I am old too! : Understanding the Impact of Empathy and Voice Characteristics on Older Adults' Perception of Voice Assistants

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***Abstract*—Despite improvements in the universal usability of digital technologies and growing numbers of conversational agents (CAs), new technologies rarely reflect older adults' needs, perceptions, and interests. Following this urgent call, we aim to identify older adults' (ranging in age from 65 to 75) perceptions, needs and challenges when conversing with a smart speaker-based voice assistant (Google Home) about the Covid-19 pandemic during the first-time user interaction. Based on CASA (Computers are Social Actors) Paradigm and Similarity Attraction Theory, our user-centered qualitative research showed that an emphatic voice assistant triggered older adults to disclose to a CA more than a human being and build a digital companionship with them. Going beyond the standard universal usability considerations, we revealed how their cultural biases, beliefs and ageing stereotypes affected their perception of the voice assistant. However, the similarity attraction effect is not activated in older adults since a voice assistant with an older voice was not perceived as close or similar to them and they perceived technology as a young tool to be adapted. Unexpectedly, the older is wiser stereotype has been deactivated in a technological context for older adults in Turkey.**

Keywords—Older Adults, Universal Usability, Smart speaker-based voice assistants, CASA Theory, Accessibility, Stereotypes

Introduction

How can we create and assess digital technology to address the requirements of an ageing population (65+)? As a result of their conversational abilities and the rapid expansion of speech technology, CAs are earning a great deal of hyped anticipation for their potential to assist older people, although the empirical proof for this population is currently limited. Given the usefulness potential of smart-speaker-based voice assistants (VAs) for older people and their low propensity to embrace them, it is essential to examine their use and perception [8] [17]. According to prior studies, older persons tend to embrace new technologies more slowly, have greater difficulties, and experience greater frustration when utilizing new technology than younger adults [4]. We must first examine older adults' impressions of new technologies to determine if the digital gap and inequality still affect older adults and to ensure that new technologies are freely accessible. Thus, the current COVID-19 pandemic has intensified the difficulties associated with providing healthcare services and social connections. New designs must propose human-supportive CAs to facilitate users' social connection, sense of isolation, fears of infection, frustration, boredom, and well-being [10]. Their potential needs to be taken into account since they could engage with the elderly more than a human-being [11].

This study seeks to identify the age-related needs and challenges of older adults (65+) when interacting with a smart speaker-based voice assistant (Google Home). We aim to set up an experiment by exploring the following factors in general which may influence the perception of a CA by older adults: (1) to assess the importance of psychological, social factors, biases and stereotypes, (2) to understand how they react and perceive CAs, (3) to identify implications for interaction design and opportunities

I. THEORETICAL FRAMEWORK

According to the Computers as Social Actors (CASA) Theory, people prefer CAs who express empathy over those who only provide advice [13]. Social cues such as small talk, self-disclosure, expert jargon, empathy, gossip, and politeness expressed in human-to-human conversations to build trust could also be used to gain the user's trust during conversations with artificial entities. For effective persuasion, the CA must maintain a social dialogue and express social cues to be trustworthy, liked and adopted [2]. Individuals interact with artificial entities using social cues derived from human-human interaction (HHI) and treat them as social entities [15]. Voices and conversational style of VA can influence users' preferences and perceptions in ways that have not been thoroughly investigated, let alone in a Turkish-speaking context.

People, according to Social Identity Theory (SIT) theory, tend to cultivate their sense of self within social groups then categorize themselves according to these groups [18]. Social identification causes the formation of a shared identity, as well as an "in-group" and "out-group"[19] Individuals are more attracted to one another when they share similar attitudes, ethnic backgrounds, voices, and facial characteristics [1].

Using CASA Paradigm and SAT as a framework, our aim is to provide a basic understanding of 1) Do older persons classify VAs as "tool-like" versus "human-like"? 2) What are the perspectives of social interactions with a voice assistant among older adults? 3) How does the gender and pitch/rate of a CA's voice affect older users' reactions to the agent?

II. METHODOLOGY

This work aims to take preliminary steps towards creating a CA that can give advice convincingly with an empathic verisimilitude. This study sought to explore whether a voice assistant should express emotional support and empathy or provide informational advice-only support about a personal problem, as suggested by prior studies with different artificial entities [6] [13]. Although the expression

of empathy and emotion is supportive in human-to-human communication, will it be the same when we converse with an artificial entity, or will we reject it due to its artificiality, uncanniness, age-related emotional or social needs, or biases?

