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# Beyond "Alexa, Good Morning": Prerequisites for a Voice Assistant That Truly Understands Older Adults with Empathy

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***Abstract*** **-** Older adults show interest in technological resources — a perception we were able to confirm through field tests conducted with 20 individuals aged between 60 and 89 in Portugal. Participants were challenged to use the virtual assistant Alexa to contact family members and perform other daily activities. A total of 6,301 interactions were recorded during the study, across different categories. The analysis of these interactions, combined with post-test interviews and the results of a loneliness scale, revealed gaps that hindered the interaction between Alexa and the participants. As a result, we were able to identify key requirements for the development of a more empathetic and age-appropriate voice assistant. In summary, the findings point to the potential of such technology to reduce loneliness and facilitate communication with family members, while also highlighting limitations related to language and command comprehension. Based on the results, we propose a set of design requirements for a virtual assistant tailored to the needs of older adults.

***Keywords*****:** older adults, voice interaction, voice assistants, Alexa, empathy.

## 1. Introduction

As the global population ages, the challenges of promoting digital inclusion among older adults and reducing feelings of loneliness are becoming increasingly significant. The World Health Organization (WHO) emphasizes that active aging depends on social participation, health, and security [1]. Within this context, digital technologies can serve as powerful allies. Among these technologies, voice-command virtual assistants stand out as promising tools for expanding access to information, entertainment, and communication in an accessible way [2]. By eliminating the need for specific motor or visual skills, these devices offer clear advantages for older users [3] However, such technologies are still predominantly designed based on the habits and expectations of younger, digitally literate users – often leading to unintentional exclusion when applied to senior populations [4].

This paper presents the results of a study conducted within the HUGTV project (**H**elping **U**nite **G**enerations through **T**ele**v**ision), which investigated how older adults interact with the Alexa virtual assistant, particularly when integrated with a system of personalized television notifications [5]. The goal was to identify both barriers and opportunities in the interaction between older users and the technology, and to propose concrete requirements for the development of virtual assistants that are more empathetic and effective. More than a functional analysis, this study sheds light on the ways in which interactive technologies can – or cannot – respond to the emotional, social, and cultural dimensions of aging.

## 2. HUGTV System

To develop a functional prototype capable of testing older adults' receptivity to virtual assistants, a solution was designed that combines different technologies in an integrated manner. The system, named HUGTV, is based on the use of a voice assistant (Alexa) integrated with a proactive notification system displayed on television [6]. The goal is to simplify communication between older adults and their family members or caregivers by offering an experience that is accessible, personalized, and empathetic.

Television was chosen as the central point of interaction because it is a device already familiar to senior users, as identified in both the literature review and the interviews and focus groups conducted in the early stages of the study [8]. The display of personalized messages directly on the TV screen represents the users' first point of contact with the system. These notifications, previously programmed by the researcher, are based on data collected through characterization and media habits questionnaires – thereby simulating the proactive component of the assistant. The purpose of these messages is to suggest specific actions, such as making a call, sending a message, or interacting with the assistant. Because they

appear on a medium that is both visually accessible and frequently used in participants' daily routines, the likelihood of engagement increases.

Upon seeing the suggestion on the screen, the user can simply say, for example, "Alexa, call Maria" or "Alexa, play the grandma-and-granddaughter playlist," and the system will automatically execute the action. This interaction flow was designed to minimize cognitive and operational barriers, bridging generations through intuitive and welcoming technology (**fig.1**).

