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Hedonic Experiences in Older Adults' Interactions with Voice-Based Conversational Agents: A Systematic Review

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Abstract

Existing research has extensively focused on the functional and practical dimensions of older adults' engagement with Voice-based Conversational Agents (VCAs). While this body of work offers valuable insights, it largely frames human–technology interaction through pragmatic and medical perspectives, leaving hedonic and experiential dimensions relatively underexplored. Yet, these aspects are equally important for enabling responsible and meaningful interactions for older adults. We therefore carried out a systematic review of six databases (ACM Digital Library, Scopus, IEEE Xplore, Web of Science, EBSCO HOST, and ScienceDirect) to consolidate current evidence and examine the relationship between VCAs and older adults beyond pragmatic aspects. 52 studies met our criteria and were analyzed using inductive qualitative content analysis.

Our analysis identified a range of positive and negative hedonic aspects and, more importantly, the recurring tensions between them.

Rather than functioning solely as assistive technologies, VCAs emerge as design-mediated systems that shape older adults' quality of life through emotional, social, and cognitive experiences. Our findings point to three recurring design tensions: (1) from social connection to potential social dissonance, (2) from assistance to user incompetence, and (3) from self-confidence to self-doubt. Across all three, autonomy and self-perception emerge as central determinants of hedonic experience. The same design features that foster independence, confidence, and companionship may, when poorly calibrated, also reinforce dependency, stigma, and mistrust.

These findings highlight the importance of responsible design for conversational agents intended for older adults. Because age-related vulnerability raises the stakes of individual design decisions, older adults' autonomy should be treated as a precondition for positive hedonic experience rather than a secondary concern. By foregrounding these tensions, this review contributes to a more holistic understanding of older adults' experiences with VCAs and offers design knowledge for human-centred design of VCAs.

Keywords

Human-Computer Interaction, Older Adults, Voice-Based Conversational Agents, User Experience, Positive Design, Responsible Design

1. INTRODUCTION

Population ageing is reshaping the design, adoption, and use of digital technologies. By 2050, one in six people worldwide will be aged 65 or

older [81]. At the same time, Voice-based Conversational Agents (VCAs) offer older adults natural, hands-free interaction that can reduce barriers associated with conventional interfaces [33, 42, 53, 85]. As conversational technologies become embedded in everyday routines, the question is no longer only whether older adults can use these systems, but how they experience and relate to them.

Existing studies show that older adults use VCAs for everyday activities, social connection, entertainment, and health management, and may view them as companions rather than tools [20, 56]. They are also widely used for healthcare management, from accessing health information to tracking medication [8, 15, 59, 66].

However, older adults also face age-related barriers, such as hearing decline and difficulty remembering activation phrases, that lead to more errors and longer task times than for younger users [6, 18, 54, 78]. Despite the barriers, older adults report more positive attitudes toward VCAs overall than other age groups [80].

Research on older adults and VCAs has largely examined interaction through pragmatic and medical perspectives, substantially advancing usability, functionality, and learnability [1, 67]. The hedonic dimension of interaction, the non-instrumental and affective qualities that shape how users emotionally relate to a product [39], remains comparatively underexplored. The Positive Design framework also argues that virtue, personal significance, and pleasure each independently support well-being, with their intersection fostering human flourishing [30], and that a balanced view of both positive and negative emotion is necessary to understand well-being [73]. For older adults, meaningful VCA interaction extends beyond pragmatic

performance to emotional, social, and psychological experiences [27, 38].

Although previous studies have documented both the benefits and challenges of VCAs, these experiences have typically been discussed independently and focusing dominantly on pragmatic aspects [41]. Less attention has been paid to how positive and negative hedonic experiences may coexist, interact, and shape older adults' relationships with these technologies. Examining these potential tensions is important because features and interaction contexts intended to support older adults may also introduce unintended consequences. Understanding the trade-offs is essential for designing VCAs that support older adults' well-being and for treating autonomy and trust as central design considerations.

In light of this, this review synthesizes existing evidence on older adults' hedonic experiences with VCAs. We first characterize the existing body of empirical work, including its methodological approaches, contexts of use, and participant groups (RQ0), before addressing:

RQ1. Which positive and negative hedonic aspects arise in older adults' experiences with VCAs?

RQ2. How do VCA characteristics and contexts of use shape these experiences?

RQ3. How can VCA design mediate the trade-offs between positive and negative hedonic aspects?

We define hedonic aspects as the non-instrumental qualities of interaction that shape how older adults emotionally experience VCAs, including feelings of confidence or self-doubt, perceptions of

companionship, and concerns about autonomy, trust, and social perception. We distinguish positive aspects (supporting well-being, enjoyment, and connectedness) from negative ones (discomfort, mistrust, or stigma) as an analytical lens rather than a rigid classification, acknowledging that the two are not mutually exclusive; rather, they may coexist within the same experience. To address these questions, we conducted a systematic review of the existing empirical literature.

2. METHODOLOGY

We conducted a systematic review, which is a method to identify, select, and evaluate existing studies grounded on a set of research questions [87]. We used the PRISMA 2020 statement and checklist to guide the reporting of the review process [61]. Figure 1 summarizes our methodology, and we elaborate on it in the following sub-sections.

