Exploring Cultural and Intergenerational Dynamics in Voice Assistant Design for Chinese Older Adults

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In this study, we examined voice assistant (VA) use among Chinese older adults through interviews with 12 older adults and 6 of their adult children, as well as observations of VA use in solo and family settings. Our findings reveal that older adults are motivated to use VA for social interaction but encounter barriers due to limited cultural and linguistic customization, such as difficulty understanding regional dialects. Additionally, adult children play a dual role, providing necessary support while sometimes limiting independent use through overprotective tendencies. These results highlight the importance of designing VA with culturally responsive features and adaptable language models that consider the unique linguistic and social needs of older Chinese adults. This study contributes to the development of VA that balances autonomy and family support, enriching the technology's effectiveness for older adults in China and potentially in other similar cultural contexts.

CCS Concepts: • **Human-centered computing → Empirical studies in HCI**.

Additional Key Words and Phrases: Chinese older adults, Voice assistant, Cultural values, Generational expectations, Technology usage

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1 INTRODUCTION

The global population is aging at an unprecedented rate, with the number of individuals aged 65 and above expected to reach 1.5 billion by 2050 [32]. This demographic shift presents both challenges and opportunities in designing technologies that can support and enhance the lives of older adults. One such technology with great potential is voice assistant (VA), which offers hands-free interaction and can assist with various tasks, from information-seeking to smart-home automation [2, 4, 19, 46].

While prior research has explored the unique needs of older adults in technology design, there has been limited attention to the diversity of cultural contexts and generational expectations that influence technology

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adoption, especially among Chinese older adults. With its rapidly aging population, China presents a unique cultural and familial dynamic, where older adults often rely on intergenerational support from their children in technology use [17, 38]. This study addresses this research gap by focusing on how cultural nuances, family support dynamics, and generational expectations shape the design and adoption of smartphone-based VA among Chinese older adults.

Although prior studies highlight benefits such as enhanced accessibility, social engagement, and cognitive stimulation from VA use among older adults [2, 24], much of this research emphasizes Western contexts, overlooking the influence of culturally specific family structures and generational expectations found in Chinese society. Our study responds to this need, exploring how these factors impact the technology adoption process for Chinese older adults. Particularly, our research reveals that while Chinese older adults face many of the same challenges as their global peers, additional cultural and inter-generational considerations—such as language variations, region-specific dialects, and family-driven technology norms—further complicate their engagement with VA.

This research thus aims to explore how smartphone-based VA can be designed to better support Chinese older adults by addressing cultural and generational expectations that influence their technology use. By examining the perspectives of both older adults and their adult children, we investigate how cultural values and intergenerational relationships affect the adoption and functionality of VA. Our research questions are:

- **RQ1**: What are the challenges and opportunities that Chinese older adults face in adopting and using voice assistant technologies, and how can these technologies be designed to better support their needs within their cultural context?
- **RQ2**: How do the perceptions and expectations of Chinese older adults regarding voice assistants align or differ from those of their adult children, and how do these generational dynamics influence technology adoption and support?

In addressing these questions, our study gathered data from in-depth interviews and observational sessions with 12 Chinese older adults and 6 of their adult children. The inclusion of both generational perspectives enabled us to examine the misalignment of technology expectations and family roles in facilitating—or impeding—VA use. Observational data also captured the actual interaction dynamics between older adults and VA, offering insights into the practical and emotional challenges that arise in their everyday use of this technology.

Our thematic analysis surfaced four key findings: (1) social engagement as a primary motivation for older adults' VA use; (2) technical and cultural challenges that hinder adoption and usage; (3) the dual roles of adult children in providing technology support, ranging from active assistance to limitations through proxy use; and (4) generational gaps in technology expectations and family dynamics that impact older adults' VA use. These findings underscore the necessity of culturally and generationally sensitive VA designs that account for the linguistic, social, and familial contexts of Chinese older adults.

The contributions of this study are twofold: First, it provides insights into the specific needs, challenges, and expectations of Chinese older adults and their adult children regarding VA adoption, with a focus on cultural and inter-generational influences. Second, it offers design implications for developing culturally responsive and age-appropriate VA that support Chinese older adults in achieving greater independence and social connection. By addressing both generational divides and cultural nuances, our research contributes to more inclusive VA designs that can enhance the quality of life for older adults in China.

2 RELATED WORK

2.1 Voice Assistant (VA) and Older Adults

VAs are increasingly recognized as significant tools in supporting older adults [2, 5, 22, 33]. VA offers an alternative means of interacting with technology that is less dependent on fine motor skills and visual acuity [22, 41].

This is especially beneficial for older adults, who may experience physical or cognitive impairments that limit their ability to use traditional interfaces [33].

Research has shown that VA can enhance the independence and mental well-being of older adults by assisting with daily tasks such as setting reminders, streaming music, and maintaining basic household routines [4, 9, 26, 35]. VA can also facilitate easy access to health information and even promote social engagement through their connectivity features [6, 7]. Studies show that designing technology for this demographic requires careful consideration of interface simplicity and accessibility to mitigate cognitive and physical barriers [23]. For instance, Talk2Care introduced a voice assistant for healthcare communication, highlighting the role of VA in bridging communication gaps, but also revealing limitations when language and interaction complexity aren't adjusted for older users [44]. These findings underscore the need for designs that prioritize both ease of use and engagement [10, 36].

Despite the benefits of VA, barriers to adoption persist. The initial setup and ongoing maintenance of these devices can be complex for those not familiar with technology [7, 24, 34]. Concerns regarding privacy and data security also play a role in the hesitancy to adopt VA among older adults [11, 13]. Older adults frequently report difficulties with speech recognition, particularly when VA struggles with non-standard accents or dialects, which can lead to repeated misinterpretations and user frustration [1, 4, 39]. The limited conversational capacity of current VA further compounds these issues, as older users often expect more fluid and adaptive dialogues that better match their needs for social and emotional engagement [2, 16, 27]. Miscommunications stemming from these limitations can prompt older adults to abandon tasks or even discontinue use altogether [1, 34, 39]. Furthermore, research highlights that the current lack of cultural sensitivity in VA impacts their appeal as companions; older users desire VA that understand and respond to their social and cultural contexts, providing a more meaningful interaction [1, 8, 16, 34, 40]. As VA increasingly become part of older adults' lives, these insights underscore the importance of culturally adaptive and empathetic design approaches that enhance the technology's utility and appeal for aging populations.

2.2 Cultural Considerations in Technology Design for Older Adults

As technology adoption continues to rise among older adults globally, researchers increasingly emphasize the critical role of cultural sensitivity in design. Culturally aware technology design considers the values, traditions, and specific language expressions that define a user's experience, especially among older populations who may prioritize different features based on their cultural context [20, 30]. Studies indicate that the way older adults perceive and use VA varies widely; for example, Western users often prioritize efficiency, while Japanese users value respectful interactions that reflect social norms [29, 37]. This is supported by studies such as Ma et al., which found that emotion- and personality-aware VA foster engagement differently across cultures, revealing that culturally attuned designs can significantly improve user experience [29].

Designing culturally sensitive VA for Chinese older adults, however, presents distinct challenges. Regional dialects, traditional phrases, and culturally specific expressions are common in Chinese older adults' everyday language, creating additional barriers to effective interaction with VA that are primarily optimized for standard Mandarin or Western speech patterns [20, 37]. For instance, Huang and Zhang noted that culturally rich media greatly influences VA adoption in non-Western contexts, advocating for interfaces that adapt to local dialects and culturally familiar terms [20]. Similarly, Cuadra et al. suggest that a multimodal approach—incorporating both visual and auditory cues—can enhance accessibility and ensure that VA responds to culturally specific requests with greater accuracy [10].

