Challenges with Voice Assistants for the Elderly in Semi-Public Spaces

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ABSTRACT

Voice Assistants such as Amazon Alexa and Google Home have recently made inroads into all walks of life as is evident from their popularity, and the growing number of users. Traditionally, research on elderly people with voice assistants has focused on private spaces - bedrooms, kitchens, and living rooms. Due to privacy concerns, ethical issues, legal issues, and noisy environments, their use in public and semi-public spaces are discouraged. However, by carefully mitigating these concerns, voice assistants could still find applications in semi-public spaces for elderly people. This paper summarizes the preliminary insights from 8 interviews that we conducted with elderly people and throws light on the potential areas where voice assistants could be used in semi-public spaces.

CCS CONCEPTS

• **Human-centered computing** → **Accessibility technologies**.

KEYWORDS

Voice Assistants, Voice User Interfaces (VUI), Conversational Agents, Elderly Population, Accessibility, Amazon Alexa, Google Home

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1 INTRODUCTION

The popularity of voice assistants such as Amazon Alexa and Google Home is on the rise across the globe. Previous studies have revealed that these devices are proving to be a boon for the users, helping them in many ways – reminding them to take medicines, accessing information in a natural way, helping with cooking, and so on[11, 14, 23]. One of the main reasons for their popularity is that voice assistants offer a natural way of interacting with devices through speech. The advancements in Natural Language Processing (NLP), Machine Learning (ML) algorithms, and improvements in Automatic Speech Recognizer (ASR) have significantly contributed to the popularity of these voice assistants. In popular parlance, these voice assistants are known by the term Smart Speakers or Intelligent Personal Assistants. Statistics reveal that there will be around 8 billion commercial smart speakers globally by the end of 2023 [27]. In the US alone, there are over 57.8 million users of smart speakers and the number of users is growing worldwide [31]. Smart speaker adoption is on the rise in Europe with Germany and UK registering 34% and 24% growth respectively [29, 30].

In the Human-Computer Interaction (HCI) community, studies on the usability and user experience of smart speakers are also on the rise. A cursory glance at recent publications [1, 7–9, 19, 24, 26, 28] shows an upward trend in the research on how users are interacting and making use of these devices. A large majority of research in voice assistants is geared toward upwardly mobile, young, educated, and technology-savvy users [4, 16]. However, some researchers are exploring the use of voice assistants among the elderly population [7, 12, 14].

2 VOICE ASSISTANTS AND ELDERLY POPULATION

In today's world, technology is playing a major role in assisting the elderly population in accessing information, healthcare, well-being, independent living, and socialization [8, 9, 19, 26]. Smart speakers such as Amazon's Alexa and Google Home is designed to respond to voice commands and help users with a variety of tasks, such as setting reminders for taking medications, being in contact with friends and family, ordering food, and grocery items. Apart from these, voice assistants can also be used to control home environments - adjusting the temperature, switching on the lights, and controlling the television. A large section of these voice assistants has both input and output modalities of voice or speech, giving rise to the term Voice User Interfaces (VUIs).

A majority of research on voice assistants with the elderly population is in the context of the home environment. Kowalski et.al. [13] conducted a study on Smart Home Technology with Google Home with elderly users wherein the users were impressed by the range of possibilities technology could perform. The conversational interaction allowed the users to renounce their reliance on screens and input devices. They could issue a command verbally and get things done. In another study of elderly patients with Type 2 Diabetes, participants who used a Google Home application for self-management of diabetes attributed the high usability to the speaker function and natural flow of conversation[3].

Zinan et. al. [32] explored the factors affecting the perception of the elderly with the voice user interfaces and compared them with other traditional modes of interaction such as using a keyboard and

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touch interface. Their study reported that a majority of users found the voice interfaces to be 'very easy' as compared to the keyboard.

The HCI research community is researching other aspects of voice user interfaces with the elderly population, and there is growing interest among researchers in developing voice interfaces as an accessibility tool [25].

3 VOICE ASSISTANTS IN SEMI-PUBLIC SPACES

The predominant view on the use of voice assistants is in the context of private spaces such as homes, bedrooms, or kitchens where the primary user uses the device individually, and sometimes along with other family members. There are only a few studies that focus on the use of voice assistants in public or semi-public spaces [5, 15].

In the traditional sense, semi-public spaces are difficult to define, however, for our purpose, we define them as public spaces inside the building, e.g. lobby of a library, bank, or community center. There is a general understanding that semi-public spaces are widely accessible, yet offers some control and responsibility [6, 21].

Moorthy et. al. [18] studied the use of voice-activated personal assistants in public spaces and found privacy concerns to be the biggest hurdle in adaption. Users were more cautious in public settings when sharing private information as compared to non-private information. The social context (in this case, the public setting) had an adverse influence on the type of information shared.

Another study conducted at the Museum of Modern Art in New York, with Amazon Alexa devices, revealed that voice assistants were unable to understand foreign names and terms, and users experienced difficulties in interacting with the system [17]. In a study conducted among Danish speakers in Denmark, language issues also surfaced by way of poor voice recognition, unnatural dialogue responses, and errors in mixed-language speech [2].