On the other hand, vocal cues such as pitch and speech rate are significant in judging the personality of voices, triggering the existing stereotypes, identifying relational bonding, and establishing rapport [3]. We created two generations for age stimuli, with a "mature voice" (speed: 0.9, pitch: -4) based on a 60-year-old male and a "young voice" (speed:1.25, pitch:6) based on a 20-year-old male, altering speech rate and pitch on the Voiser platform to determine how similar vocal cues influence the development of relationships between older adults. We selected to employ solely male voices to narrow the scope of the project and because voice assistants are typically made using female voices. After developing voices on the platform, we asked 60 people to predict the ages of the voice assistants to double-check; everyone agreed on the age range.

When matching the participants' age and identification qualities with the CA's perceived audio signals, this study hopes to find evidence supporting the similarity attraction theory. We planned to conduct a user-centered qualitative research to determine which voice characteristics of CAs may be preferred and which personality factors are associated with voice pitch by older adults in Turkey. One of the goals of this study is to determine how one single in-group and out-group social cue (an 'older' and 'younger' voice) affects older individuals' views of CAs. Based on the similarity attraction and social identification theories, it can be hypothesized that older persons will have a greater link with a CA with a mature voice. The other objective is to investigate how perceptions of older persons alter depending on the VA's degree of emphatic expression.

A. Research Procedure and the Experimental Set-up with Wizard of Oz

Our research methodology was founded on a user-centered qualitative approach and consisted of three stages: pre-test, momentary test, and post-test. During pre-test interviews, we initially sought to grasp the early impressions of new technology, synthetic voices, and robots. In addition, we seek to comprehend how individuals respond to stressful events and their age-related patterns concerning the concept of empathy.

This qualitative study tested a voice-enabled CA prototype using the Wizard of Oz method. The experiment was conducted in an environment reminiscent of The Wizard of Oz, in which participants were led to believe they were interacting with an autonomous system. The operations of the system were controlled by a remote experimenter or "wizard" [5]. In this experiment, participants were told they engaged with a conversational AI that automatically responded to their answers. The "wizard" was the one talking with the participants via a script. To test our prototype voice assistant, we have uploaded audio files that will be played in response to a wide variety of user utterances. We created a soundboard in PowerPoint and hyperlinked each audio as a response button. As the voice assistant reacted to the user's response, the wizard played the relevant audio button. Bluetooth was used to connect our laptop to Google Home (Assistant) so that our participants will assume that the audio is being played by Google Home (Assistant). During testing, we observed the participants' gestures and body language to determine whether they employed human-like conversational conventions like as nodding, uh-hums, and facing.

In post-test interviews, we focused on gaining a comprehensive understanding of the user experience, including usage patterns, needs and challenges, their ontological perception of voice assistants, their tendency to use conversational norms when interacting with a VA, and their mood change.

B. Momentary Test Design and the Dialog Flow

We sought to provide older adult users with an empathic advice-giving voice assistant regarding Covid-19 quarantine. Initially, we investigated their Covid-19 experience and feelings by surveying 60 adults over the age of 60 to determine the dialogue flow. Second, to determine the level of empathy expressed by the voice assistant, a second group of 60 older adult users scored our voice assistant's empathy based on the predetermined dialogue flow script. Before beginning the ratings, each of the sixty older adult participants was provided with definitions of empathy and sentences expressing high/low empathy to rate in accordance with our theoretical framework. On a five-point scale, empathy was rated as follows: 1 = low empathy; 5 = excellent empathy. In times of strong emphatic expressiveness, words showed empathy. In low emphatic situations, utterances were mostly formal and centered on only advice-giving.

Fig. 1: Wizard of Oz's Controlled Dialog Flow Panel

We carried out a study in a home-based trial using a 2x2 between subject factorial design, with the variables being voice characteristics (mature vs young) and the presence of empathic expression (high empathic expression vs low empathetic expression) on the social outcomes of older adult users.

Participants were instructed to interact with the voice assistants in four parts, depending on which group they belonged to: an initial greeting, small talk, suggestions, and sensitive inquiries. The two types of chats included the same conversational subjects and suggestions but presented varying amounts of empathy from the CA. We designed our four-step discussion flow by adopting earlier relevant works [6] [9].