Despite this understanding, mainstream VA technology often lacks the customization necessary to effectively meet the needs of non-Western users, leading to frequent misinterpretations and reduced user satisfaction among Chinese older adults [44]. For instance, culturally specific knowledge and idiomatic expressions, such as regional

dialects or references to local traditions, are typically missing from VA responses, which can frustrate users who rely on these cues in daily conversations. Xu et al. highlight that large language model-based assistants, like those embedded in wearable technology, can foster a sense of conversational grounding, but they still require adaptation for non-Western cultural nuances [43]. These findings underscore the need for continuous innovation in VA design to account for the unique linguistic and cultural preferences of older adults in various regions, promoting greater inclusivity and satisfaction in their interactions with VA.

2.3 Family Influence on Technology Use Among Older Adults

Existing research underscores the significant influence of family members, particularly adult children, on older adults' technology adoption and use [15, 28, 42]. Family members often act as facilitators, helping older adults navigate the complexities of digital tools by providing guidance and encouragement [14, 17, 38]. This supportive role has been found to foster greater confidence and ease in technology adoption among older adults, especially when they face cognitive or physical limitations [17, 36, 38]. Studies also show that this involvement can ease the transition for older adults, fostering a sense of safety as they explore new technologies [9, 31].

However, family involvement can sometimes become a barrier rather than a facilitator. Research indicates that adult children often prioritize practical support over fostering independence, frequently taking control of technology use to prevent perceived risks or errors [15]. This protective approach, although well-intentioned, can lead to frustration among older adults who wish to explore VA independently and engage with the technology on their terms [39]. When family members prioritize efficiency and control over learning opportunities, older adults may feel marginalized in the decision-making process, affecting their engagement and satisfaction with VA [29].

Cultural factors further complicate these family dynamics, especially in China where filial piety and collective family values shape the expectations around intergenerational support and care [12, 45]. In cultures that emphasize close family involvement, adult children may feel an obligation to monitor and manage their parents' use of technology, often to prevent mistakes or potential privacy issues [42]. While this approach aligns with traditional cultural expectations, it may conflict with the autonomy and independence that many older adults seek, particularly in using VA for social or intellectual engagement rather than mere utility [20]. Current literature in Western contexts provides limited insights into these culturally specific family dynamics, particularly regarding how non-Western families mediate technology use among older adults.

Our study addresses this gap by exploring how Chinese family dynamics influence older adults' experiences with VA, highlighting the dual role of adult children as both supporters and gatekeepers. By focusing on the unique expectations within Chinese families, this research provides a culturally grounded perspective on intergenerational influence, revealing the need for VA designs that accommodate both older adults' desire for independence and the culturally embedded expectations of family-connected support.

3 METHOD

3.1 Data Collection

3.1.1 Recruitment. Participant recruitment took place from September to November 2023. We advertised the study through community centers, and local elderly associations, and employed snowball sampling methods. This approach allowed us to successfully recruit 12 Chinese older adults aged 65 and above, as well as 6 adult children of Chinese older adults. The older adult participants were all residents of urban areas in China. The inclusion criteria for older adult participants were: (1) aged 65 or above, (2) residing in urban areas of China, (3) owning and using a smartphone, and (4) having at least one adult child. From the pool of 12 older adult participants, 6 expressed interest in having their adult children participate in the study as well. With their consent, we

invited these 6 adult children to take part in separate interviews. Participants were offered a small gift valued at 10 USD as a token of appreciation for their time and effort.

Upon expressing interest, all participants were briefed about the study objectives and procedures and provided informed consent. Table 1 presents the demographic information of the 12 older adult participants, including gender, age, education level, employment status, smartphone usage duration, and need for assistance from adult children in using technology. Table 2 provides the demographic details of the 6 adult children participants, such as gender, age, education level, employment status, smartphone usage duration, and experience in teaching their parents to use technology.

Table 1. Demographic information of older adult participants

Participant	Gender	Age	Education	Employment	Smartphone Usage
P1	Male	68	Primary School	Retired	4 years
P2	Female	72	Bachelor's	Retired	3 years
P3	Male	67	Middle School	Employed	5 years
P4	Female	70	Never Attended	Retired	2 years
P5	Male	73	High School	Retired	4 years
P6	Female	65	Vocational School	Retired	3 years
P7	Male	71	Primary School	Retired	2 years
P8	Female	68	Middle School	Retired	4 years
P9	Male	75	Never Attended	Retired	1 years
P10	Female	69	High School	Retired	5 years
P11	Male	67	Vocational School	Employed	6 years
P12	Female	75	Primary School	Retired	2 years

Table 2. Demographic information of adult children participants

Participant	Gender	Age	Education	Employment	Smartphone Usage
C1	Male	42	Master	Employed	8 years
C2	Female	38	Bachelor	Employed	7 years
C3	Male	45	Vocational School	Employed	6 years
C4	Female	40	High School	Employed	9 years
C5	Male	43	Bachelor	Employed	8 years
C6	Female	40	High School	Employed	5 years

We used Huawei's Celia Voice Assistant (version 11.1.8.332) for our experimentation, which is one of the most widely adopted Chinese VAs with over 200 million monthly active users [21]. To ensure experimental consistency, we conducted all tests on identical Huawei Mate 60 smartphones with uniform hardware configurations and system settings. Throughout all test sessions, the VA was set to standard Mandarin Chinese as its default language to maintain consistency in speech recognition and response.

3.1.2 Observation. We conducted unstructured observation sessions with 12 older adult participants, focusing on their interactions with VAs in familiar settings such as community centers. Each older adult was observed independently using the VA for 30-45 minutes, where they were asked to perform everyday tasks like setting

reminders, sending messages, playing music, or searching for information. The unstructured nature of the observation allowed participants to explore the VA on their own, without guidance from researchers. During these sessions, we recorded key aspects such as the tasks chosen, the success or failure in completing those tasks, and any difficulties encountered, such as misrecognition of commands. Researchers took detailed field notes, capturing the nature of the tasks performed, verbal and non-verbal cues (such as frustration or satisfaction), and any patterns in the difficulties they encountered. This approach allowed us to gather insights into the practical usage patterns and challenges older adults face when interacting with VA independently.

For the 6 older adults who were observed with their adult children present, the 40-60 minutes observations focused on how the adult children influenced the older adults' VA usage. We recorded the types of assistance provided by the adult children, such as clarifying commands or offering suggestions, as well as instances where the children might take over the interaction or discourage the older adults from exploring features on their own. In addition, we observed the dynamics and communication patterns between the older adults and their children, noting how the presence of the children affected the older adults' behavior with the VA. We specifically tracked both enabling and limiting behaviors from the adult children, to understand how family dynamics could either support or hinder independent use of the technology by older adults. For the 6 older adults who participated in both independent and accompanied sessions, we conducted a comparative observation to identify differences in their behavior when using the VA alone versus when their adult children were present. This comparison allowed us to explore how the older adults' interaction with the technology changed when they had external support versus when they were independently navigating the system.

3.1.3 Semi-structured Interviews. We employed semi-structured interviews as one of our primary data collection methods. This approach was chosen because it allows for a flexible yet structured exploration of participants' experiences with VAs, enabling us to capture both their perceptions and the broader patterns across different participants. Semi-structured interviews provide the opportunity to ask open-ended questions, encouraging participants to elaborate on their thoughts while ensuring that key topics related to the study are covered.