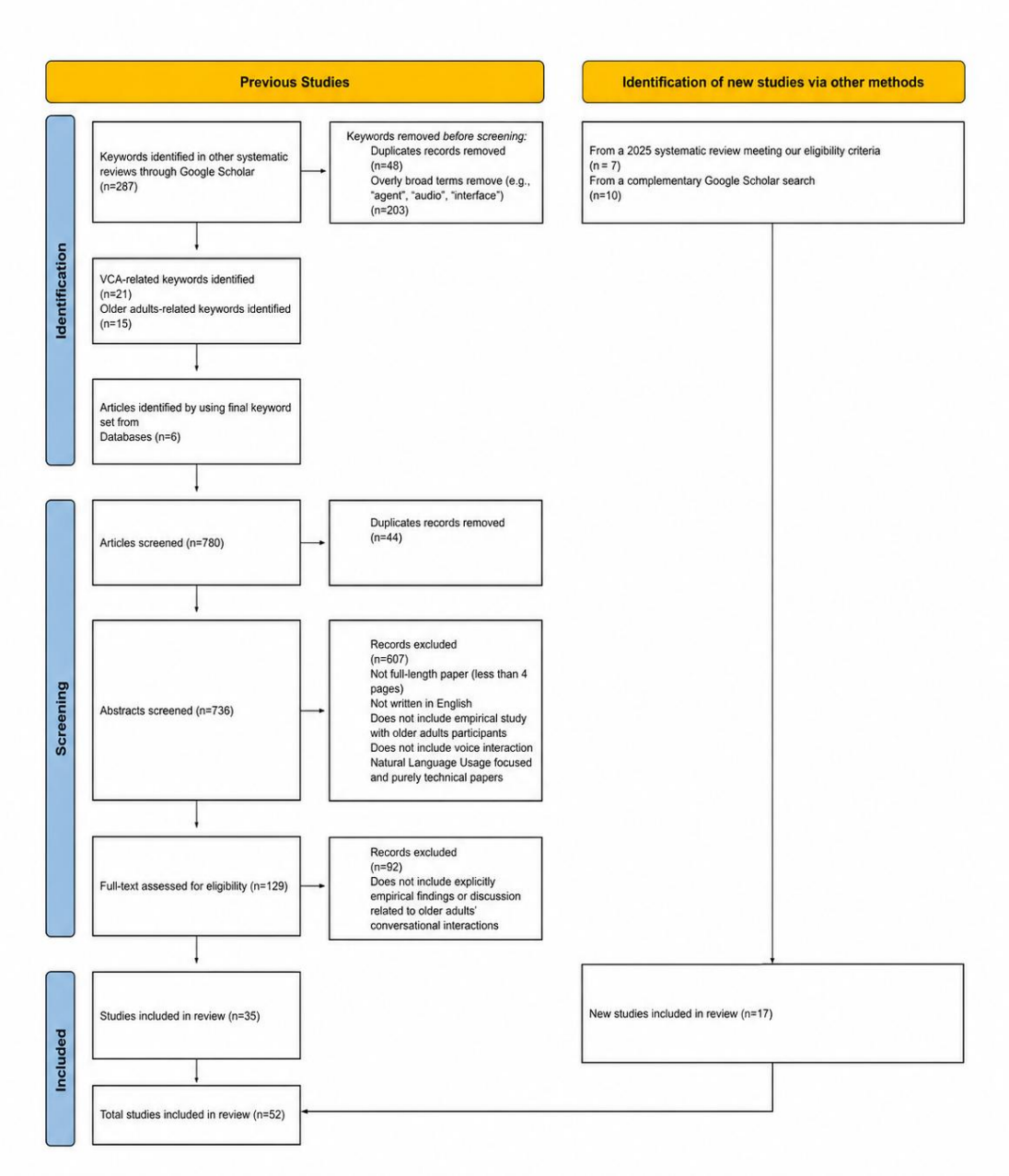


Figure 1: Data collection process

2.1 Data Collection Process

Given the wide range of terminology used in the field [78], we conducted a preliminary scan to identify appropriate search terms before starting the systematic review. We first compiled a keyword

pool from several systematic reviews on VCAs [62, 71, 78]. After removing duplicates, we collated 238 relevant keywords into two main categories, VCAs (218 keywords) and older adults (20 keywords). We then excluded overly broad terms that could capture other technologies and paradigms beyond the current scope (e.g., "agent", "audio", "interface"). This process resulted in 21 VCA-related keywords and 15 older adults-related keywords, which were used in the systematic review (Figure 2).

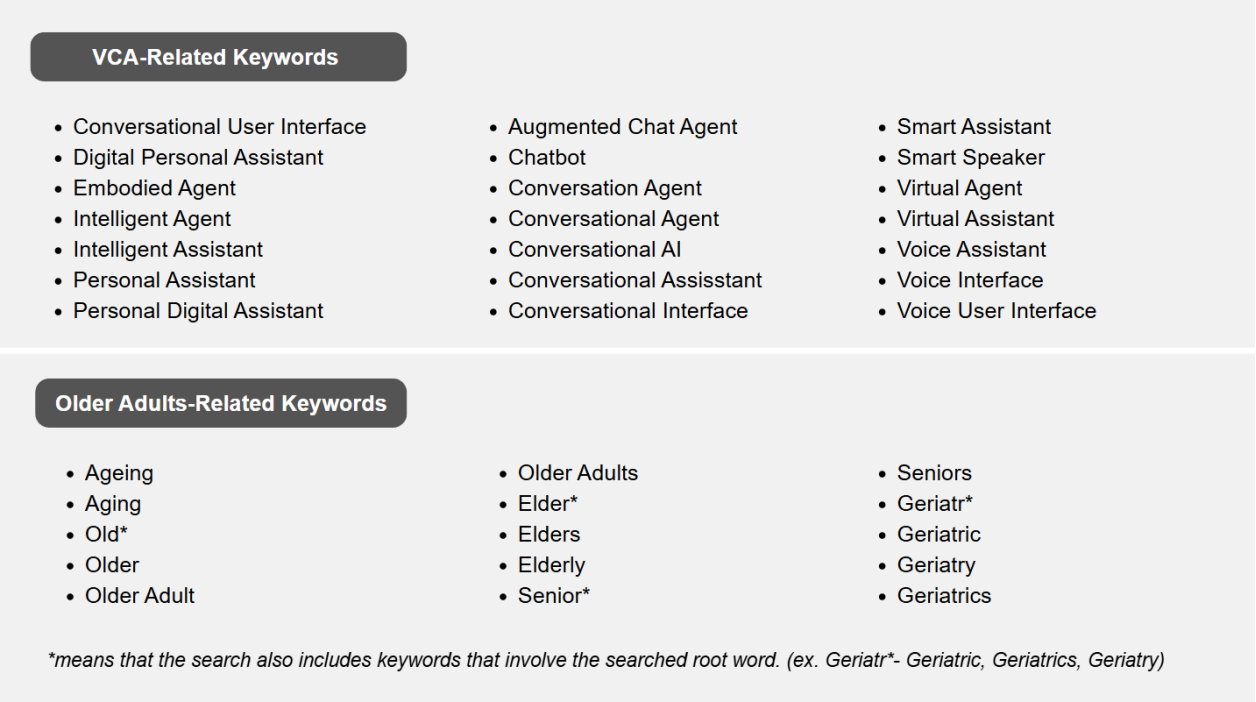


Figure 2: Selected keywords

We searched ACM Digital Library, Scopus, IEEE Xplore, Web of Science, EBSCO HOST and ScienceDirect with the selected keyword combinations in article titles and abstracts. The search strategy for each database is available in Table A.1. We did not set a time limit to be as comprehensive as possible. At the end of this process, we listed 780 articles that met our eligibility criteria. After removing 44

duplicate articles, we included 736 articles in the abstract level selection. At this first level of review, we excluded articles that were not full-length papers, such as posters, short communications, and works in progress, and not written in English, did not include voice interaction, or were primarily focused on Natural Language Understanding (NLU) performance or other purely technical development without empirical investigation of users. We also made sure that the main focus was on older adults. Studies were included if older adults were either the sole participant group or if mixed participant samples were used. Other potential key actors were also considered(e.g., caregivers, healthcare providers, and designers) since they may have insights into the lives of older adults and thus help to design products that are in line with their wants and needs. Yet, studies were excluded when older adults were only marginally mentioned, included as a small subgroup without separate analysis, or not central to the study's research questions.We reached 129 articles with older adult focus in their abstracts. These articles passed to the full text level selection stage for further detailed review.

Then, informed by prior human-centered systematic reviews in HCI and VCAs [e.g., 32, 35], we conducted a more rigorous screening of the 129 articles. Title and abstract screening and full-text eligibility assessment were conducted by the first author based on the predefined inclusion and exclusion criteria, selecting studies that included empirical investigations with users and examined their experiences, perceptions, or interactions with the technology. Uncertain or borderline eligibility decisions were discussed with the co-authors before a final determination was made. This process resulted in 35 studies that met the inclusion criteria and formed the initial corpus.

The search was originally conducted in late 2022. To incorporate recent developments, a targeted update search was conducted in April 2026. This update identified 7 studies from a 2025 systematic review [41] that met our eligibility criteria and 10 additional studies through a complementary Google Scholar search, yielding 17 additional eligible studies and resulting in a final corpus of 52 studies. The same inclusion and exclusion criteria and screening procedure were applied to the newly identified studies. They were coded using the same codebook and contributed additional examples to existing categories without altering the overall thematic structure of the findings.

2.2 Analysis

The analysis included two strands. First, in relation to the RQ0, we extracted descriptive information from the articles to contextualize the subsequent analytical findings by outlining key characteristics of the reviewed literature, including study contexts, participant groups, application domains, and methodological approaches.

Second, to address the remaining RQs, we conducted an inductive qualitative content analysis focusing on interpreting the substance of textual data in relation to its meanings, contexts, and purposes [25]. This approach allowed patterns related to hedonic aspects and VCA characteristics influencing older adults' experiences to emerge across studies.

The first author initially coded 10% of the corpus in MAXQDA to develop a preliminary coding scheme. These codes were then discussed with the other authors to refine code definitions, clarify ambiguities, and establish a shared understanding. Following these discussions, a consensus-based codebook was developed. The first

author subsequently coded the remaining articles using this codebook, with regular discussions among all authors to review coding decisions, identify emerging patterns, and resolve ambiguities. This iterative and collaborative process supported reflexivity and analytical consistency, in line with recommendations for inductive qualitative analysis in HCI research [58].