C. Participants

A total of 60 participants ranged in age from 65 to 75 years old and had no prior experience with voice assistants (e.g., Alexa, Siri, Cortana). Every participant uses a computer, smartphone, or tablet at least once every day and has at least a high school graduation. Participants provided informed consent, which was written to utilize acquired data, before participating in the study.

III. Results & Discussion

The findings demonstrated that the conversational style and voice age of the voice assistant had substantial qualitative implications on social, functional, and cultural outcomes. Even though older individuals are frequently perceived to be resistant to adopting new technologies or technophobic, our findings add to the body of research demonstrating that older adults prefer context-based interactions with a realistic conversation to be motivated to use new technology. The idea that smart speaker-based voice assistants deliver objective information, emotional support, and social engagement were important motivators, according to our findings.

A. Pre-test Results

Due to lack of digital technology experience, age-related problems, and poorly designed technologies, older adults may face challenges to technology use as digitally excluded individuals. They were found to acquire new technologies more slowly and have greater difficulties, frustration, fear and less interest when utilizing digital technology [16]. We have discovered that it is more complicated than just simply a fear of emerging technologies. Before and after their initial interaction with a voice assistant, our participants reported a range of emotions and assumptions, including curiosity, intimidation, security, insecurity, admiration, and even a desire to defeat the VA. However, they were all engaged and willing to interact with our voice assistant, and none of them shown any phobia before to or during their initial interaction. The majority (n=45) of respondents did not believe they would be able to handle the voice assistant, but when given the opportunity, individuals either praised or patronized the voice assistant, but shown a willingness to sustain communication.

B. Momentary Test results

The elderly population in Turkey was the most vulnerable to the Covid-19 outbreak and was also the population that spent the most time alone during the process. (Binark & Kandemir, n.d.). During the conversation, participants started to use more intimate and sincere expression and back-channelling such as (for example, "inşallah- if Allah wills") or (for example, "good to have you here"), which can be considered explicitly intended by the participants and not a “social mindless response”. In addition, despite the fact that the device does not have a face, participants stared directly at it, controlled turn-taking, answered with back-channelling, and utilized uh-hums just as they would during a conversation between two humans.

C. Post-test results

In spite of the short amount of time they had to get to know each other, participants saw the value in "having a discreet assistant" and began to form a digital friendship with their voice assistant. All the people who participated in our study were adamant about not disclosing their emotional struggles to people close to them. Based on our findings, they said they *"did not want to go deep with people"* (F3) and *"weren't raised as cry-babies"* (M4) because of *"their reliability and trust problems as a generation"* (F16). They *"did not want to be grumbling old guys"* (M8) and *"do not want to upset their loved ones by complaining about their issues"* (M9). A common theme that emerged from the participants' responses was that they don't *"communicate personal and familial difficulties with outsiders"* (F16) or *"with other hypocrite people"* (F26). However, people in this group were enthusiastic about the prospect of acquiring an emotionally supportive voice assistant, because they thought they *"need to resolve everything inside the house"* (F19). We could derive that older adults" needs for new technology in Turkey need to be addressed by referring to their "protective" cultural and generational reflexes while designing for them.

a) Insights about Emphatic Voice Assistant

Consistent with the CASA Paradigm, our study showed that participants responded favourably to a CA's display of empathy, just as they would to a human's. Unexpectedly, they stressed that they would rather talk to the VA than a human being since the VA would listen without passing judgment and would be more objective and discreet than a human. Our agent's empathic response led to more openness from the participants, who apparently felt validated in their own experiences.

VA as a Comfort giving Quarantine Counselor

Half of the participants (n=30) found our voice assistant's use of *"such nice words"* to be amusing and helpful (F4). If you were to talk to a human being, M21 said, *"you know, people wouldn't always say the nicest things"* because he didn't get many opportunities for such words. To M22, it served as a form of therapy: *"In the end, I answer for myself. He asks me questions, and by answering them, I get a better understanding of myself and had a chance to discharge about our suffering during quarantine."*

After the Covid-19 quarantine, participants emphasized the importance of seniors being heard and supported emotionally. Without being stereotyped as *"whining old people,"* they require opportunities to interact with others and feel some compassion:

> *"We as a generation felt imprisoned and limited by the state. We don't generally complain, but I was flattered that the VA was able to grasp what I was saying and*

compliment me on it…. I ended up sharing more than I had planned." (M6)

They constantly referred to themselves as *"a generation"* and highlighted that they needed to be convinced to talk even though they were emotionally incapable of handling the process themselves:

"It indulged me, and I told him my Covid quarantine process. As a generation, sometimes we need to be pushed to talk about our bad times. We don't have that habit." (F13)

Our results show that people place a high value on the opinions and experiences of those who make them feel heard and understood without passing judgment. The recommendation made by our more emphatic voice assistant was rated as more reliable than the other, despite the fact that they both offered the same suggestion.