In the interviews with older adults, we focused on understanding their overall attitudes toward VA, including how they perceive the technology and what motivates them to use it. We asked participants how they first encountered VA, what kinds of tasks they typically performed with the technology (e.g., reminders, music, or information retrieval), and what challenges they encountered, such as difficulties with voice recognition or specific features. We also explored in which situations they felt more motivated to use VA and what aspects of the technology attracted them. Furthermore, participants were asked how they thought VA could be improved to better suit their needs. In addition to these general usage questions, we delved deeper into how their adult children influenced their VA usage. We asked whether they sought help from their children when encountering problems with the VA, and if so, how their children assisted them. Further, we explored whether they felt supported or hindered in their technology exploration when using VA in the presence of their children. For example, did the adult children guide them step-by-step, take control of the interaction, or encourage independent exploration? We also investigated how their children's attitudes towards technology impacted their attitudes and behaviors, noting whether they felt motivated or discouraged to continue using the VA based on their children's reactions or involvement.

In the interviews with the 6 adult children of older participants, which lasted between 45 and 60 minutes, the primary focus was on their perceptions of their parents' use of VA. We explored how they felt about their parents adopting this technology—whether they were concerned about its complexity or encouraged its use—and the barriers they observed their parents facing while using VA. We also asked about the specific contexts in which they noticed their parents using VA and how they responded when their parents encountered difficulties. The interviews delved into their previous experiences in providing technological support to their parents, focusing on the level of involvement: whether they took a hands-on approach by stepping in to assist directly or allowed

their parents to explore independently, offering help only when requested. Additionally, we examined how the adult children communicated with their parents about VA use, including their expectations of how VA should be used (e.g., for specific functions or in particular scenarios) and the features they hoped their parents would utilize.

All interviews were conducted in Mandarin and audio-recorded with participants' consent. The recordings were then transcribed, and any identifiable information was anonymized to ensure participants' privacy. This process ensured that the data was both accurate and respectful of the participants' confidentiality.

3.2 Data Analysis

We conducted an inductive thematic analysis [3] of both interview transcripts and observational field notes to identify patterns and insights related to the participants' experiences with VA. This approach encompasses iterative phases of data familiarization, initial coding, theme development, and refinement to ensure rigorous qualitative analysis. Two researchers independently performed the initial coding, using a line-by-line approach to capture both explicit and implicit meanings [3]. For instance, codes such as *"difficulty with VA commands"* and *"misunderstanding voice inputs"* were frequently assigned when participants described challenges in interacting with the VA. This open coding approach ensured that the analysis was deeply grounded in the participants' language and reflections, capturing both their practical and affective interactions with the technology.

Once the initial coding was complete, the researchers collaboratively grouped related codes into broader, more complex themes. For example, the codes *"adult children's technology support"* and *"proxy usage"* were combined under the broader theme of *"the role of adult children in supporting or hindering VA use among older adults"*. Similarly, codes such as *"speech interruptions"*, *"regional accent challenges"*, and *"colloquial expressions"* were clustered under the theme of *"the need for customization and cultural sensitivity in VA usage"*. This iterative process involved multiple rounds of cross-referencing to ensure that each theme accurately reflected participants' experiences and the nuances of their interaction with VA. Four main themes ultimately emerged from the analysis, highlighting both the potential benefits and unique challenges older adults face with VA: (1) *Social Motivation as the Primary Driver for VA Use Among Older Adults*; (2) *The Need for Customization and Cultural Sensitivity in VA Usage*; (3) *The Role of Adult Children's Support in Older Adults' VA Use*; and (4) *Generational Gaps in VA Usage and Expectations*. Each theme revealed distinct patterns of interaction, expectation, and frustration, often rooted in cultural nuances specific to Chinese older adults' communication and family structures.

To enhance the validity of our findings, we employed triangulation by comparing interview data with observational field notes. For instance, participants frequently described frustrations in interviews about VA misunderstanding regional accents or informal phrases, which we corroborated through observational notes that documented instances where participants struggled to execute tasks like setting reminders or playing specific songs. Observations provided additional insights, showing that older adults often experienced interruptions in speech processing due to natural pauses or longer commands—a recurring issue also expressed in interviews. By cross-referencing both data sources, we strengthened the reliability of each theme and ensured they consistently represented participants' diverse experiences.

3.3 Ethical Considerations

Ethical considerations were paramount throughout this study. All participants provided informed consent after being fully briefed on the study's objectives, procedures, and their rights, including the option to withdraw at any time without consequence. To protect participant privacy, all data were anonymized by removing any identifying details, and pseudonyms were used in all reporting. Confidential data were securely stored, with access restricted to the research team. Given the sensitivity of working with older adults, we prioritized their comfort during data collection. Observation sessions were conducted without intrusive recording devices, and

participants were free to decline tasks they found challenging. The monetary incentive was modest and intended as a token of appreciation, ensuring voluntary participation without any coercion.

4 FINDINGS

4.1 Social Motivation as the Primary Driver for VA Use Among Older Adults

4.1.1 Social Interaction as a Key Motivator. A key theme that emerged from the interviews was the role of social interaction as a primary motivator for older adults to use VA. 8 out of 12 participants mentioned that they began using VA to alleviate feelings of loneliness and to create a sense of companionship, particularly during quiet or isolated times at home. For many participants, VA served as a temporary source of interaction, offering them a way to feel less alone, even though it was understood to be limited in its conversational depth. *"In the evenings, after my wife passed away, the house feels empty. I talk to the voice assistant. It's not the same as talking to a person, but it helps with the silence."* (P3). Some participants even personified their voice assistants, attributing human-like qualities and developing a sense of attachment. *"Sometimes, I just want to hear a voice, especially when my family isn't around. It doesn't matter that it's not a real person. It makes the house feel a bit more alive."* (P8). These examples illustrate how older adults turned to VA as a coping mechanism to manage social isolation. While the interactions were often basic, the participants still found some comfort in the regularity and presence that VA offered.

4.1.2 Mismatch Between Social Motivation and Actual Experience. Despite the initial social appeal, the experience of using VAs often fell short of participants' expectations. 7 out of the 12 participants who used VAs for social engagement reported disappointment, particularly with the limited conversational abilities of the technology. They found that while VAs could respond to commands, they lacked the emotional depth and understanding necessary to provide real companionship or stimulating dialogue. *"It's good for setting reminders and things like that, but when I try to have a conversation, it's just not there. It can't talk to me like a person would."*(P5). P9 also stated, *"I wanted something that would keep me company, but all it does is give me answers to simple questions. It doesn't understand how I'm feeling or what I need emotionally"*. These reflect older adults' frustration with the emotional limitations of VA. While they found some utility in the technology, it did not fully meet their social needs, revealing a gap between what the older adults hoped for and what the VA could provide.

4.1.3 Potential and Limitations of VA in Social Engagement. Despite the disappointment with current VA capabilities, 5 out of 12 participants remained optimistic about the future potential of VA. They expressed hope that future versions of the technology could better cater to their social needs, with more advanced conversational abilities and emotional recognition features. Participants wanted VA that could offer meaningful conversations and respond to their emotions, thus providing a deeper level of interaction. As P7 stated, *"If it could talk to me about things I'm interested in, like history or what's happening in the world, that would be amazing. Right now, it's just too basic."* Besides, some older adults want VAs can understand them more. *"I think it would be great if it could pick up on how I'm feeling. If it could recognize when I'm down or lonely and suggest something to cheer me up, that would make it much more useful."* (P11) Older adults want VA can be the tools that not only assist with practical tasks but also provide emotional and intellectual companionship, though they found that current technology is still far from meeting those needs.