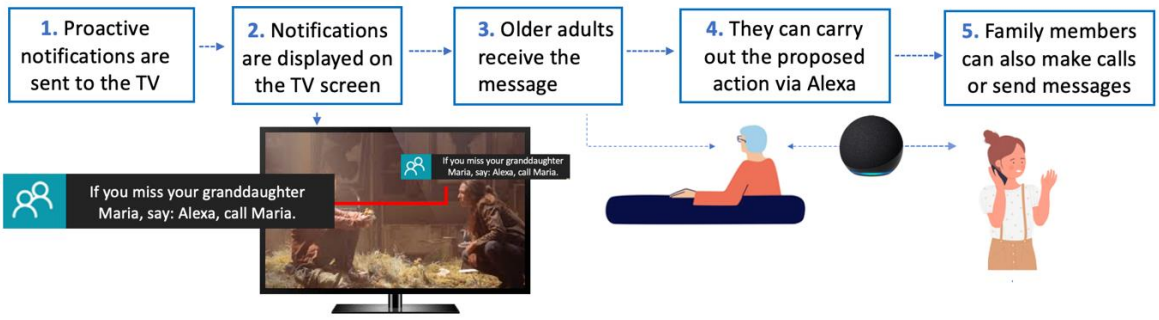


**Fig. 1:** Functioning of the HUGTV project, its technical framework, and integrated technologies.

All messages follow a clear call-to-action format, and responses are delivered by Alexa in real time, with no need for users to handle mobile phones or other devices.

## 3. Field tests

The tests were conducted between November 2023 and July 2024. The experience took place in the participants' homes, with prior consent and in full compliance with the General Data Protection Regulation (GDPR). Before the system installation, a characterization questionnaire was applied, focusing on three main dimensions: (i) the participants' sociodemographic profile; (ii) television content consumption habits; and (iii) use of technology to stay in touch with others.

### 3.1. Sample

A total of 20 individuals aged between 60 and 89 participated in the study, with a mean age of 72.4 years. Most participants were concentrated in the 68 to 77 age range (interquartile interval). In terms of gender identity, 12 participants identified as female and 8 as male. All reported having children, and 6 stated that they had grandchildren and/or great-grandchildren. Regarding health conditions, 6 participants reported visual Impairments – especially when using mobile phones – and 2 reported hearing difficulties. No participants mentioned motor limitations; however, one woman reported being in the early stages of dementia. In terms of educational attainment, the sample was distributed as follows: 10 participants completed secondary education, 7 held a university degree, 1 had a master's degree and 2 had completed only basic education.

As for household composition, 6 participants lived alone, 12 lived with their partners, and the remaining 2 lived with children or other relatives. To assess digital competence levels, the European Union's "Digital Competence Framework for Citizens[1]" was used. This model categorizes individuals into three levels based on five domains: "Information and data literacy", "Communication and collaboration", "Digital content creation", "Safety" and "Problem-solving". If a participant was able to perform at least one task per domain, they were at a "basic level"; two tasks "above basic"; and failure to complete at least one task in each domain indicated a level "below basic."

[1] Available on: https://ec.europa.eu/eurostat/cache/metadata/en/isoc_sk_dskl_i21_esmsip2.htm.

The distribution: 14 participants (70%) were classified as “below basic”; 3 (15%) as “basic”; 3 (15%) as “above basic”.

All participants reported frequent use of both mobile phones and television. Other devices mentioned included computers (12 participants), smartwatches (8), and tablets (6). When asked about difficulties with technology, 18 participants said they experienced some form of difficulty and frequently relied on close family members – mainly children or grandchildren – for help. Regarding the frequency of communication with family and friends, 17 participants stated that they spoke with family members daily, 2 communicated twice a week, and 1 reported doing so once a week. Even among those who communicated daily, 12 expressed a desire to talk more.

Additionally, 8 individuals reported having avoided contacting someone due to technological difficulties, highlighting a limited use of available digital functionalities. Nevertheless, most participants showed a willingness to learn more about these tools. A statistical analysis conducted in SPSS revealed a significant correlation between educational level and digital skills ($r = 0.575$, $p = 0.008$), suggesting that digital inclusion efforts should consider older adults’ educational backgrounds as a key factor in designing effective training strategies.

In conclusion, the sample was heterogeneous, comprising participants with diverse age ranges, educational levels, family contexts, and degrees of digital familiarity. Although the group distribution was not entirely balanced, this diversity enriched the qualitative analysis and lent greater validity to the observation and listening processes.