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VA as an Invisible Friend with no Judgement and Gossip

Even though this was their first time interacting with a VA, they came to see it as an "objective and discreet companion". Discussions about the essential value and need for the voice assistant were tied to participants' cultural beliefs about the fear of other people's judgement. Several participants agreed that our voice assistant may be of great help to them (sometimes more so than with humans) because they can have a dialogue about delicate matters without fear of judgment as F2 explained:

"... These days, if you try to have a conversation with someone about your feelings, they will inevitably turn the conversation back to themselves. If actual individuals offered the same advice as the assistant, they would likely boast about it and look down on me. The robot never spoke to me in a condescending manner."

After the small talk session, F4 opened up about her breakup with the voice assistant, describing it as "a nice companion to chat to and VA never gets bored when she asks the same questions over and over again. There was a high level of confidence among participants (n=40) that our forceful voice assistant could conduct a *"heart to heart chat"* with them and *"keep the conversation to itself unlike certain blabbermouth buddies"* (F12). We found that our VA was most successful at eliciting self-disclosure from participants when it recognized the participant's distress in their responses to sensitive questions and acted accordingly with empathic realism.

b) Insights about Non-Emphatic Voice Assistant

Users had a poor impression of our non-emphatic voice assistant, found it less human-like, and even wanted to double-check if they were being recorded out of a sense of unease. Our first results suggest that a user's impression of a voice assistant's interest in initiating conversation or showing concern can increase their sense that it is intelligent and sympathetic. Caring and empathetic conversation partners are necessary for elderly to feel comfortable and be themselves when interacting with synthetic voices.

VA as an untrustworthy recording machine

Participants described our less emphatic voice assistant as *"formal," "distant," "bossy," "arrogant*," and *"rude,"* despite the fact that their suggestions were identical. Some VA's remarks were described as flippant and offensive. Most of our test subjects (n=28) reported feeling uneasy, unsure, and hesitant when interacting with our low emphatic voice helper. M15 had reliability concerns due to the way of speaking of the voice assistant:

"... He seemed to be recording the conversation, so I avoided answering any personal questions."

F9 criticized the dearth of empathy and suggested that a voice assistant with less empathy would come across as less real, less virtual, and more sterile:

"...I found his suggestions for a pilates app to be intriguing, I wouldn't put too much stock in them coming from such a weary-sounding old man. What about making me talk with something a little more youthful and entertaining than this emotionless calculator?"

They got even irritated and indicated that they "felt stupid talking to this machine" (F10) due to his conversational style:

"...He was like an online bank assistant. He has to be more understanding or sympathetic maybe. Why I bother talking about myself with it?" (M20)

Participants felt insecure about our voice assistant with low emphatic expression. They *"did not feel closed to answer personal questions"* (M7) and *"felt like the machine is recording his personal information"* (F21), and *"felt like being investigated"* (F22).

Based on our findings, we might assume that older adults *"as a generation"* desire flattery and persuasion to open up during conversation prior to establishing a trustworthy digital relationship, perhaps more than other populations. The conversational style of our less emphatic voice assistant made participants feel as though they were chatting in an unnatural manner and with a tool.

c) Insights about the VA with Mature/Young Voice

Young voices were described as *"dynamic," "enthusiastic"* and *"soft,"* while mature voices were described as *"deep", "slow"* and *"rumbling"*. Contrary to our assumptions, the majority of our older adult participants did not identify with or feel connected to the VA with a mature voice. Participants' interactions with our voice assistant revealed similar user expectations and beliefs consistent with age-related social cues indicating that new technology is "a young tool." However, they shown a desire to be a part of that

community and became readily agitated if they saw an age-related negative implication, as M12 demonstrated:

> *".. I felt like I was conversing with an elderly man, and it made me feel old due to his slow speech. Did he do it because he believes I am too old to comprehend him?"*

Participants regarded our less emphatic voice assistant with a more mature voice to be less likable: *"you brought something to play a teacher, I did not like him"* (F18). They believed that *"a younger generation understands technology better than themselves, thus they would place greater reliance on a younger robot"* (M12). Participants judged the VA with the younger voice to be more *"energetic"* and *"dynamic,"* and they were more inclined to befriend this VA and not to see it as a tool.