4.2 The Need for Customization and Cultural Sensitivity in VA Usage

Our findings reveal that while Chinese older adults face several challenges similar to their global counterparts when using VA, they also encounter unique obstacles rooted in cultural and linguistic nuances specific to their context. These challenges highlight the need for enhanced customization and cultural sensitivity in VA design, especially for Chinese older adults.

4.2.1 Common Challenges in VA Usage Among Older Adults. ***Speech Interruptions Due to Pauses and Long Commands.*** One challenge commonly faced by older adults when using VA is the frequent misinterpretation caused by natural pauses or repetition in speech [6, 25]. Older adults often speak more slowly or pause for reflection, leading VA to misinterpret these pauses as the end of a command. For instance, P6 tried to say, *"我要去那个那个人民广场，帮我叫个车子，要那个那个那个快车"* (*I want to go to People Square, call a car for me, I want a fast car*). However, the VA interrupted her mid-command, causing a breakdown in communication. This issue is prevalent in older users who naturally speak in a reflective and extended manner, which VA struggle to accommodate. Additionally, VAs often struggle with long, detailed commands, which are common in older adults' conversational styles [25]. For example, P9 tried to request information on comprehensive health checkups: *"我要找找看哪里可以做一次全面体检，能帮我查一下吗？要正规地方的，好的医院的，不灵的私立的小地方的那种便宜也不要的。要适合我们年纪大的人全面的体检项目的。"* (*I'm looking for a place to do a full medical check-up. Can you help me find a reliable place, a good hospital, not some small, cheap private clinic? I need something suitable for older people like me.*) The VA, unable to process this level of detail, responded with *"I can't keep up with your request"*, demonstrating the limitations of VA technology in handling lengthy speech.

Inadequate Support for Multi-modal Feedback Another significant challenge was older adults' difficulty in processing lengthy or fast-paced audio responses from the VA. 8 out of 12 participants reported feeling overwhelmed by the VA's rapid or dense verbal responses. For instance, P8 mentioned that after receiving a long-winded answer from the VA, she felt confused and opted to manually check the screen for more clarity. P4 also found that the lack of step-by-step visual feedback made it challenging to follow instructions, *"It spoke too fast and didn't display the steps clearly on the screen. I didn't know what to do next"*. This issue highlights the need for multi-modal interaction, where visual feedback complements auditory responses. Older adults with diminished hearing or slower cognitive processing often struggle to retain all the information provided by the VA. This difficulty was exacerbated in tasks that required multiple steps, making it challenging for users to understand without additional visual cues.

4.2.2 Unique Cultural and Linguistic Challenges for Chinese Older Adults. While the above issues reflect common challenges for older adults using VA, Chinese older adults face additional, culturally-specific barriers. These include difficulties in recognizing non-standard Mandarin, understanding regional expressions, and processing culturally rooted knowledge, all of which limit the VA's effectiveness for this group.

Limited Recognition of Non-standard Mandarin.

A significant challenge emerging from our study was the VA's limited ability to recognize non-standard Mandarin, particularly affecting older adults who speak with regional accents or use colloquial expressions. Among our participants, 11 out of 12 reported consistent difficulties with voice recognition. The misinterpretations ranged from simple word confusion to complete command failure. For instance, when P1 asked the VA to *"帮我去淘宝看看什么洗衣机评价好" (Help me check out the reviews for washing machines on Taobao).*, the VA misheard and searched for "喜剧" (comedy) instead of "洗衣机" (washing machine). In another case, P3, who uses a regional dialect, reported asking the VA to *"把手电给熄了" (Turn off the flashlight)*, which the VA interpreted as *"把手电给我吸了" (Suck the flashlight for me).* These misunderstandings particularly frustrated users when dealing with everyday tasks. As P7's experience illustrated, even simple requests like playing music became challenging when the VA interpreted "酷狗" (Kugou music app) as "酷 girl" (cool girl). P6 articulated this frustration: *"Sometimes I use more casual phrases, and it doesn't understand me. It only works if I speak very clearly and formally, but that's not how I usually talk."* This linguistic barrier effectively forced users to modify their natural speech patterns, limiting the technology's accessibility and user experience.

Difficulty with Regional Expressions and Informal Terms. Another significant cultural barrier is the VA's difficulty understanding regional dialects and informal language. For many Chinese older adults, colloquial terms and regional expressions are integral to their daily communication, yet VAs are often unable to process these

unique language patterns. For example, P7 from Shanghai referred to "茄子" (eggplant) as "落苏" (a local dialect term for eggplant), when asking for recipes, but the VA could not understand this informal term. This issue extended to common colloquial phrases like "说白了话" (to be frank) or "头条" (a colloquial reference to the news app "今日头条"), which the VA consistently failed to interpret accurately. Such limitations in recognizing commonly used regional terms hinder the VA's effectiveness, making it feel less accessible and responsive to older users' everyday language needs. Additionally, these misunderstandings also occur with familiar, informal commands. For instance, P8's preference for saying "打亮" (turn on) instead of the standard "打开手电筒" (turn on the flashlight), was consistently misinterpreted by the VA. Participants also highlighted the VA's inability to interpret locally specific terminology in shopping contexts. For example, P5 requested help finding affordable leather gloves, specifying "不要大兴货" (referring to no low-quality goods). However, the VA misinterpreted "大兴" as the district name in Beijing, yielding irrelevant results. These failures reflect a lack of adaptability to a regionally specific language, which alienates users who expect the VA to accommodate their natural linguistic preferences.

Inadequate Knowledge of Local Cultural Contexts The VA's limited understanding of local cultural contexts significantly reduces its effectiveness for Chinese older adults, who often seek meaningful interactions related to their regional heritage. 9 out of 12 participants shared experiences where they hoped the VA could provide information on culturally significant topics, only to receive generic or misinformed responses. For instance, P9 wanted to hear stories about "老江桥" (Lao-Chiang Bridge), a well-known landmark with historical significance in this place, but the VA didn't understand these local stories, and thus its response did not include any meaningful details, leaving the user unsatisfied. In another case, P1 asked the VA to describe traditions related to the "二月二龙抬头" (Longtaitou Festival), a cultural event celebrating local folklore. However, the VA's response was limited to a generic description, failing to connect with the specific customs and historical context that older adults value.

The cultural disconnect manifested most poignantly in P9's interaction with the VA around Shaoxing opera. His initial request for "绍兴大板" (Shaoxing Daban)—a term historically referring to the wooden stages where rural opera troupes performed—was incomprehensible to the VA, revealing its inability to grasp regional cultural nuances. Even as P9 attempted to bridge this gap by progressively using more standardized terms, from "绍兴戏" (Shaoxingxi) to "绍剧" (Shaoju), the VA remained confined to mainstream theatrical categories. The depth of this cultural misalignment became particularly evident when P9's request for the dynamic "三打白骨精" (Fighting the Skeleton Demon) was met with "十八相送" (Mile Journey to Accompany Yingtai Home)—the VA confusing the bold, martial style of Shaoxing opera with the gentler romantic themes of Yue opera. When P9 tried to share his memories of vibrant rural performances, the VA further demonstrated its urban-centric bias by defaulting to references of 京剧 (Beijing Opera) and 梅兰芳 (Lanfang Mei). This persistent misunderstanding of P9's cultural context ultimately led him to withdraw from interacting with the VA.