Hedonic aspects were subsequently organized into positive and negative categories. This categorization was employed as an analytical lens to structure the findings rather than as a rigid classification of user experience. Within these categories, subcategories were identified to capture recurring patterns across studies and mapped to relevant VCA characteristics. Figure 3 summarizes the refined codebook with major themes and the relationships between the identified codes.

3. FINDINGS

3.1 Descriptive Information Related to Studies

The descriptive analysis addresses RQ0, providing an overview of study characteristics, including user profiles, methods, durations, contexts, and VCA terminology. Table 1 presents the main patterns, while Table A.2 provides an extended matrix.

Overall, the distribution of studies suggests that research on VCAs with older adults has been shaped primarily by care- and support-oriented applications, with health emerging as the dominant context, reflected also in the broader involvement of caregivers and professionals in this domain. This care orientation is further reflected in the diversity of settings covered by health-related studies, which spanned home, hospital, facility, and laboratory contexts, whereas

studies in other domains were concentrated almost exclusively in the home, suggesting that health research has achieved not only greater volume but also broader institutional reach. Notably, however, this care orientation has not extended to the oldest-old, as samples were dominated by the young-old (60–75), while the old-old (75+) remain markedly underrepresented, a gap worth noting given that these are the groups most likely to benefit from, or struggle with, VCA-based support. The limited representation of everyday and psychological/well-being applications suggests that VCAs' potential beyond functional purposes remains underexplored.

Methodologically, the evidence base is characterized largely by interviews and surveys, while participatory approaches such as co-design and workshops appear less frequently, suggesting that older adults have more often been positioned as evaluated users than as active contributors to design. Study durations are predominantly short-term, though a smaller body of longitudinal work has examined VCA use over extended periods. Taken together, these patterns point to a literature with a substantial empirical basis for understanding older adults' experiences with VCAs, but one still limited in participatory design, everyday non-care applications, and long-term engagement. Finally, although the terminology used to describe VCAs varies considerably, reflecting the field's conceptual heterogeneity and lack of a standardized vocabulary, this diversity at the level of language is not matched at the level of technology. The studies converge heavily on a small number of commercial platforms, most notably Amazon Alexa, followed by Google Assistant, indicating that the field's terminological pluralism coexists with a fairly narrow industrial base.

Table 1: Descriptive characteristics of included studies by topic

TOPIC	Number of Articles	User Profile										Method														Length							Context					Preferred VCA Terms***							VCA Platform***		
		Older Adults**							Other																																							
		50+	55+	60+	65+	70+	75+	85+	Relatives	Professional	Caregiver	Interview	Focus Group	Usability Test	Workshop	Co-design	Usage Log Analysis	Content Analysis	Wizard of Oz	Participant Observation	Scale/Survey/ Questionnaire	Diary	Home Tour	Think Aloud	≤ 1 day	1-15 Days	15 - 30 days	1-3 months	3-6 months	6-9 months	≥ 1 year	Home	Hospital	Facility	Lab	Other Setting	Embodied Conversational Agent	Conversational Agent	Chatbot	Intelligent Virtual Agent	Smart Speaker Based Voice Assistant	Virtual Agent	Voice Assistant	Voice User Interface	Amazon Alexa	Google Assistant	In-house developed
Health	27	3	2	13	6	2				1	5	13	2	2	1	3	6		5	1	17	3		1	13	4	5	2	2	1		11	1	3	8	4	4		4		3			5	2	3	2	21
General/Daily Life	17		1	3	7	3	3		2		1	13					3		2	1	6	1	1		8	1	2	3	1		2	8		5	3	3			2	1	2		6			8	2	7
Psychological/Well-being	7		2		3		1	1		1		6	1				2				1	2	1		1	2	3		2			4		2	1	1	1	1	1		1					1	1	5
E-Commerce	1				1								1						1						1										1														1

**Age categories reflect the definitions adopted by the included studies. Studies were included when they referred to their participants as older adults/elderly, regardless of the specific age threshold used by the authors.

***Only categories occurring in ≥2 studies are shown. Single-occurrence terms and platforms were excluded.

3.2 Hedonic Aspects during Older Adults' Interaction with VCAs

Addressing RQ1 and RQ2, we examined older adults' experiences with VCAs in terms of positive and negative hedonic aspects, together with the VCA characteristics and contextual factors shaping them (Figure 3).

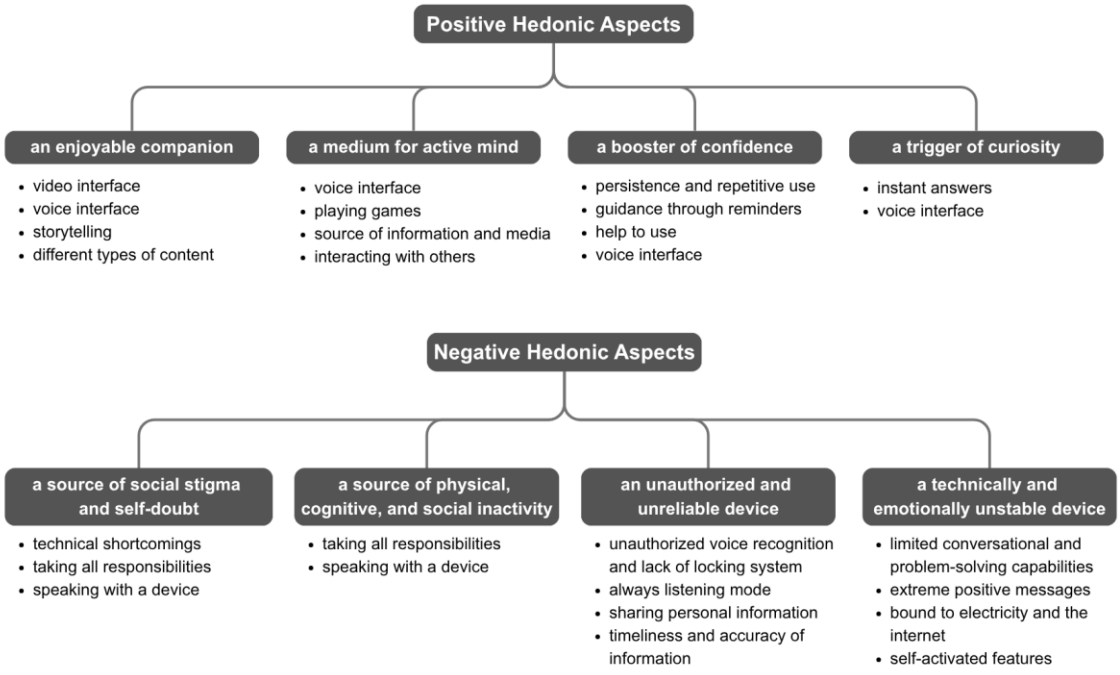


Figure 3: Hedonic aspects and their relationship with VCA features

3.2.1 Positive Hedonic Aspects

VCA as an enjoyable companion: Because older adults generally have lower access to digital technologies and media compared to younger generations, VCAs served as a gateway to entertainment and digital experiences [34], leading some users to perceive them as companions [31].

This sense of companionship was reinforced through enjoyable and meaningful interactions. Listening to music through VCAs had been reported to alleviate pain among those with chronic illnesses [31, 79], encourage dancing to the rhythm [60] and together with card games and video calling features made them feel good, especially during periods of social isolation such as Covid19 [31, 74, 76, 77]. Video calling and conversational interactions especially helped alleviate loneliness and created a feeling comparable to receiving visitors at home [22, 31, 64].

Additionally, accessing stories, jokes and recipes on demand, and repeating religious verses together, reduced feelings of boredom and loneliness [65, 74], leading some older adults to form deep emotional attachments to VCAs as indispensable companions [24]. The constant availability of VCAs further strengthened the perception of companionship, providing reassurance for older adults living alone and reducing the burden on caregivers of socially isolated individuals [7, 10, 47, 86]. According to Astell and Clayton (2024), companionship was associated with both a perceived sense of presence and the ability to engage with the assistant on users' own terms, as VCAs created a feeling of someone being there while allowing older adults to decide when and how to interact [2]. Its experience also varied depending on the context of use, with VCAs

described as particularly comforting at home after social gatherings, during extended periods of being alone, or in residential and care settings where opportunities for social interaction were limited [31, 64, 65].