### 3.2. Method

Participants used the system for 60 days, with continuous in-person support (regular visits) and follow-up phone calls. The study adopted a mixed-methods approach, combining the collection and analysis of both quantitative and qualitative data. Among the quantitative instruments used were: the UCLA Loneliness Scale (administered pre and post-test) [8] [9]; automatic logging of voice interactions ($n = 6{,}301$); and statistical analyses using SPSS to identify correlations between age, digital skills, family context, and volume of interactions.

On the qualitative side, the following methods were employed: 20 post-test interviews (conducted in person, by phone, or via video call, according to participant preference), using a semi-structured script; thematic analysis of the interviews, supported by webQDA software[2]; and participant logbooks, in which individuals recorded their experiences, difficulties, and perceptions regarding the use of the technology.

Voice interactions were categorized (e.g., messages, music, weather forecast, calls, reminders, etc.) and analysed in relation to sociodemographic data. Additional variables were also examined, such as frequency of use, variety of commands, and types of language used.

### 3.3. Results

In total, 6,301 interactions were recorded, averaging 315 per participant. When divided by the 60-day testing period, this results in an average of 5.25 interactions per individual per day, exceeding the one-interaction-per-day guideline suggested in the participants’ logbook. It is worth highlighting that 19 participants interacted with the voice assistant daily, engaging with different functionalities – except for Participant 12, who reported having dementia and, according to family members, this diagnosis influenced her ability to use the system.

Another noteworthy finding is that all participants performed at least one task for the first time, such as registering a birthday in the calendar, setting a timer, sending a voice message, searching for information online, checking the weather forecast, and choosing music to play – without having to “wait for it to come on the radio.” This suggests that voice commands can serve as a stimulus for older adults to try and adopt new digital resources.

Regarding difficulties encountered, all participants reported recurring problems with Alexa, particularly related to speech comprehension. The main issues reported during the post-test interviews included:

- **Lack of comprehension:** The absence of a European Portuguese version significantly hindered communication. Thirteen participants explicitly mentioned this issue in the post-test interviews.

[2] Available on: https://app.webqda.net.

- **Speech pacing:** All 20 participants stated that they had to learn to speak in shorter, slower phrases, which was not natural for them. Ten reported that this difficulty persisted throughout the testing period. Two participants even reduced their interaction volume due to persistent comprehension problems.
- **Use of regional expressions or slang:** All participants experienced instances where Alexa failed to understand them, particularly when local expressions or informal language were used, making interactions more difficult.

Still within this context, a word cloud (**fig.2**) generated through discourse analysis using the webQDA software revealed the prominence of the Alexa assistant in the participants' experiences. Terms like "message," "speak," "say," "mobile phone," and "call" stood out, reflecting the frequent use of voice commands to communicate with family and friends. This supports the notion of the system as a mediator of social interaction, which was one of the central goals of the HUGTV project. The presence of words like "company" and "home" further suggests that, for many participants, Alexa represented a constant presence in their daily lives, especially for those who live alone.


**Fig. 2:** Word cloud created based on the qualitative analysis of the 20 post-test interviews.

Although positive perceptions were dominant, the word cloud also displayed terms associated with difficulty, such as "difficult," "problem," "alone," and "understand." The coexistence of such terms highlights that not all participants experienced the technology as intuitive or seamless. Technical limitations, especially those linked to linguistic mismatches, were frequently reported in interviews, as reflected in phrases like "speak slowly" and "she didn't understand." While mentioned less frequently in absolute terms, these barriers had a direct impact on how intensively the technology was used, as shown in the quantitative analysis of interaction volume.

Thus, the word cloud offers a visual synthesis that aligns with other findings from the study: while Alexa shows strong potential as a tool for socialization and companionship, issues related to usability and language barriers remain significant obstacles to full digital inclusion among older adults. This emphasizes the need for technological solutions that are more linguistically, sensorially, and culturally adapted to the realities of aging populations – otherwise, the benefits of innovation risk being limited to those with higher digital literacy or fewer functional limitations.