This experience illustrates the VA's lack of sensitivity to the nuances of regional Chinese cultural contexts and its inability to distinguish between local art forms that hold distinct significance for older users. The failure to adapt to local knowledge, terminology, and expressions results in missed opportunities for meaningful connections with users, ultimately diminishing the VA's appeal and leaving older adults like P9 feeling disconnected from the technology.

4.3 The Role of Adult Children's Support in Older Adults VA Use

Our study reveals that adult children often play a crucial role in assisting or sometimes unintentionally hindering their older parents' use of VA.

4.3.1 Supportive Roles: Providing Technical Assistance to Older Adults. Adult children often provide vital technical assistance, enabling older adults to overcome various challenges with VAs, such as understanding complex

commands, dealing with non-standard Mandarin recognition issues, and navigating the technology's interface. By offering guidance, simplifying steps, and enhancing accessibility, adult children help foster greater confidence in their parents' VA use. For example, P4's son, C3, noted his mother's struggle to set a reminder for a doctor's appointment when the VA misinterpreted her regional accent. Observing her mother's frustration, C3 intervened and provided step-by-step instructions to rephrase the command in a simpler way, which ultimately helped P4 complete the task successfully. C3 shared in his interview, *"My mother often finds these functions confusing, but when I guide her through once or twice, she feels more confident."*. This supportive approach not only resolved the immediate issue but also empowered P4 to try similar tasks on her own.

Similarly, C5, the son of P8, observed that his mother frequently struggled with remembering specific command sequences. To address this, he created custom shortcuts on her VA interface, including a single command to set a daily medication reminder. During the interview, P8 expressed gratitude, stating, *"With these shortcuts, I don't feel as lost. It's like having a small helping hand even when he's not around."* This personalization support from adult children allowed P8 to engage more comfortably with the VA and build confidence over time. In another instance, C1, the son of P11, took the time to teach his father how to access different VA functions, such as checking weather forecasts and managing a health management list. He broke down each step, ensuring his father understood how to use the functions independently. C1 explained in his interview, *"I noticed he learns best with repetition and small steps, so I make sure he feels comfortable before moving on."* This method of gradual reinforcement enabled older adults to explore additional VA functions.

4.4 Obstructive Roles: Hindering Independent Use Through Proxy Use and Over-protectiveness

In our study, we found while some adult children offer empowering support, others unintentionally limit their parents' autonomy by assuming control over the technology or expressing excessive concerns about its use. This protective behavior, often rooted in a desire to prevent mistakes or protect their parents, can inadvertently discourage older adults from independently engaging with VA. For example, C3, the son of P4, frequently took over interactions with the VA on his mother's behalf, fearing his mother would make errors. During the observation, C3 would preemptively use the VA to perform tasks his mother was attempting to learn. In her interview, P4 expressed her frustration, saying, *"I want to try on my own, but he thinks I'll just mess it up."* C3's intervention, while well-meaning, prevented P4 from learning through trial and error, an essential process for building competence and self-efficacy in technology use.

Similarly, C5, the son of P8, expressed concerns about potential privacy risks associated with VA use, often advising his mother against exploring certain features. During an observation, when P8 attempted to use the VA to access local news updates, C5 interjected, saying, *"You don't know who might be listening in; it's safer to avoid these functions."* This cautious approach led P8 to become hesitant about using the VA independently. Reflecting on her experience, she shared, *"My son always tells me it's risky, so I don't dare to use it unless he's here."* This situation illustrates how concerns about data privacy, while valid, can create barriers to technology use when not balanced with guidance on safe usage practices. In another case, C2, the daughter of P3, preferred that her father only use the VA for simple commands, citing ease and efficiency. During the observation, when P3 expressed interest in using the VA to play traditional operatic music, C2 discouraged him, saying, *"Let's keep it simple. You don't need all those extra features."* This dismissal prevented P3 from exploring the VA's potential beyond basic tasks. In the interview, P3 commented, *"I would like to try more, but she prefers I only use it for simple things."* C2's over-protective approach hindered P3's opportunity to independently engage with the VA, ultimately limiting his satisfaction with the technology.

These examples highlight the dual influence adult children can have on older adults' technology use. While their support can be instrumental in overcoming barriers, over-protectiveness or proxy usage may restrict older

adults from fully exploring and engaging with VA. This underscores the importance of a balanced approach in assisting—one that fosters independence while still offering the necessary support.

4.5 Generational Gaps in VA Usage and Expectations

Our findings indicate that significant generational gaps exist between older adults and their adult children regarding VA usage and expectations. While both generations share an interest in VA, their perceptions of the technology's role and purpose often diverge. This section explores these differences and the family dynamics that influence VA use, offering insights into how generational expectations impact older adults' interaction with technology.

4.5.1 Differences in Perception Between Older Adults and Their Adult Children. Older adults tend to view VA as potential companions that can alleviate social isolation, and provide social engagement. In contrast, adult children typically view VA as practical tools designed to assist with daily tasks and to improve efficiency, which sometimes leads to differences in expectations and even frustration.

For instance, P6 described the VA as a comforting presence, saying, *"I like to chat with it, even if it's just to pass the time."* Her daughter, C6, however, saw the VA's value primarily in task management. She commented in her interview, *"I'd rather she use it to set reminders or alarms instead of talking to it about random things. It's not a real person, after all."* This divergence in perception highlights the different roles that each generation expects the VA to fulfill—older adults seeking companionship versus adult children expecting functional utility. Similarly, P11 expressed a desire to explore more creative uses of the VA, such as learning new facts and listening to music from different genres, which he considered intellectually stimulating. However, his son, C1, preferred his father to use the VA only for basic tasks, believing that simpler interactions would avoid confusion. C1 remarked, *"My father sometimes gets overwhelmed, so I think it's better if he sticks to basic things."* This sentiment reflects an underestimation of older adults' curiosity and their willingness to engage with technology in ways that extend beyond immediate, functional needs.

In another example, P4 wanted to use the VA for interactive experiences, such as learning local news updates, while her son, C3, preferred her to limit usage to essential tasks like setting reminders. During observations, C3 expressed concern that his mother might inadvertently share personal information through the VA. In her interview, P4 shared her frustration, saying, *"I want to use it to keep up with things, but he always tells me to be careful. I feel like he doesn't trust me to use it wisely."* These differences reveal the generational gap in understanding the boundaries of technology use, with older adults viewing the VA as a tool for exploration and connection, and their children perceiving it through a lens of practicality and risk management.

4.5.2 Family Dynamics Shaping VA Use. Family dynamics, including the protective attitudes and implicit communication styles between older adults and their adult children, significantly shape VA use. Many adult children assume the role of a cautious guide, attempting to protect their parents from perceived risks associated with technology. However, this approach often creates tension between supporting exploration and imposing limitations, leading older adults to feel restricted.