VCA as a medium for active mind: Several studies highlighted VCA's role in simulating cognitive activity among older adults. Conversational interactions, access to information, media content and games helped older adults remain mentally engaged, while communication features supported both cognitive and social stimulation, particularly for users experiencing memory decline and social isolation [10, 31, 36, 77, 79 86]. VCAs also enabled older adults to search for information, verify knowledge, and engage in cognitively stimulating activities, supporting their active involvement in maintaining cognitive health rather than focusing solely on cognitive decline [82]. Similarly, older adults expressed willingness to incorporate VCAs into their daily routines for cognitive stimulation through engaging activities [13, 23]. This need to keep the mind engaged was also reflected in a study where older adults expressed a desire to incorporate a positive reminiscing probe, which asked reflective questions about personal achievements, attitudes towards loneliness, and life experiences, into their daily routine, as it encouraged them to think more [24]. Beyond supporting older adults themselves, VCAs may also provide meaningful support for individuals in caregiving roles. For example, a participant caring for his wife with dementia described Amazon Echo as a companion that helped him remain mentally active and reduced feelings of isolation [66].

VCA as a booster of confidence: Successful interactions with VCAs boosted older adults' confidence, particularly when these devices

helped them accomplish tasks that might otherwise create difficulties. Reminder functions reduced concerns about making mistakes [3, 69] and voice interaction enabled users to ask "silly questions" [49, 76]. This non-judgmental quality also encouraged users to push their own boundaries, as errors met with a neutral or reassuring response rather than criticism made older adults feel more comfortable continuing to experiment and engage with the assistant [24, 28, 75]. For older adults with mild cognitive impairment specifically, positive reinforcement from the assistant fostered a distinct sense of accomplishment, with users reporting that being praised for completing a task made them feel they had achieved something meaningful [57], while for people with dementia, similar comfort emerged from the assistant's patience with repeated questions, expressed without frustration [88]. Moreover, repetitive use and persistence, together with appropriate onboarding support facilitated technology adoption [22, 31, 62, 63, 86]. Importantly, such confidence gained through VCA use was transferred to use of other digital technologies [66], as curiosity, experimentation, and repeated engagement helped older adults develop "digital living skills" by learning how to integrate and navigate digital devices in everyday life [79, p. 710].

VCA as a trigger of curiosity: The conversational nature of VCAs sparked older adults' curiosity about technology, while the ease and simplicity of voice interaction encouraged them to explore device capabilities [66]. Participants actively experimented with different questions to test the system's abilities and understand its limitations, reflecting an exploratory engagement with technology. In peer and group settings, these exploratory behaviours tended to become stronger, as observing how others interacted with VCAs encouraged

older adults to try out new commands and question formats themselves [12]. Time emerged as an important factor in this exploratory engagement, as sustained use over a longer period supported an ongoing process of discovery, with older adults increasingly testing the boundaries between the assistant's pre-programmed responses and its natural language capacities [82]. Moreover, experiences with VCAs could evoke a sense of amazement among older users, demonstrating how these devices may foster curiosity and engagement with emerging technologies [2, 49].

3.2.2 Negative Hedonic Aspects

VCA as a source of social stigma and self-doubt: Social perceptions surrounding talking to digital devices prevented older adults from adopting VCAs. Some older adults expressed distancing attitudes toward peers perceived as dependent on others or living with disabilities, reflecting broader societal narratives around technology dependency [48]. Although VCAs were intended to support daily living, they unintentionally reinforced stigmas regarding technology dependency and diminished autonomy [48, 64, 70]. In some cases, the omnipresence of VCAs in the home served as a constant reminder of aging and caused irritation [77]. Also, older adults were concerned that they are perceived as "silly", "crazy" or even "pathetic" for talking to machines [49, 65, 66], although these feelings often diminished with continued use [65].

Self-doubt regarding technological competence further discouraged adoption [24, 26, 46, 49,]. This especially happens during initial setup [26] or when memory related difficulties disrupted interaction, which occurred in two ways: Older adults may forget information provided during conversations, affecting continuity of interaction [14], or

forget to use VCAs when they could be helpful, which can be supported through reminders [66]. Beyond individual concerns about technological ability, self-doubt could also emerge through family dynamics. In some multigenerational households, adult children's overprotectiveness contributed to self-doubt, as older adults feared both using it wrong and being labelled as the parent who constantly causes problems when something went wrong [68].

VCA as a source of physical, cognitive and social inactivity: The possibility of developing dependence on VCAs and losing autonomy was a recurring concern, as devices are perceived as taking over responsibilities from older adults and potentially pushing them toward passivity [64, 79]. Fears about physical inactivity emerged when VCAs are imagined as enabling a lifestyle where users rely on technology instead of moving or performing tasks themselves, while concerns about cognitive inactivity center on preferring active reading and mental effort over passive consumption of content read aloud by VCAs [55].

Older adults themselves voiced this risk, associating excessive reliance on the system with an idle, sedentary lifestyle that could hasten decline unless offset by continued activity [64]. Caregivers raised a related but distinct concern. They stressed that VCAs should remain assistants rather than independent decision-makers acting on the user's behalf, warning that if VCAs took over caregiving responsibilities, older adults' social interactions might diminish and contribute to isolation [64, 66]. This dynamic was not limited to caregiver concerns; older adults themselves resisted assistant-initiated interventions that threatened their autonomy [40]. Some older adults rejected proactive suggestions from assistants, such as unsolicited reminders or recommendations triggered without their

explicit request but framed as being in the older person's best interest, because they perceived these interventions, even when benevolently intended, as a form of "benevolent paternalism" that threatened their independence [40].

VCA as an unauthorized and unreliable device: Despite reassurance from emergencies and reminder features, trust eroded when these proved insufficient [26, 55, 64, 66, 77]. Concerns about security further weakened trust, as the absence of voice authentication or locking mechanisms raised fears of unauthorized access, including misuse by family members and exposure of financial information to intruders [55, 64, 66]. Privacy and surveillance concerns compounded distrust, as always-listening modes evoked "Big Brother" surveillance, fears of overheard conversations, and threats to freedom and autonomy [26, 31, 48, 59, 64, 70]. Among some older adults experiencing cognitive decline, these anxieties escalated into beliefs that the device was "watching" them, leading them to turn it off at night and further illustrating how surveillance-related fears can undermine trust in VCAs [10].

Beyond privacy concerns, distrust also extended to the reliability and credibility of information provided by VCAs. Some older adults avoided voice purchasing, preferred local data storage, or misunderstood the personal data required for VCA operation [48, 55, 66]. In health-related contexts, concerns emerged when VCAs could not provide rapidly changing medical knowledge or comprehensive symptom coverage [22, 59]. Worries about who could access and use health information, together with unclear reasoning behind recommendations, further undermined trust in health-related assistants [11, 21]. In a health-focused co-design study, older adults emphasized the importance of credibility mechanisms, such as

references to trusted medical providers, citations to underlying studies, visible update dates, and disclosure of the assistant's background and credentials, highlighting that trust depends not only on functionality but also on transparency and perceived authority [29]. Proposed mitigations included professional oversight, multi-stakeholder consensus [55, 59], and crowdsourced credibility assessment mechanisms [66].

VCA as a technically and emotionally unstable device: Gaps between expected and actual VCA conversational abilities frequently led to misunderstandings, disappointment, and frustration [17, 19, 24, 60, 66, 84]. Dependence on electricity and internet connectivity further undermined distrust, discouraging reliance on VCAs for critical functions such as alarms and reminders [31, 59, 64, 66]. These technical limitations were compounded by linguistic diversity, as regional accents, dialects, and unfamiliar speech patterns were frequently misrecognized, at times so severely that users had to consciously adapt their manner of speaking to be understood [9, 37, 68]. In some cases, this extended to the assistant failing to register even simple, clearly enunciated responses [52], which one participant described as "a critical failure" given the voice-driven nature of the system [43].

