

# Exploring older adults' perception and use of smart speaker-based voice assistants: A longitudinal study

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# Research Questions

“perception and experience over time”

- What do older adults use a voice assistant for?
- What different benefits do they perceive as they use the device over time?
- What different challenges do they face when using the device over time, and how do they progressively respond to or cope with those challenges?

Kim, S., & Choudhury, A. (2021). Exploring older adults' perception and use of smart speaker-based voice assistants: A longitudinal study. *Computers in Human Behavior*, 124, 106914.  
<https://doi.org/10.1016/j.chb.2021.106914>

# Why it is important

- “It is predicted that (smart speakers) reach up to 409.4 million units in 2025 (Vailshery, 2019). Nearly a quarter of households own a smart speaker in the US, and more than half of them use two or more smart speakers (Richter, 2020).”
- People are living longer
  - Some abilities are limited
  - Weakening vocal folds
  - Technologies are always changing



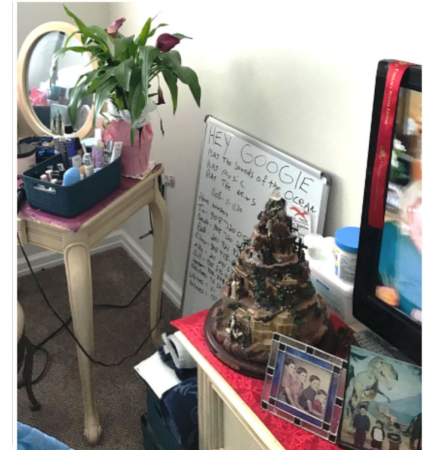
# Recruitment and Setup

- 12 participants
  - 7 female (2 did not complete study)
  - 5 male (1 did not complete study)
- 65 - 95 years old
- Single-person units of people part of two Senior Living Communities
- Familiar with GUIs
- Greater New York
- 16 weeks
- In-person interviews every other week
- Only used Google Home voice assistants
- One account for all users
  - Collected usage logs from each system's history

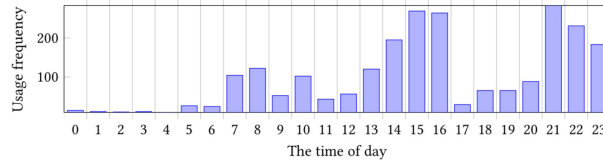


# Challenges

- Fear of making operational mistakes
  - Wake word unfamiliarity
  - Unfamiliar user interface ie. no buttons
- Disfluency
  - stuttering, pauses, repeats, stretching, incomplete or false syntactic structures, and erroneous articulation
- Alarms and reminders not captured as part of data



# Findings



Graph 1. The frequency of operation by the time of day.

- 2242 pairs of request-response communications
  - 1488 pairs of communications (66.4%) were successful
  - 754 pairs (33.6%) logged as “Sorry, I don’t understand.”
- Frequency of usage jumped around 9pm and 7 am, 1-4pm
  - Mean usage frequency is 1.8 times per day
- Mainly used for playing music
- Some companionship
  - 12.1% small talk
  - Politeness
- Don’t expect the system to always know or to always respond correctly
- The basic operational difficulties resolved, functional errors persistent throughout the study.
- “Experienced participants gradually developed a resilient response to the functional errors, which contributes to their sustained use and adoption of this technology.”

# Improvements

- Feedback to user on what went wrong (Error Recognition)
- Verbal explanations from the VA on how it is operating in a given moment (Visibility of System Status)
- Shape doesn't tell much about how to interact/ affordance (Match Between System and Real World)
  - What wake word is
  - How to adjust volume
  - How to turn on/off
  - Wifi enabled

Nielsen, J., & Molich, R. (1990). *Heuristic evaluation of user interfaces*, Proc. ACM CHI'90 Conf. (Seattle, WA, 1-5 April), 249-256

## 1 Visibility of System Status

Designs should **keep users informed** about what is going on, through appropriate, timely feedback.

## 2 Match between System and the Real World

The design should speak the users' language. Use words, phrases, and concepts **familiar to the user**, rather than internal jargon.

## 5 Error Prevention

Good error messages are important, but the best designs **prevent problems** from occurring in the first place.

## 8 Aesthetic and Minimalist Design

Interfaces should not contain information which is irrelevant. Every extra unit of information in an interface **competes** with the relevant units of information.

Nielsen Norman Group

# Jakob's Ten Usability Heuristics

## 3 User Control and Freedom

Users often perform actions by mistake. They **need a clearly marked "emergency exit"** to leave the unwanted state.

## 6 Recognition Rather Than Recall

**Minimize the user's memory load** by making elements, actions, and options visible. Avoid making users remember information.

## 9 Recognize, Diagnose, and Recover from Errors

Error messages should be expressed in **plain language** (no error codes), precisely indicate the problem, and constructively suggest a solution.

## 4 Consistency and Standards

Users should not have to wonder whether different words, situations, or actions mean the same thing. **Follow platform conventions.**

## 7 Flexibility and Efficiency of Use

Shortcuts — hidden from novice users — may **speed up the interaction** for the expert user.

## 10 Help and Documentation

It's best if the design **doesn't need** any additional explanation. However, it may be necessary to provide documentation to help users understand how to complete their tasks.