For example, C5, P8's son, expressed worry about his mother's tendency to try new VA functions, fearing she might accidentally share sensitive information or become too dependent on the device. *"I don't want her relying on it too much. She should still remember things on her own"*, he explained. This protective stance, while intended to safeguard his mother, left P8 feeling misunderstood and limited in her use of the VA. She expressed a desire for independence, stating, *"I'm not a child. I want to try things on my own, even if I make mistakes."* Another layer of family dynamics involves the role of guidance versus control in VA use. While some adult children, like C3, sought to empower their parents by offering step-by-step support, others inadvertently took on a controlling role, as seen with C3, who preemptively restricted his mother, P4, from using certain VA functions due to privacy

concerns. This dynamic can lead older adults to feel that they lack agency in their technological interactions. P4 described the experience, saying, *"Sometimes I just stop asking him for help. I'd rather explore it by myself than feel like I'm being told what I can and can't do."*

Additionally, there is an implicit tension between efficiency and self-learning within family dynamics. Many adult children, such as C2 (P3's daughter), favor streamlined approaches, believing that simplified interactions will prevent confusion. C2 shared, *"The simpler it is, the easier it'll be for him."* However, P3 expressed a different view, saying, *"I like to figure things out slowly. That's how I learn."* This difference illustrates the tendency of adult children to prioritize efficiency, while older adults value the learning process, even if it takes longer. Together, these family dynamics reflect a generational divide where adult children's protective instincts and desire for simplicity may restrict older adults' ability to engage fully with VA.

5 DISCUSSION

5.1 Cultural Considerations in VA Design for Older Adults

The cultural differences between countries and regions are an important factor to consider when designing VA. Previous research has highlighted the importance of co-imagining the future of voice assistants with cultural sensitivity [37]. For example, studies have compared the interaction differences between American and Japanese users, focusing on language use and preferred interaction modes. Similarly, a cross-cultural study found that British users preferred shorter, transactional voice assistant dialogues, while Taiwanese users preferred longer, richer conversations [20]. In studies focusing on older adults, Western seniors have shown more concern about privacy and personal data protection [18], while in our study, we found that cultural barriers leading to interaction failures were a major reason why many Chinese older adults abandoned using VA.

Our study identifies several culturally specific challenges faced by Chinese older adults in VA interactions, suggesting that current VA designs lack adequate cultural sensitivity and adaptability to diverse linguistic backgrounds. Previous research has underscored the need for age-appropriate VA designs that incorporate intuitive commands and adaptable feedback modes to support older users' cognitive and sensory needs [4, 8, 24]. However, our findings reveal an additional layer of complexity in the Chinese context, where older adults frequently communicate using non-standard Mandarin, regional dialects, and culturally specific expressions that standard VA struggle to comprehend.

This study's emphasis on different older adult groups' language recognition aligns with findings from Harrington et al.'s work on the limitations of VA in understanding black older adults [16]. However, we extend this insight by highlighting the importance of region-specific vernacular and culturally rooted terms, which can deeply influence older adults' willingness to engage with VA. Participants in our study, for instance, frequently referred to the "绍兴大板 (Shaoxing opera)" and other local cultural symbols that were integral to their identity and daily lives. Current VA systems, with their limited ability to comprehend and engage with such cultural references, fail to provide meaningful engagement, thereby reinforcing a sense of technological alienation and exclusion among older adults.

We argued that culturally responsive designs contribute to increased acceptance of technology among older adults. Yet, we found that VA systems designed with a broad international audience in mind often lack the nuanced understanding of local traditions, customs, and social histories that resonate with users in specific cultural contexts. For instance, requests from participants like P9, who desired conversational exchanges around culturally specific narratives or stories, were met with frustration due to the VA's limited cultural knowledge base. To bridge this gap, culturally adaptive VA would need to incorporate databases of regionally significant knowledge and adopt more flexible, locally relevant interaction protocols, thereby creating a more inclusive experience.

5.2 The Dual Role of Adult Children in VA Usage: Support and Barriers

The role of adult children in supporting or hindering VA adoption among older adults is a nuanced one, aligning with prior studies that emphasize family members' critical support in facilitating technology use in aging populations [17, 38]. However, our study finds a dual role wherein adult children not only support VA use by providing direct assistance and simplifying technology but also unintentionally limit older adults' independence due to protective behaviors. This finding underscores the need to address the complex family dynamics that influence VA adoption and use, a factor that remains underexplored in current VA literature.

Supportive behaviors, such as setting up shortcuts or simplifying commands, mirror findings from Tang et al., who highlighted the importance of family support in reducing technical barriers for older adults 2022 [38]. Yet, our study further reveals that while these interventions enable initial engagement, overprotective behaviors, such as assuming full control over the VA or restricting exploratory use, can inhibit older adults' confidence and autonomy. C3, for example, intervened during his mother's interaction with the VA, assuming control due to concerns over potential mistakes. Such behaviors, although well-intentioned, create dependency patterns that hinder older adults from developing self-efficacy in technology use. Additionally, protective attitudes surrounding data privacy and security often discourage older adults from fully utilizing VA, despite their interest in exploring these technologies independently. Our findings illustrate a generational divide where adult children's concerns about data privacy sometimes conflict with older adults' desire for broader engagement with VA. This misalignment suggests a need for VA design improvements that incorporate family-centered privacy features, such as guided privacy tutorials or modular settings, to balance independence and security. By addressing these intergenerational concerns, VA could better support autonomous use while maintaining the safeguards that families desire.

5.3 Implications for VA Design

Our findings have several design implications for creating culturally sensitive, family-inclusive VA. First, VA developers should consider integrating a ***flexible linguistic model*** that accommodates regional accents, colloquial terms, and culturally relevant expressions specific to local contexts. Customizable dialect recognition features, paired with interactive feedback allowing users to train the VA on preferred terminology, could enhance accessibility and usability among older adults. Secondly, to accommodate the complex family dynamics that influence older adults' technology use, future VA might include a "***family support mode***" that allows adult children to set customizable assistance levels and permissions. This feature could help adult children provide support without overshadowing older adults' independence. For example, guided tutorials or a "collaborative mode" could enable older adults and their families to explore VA functions together, gradually fostering more independent use. Lastly, given the cognitive and sensory needs of aging users, VA should be equipped with ***multimodal feedback options*** that combine auditory responses with visual prompts. This feature could cater to older adults' preferences for slower-paced interactions, mitigating the frustration caused by rapid voice responses and enhancing user comprehension. Through these adjustments, VA can become more inclusive, fostering long-term engagement and satisfaction among older adults.

To effectively implement these design implications, we emphasize two key approaches. First, the importance of leveraging support networks - including family members, community centers, and local senior organizations. These networks can provide valuable insights into cultural nuances, assist in the iterative design process, and serve as crucial bridges in technology adoption and ongoing support for older adults. Second, the necessity of adopting a multidisciplinary approach, bringing together expertise from linguistics, cultural anthropology, gerontology, and human-computer interaction. This comprehensive perspective ensures that technical solutions are grounded in a deep understanding of cultural contexts, aging processes, and social dynamics.

Moving forward, our research points to several critical considerations that warrant deeper reflection in future VA design. First, while personalization is crucial, designers must balance customization with cognitive load - excessive options might overwhelm older users rather than help them. Second, though promising, the "family support mode" concept raises important questions about privacy, autonomy, and power dynamics in family relationships. Future designs must carefully navigate these tensions. Third, while multimodal feedback can enhance accessibility, we must ensure these features don't create new barriers for users with limited digital literacy or specific sensory impairments. Finally, our findings suggest that successful VA design for older adults requires moving beyond technical solutions to consider broader social, cultural, and ethical implications. This includes questions about digital inclusion and intergenerational relationships.