Instabilities also extended to emotional interactions. Poorly timed, self-activated notifications disrupted daily routines [64]. Additionally, contextually inappropriate affective responses, such as repeated expressions of affection, caused irritation rather than comfort or encouragement [17]. This unpredictability could also run in the opposite direction, toward an unexpectedly critical or scolding tone, as when an assistant reprimanded a user for repeating a request more than three times, illustrating how an assistant's affective

register could shift without contextual justification [79]. Emotional responses that were intended positively could also backfire in their intensity. In one deployment, enthusiastic verbal praise and celebratory sound effects following successful task completion were experienced by some users as overwhelming rather than encouraging [57].

4. DISCUSSION

While our analysis distinguishes between positive and negative hedonic aspects, these experiences are deeply interconnected and shaped by the pragmatic characteristics of VCAs. Factors such as functional support, reliability, and ease of use influence older adults' emotional responses, self-perception, and sense of autonomy, blurring the boundary between hedonic and pragmatic qualities in later life.

Across the reviewed literature, these hedonic aspects consistently involve trade-offs rather than isolated states. VCAs support companionship through voice-based interaction and their physical presence in the home, yet the resulting sense of closeness must be carefully calibrated, as concerns about social stigma and impersonal interaction can undermine it. Similarly, while VCAs offer valuable reminders and information, the appropriate level of assistance varies across individuals and requires deliberate design choices to avoid fostering dependency. Voice communication is engaging, yet trust breaks down when communication fails or privacy is threatened, underscoring the need for trustworthy design. We argue that attending to these trade-offs is what allows VCAs' pragmatic qualities to reinforce, rather than undermine, positive hedonic experience for

older users. Below, in response to RQ3, we discuss these trade-offs along three dimensions: social, assistance, and confidence.

4.1 From Social Connection to Potential Social Dissonance: VCA Influence on Companionship and User Labeling

Consistent with previous research [44], companionship emerged as a core role of VCAs. Alternative entertainment features such as music, storytelling, and games strengthened this relationship, while the context of use (e.g., bedroom, hospital, care home) shaped how companionship was experienced. For example, older adults could feel socially connected during the day yet lonely returning to a room without a companion to say "good night." Design decisions should therefore consider not only when and where VCAs are used, but also relational features, such as personality and screen presence, that help older adults build a sense of intimacy with the device. VCAs may also become companions for caregivers themselves, for instance supporting those caring for an older adult with dementia [7, 20].

However, companionship through VCAs involved tensions, including communication interruptions, persistent speech limitations for continuous everyday conversation, and the feeling of talking to a machine, all of which fed worries about appearing foolish. The level of emotional closeness established with VCAs therefore requires careful balancing. While some users developed strong emotional attachment, inappropriate affective responses, ranging from repeated expressions of affection to unpredictable shifts toward an overly critical or overly enthusiastic tone, became irritating rather than reassuring [17, 57, 70, 79], clearly illustrating this trade-off.

Thus, designing responsible VCA experiences requires attention not only to conversational quality but also to appearance, personality, and social interpretation around stigma and inadequacy. As VCAs can be embodied in visual forms such as holograms or anthropomorphic agents [65], designers should carefully consider how features such as voice, appearance, gender, and language shape attachment, social substitution, and gender stereotypes, particularly given the significance of personal relationships in older adults' lives [45, 83, 85].

4.2 From VCA Assistance to User Incompetence: VCA Influence on Well-being and User Dependency

VCAs' assistance features, particularly reminders and information provision, positioned them as helpers [4, 26, 72] . Yet older adults with established routines, such as using a medicine box instead of an alarm, or those who could otherwise meet their own needs, often found VCAs less useful [48]. Expectations of assistance therefore varied with health conditions, living situations, and whether others also interacted with the device, meaning the appropriate level of support differed across individuals rather than following a single template.

This variability extended to autonomy itself. Both older adults and caregivers cautioned that excessive reliance on VCAs could foster inactivity and eroded autonomy, echoing calls in the literature for assistive technologies that support independence, social connection, and self-efficacy rather than substituting for them [5, 7, 16]. This tension surfaced concretely when VCAs moved from assisting to deciding. Older adults resisted proactive suggestions, unsolicited

reminders and recommendations they had not requested, even when well intentioned, experiencing them as a form of benevolent paternalism that undermined their independence [40]. Within families, this dynamic could be reinforced rather than resolved, as adult children's overprotectiveness left some older adults doubting their own competence and fearing being labelled as the parent who constantly causes problems [68]. Designing for assistance therefore means preserving the older adult's role as decision maker. Rather than replacing meaningful activities, VCAs could enhance existing routines. For instance, replacing reading with automated narration may reduce enjoyment and mental engagement, whereas features such as personalized playlists, reading trackers, and reminders could support the activity without displacing it. VCA design should also avoid reinforcing feelings of aging by allowing personalization of both functionality and appearance.

4.3 From Self-Confidence to Self-Doubt: VCA Influence on Older Adults´ Confidence

Voice-based interaction itself triggers curiosity among older adults. Eliminating the worry of pressing the wrong button can motivate them to use the product, or even to ask seemingly silly questions. The reminder feature and accompanying guidance made them confident in knowing what to do and encouraged experimentation with new technological products. However, certain concerns discouraged sustained interaction, including unauthorized use of the voice assistant and forgetfulness, such as difficulty remembering a simple wake-up word [14, 26, 66]. Limited conversational and problem-solving skills, such as being unable to sustain daily communication, misunderstanding the user, or repeating similar answers, made older

adults feel guilty and undermined their self-confidence. Concerns about privacy, constant surveillance, storage of sensitive personal data, and the accuracy of information provided, particularly for health-related questions, further weakened trust [51]. Perceived system reliability therefore emerges as a critical design consideration, supporting both sustained engagement and users' confidence in interacting with VCAs. Together with the ethical concerns already raised around companionship and social labeling, these reliability and privacy issues raise a further question that designers cannot avoid, namely whether older adults should be encouraged to commit to an always-connected voice assistant at all.

Looking across these trade-offs, the interaction between the hedonic dimensions plays a central role in shaping design decisions for VCAs targeting older adults. Rather than addressing individual hedonic aspects in isolation, designers need to consider how improvements in one dimension may influence others. For example, reminder features that support well-being and reinforce self-confidence can, if relied upon too heavily, tip toward dependency and self-doubt, illustrating how the same feature can move users along both the assistance and confidence dimensions at once. Figure 4 visualizes these trade-offs across the three dimensions.