The integration of quantitative data (number of interactions) with qualitative post-test interview analysis reinforces a consistent relationship between perceived difficulty and reduced use of the HUGTV system.

Participants who reported difficulties had, on average, significantly fewer interactions than those who did not report such issues (**fig.3**). All five participants with the lowest usage levels reported comprehension or usability difficulties, further reinforcing the hypothesis that perceived challenges act as inhibitors to engagement.

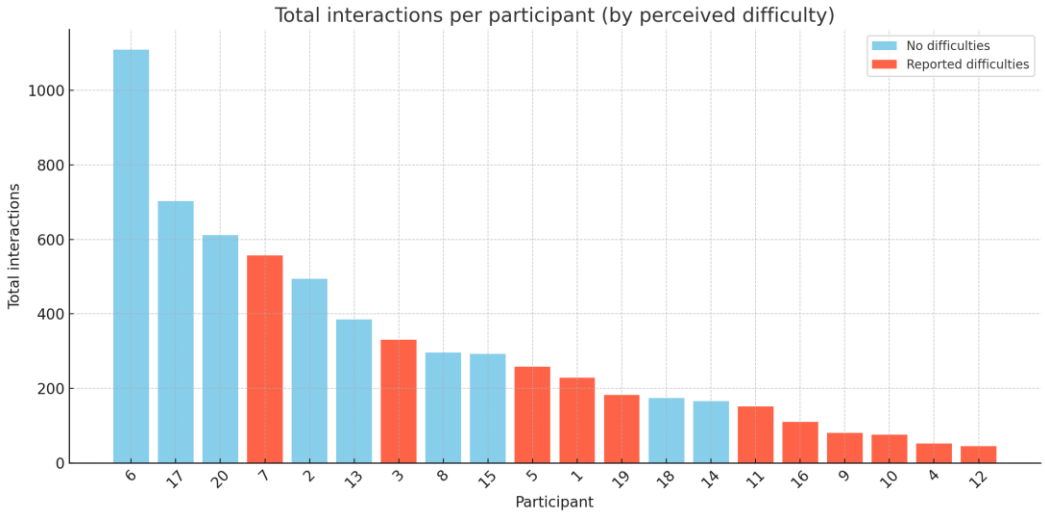


**Fig. 3:** Interaction ranking showing that participants who used Alexa the most were those who experienced the fewest difficulties with the technology.

This pattern was confirmed in the interviews. Participants such as IDs 7, 12, 13, and 16 described initial confusion, particularly because they were unfamiliar with voice-based interaction or experienced auditory and visual impairments. Additionally, the absence of a European Portuguese version of Alexa was a common source of misunderstanding. Expressions like “speak slowly,” “she didn’t understand,” and “accent” appeared frequently in the comments of those who interacted less with the system.

Nonetheless, the qualitative data also revealed a progressive adaptation. Participants who initially reported difficulties found ways to overcome them over time, especially with the help of in-person guidance. Strategies such as simplifying phrasing or adjusting speech rhythm proved useful. For many, the assistant became a symbolic channel of reconnection with technology. In terms of social interaction, features like sending messages and making calls were considered valuable, although they were more frequently explored by participants already familiar with digital tools.

In summary, the data suggest that reduced usage of the system is directly related to the perception of difficulty. These perceptions are tied to factors such as sensory barriers, language mismatches, low digital literacy, and cultural resistance. On the other hand, human support, guided repetition, and the naturalness of voice interaction emerged as elements capable of mitigating these challenges over time. These findings reinforce the importance of human-centred and inclusive design in the development of technologies for older adults – not only from a functional standpoint, but also as a tool for emotional connection and social inclusion.

### 3.4. Impact on loneliness and social engagement

Regarding the feeling of loneliness, the application of the UCLA Loneliness Scale before and after the testing period demonstrated a significant reduction in the overall average scores: from 30.85 to 25.55 points (it is important to note that the lower the score, the lower the perceived loneliness). Among the 20 participants, 17 showed a decrease in loneliness levels, while only one (participant 15) reported an increase. The paired samples correlation test ($r = 0.775$; $p < 0.01$) indicated a strong relationship between pre- and post-test scores, and the paired samples t-test revealed that the mean difference of 5.33 points was statistically significant ($p < 0.001$). This suggests that the use of the HUGTV system played a relevant role in reducing loneliness.