5.4 Limitations and Future Research Directions

This study has several limitations that suggest avenues for future research. First, our sample size, although adequate for qualitative insights, limits the generalizability of the findings, as cultural and technological perspectives among Chinese older adults may vary significantly across urban and rural settings. Future studies with larger, more diverse samples would provide broader insights into the regional variations within China. Additionally, this study focused on VA usage in a single cultural context, which constrains its applicability across other cultural groups. Cross-cultural comparative studies examining VA adoption in various countries with similarly diverse linguistic landscapes could reveal universal versus culturally specific factors influencing older adults' technology use. Furthermore, our research highlights the need for emotional sensitivity in VA interactions, particularly for users seeking companionship. Investigating the integration of empathetic AI features, such as emotion recognition or mood-based interaction adjustments, could offer new pathways for enhancing older adults' social and emotional experiences with VA. Finally, as intergenerational family dynamics significantly impact older adults' VA usage, future research could explore how targeted design features might facilitate shared technology experiences that respect older adults' autonomy while addressing adult children's privacy concerns.

6 CONCLUSION

In this study, we examined the unique challenges and opportunities of VA use among Chinese older adults, focusing on the cultural, and generational dynamics that shape their interactions with this technology. Through a combination of interviews and observations involving both older adults and their adult children, we identified several critical factors influencing VA adoption and usage. Older adults in China demonstrated a strong motivation to use VA for social interaction, yet their experiences were often marred by a lack of customization, cultural sensitivity, and language adaptability, with VA struggling to interpret regional dialects and culturally specific expressions. Our findings highlight the dual role of adult children as both enablers and, at times, barriers to their parents' engagement with VA; while family support can reduce technological challenges, overprotective behaviors may hinder older adults' autonomy and willingness to explore. These insights underscore the importance of designing culturally responsive VA with adaptable language models, supportive multimodal feedback, and family-centered features that balance independent and assisted use. By advancing our understanding of the distinct needs and expectations of Chinese older adults and their families, this study contributes to the development of VA that is not only technologically effective but also socially and culturally aligned, enhancing the quality of life for older users in China and potentially across similar contexts globally.

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REFERENCES

[1] Rebecca Adaimi, Howard Yong, and Edison Thomaz. 2021. Ok google, what am i doing? acoustic activity recognition bounded by conversational assistant interactions. *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies* 5, 1 (2021), 1–24.

[2] Anneliese Arnold, Stephanie Kolody, Aidan Comeau, and Antonio Miguel Cruz. 2022. What does the literature say about the use of personal voice assistants in older adults? A scoping review. *Disability and Rehabilitation: Assistive Technology* (2022), 1–12.

[3] Virginia Braun and Victoria Clarke. 2006. Using thematic analysis in psychology. *Qualitative research in psychology* 3, 2 (2006), 77–101.

[4] Robin Brewer, Casey Pierce, Pooja Upadhyay, and Leeseul Park. 2022. An empirical study of older adult's voice assistant use for health information seeking. *ACM Transactions on Interactive Intelligent Systems (TiiS)* 12, 2 (2022), 1–32.

[5] Narae Cha, Auk Kim, Cheul Young Park, Soowon Kang, Mingyu Park, Jae-Gil Lee, Sangsu Lee, and Uichin Lee. 2020. Hello there! is now a good time to talk? Opportune moments for proactive interactions with smart speakers. *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies* 4, 3 (2020), 1–28.

[6] Chen Chen, Janet G Johnson, Kemeberly Charles, Alice Lee, Ella T Lifset, Michael Hogarth, Alison A Moore, Emilia Farcas, and Nadir Weibel. 2021. Understanding barriers and design opportunities to improve healthcare and QOL for older adults through voice assistants. In *Proceedings of the 23rd International ACM SIGACCESS Conference on Computers and Accessibility*. 1–16.

[7] Chen Chen, Ella T Lifset, Yichen Han, Arkajyoti Roy, Michael Hogarth, Alison A Moore, Emilia Farcas, and Nadir Weibel. 2023. How do Older Adults Set Up Voice Assistants? Lessons Learned from a Deployment Experience for Older Adults to Set Up Standalone Voice Assistants. In *Companion Publication of the 2023 ACM Designing Interactive Systems Conference*. 164–168.

[8] Lorena Colombo-Ruano, Carlota Rodríguez-Silva, Verónica Violant-Holz, and Carina Soledad González-González. 2021. Technological acceptance of voice assistants in older adults: an online co-creation experience. In *Proceedings of the XXI International Conference on Human Computer Interaction*. 1–5.

[9] Cynthia F Corbett, Pamela J Wright, Kate Jones, and Michael Parmer. 2021. Voice-activated virtual home assistant use and social isolation and loneliness among older adults: mini review. *Frontiers in Public Health* 9 (2021), 742012.

[10] Andrea Cuadra, Justine Breuch, Samantha Estrada, David Ihim, Isabelle Hung, Derek Askaryar, Marwan Hassanien, Kristen L Fessele, and James A Landay. 2024. Digital Forms for All: A Holistic Multimodal Large Language Model Agent for Health Data Entry. *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies* 8, 2 (2024), 1–39.

[11] Smit Desai and Jessie Chin. 2023. OK Google, Let's Learn: Using Voice User Interfaces for Informal Self-Regulated Learning of Health Topics among Younger and Older Adults. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems*. ACM, Taipei, 1–21.

[12] Xinqi Dong and Ying Xu. 2016. Filial piety among global Chinese adult children: A systematic review. *Research & Review: Journal of Social Science* 2, 1 (2016), 46–55.

[13] Julia C Dunbar, Emily Bascom, Ashley Boone, and Alexis Hiniker. 2021. Is someone listening? audio-related privacy perceptions and design recommendations from guardians, pragmatists, and cynics. *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies* 5, 3 (2021), 1–23.

[14] Radhika Garg and Subhasree Sengupta. 2020. He is just like me: a study of the long-term use of smart speakers by parents and children. *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies* 4, 1 (2020), 1–24.

[15] Aslı Günay, Gülşen Töre Yargın, Sedef Süner-Pla-Cerdà, and Mert Kulaksız. 2023. "How should my family assistant be?": initial perceptions about prospective and anticipated use of in-home virtual assistants in an emerging context. *Behaviour & Information Technology* 42, 7 (2023), 961–984.

[16] Christina N. Harrington, Radhika Garg, Amanda Woodward, and Dimitri Williams. 2022. "It's Kind of Like Code-Switching": Black Older Adults' Experiences with a Voice Assistant for Health Information Seeking. In *CHI '22: CHI Conference on Human Factors in Computing Systems (CHI '22)*. ACM, U.S, 604:1–604:15.

[17] Changyang He, Lu He, Zhicong Lu, and Bo Li. 2023. "I Have to Use My Son's QR Code to Run the Business": Unpacking Senior Street Vendors' Challenges in Mobile Money Collection in China. *Proceedings of the ACM on Human-Computer Interaction* 7, CSCW1 (2023), 1–28.

[18] Aike C Horstmann, Till Schubert, Lea Lambrich, and Clara Strathmann. 2023. Alexa, I Do Not Want to Be Patronized: A Qualitative Interview Study to Explore Older Adults' Attitudes Towards Intelligent Voice Assistants. In *Proceedings of the 23rd ACM International Conference on Intelligent Virtual Agents*. 1–10.

[19] Matthew B Hoy. 2018. Alexa, Siri, Cortana, and more: an introduction to voice assistants. *Medical reference services quarterly* 37, 1 (2018), 81–88.