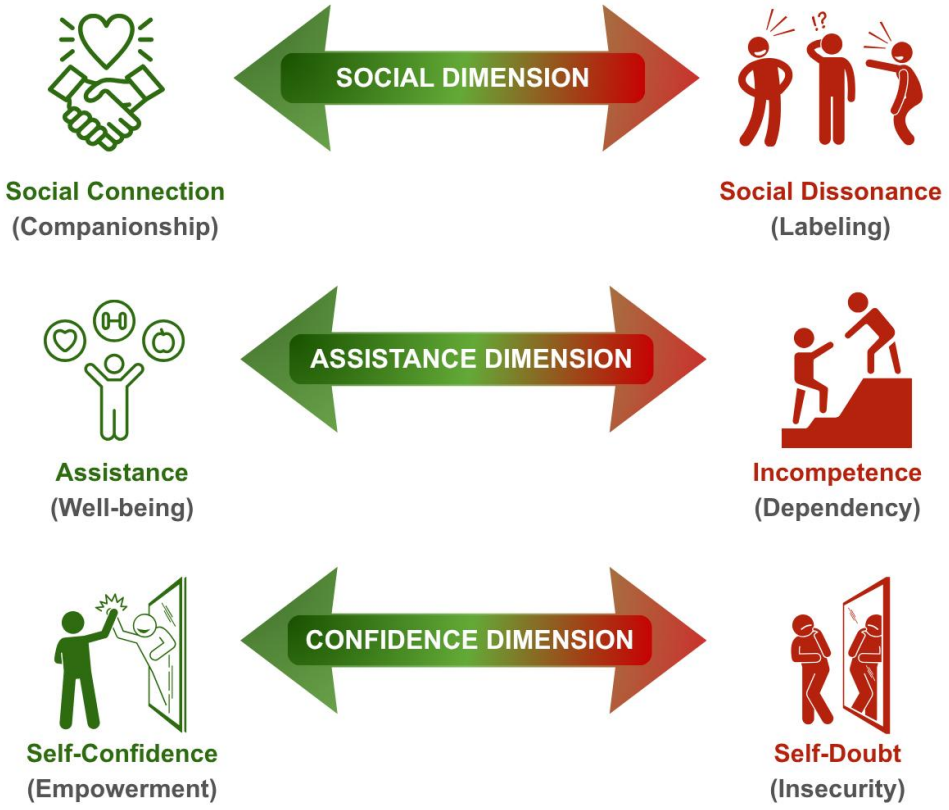


Figure 4: Trade-offs across hedonic aspects

5. LIMITATIONS

This review synthesizes patterns in literature rather than making definitive or causal claims about the positive and negative hedonic aspects of older adults' interactions with VCAs. To focus on dimensions beyond pragmatics, we included studies that examined users' experiences and design implications, while excluding studies focused primarily on NLU or other pragmatic concerns. Consequently, studies without direct user involvement that may nevertheless inform hedonic experience could have been overlooked.

The literature also has methodological gaps. Adults aged 75 and over are underrepresented relative to younger older adults, participatory approaches such as co-design are less common than interviews and surveys, and evidence is concentrated on a narrow range of commercial platforms. Future research should address these gaps.

6. CONCLUSION

This review synthesized 52 studies from 6 databases to examine hedonic aspects of older adults' interactions with VCAs. Balance emerged as a key design principle, as companionship may entail social labeling, assistance may foster passivity, and confidence may be undermined by mistrust. Designing VCAs for older adults therefore requires addressing these trade-offs rather than optimizing any single dimension. Understanding these hedonic elements and their trade-offs can guide the development of VCAs that address not only pragmatic but also emotional and social needs.

REFERENCES

[1] Arnold, A., Kolody, S., Comeau, A., & Miguel Cruz, A. (2024). What does the literature say about the use of personal voice assistants in older adults? A scoping review. Disability and Rehabilitation: Assistive Technology, 19(1), 100-111.

[2] Astell, A., & Clayton, D. (2024). "Like another human being in the room": A community case study of smart speakers to reduce loneliness in the oldest-old. Frontiers in Psychology, 15, 1320555.

[3] Azevedo, R. F., Morrow, D., Graumlich, J., Willemsen-Dunlap, A., Hasegawa-Johnson, M., Huang, T. S., ... & Halpin, D. J. (2018). Using conversational agents to explain medication instructions to older adults. In AMIA annual symposium proceedings (Vol. 2018, p. 185). American Medical Informatics Association.

[4] Balsa, J., Félix, I., Cláudio, A. P., Carmo, M. B., Guerreiro, A., Guedes, M., ... & Guerreiro, M. P. (2020). Usability of an intelligent virtual assistant for promoting behavior change and self-care in older people with type 2 diabetes. Journal of Medical Systems, 44(7), 1-12.

[5] Birnholtz, J., & Jones-Rounds, M. (2010, April). Independence and interaction: Understanding seniors' privacy and awareness needs for aging in place. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (pp. 143-152).

[6] Blair, J., & Abdullah, S. (2019, November). Understanding the needs and challenges of using conversational agents for deaf older adults. In Companion Publication of the 2019 Conference on Computer Supported Cooperative Work and Social Computing (pp. 161-165).

[7] Bott, N., Wexler, S., Drury, L., Pollak, C., Wang, V., Scher, K., & Narducci, S. (2019). A protocol-driven, bedside digital conversational agent to support nurse teams and mitigate risks of hospitalization in older adults: Case control pre-post study. Journal of Medical Internet Research, 21(10), e13440.

[8] Brewer, R., Pierce, C., Upadhyay, P., & Park, L. (2022). An empirical study of older adult's voice assistant use for health information seeking. ACM Transactions on Interactive Intelligent Systems (TiiS), 12(2), 1-32.

[9] Brewer, R. N., Harrington, C., & Heldreth, C. (2023, June). Envisioning equitable speech technologies for black older adults. In Proceedings of the 2023 ACM Conference on Fairness, Accountability, and Transparency (pp. 379-388).

[10] Bults, M., van Leersum, C. M., Olthuis, T. J. J., Siebrand, E., Malik, Z., Liu, L., ... & den Ouden, M. E. M. (2024). Acceptance of a digital assistant (Anne4Care) for older adult immigrants living with dementia: Qualitative descriptive study. JMIR Aging, 7, e50219.

[11] Cao, X., Zhang, H., Zhou, B., Wang, D., Cui, C., & Bai, X. (2024). Factors influencing older adults' acceptance of voice assistants. Frontiers in Psychology, 15, 1376207.

[12] Cerezo, E., Lacuesta, R., Gallardo, J., & Aguelo, A. (2025). Exploring the use of voice assistants in nursing homes. International Journal of Human–Computer Interaction, 41(20), 13175-13191.

[13] Chan, S. W., Sapkota, S., Mathews, R., Zhang, H., & Nanayakkara, S. (2020). Prompto: Investigating receptivity to prompts based on cognitive load from memory training conversational agent.

Proceedings of the ACM on interactive, mobile, wearable and ubiquitous technologies, 4(4), 1-23.

[14] Chattaraman, V., Kwon, W. S., Gilbert, J. E., & Shim, S. I. (2011). Virtual agents in e-commerce: Representational characteristics for seniors. Journal of Research in Interactive Marketing.

[15] Chen, C., Johnson, J. G., Charles, K., Lee, A., Lifset, E. T., Hogarth, M., ... & Weibel, N. (2021, October). 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 (pp. 1-16).

[16] Chen, K. (2020). Why do older people love and hate assistive technology? An emotional experience perspective. Ergonomics, 63(12), 1463-1474.

[17] Chi, N. C., Sparks, O., Lin, S. Y., Lazar, A., Thompson, H. J., &Demiris, G. (2017). Pilot testing a digital pet avatar for older adults. Geriatric Nursing, 38(6), 542-547.

[18] Chiaradia, T. S., Seabra, R. D., & Mattedi, A. P. (2019, May). Evaluating the usability of the Siri virtual assistant on mobile devices with emphasis on Brazilian elderly users. In 16th International Conference on Information Technology-New Generations (ITNG 2019) (pp. 437-441). Cham: Springer International Publishing.

[19] Chung, J., Bleich, M., Wheeler, D. C., Winship, J. M., McDowell, B., Baker, D., & Parsons, P. (2021). Attitudes and perceptions toward voice-operated smart speakers among low-income senior housing residents: Comparison of pre-and post-installation surveys. Gerontology and Geriatric Medicine, 7, 23337214211005869.

[20] Chung, K., Oh, Y. H., & Ju, D. Y. (2019, September). Elderly users' interaction with conversational agent. In Proceedings of the 7th International Conference on Human-Agent Interaction (pp. 277-279).

[21] Conde-Caballero, D., Rivero-Jiménez, B., Cipriano-Crespo, C., Jesus-Azabal, M., Garcia-Alonso, J., & Mariano-Juárez, L. (2021). Treatment adherence in chronic conditions during ageing: uses, functionalities, and cultural adaptation of the assistant on care and health offline (acho) in rural areas. Journal of Personalized Medicine, 11(3), 173.