Complementing the quantitative findings, the analysis of the interviews revealed 58 references to the system's impact on loneliness: 47 were associated with the assistant being perceived as a companion, 10 with the strengthening of family ties, and only one participant did not notice any change.

The narratives portrayed Alexa as a "constant presence," "a friend," "someone to talk to," and even "a companion that fills the house." These descriptions indicate that, beyond its practical functions, the virtual assistant had a significant emotional impact.

In summary, there is evidence that reduced use of the system is directly related to participants' perceived difficulties. These perceptions are associated with factors such as sensory barriers, language limitations of the virtual assistant, low digital literacy, and cultural resistance. On the other hand, human support, guided repetition, and the naturalness of voice interaction proved to be elements capable of mitigating these challenges over time. These findings underscore the importance of human-centred and inclusive design in the implementation of technologies for older adults, with the potential to serve not only functional needs but also emotional well-being, acting as an ally in the fight against loneliness.

### 3.5. Prerequisites for a voice assistant tailored to the needs of older adults

Based on the system usage experience, interviews, and interaction analysis, it was possible to identify **11 key requirements for a voice assistant truly suited to the needs of older adults**:

**1. Understanding of different accents and linguistic variations:** several participants reported mutual comprehension issues with Alexa, especially due to the limitation of the Brazilian Portuguese version. To be effective, the assistant must understand European Portuguese and other regional variants, respecting the specific speech patterns of older adults.

**2. Slower and more articulated responses:** older adults with hearing difficulties or less technological familiarity need a slower, more clearly articulated speech rhythm. Paused and clear phrases help avoid frustration and make commands and responses easier to understand.

**3. Adjustable volume and complementary visual or auditory cues:** sensory limitations, such as hearing loss, were common among participants. Ideally, the assistant could adjust its volume automatically based on ambient noise levels—for example, increasing volume if the TV is on when a message arrives. Flashing lights may also improve accessibility for those with partial hearing impairments.

**4. Simple language and natural commands:** long or complex sentences caused confusion during the tests. Commands should be intuitive and use everyday vocabulary, structured in a way that aligns with the linguistic habits of older adults. It's crucial to build a dataset based on expressions commonly used by seniors, enabling more natural interactions. Currently, Alexa is limited in this aspect, restricting the flow and understanding of conversations.

**5. Proactive assistant behaviour:** to truly support the daily lives of older adults, the system must go beyond reactive responses. The assistant should anticipate needs and suggest relevant actions, such as reminding users to take their medication or prompting them to send a message on a loved one's birthday. This proactive behaviour helps reduce cognitive load and encourages consistent use of the technology, particularly among those unfamiliar with digital interaction. By offering reminders based on prior preferences and routines, the system promotes healthy habits and strengthens social engagement—two key elements of active aging and loneliness reduction.

**6. Personalized interaction capabilities:** participants felt more connected when Alexa used their names or personalized greetings. This humanization fosters a sense of comfort and companionship.

**7. Integration with familiar devices such as the television:** in the HUGTV project, the television proved to be an ideal starting point, as it is already part of most older adults' routines. Integrating the assistant with familiar devices facilitates adoption and minimizes the need for new technical learning.

**8. Easy setup and in-person support:** many participants required in-person guidance to overcome initial barriers. Therefore, the assistant should have a highly simplified installation and activation process, with the option for remote or on-site support using accessible language.

**9. Features with emotional and everyday impact:** functionalities such as listening to favourite music, receiving medication reminders, checking the weather, or hearing a story were sources of delight, empowerment, and reduced loneliness. These features should be central to the assistant's purpose.

**10. Respect for privacy in shared environments:** one participant reported discomfort when voicing messages aloud in the presence of others. The ideal assistant should offer adjustable privacy modes (e.g., silent message reading, password-activated commands).