[20] Ping-Hsuan Huang and Yu-Shan Zhang. 2020. Media richness and adoption intention of voice assistants: a cross-cultural study. *International Journal of Multinational Corporation Strategy* 3, 2 (2020), 108–129.
[21] Huawei. 2023. *Huawei: Monthly Active Users of Mobile Voice Assistant Xiaoyi Exceeds 200 Million (华为：手机语音助手小艺月活用户数超 2 亿).* Tencent News. https://news.qq.com/rain/a/20230804A05IQ500
[22] Dietmar Jakob. 2022. Voice Controlled Devices and Older Adults–A Systematic Literature Review. In *International Conference on Human-Computer Interaction*. Springer, 175–200.
[23] Xiaofu Jin, Xiaozhu Hu, Xiaoying Wei, and Mingming Fan. 2022. Synapse: interactive guidance by demonstration with trial-and-error support for older adults to use smartphone apps. *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies* 6, 3 (2022), 1–24.
[24] Sunyoung Kim and Abhishek Choudhury. 2021. Exploring older adults' perception and use of smart speaker-based voice assistants: A longitudinal study. *Computers in Human Behavior* 124 (2021), 106914.
[25] Masatomo Kobayashi, Akihiro Kosugi, Hironobu Takagi, Miyuki Nemoto, Kiyotaka Nemoto, Tetsuaki Arai, and Yasunori Yamada. 2019. Effects of age-related cognitive decline on elderly user interactions with voice-based dialogue systems. In *Human-Computer Interaction–INTERACT 2019: 17th IFIP TC 13 International Conference, Paphos, Cyprus, September 2–6, 2019, Proceedings, Part IV 17*. Springer, 53–74.
[26] Sanna Kuoppamäki, Sylvaine Tuncer, Sara Eriksson, and Donald McMillan. 2021. Designing Kitchen Technologies for Ageing in Place: A Video Study of Older Adults' Cooking at Home. *Proceedings of the ACM on interactive, mobile, wearable and ubiquitous technologies* 5, 2 (2021), 1–19.
[27] Sunok Lee, Minji Cho, and Sangsu Lee. 2020. What if conversational agents became invisible? comparing users' mental models according to physical entity of ai speaker. *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies* 4, 3 (2020), 1–24.
[28] Katrien Luijkx, Sebastiaan Peek, and Eveline Wouters. 2015. "Grandma, you should do it—It's cool" Older Adults and the Role of Family Members in Their Acceptance of Technology. *International journal of environmental research and public health* 12, 12 (2015), 15470–15485.
[29] Yong Ma, Yomna Abdelrahman, Barbarella Petz, Heiko Drewes, Florian Alt, Heinrich Hussmann, and Andreas Butz. 2022. Enthusiasts, pragmatists, and skeptics: investigating users' attitudes towards emotion-and personality-aware voice assistants across cultures. In *Proceedings of Mensch und Computer 2022*. 308–322.
[30] Ittay Mannheim, Eveline JM Wouters, Hanna Köttl, Leonieke C Van Boekel, Rens Brankaert, and Yvonne Van Zaalen. 2023. Ageism in the discourse and practice of designing digital technology for older persons: A scoping review. *The Gerontologist* 63, 7 (2023), 1188–1200.
[31] Lina Mavrina, Jessica Szczuka, Clara Strathmann, Lisa Michelle Bohnenkamp, Nicole Kr'amer, and Stefan Kopp. 2022. "Alexa, You're Really Stupid": A Longitudinal Field Study on Communication Breakdowns Between Family Members and a Voice Assistant. *Frontiers in Computer Science* 4 (2022), 791704.
[32] United Nations. 2020. *World Population Ageing 2020: Highlights.* United Nations. Retrieved March 29, 2023 from https://www.un.org/development/desa/pd/sites/www.un.org.development.desa.pd/files/files/documents/2020/Sep/un_2019_worldpopulationageing_highlights.pdf
[33] Katherine O'Brien, Anna Liggett, Vanessa Ramirez-Zohfeld, Priya Sunkara, and Lee A Lindquist. 2020. Voice-controlled intelligent personal assistants to support aging in place. *Journal of the American Geriatrics Society* 68, 1 (2020), 176–179.
[34] Alisha Pradhan, Leah Findlater, and Amanda Lazar. 2019. "Phantom Friend" or "Just a Box with Information": Personification and Ontological Categorization of Smart Speaker-Based Voice Assistants by Older Adults. *Proc. ACM Hum.-Comput. Interact.* 3, CSCW, Article 214 (nov 2019), 21 pages.
[35] Alisha Pradhan, Amanda Lazar, and Leah Findlater. 2020. Use of intelligent voice assistants by older adults with low technology use. *ACM Transactions on Computer-Human Interaction (TOCHI)* 27, 4 (2020), 1–27.
[36] Hilal Şahin, Aslı Günay, and Gülşen Töre Yargın. 2023. Elderly's perceptions of a meaningful interaction with voice-based conversational agents: integrate into daily routines, support relatedness, but do not hamper autonomy. (2023).
[37] Katie Seaborn, Yuto Sawa, and Mizuki Watanabe. 2024. Coimagining the Future of Voice Assistants with Cultural Sensitivity. *Human Behavior and Emerging Technologies* 2024, 1 (2024), 3238737.
[38] Xinru Tang, Yuling Sun, Bowen Zhang, Zimi Liu, RAY LC, Zhicong Lu, and Xin Tong. 2022. "I Never Imagined Grandma Could Do So Well with Technology": Evolving Roles of Younger Family Members in Older Adults' Technology Learning and Use. *Proc. ACM Hum.-Comput. Interact.* 6, CSCW2 (2022), 478–507.
[39] Milka Trajkova and Aqueasha Martin-Hammond. 2020. "Alexa is a Toy": Exploring Older Adults' Reasons for Using, Limiting, and Abandoning Echo. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems (CHI '20)*. 1–13.
[40] POOJA Upadhyay and L Park. 2021. An empirical study of older adult's voice assistant use for health information seeking. *ACM Trans. Interact. Intell. Syst* (2021).
[41] Jing Wei, Tilman Dingler, and Vassilis Kostakos. 2021. Understanding user perceptions of proactive smart speakers. *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies* 5, 4 (2021), 1–28.

[42] Jie Xiong and Meiyun Zuo. 2019. How does family support work when older adults obtain information from mobile internet? *Information Technology & People* 32, 6 (2019), 1496–1516.

[43] Zhenyu Xu, Hailin Xu, Zhouyang Lu, Yingying Zhao, Rui Zhu, Yujiang Wang, Mingzhi Dong, Yuhu Chang, Qin Lv, Robert P Dick, et al. 2024. Can Large Language Models Be Good Companions? An LLM-Based Eyewear System with Conversational Common Ground. *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies* 8, 2 (2024), 1–41.

[44] Ziqi Yang, Xuhai Xu, Bingsheng Yao, Ethan Rogers, Shao Zhang, Stephen Intille, Nawar Shara, Guodong Gordon Gao, and Dakuo Wang. 2024. Talk2Care: An LLM-based Voice Assistant for Communication between Healthcare Providers and Older Adults. *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies* 8, 2 (2024), 1–35.

[45] Kuang-Hui Yeh, Chin-Chun Yi, Wei-Chun Tsao, and Po-San Wan. 2013. Filial piety in contemporary Chinese societies: A comparative study of Taiwan, Hong Kong, and China. *International Sociology* 28, 3 (2013), 277–296.

[46] Ja Eun Yu, Natalie Parde, and Debaleena Chattopadhyay. 2023. "Where is history": Toward Designing a Voice Assistant to help Older Adults locate Interface Features quickly. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems*. 1–19.