[22] Corbett, F. C., Combs, E. M., Wright, P. J., Owens, O. L., Stringfellow, I., Nguyen, T., & Van Son, C. R. (2021). Virtual home assistant use and perceptions of usefulness by older adults and support person dyads. International Journal of Environmental Research and Public Health, 18(3), 1113.

[23] Corcoba, V., Melendi, D., Pañeda, X. G., García, R., Pozueco, L., García-Carrillo, D., & Peña, J. P. (2022, July). Prototype of a system based on voice assistants for cognitive stimulation of the elderly. In 2022 44th Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC) (pp. 2672-2675). IEEE.

[24] Cuadra, A., Bethune, J., Krell, R., Lempel, A., Hänsel, K., Shahrokni, A., ... & Dell, N. (2023, July). Designing voice-first ambient interfaces to support aging in place. In Proceedings of the 2023 ACM Designing Interactive Systems Conference (pp. 2189-2205).

[25] Das, D. K., & Bhaskaran, V. (2008). Research methods for social work.

[26] de Arriba-Pérez, F., García-Méndez, S., González-Castaño, F. J., & Costa-Montenegro, E. (2021). Evaluation of abstraction capabilities and detection of discomfort with a newscaster chatbot for entertaining elderly users. Sensors, 21(16), 5515.

[27] De Medeiros, J. F., Ribeiro, J. L. D., & Cortimiglia, M. N. (2014). Success factors for environmentally sustainable product innovation: A systematic literature review. Journal of Cleaner Production, 65, 76-86.

[28] Desai, S., Hu, X., Lundy, M., & Chin, J. (2023, December). Using experience-based participatory approach to design interactive voice user interfaces for delivering physical activity programs with older adults. In Proceedings of the 11th International Conference on Human-Agent Interaction (pp. 180-190).

[29] Desai, S., Lundy, M., & Chin, J. (2023, July). "A painless way to learn:" Designing an interactive storytelling voice user interface to engage older adults in informal health information learning. In Proceedings of the 5th International Conference on Conversational User Interfaces (pp. 1-16).

[30] Desmet, P. M., & Pohlmeyer, A. E. (2013). Positive design: An introduction to design for subjective well-being. International Journal of Design, 7(3).

[31] Duque, M., Pink, S., Strengers, Y., Martin, R., & Nicholls, L. (2021). Automation, wellbeing and digital voice assistants: Older people and Google devices. Convergence, 27(5), 1189-1206.

[32] Dutsinma, F. L. I., Pal, D., Funilkul, S., & Chan, J. H. (2022). A systematic review of voice assistant usability: An ISO 9241–11 approach. SN Computer Science, 3(4), 267.

[33] Even, C., Hammann, T., Heyl, V., Rietz, C., Wahl, H. W., Zentel, P., & Schlomann, A. (2022). Benefits and challenges of conversational agents in older adults: A scoping review. Zeitschrift für Gerontologie und Geriatrie, 55(5), 381-387.

[34] García-Méndez, S., De Arriba-Pérez, F., González-Castaño, F. J., Regueiro-Janeiro, J. A., & Gil-Castiñeira, F. (2021). Entertainment chatbot for the digital inclusion of elderly people without abstraction capabilities. IEEE Access, 9, 75878-75891.

[35] Gatos, D., Günay, A., Kırlangıç, G., Kuscu, K., & Yantac, A. E. (2021, June). How HCI bridges health and design in online health communities: A systematic review. In Proceedings of the 2021 ACM Designing Interactive Systems Conference (pp. 970-983).

[36] Griol, D., & Callejas, Z. (2016). Mobile conversational agents for context-aware care applications. Cognitive Computation, 8(2), 336-356.

[37] Harrington, C. N., Garg, R., Woodward, A., & Williams, D. (2022, April). "It's kind of like code-switching": Black older adults' experiences with a voice assistant for health information seeking. In Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems (pp. 1-15).

[38] Hassenzahl, M. (2013). Designing moments of meaning and pleasure. Experience design and happiness. International Journal of Design.

[39] Hassenzahl, M., & Tractinsky, N. (2006). User experience-a research agenda. Behaviour & Information Technology, 25(2), 91-97.

[40] Horstmann, A. C., Schubert, T., Lambrich, L., & Strathmann, C. (2023, September). 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 (pp. 1-10).

[41] Huang, Y., Zhou, Q., & Piper, A. M. (2025, April). Designing conversational AI for aging: A systematic review of older adults' perceptions and needs. In Proceedings of the 2025 CHI Conference on Human Factors in Computing Systems (pp. 1-20).

[42] Jakob, D. (2022, June). Voice controlled devices and older adults–a systematic literature review. In International Conference on Human-Computer Interaction (pp. 175-200). Cham: Springer International Publishing.

[43] Jansons, P., Fyfe, J., Via, J. D., Daly, R. M., Gvozdenko, E., & Scott, D. (2022). Barriers and enablers for older adults participating in a home-based pragmatic exercise program delivered and monitored by Amazon Alexa: A qualitative study. BMC Geriatrics, 22(1), 248.

[44] Jones, V. K., Hanus, M., Yan, C., Shade, M. Y., Blaskewicz Boron, J., & Maschieri Bicudo, R. (2021). Reducing loneliness among aging adults: The roles of personal voice assistants and anthropomorphic interactions. Frontiers in Public Health, 9, 750736.

[45] Joshi, S. G. (2017). Designing for capabilities: A phenomenological approach to the design of enabling technologies for older adults. PhD dissertation, University of Oslo.

[46] Justo, R., Ben Letaifa, L., Palmero, C., Gonzalez-Fraile, E., Torp Johansen, A., Vázquez, A., ... & Torres, M. I. (2020). Analysis of the interaction between elderly people and a simulated virtual coach. Journal of Ambient Intelligence and Humanized Computing, 11(12), 6125-6140.

[47] Kim, K. M., & Kim, S. H. (2024). Experience of the use of AI conversational agents among low-income older adults living alone. Sage Open, 14(4), 21582440241301022.

[48] Kim, S. (2021). Exploring how older adults use a smart speaker–based voice assistant in their first interactions: Qualitative study. JMIR mHealth and uHealth, 9(1), e20427.

[49] Kim, S., & Choudhury, A. (2021). Exploring older adults' perception and use of smart speaker-based voice assistants: A longitudinal study. Computers in Human Behavior, 124, 106914.

[50] Kim, H. N., & Oumarou, B. (2020). User requirement analysis for smart voice technology for older adults with visual impairments. International Journal of Human–Computer Interaction, 36(16), 1551-1557.

[51] Li, Y., Kim, S., & Sy, E. (2021, January). A survey on Amazon Alexa attack surfaces. In 2021 IEEE 18th Annual Consumer Communications & Networking Conference (CCNC) (pp. 1-7). IEEE.

[52] Liang, X., Batsis, J. A., Zhu, Y., Driesse, T. M., Roth, R. M., Kotz, D., & MacWhinney, B. (2022). Evaluating voice-assistant commands for dementia detection. Computer Speech & Language, 72, 101297.

[53] Liu, N., Pu, Q., Shi, Y., Zhang, S., & Qiu, L. (2023). Older adults' interaction with intelligent virtual assistants: The role of information modality and feedback. International Journal of Human–Computer Interaction, 39(5), 1162-1183.

[54] Lopatovska, I., Griffin, A. L., Gallagher, K., Ballingall, C., Rock, C., & Velazquez, M. (2020). User recommendations for intelligent personal assistants. Journal of Librarianship and Information Science, 52(2), 577-591.

[55] Martin-Hammond, A., Vemireddy, S., & Rao, K. (2019). Exploring older adults' beliefs about the use of intelligent assistants for consumer health information management: A participatory design study. JMIR Aging, 2(2), e15381.

[56] Marziali, R. A., Franceschetti, C., Dinculescu, A., Nistorescu, A., Kristály, D. M., Moșoi, A. A., ... & Di Rosa, M. (2024). Reducing loneliness and social isolation of older adults through voice assistants: Literature review and bibliometric analysis. Journal of Medical Internet Research, 26, e50534.