Lopatovska and Oropeza [15] carried out studies with Amazon Alexa voice assistants in public academic settings and found that users did not engage with the device due to a lack of awareness or relevant functionality.

All the studies mentioned were focused on the general population or younger audiences. Research on the usage patterns of voice assistants among the elderly population is still lacking. Further research is required in this direction to explore the potential and capabilities of voice assistants in semi-public spaces.

Despite the advancements in voice technology, VUIs are still in a nascent stage, especially in public or semi-public settings. There are studies on social robots in public spaces that draw some parallels in terms of privacy and understanding and could provide useful pointers for speech interaction in semi-public spaces [10, 20, 22]. Nevertheless, with improved design and carefully selected use cases, it is hoped that voice assistants will find wider adoption among a diverse user base.

4 STUDY AND RESULTS

To understand how the elderly population perceived voice assistants and voice user interfaces in semi-public spaces, we conducted semi-structured interviews with 8 participants. The primary idea was to explore potential applications, contexts, and functionality for voice assistants in semi-public spaces. In addition, we also wanted to understand the barriers and limitations of voice assistants in such an environment.

The participants (5 females and 3 males) had no prior experience with voice assistants or voice user interfaces. However, all participants were familiar with the Internet, and smartphones and used them in their day-to-day life. The participants were recruited through the personal contacts of the researchers, snowball sampling, and word of mouth. All the participants were 60 years or older (the oldest participant was 74), mean age being 68.3 years (SD 4.29). All participants had Finnish as their mother tongue and had good conversational skills in English. Some participants had self-reported issues with memory and motor skills.

Our interview questionnaire consisted of two parts, first part enquired about their familiarity with technology, and how they use them. This was to gain an understanding of their familiarity with different modalities such as touch, keyboard input, and other modes of interaction. The second part was more towards the use of voice assistants and voice user interfaces and enquired about the possible scenarios of their use. This also allowed us to have a preliminary comparison of voice interfaces with other modalities.

The interviews provided us with preliminary insights into many aspects of using voice assistants and voice user interfaces in a semi-public space. In general, all the participants were positive towards the idea of using speech or voice as a mode of interaction. The primary reasoning was the naturalness of the voice commands as compared to typing something on the screen or touching a button on the phone. Hypothetically, the participants preferred the idea of talking to a device to 'get things done', e.g. changing the television channel, rather than looking for the remote controller, finding the small button, and then changing the channel. As none of the participants had any familiarity with voice assistants, the enthusiasm was towards trying out a novel technology, and their perceived ease with which the voice interface would function. Although, an actual evaluation of the comparison can only be ascertained after a thorough user evaluation.

On the question of using voice assistants in a semi-public space, the general perception was negative. The participants were reluctant to use them in public as they felt that it would be awkward to speak loudly in front of a machine. However, on probing further, and providing a scenario, such as interacting with an ATM on bank premises, some participants agreed that they might still use them. However, reluctance was still weighing as a deterring factor.

These interviews also provided us with potential semi-public spaces where voice assistants could be deployed. We initially had banks, libraries, health centers, community centers, and museums as possible/probable semi-public spaces. One of the interviewees, who is a regular churchgoer suggested they be used in the church lobby, where she could get information about upcoming events. Another participant who works at a community center for the disabled also welcomed the idea of having a voice assistant at their premises. Yet another participant wanted to try out these assistants at her grandchild's daycare center. However, children as target users were beyond the scope of our discussions.

The issue of privacy also figured prominently during the interviews, and a majority of participants were concerned about using

voice assistants in a semi-public space. These concerns were primarily related to personal information such as bank account details or social security or medical information.

There was also a concern about using voice assistants at the health center. The participants were concerned that their personal medical information might be compromised if they use a voice assistant in a health center. This was further aggravated by the recent news reports in newspapers regarding data theft by hackers attacking medical databases.

Another important issue raised by the participants was regarding the language of communication used by the voice assistants. As all the participants had Finnish as their native language, they naturally expected to communicate in Finnish with the voice assistant. At the moment, this is a major challenge in adaptation as both Amazon's Alexa and Google Home do not support the Finnish language.

In summary, we may argue that the overall inclination toward using voice assistants in semi-public spaces remains mixed. Certainly, the concerns raised by the participants need to be addressed for a successful adaptation. At the same time, it also opens up avenues where voice assistants could possibly provide useful service to the users.

5 CONCLUSION

The preliminary impressions gathered from the interviews with the participants indicate that voice assistants can be a useful and interesting way of providing information and services in semi-public spaces. For e.g. VAs could be used in providing information about flights and trains, upcoming events in the church or museums, the arrival of new books in the library, navigation support for blind users, or providing accessible route information. However, in the current state of development, their adaptability appears challenging owing to the concerns of privacy, language support, background noises, and ease of use. Moreover, studies need to be carried out with diverse user groups, as there are cultural, language, and demographic differences among users. Future work will use these initial results in designing and developing voice interfaces for the elderly in semi-public spaces.

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