Participants favoured voice assistants with a younger voice because they considered that they needed to embrace and adapt the norms of the younger generation to participate in the digital world. They claimed that *"a younger person and a robot both had a fresh memory"* (F27):

> *"…If it sounded like me, it would reflect the thoughts and emotions of my generation…I like a younger voice because they are more tech-savvy, receptive to technology, more tolerant than we are." (F7)*

Surprisingly, the "older is wiser" stereotype has been deactivated among the majority of participants (n=50) who believed that they may learn new things from younger individuals. They believed that technical tools must be young in order to be reliable and natural (F29). They did not identify with our adult VA, found it *"dull"* (M28) and *"narrow-minded"* (F29), and felt as though they were conversing with an elderly robot. As M27 explained, our findings revealed that people linked wisdom more with the VA, which has a younger voice.

> *"It makes sense to converse with younger individuals; if I want to create new acquaintances, they must be young. What can I learn from a peer?"*.

We assumed that a mature voice will have a positive effect on the activation of age-related stereotypes in interaction and similarity attraction rate. However, when we compared the perceptions of older and young voices, we discovered that the mature voice was viewed as domineering and low-vibe, and they did not identify with it.

In addition, we discovered that not all participants desire a female voice for the virtual assistant. The majority of male participants (n= 20) desired the option to switch to a young female voice because, according to their statements, the female voice is softer, more naïve, and more understanding. Due to the gender preconceptions that male participants still assign to women, a female-gendered VA matches the expectations and presumptions that male participants currently hold: a lower status as an assistant, and a nice attitude in a caring position. Therefore, female participants (n=10) favored the young male voice because *"they were tired of hearing the female voice all day long"* (F1) and *"it would be good to have a young male buddy like their kid or a gorgeous doctor"* (F12). The majority of women did not have a preferred gender. Although the majority of male participants find the female-gendered voice more appealing, designers and businesses must question these outdated stereotypes and utilize their market dominance not to impose them.

IV. CONCLUSION

Human-computer interaction (HCI) frequently addresses the importance of universal usability, however not all populations will find cutting-edge technologies usable. It is quite improbable that a single, general CA would be accepted and used by everyone, because of the wide range of demographics (including age, ethnicity, and language). Our research intends to help bridge this knowledge gap by illuminating (1) how older individuals' social reactions to CAs' verbal cues vary, and (2) the impact of elders' cultural norms, biases, assumptions and stereotypes on their relationships with CAs.

Our research shows that older individuals' societal and cultural biases "as a generation" may make them more receptive to a smart speaker-based VA that may assist and advise them as "a trusted confidant." We found that older people who avoid talking to others for fear of being labelled as frail and grumpy can benefit from and enjoy using a VA. A person's impression of a VA might be bolstered if they get the impression that VA is enthusiastic about conversing or cares about their needs. In contrast to what we might have expected based on our theoretical framework, older adults appear to challenge the "old is wiser" stereotype by actively rejecting the idea that they are more resistant to change because of their age.

Our results revealed that when VA showed concern for and empathy with the user, it was seen as more human. Because they thought VA was a private conversation partner, they felt more comfortable sharing personal details with VA. On the contrary, it was perceived as a tool when it gave advice-only support, and they felt insecure. After the first engagement, older individuals may indicate a desire to embrace voice-based smart speakers if they provide more than just an information kiosk or automation control.

We propose that an emotionally responsive and expressive VA with a younger voice can help older people feel less isolated. Our results suggested that during the Covid-19 quarantine, our subjects were more at ease engaging with an agent than a human being because they feared being judged or seen as emotionally weak. As part of future research we plan to expand this model to other disadvantaged groups like blind people. Even though the dialog flows were validated, one of the limitations of our study was that it was conducted by the wizard who instantly controlled the experimental set-up, which may cause some biases. There is also some limitations about our sample size. There could be idiosyncrasies to our older adults sample that could not extent to older adult groups and needs to be tested with a bigger sample size.

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