[57] Mathur, N., Dhodapkar, K., Zubatiy, T., Li, J., Jones, B., & Mynatt, E. (2022, October). A collaborative approach to support medication management in older adults with mild cognitive impairment using conversational assistants (CAs). In Proceedings of the 24th International ACM SIGACCESS Conference on Computers and Accessibility (pp. 1-14).

[58] McDonald, N., Schoenebeck, S., & Forte, A. (2019). Reliability and inter-rater reliability in qualitative research: Norms and guidelines for CSCW and HCI practice. Proceedings of the ACM on Human-Computer Interaction, 3(CSCW), 1-23.

[59] Nallam, P., Bhandari, S., Sanders, J., & Martin-Hammond, A. (2020). A question of access: Exploring the perceived benefits and barriers of intelligent voice assistants for improving access to consumer health resources among low-income older adults. Gerontology and Geriatric Medicine, 6, 2333721420985975.

[60] Oh, Y. H., Chung, K., & Ju, D. Y. (2020). Differences in interactions with a conversational agent. International Journal of Environmental Research and Public Health, 17(9), 3189.

[61] Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... & Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. BMJ, 372. #

[62] Pereira, J., & Díaz, Ó. (2019). Using health chatbots for behavior change: A mapping study. Journal of Medical Systems, 43(5), 135.

[63] Ponathil, A., Ozkan, F., Bertrand, J., Agnisarman, S., Narasimha, S., Welch, B., & Chalil Madathil, K. (2020). An empirical study investigating the user acceptance of a virtual conversational agent interface for family health history collection among the geriatric population. Health Informatics Journal, 26(4), 2946-2966.

[64] Portet, F., Vacher, M., Golanski, C., Roux, C., & Meillon, B. (2013). Design and evaluation of a smart home voice interface for the elderly: Acceptability and objection aspects. Personal and Ubiquitous Computing, 17(1), 127-144.

[65] Pradhan, A., Findlater, L., & Lazar, A. (2019). "Phantom Friend" or "Just a Box with Information": Personification and ontological categorization of smart speaker-based voice assistants by older adults. Proceedings of the ACM on Human-Computer Interaction, 3(CSCW), 1-21.

[66] Pradhan, A., Lazar, A., & Findlater, L. (2020). Use of intelligent voice assistants by older adults with low technology use. ACM Transactions on Computer-Human Interaction (TOCHI), 27(4), 1-27.

[67] Purao, S., Hao, H., & Meng, C. (2021). The use of smart home speakers by the elderly: Exploratory analyses and potential for big data. Big Data Research, 25, 100224.

[68] Qian, Z., Fu, J., & Zhou, Y. (2025). Exploring cultural and intergenerational dynamics in voice assistant design for Chinese older adults. Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies, 9(1), 1-18.

[69] Rodríguez, M. D., Beltrán, J., Valenzuela-Beltrán, M., Cruz-Sandoval, D., & Favela, J. (2021). Assisting older adults with medication reminders through an audio-based activity recognition system. Personal and Ubiquitous Computing, 25(2), 337-351.

[70] Ryu, H., Kim, S., Kim, D., Han, S., Lee, K., & Kang, Y. (2020). Simple and steady interactions win the healthy mentality: Designing a chatbot service for the elderly. Proceedings of the ACM on Human-Computer Interaction, 4(CSCW2), 1-25.

[71] Sezgin, E., Militello, L. K., Huang, Y., & Lin, S. (2020). A scoping review of patient-facing, behavioral health interventions with voice assistant technology targeting self-management and healthy lifestyle behaviors. Translational Behavioral Medicine, 10(3), 606–628. https://doi.org/10.1093/tbm/ibz141

[72] Shade, M., Rector, K., & Kupzyk, K. (2021). Voice Assistant Reminders and the Latency of Scheduled Medication Use in Older Adults With Pain: Descriptive Feasibility Study. JMIR formative research, 5(9), e26361.

[73] Sheldon, K. M., Corcoran, M., & Prentice, M. (2019). Pursuing eudaimonic functioning versus pursuing hedonic well-being: The first goal succeeds in its aim, whereas the second does not. Journal of Happiness Studies, 20(3), 919-933.

[74] Sidner, C. L., Bickmore, T., Nooraie, B., Rich, C., Ring, L., Shayganfar, M., & Vardoulakis, L. (2018). Creating new technologies for companionable agents to support isolated older adults. ACM Transactions on Interactive Intelligent Systems (TiiS), 8(3), 1-27.

[75] Sin, J., & Munteanu, C. (2020). An empirically grounded sociotechnical perspective on designing virtual agents for older adults. Human–Computer Interaction, 35(5-6), 481-510.

[76] Stara, V., Vera, B., Bolliger, D., Paolini, S., De Jong, M., Felici, E., ... & Di Rosa, M. (2021). Toward the integration of technology-based interventions in the care pathway for people with dementia: A cross-national study. International Journal of Environmental Research and Public Health, 18(19), 10405.

[77] Stara, V., Vera, B., Bolliger, D., Rossi, L., Felici, E., Di Rosa, M., ... & Paolini, S. (2021). Usability and acceptance of the embodied conversational agent Anne by people with dementia and their caregivers: Exploratory study in home environment settings. JMIR mHealth and uHealth, 9(6), e25891.

[78] Stigall, B., Waycott, J., Baker, S., & Caine, K. (2019, December). Older adults' perception and use of voice user interfaces: A preliminary review of the computing literature. In Proceedings of the 31st Australian Conference on Human-Computer-Interaction (pp. 423-427).

[79] Strengers, Y., Duque, M., Mortimer, M., Pink, S., Martin, R., Nicholls, L., ... & Thomson, S. (2022, June). "Isn't this marvelous" Supporting older adults' wellbeing with smart home devices through curiosity, play and experimentation. In Proceedings of the 2022 ACM Designing Interactive Systems Conference (pp. 707-725).

[80] Tsiourti, C., Quintas, J., Ben-Moussa, M., Hanke, S., Nijdam, N. A., & Konstantas, D. (2016, September). The CaMeLi framework—a multimodal virtual companion for older adults. In Proceedings of SAI Intelligent Systems Conference (pp. 196-217). Cham: Springer International Publishing.

[81] United Nations, Department of Economic and Social Affairs. (2023). World Social Report 2023: Leaving No One Behind in an Ageing World. Report. New York: United Nations. Available at: https://desapublications.un.org/publications/world-social-report-2023-leaving-no-one-behind-ageing-world

[82] Upadhyay, P., Heung, S., Azenkot, S., & Brewer, R. N. (2023, April). Studying exploration & long-term use of voice assistants by older adults. In Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems (pp. 1-11).

[83] Wachsmuth, I. (2018). Robots like me: Challenges and ethical issues in aged care. Frontiers in Psychology, 9, 432.

[84] Wargnier, P., Benveniste, S., Jouvelot, P., & Rigaud, A. S. (2018). Usability assessment of interaction management support in LOUISE, an ECA-based user interface for elders with cognitive impairment. Technology and Disability, 30(3), 105-126.

[85] West, M., Kraut, R., & Chew, H. E. (2019). I'd blush if I could: Closing gender divides in digital skills through education. UNESCO. Epub ahead of print 2019.

[86] Wolters, M. K., Kelly, F., & Kilgour, J. (2016). Designing a spoken dialogue interface to an intelligent cognitive assistant for people with dementia. Health Informatics Journal, 22(4), 854-866.

[87] Xiao, Y., & Watson, M. (2019). Guidance on conducting a systematic literature review. Journal of Planning Education and Research, 39(1), 93-112.

[88] Xygkou, A., Ang, C. S., Siriaraya, P., Kopecki, J. P., Covaci, A., Kanjo, E., & She, W. J. (2024, May). MindTalker: Navigating the complexities of AI-enhanced social engagement for people with early-stage dementia. In Proceedings of the 2024 CHI Conference on Human Factors in Computing Systems (pp. 1-15).