests**
-- *"renaming contacts to things Siri could understand"* (P1)
- Only relied on devices for **short, simple responses**, if no screen feedback was provided
-- *"The screen on the [Amazon Echo] Show let me do more"* (P3)
- Expressed a need for using devices for some tasks **without the use of hearing devices**

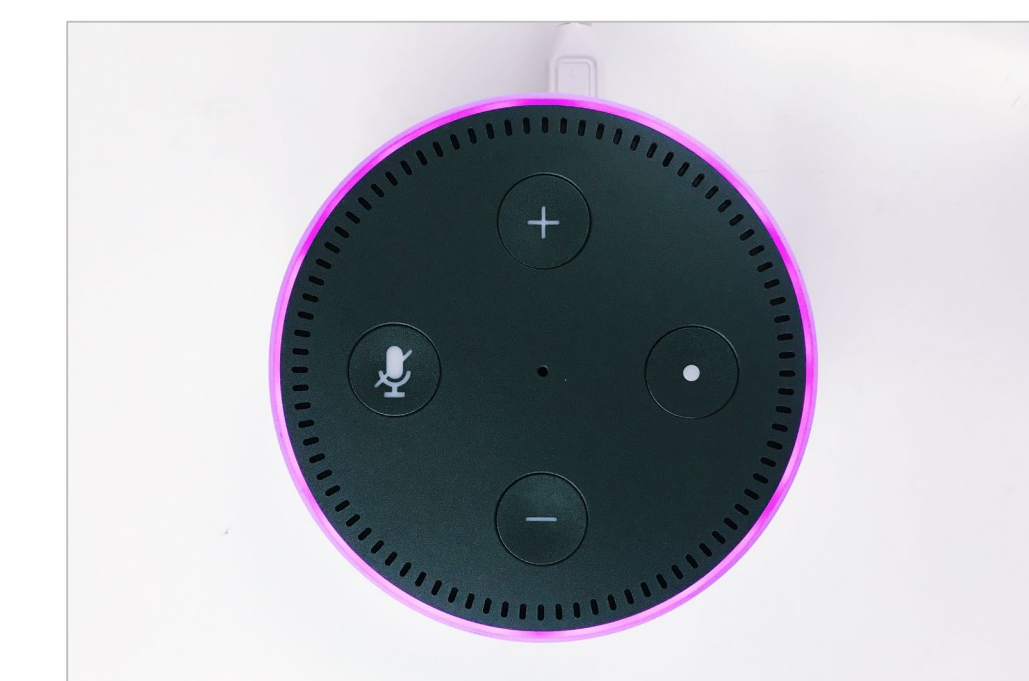
Discussion

Diversity of DHH Users

- Wide range of needs within the DHH community, as well as individuals over time as hearing devices change
- Voice inflections and speech patterns of some DHH users may not match what voice recognition models expect

Flexibility and Customization

- New features should be considered to increase the level of flexibility and customization of CA devices
- Voice customization options across multiple factors: **pitch, volume, and speed**
- Recalibrate the device to adapt to changes in hearing frequencies over time in a similar manner to **audiograms**



New Modalities

- Connectivity options for **Bluetooth-enabled** hearing aids for more direct device interaction
- More opportunities for dual feedback – clear, **expressive lights** and the inclusion of screen-based feedback in standalone smart speakers

Future Work

- Deployed a survey to **73 DHH respondents** to address these concerns on a wider scale -- *including younger users and those with different hearing needs*

Next Steps

- Longitudinal look at **real-time** Amazon Echo usage to uncover additional usability challenges with CAs
- Leverage DHH users' experiences in **participatory design**