**11. Empathetic and emotionally intelligent communication:** many participants felt accompanied when hearing "good morning," "good night," or engaging in spontaneous conversation with the assistant. Simulating basic human interactions may positively affect the emotional well-being of those living alone. Therefore, the assistant should be designed with emotional intelligence in mind, offering warm, context-aware responses that go beyond functionality. Empathy in voice interaction helps establish a sense of connection, comfort, and trust – essential elements for fostering user engagement and reducing feelings of isolation [10]. In summary, the prerequisites for a **voice assistant specifically designed for older adults** are systematized in **Table 1**.

**Table 1:** Core requirements for a voice assistant designed for older adults.

| Prerequisite | Justification |
|---|---|
| **Understanding of different accents and linguistic variations** | The assistant must support regional speech patterns, such as European Portuguese, to ensure mutual comprehension. |
| **Slower and more articulated responses** | Slower and clearer speech is essential for older adults with hearing impairments or low-tech familiarity. |
| **Adjustable volume and complementary visual or auditory cues** | Automatic volume adjustment and visual cues (e.g., lights) enhance accessibility in noisy or shared environments. |
| **Simple language and natural commands** | Using everyday vocabulary and intuitive phrasing prevents confusion and aligns with seniors' communication styles. |
| **Proactive assistant behaviour** | The assistant should suggest relevant tasks like taking medicine or making birthday calls, promoting autonomy and routine. |
| **Personalized interaction capabilities** | Using names and greetings makes the assistant feel more human and comforting to the user. |
| **Integration with familiar devices (e.g., TV)** | Leveraging familiar devices like TVs improves adoption and reduces learning effort for older adults. |
| **Easy setup and in-person support** | A simplified installation process and the possibility of in-person support help overcome technical barriers. |
| **Features with emotional and everyday impact** | Useful features like music, weather, and reminders increase user satisfaction and reduce loneliness. |
| **Respect for privacy in shared environments** | Privacy modes (e.g., silent message reading) are crucial for users living in shared spaces. |
| **Ability to simulate social interactions** | Simulating friendly exchanges like greetings provides emotional comfort for those who live alone. |

## 4. Conclusion

The results of this study demonstrate that voice-command-based technologies, such as virtual assistants, hold significant potential to foster digital inclusion among older adults, improve access to information, and promote social interaction with family and friends. The practical experience with the HUGTV system revealed that, when properly mediated and integrated with familiar devices (such as television), older adults not only adapt to the technology but also incorporate it into their routines with enthusiasm and a sense of empowerment. The statistically significant reduction in

loneliness scores, as measured by the UCLA Scale, reinforces the hypothesis that well-designed technologies can play a meaningful role in the emotional well-being of the senior population. However, difficulties in usage (particularly those related to language comprehension, command recognition, and sensory limitations) underscore that the mere availability of technology is not enough to ensure its effectiveness. For innovation to be truly inclusive, its design must consider the social, emotional, and cognitive contexts of aging.

The central contribution of this work lies in the proposal of a concrete set of key prerequisites for the development of virtual assistants that are truly empathetic, accessible, and aligned with the needs of older adults. These include, for instance, the ability to understand different accents, provide slower and clearer responses, adjust volume and vocabulary to user profiles, exhibit proactive behaviour (such as medication reminders or prompting birthday calls), and simulate basic human-like interactions in a comforting and meaningful way. More than just technical features, these elements represent the foundation of an aging-centred design, one that embraces cognitive, emotional, and cultural diversity in later life. By incorporating these needs from the outset, developers and researchers can move toward more meaningful and impactful uses of technology in support of active aging.

For future studies, we recommend expanding the sample size, testing the system in more diverse contexts, and developing new prototypes with support for European Portuguese, refined speech pace controls, private interaction modes, and native integration with widely used apps (such as WhatsApp). Longitudinal research may further uncover the effects of sustained engagement with such technologies on older adults' mental health, emotional resilience, and social connectedness.

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