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Speaker Accommodations and Voice User Interfaces: Does Human-likeness of a Voice Matter?

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Overview

- Voice user interfaces (VUIs):
  - Used with smartphones & smart home devices to execute automated tasks [1]
  - VUIs consist of:
    - Automatic speech recognition (ASR) - process speech
    - Artificial Intelligence (AI) - execute instructions
    - Text to [synthetic] speech - respond to speaker
- Research with earlier rudimentary VUI's found
  - To be better understood, speakers hyperarticulate; this accommodation includes converging or diverging pitch (f0), voice onset time (VOT), pause & vowel insertions [2]
- Recent research focuses on user experience:
  - Less on phonetic adjustments
  - Has targeted the advancement ASR
- Hyperarticulation in human-animate speech:
  - Relate speech to human interlocutor's [3, 4]:
    - Converge with in-group (speakers of same region or status, etc.) or diverge from out-group
  - Human-VUI speech may be distinct from human-human, more like human-animal [5]

Question

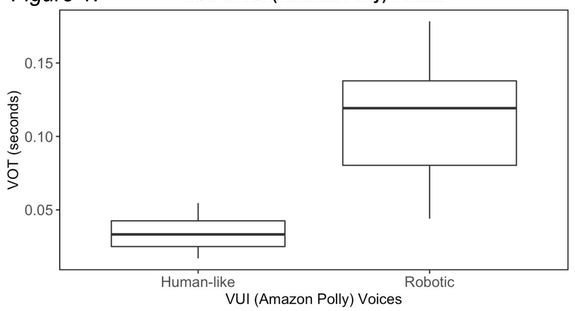
Do speakers change their speech to accommodate to a VUI?

- If considered in-group, speaker will converge to VUI, minimizing distance and treat VUI as human
- If not considered in-group, speaker will diverge from VUI, increasing distance and treat VUI as non-human
- If considered inanimate, speaker will not accommodation to the VUI

Methods

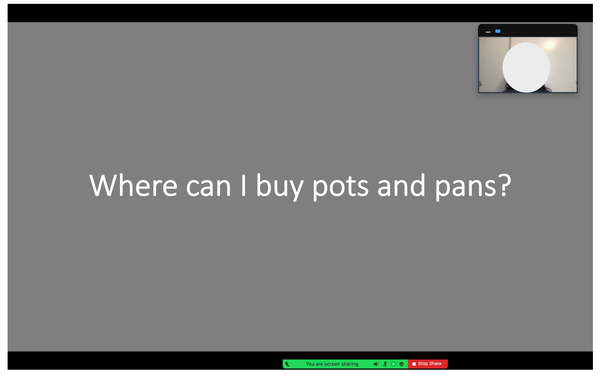
- To determine exposure effects, compared VOT pre- & post-exposure to robotic and human-like VUIs
- Materials (Fig 1):
  - 2 voices generated for VUI responses
    - In Praat, VOT of /p/ and /t/ were edited:
      - VOT shortened in Human-like VUI voice
      - VOT lengthened in Robotic VUI voice

Figure 1. **VOT of VUI (Amazon Polly) Voices**



- Participants:
  - 18 students from the University of British Columbia participated via Zoom
  - Participants counterbalanced for voice order
- Procedure (Fig 2):
  - Participants told they were speaking to virtual assistants
  - Provided sentences to read via share screen
  - Participants heard a beep (signalling speech recognition), read sentence aloud, heard the VUI response and waited for next sentence
  - Practice: 3 sentences prior to exposure to voices
  - Read 12 sentences to each VUI, received spoken response from VUI
  - Repeated with second VUI

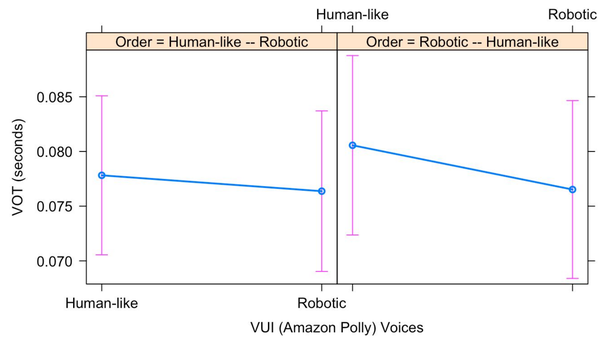
Figure 2. Screenshot of participants' view



Analysis

- Participants who didn't speak English as their dominant language, and/or had poor audio quality were excluded from the analysis
- Extracted audio was manually segmented at the sentence level in Praat, after forced alignment (Darla), manually annotated VOT in Praat, time extracted with script
- Statistical analysis: R - Linear mixed effect models across participants and T-tests within participants

Figure 3. **VOT of Speakers by Exposure to VUI Voices**



Results

- Insignificant differences in VOT between voices:
  - Within and across participants
  - Following each of the voices (Fig 3)
  - Between counterbalanced VUI order (Fig 3)

Conclusion

Results show that speakers do not accommodate to synthetic VUI voices regardless of how human-like or robotic they sound. This indicates that VUIs are treated as inanimate interlocutors and are unlikely to change the way people produce speech.

References

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Speaker Accommodations and Voice User Interfaces (VUI): Does Human-likeness of a Voice Matter?

Background: Speakers often accommodate their speech to interlocutors.

Question: How do we adjust our speech to a **human-like** but **inanimate** speaker?

Methods: Participants spoke to 2 virtual assistants with either robotic and human-like voices with VOT manipulated.

Results: No change in participants' VOT to either voice.

Implications: We may treat VUIs as inanimate despite their human-like voices.