Bridging the Gap Between Designers and Users: Co-designing Health-Related Voice User Interface Experiences with Older Adults

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ABSTRACT

In this paper, we describe our approach to bridging the designer-user gap by engaging 20 older adults in codesign workshops to generatively re-imagine health-related voice agent (VA) design for voice user interfaces (VUI) for older adults, by older adults. Drawing on recent research in Library and Information Science (LIS), we describe codesign as a method, as well as how the 20 older adults perceived codesign in our two case studies of health-related VA design for health learning and exercise. Older adult codesigners perceived codesign as transformative, enjoyable, educational, and useful. We also share specific experiential recommendations of strategies for conducting codesign, including strategies for transitioning from expert to facilitator, creating experience-based questions, probing for deeper design ideation and priorities, and ways of approaching codesign through humility and care. We describe the codesign method's generative benefits in our two case studies and encourage LIS researchers to consider including codesign methods in their research.

ALISE RESEARCH TAXONOMY TOPICS

information practices of specific populations; community engagement; user interfaces; information system design; interactive information retrieval.

AUTHOR KEYWORDS

codesign; participatory design; participatory methods; voice user interfaces; older adults.

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INTRODUCTION

Recent years have seen a rise in calls for participatory design practices in library and information science (LIS) research. LIS design of user interfaces too often faces the challenge of mismatches between designers, design students, and design capabilities, and the information practices, information needs, and interests of specific populations. Specifically, we also often incorrectly assume that older adults are uninterested in technology or information system design (Harrington et al., 2018). This paper describes an approach to bridging this gap between LIS researchers and a population often neglected in design: co-designing with older adults. Herein we describe codesign as a method, how older adults perceive these participatory methods, and our specific experiential advice on how to conduct codesign from our trial-and-error experiences conducting two case studies.

In this paper, we describe our approach to bridging the designer-user divide by engaging older adults in codesign workshops to generatively re-imagine voice agent (VA) design for voice user interfaces (VUI) for older adults, by older adults. Drawing on the latest thinking and research from the domains of LIS, human-computer interaction (HCI) and participatory research, we built our approach from values of:

1. the inclusion of those most effected by design in the design process (Bardzell, 2010),
2. placing designers in the role of facilitator rather than expert (Subramaniam et al., 2018),
3. collaboration with older adults, who have respected expertise and are codesigners rather than research subjects (Costanza-Chock, 2020), and
4. a humility-based codesign approach emphasizing truly shared agency (Spiel, 2020)

Participatory design has recently been an effective method for enabling meaningful collaboration with specific populations in LIS research, including children and youth librarians (Subramaniam et al., 2018), and young people around issues of power (Magee et al., 2022) and health entrepreneurship (Subramaniam et al., 2014). Codesign has also been generatively used with older adults in library contexts (Nesset & Stewart-Robertson, 2021), home technology contexts (Pradhan, Jelen, et al., 2020), fitness app design (Harrington et al., 2018) and voice agents for VUI (Harrington et al., 2022).

Older adults, while by no means a homogenous group, have information interaction needs and preferences that may differ from other age groups. Older adults are also pervasively already using VUI, with a fifth of older adults in the U.S. owning a smart speaker (Auxier, 2019), and many finding VUI accessible and useful for health information seeking (Pradhan, Lazer, et al., 2020).

Research questions.

Through a series of individual codesign workshops with 20 older adults, we answer the following questions:

1. What are older adults' perceptions of codesign?

2. What specific strategies, from two case studies codesigning health-related voice agents, are effective for engaging older adults in codesign?

METHOD

The 20 individual codesign workshops analyzed here took place in the larger methodological frameworks of two studies. One study deployed a prototype of an interactive storytelling voice agent for health information learning, and the other deployed a prototype of an interactive gentle exercise voice agent. Each of these studies began with participant interaction with the voice agent prototype, followed by short surveys and an interview with the researcher about their experiences with the prototype. Then, each older adult engaged in a 30-minute codesign workshop with the researcher and debriefed to discuss the codesign experience. Only findings related to codesign are shared here, as two case studies using the codesign method.

This approach to codesign is grounded in what Harrington et al. (2018) call "experience-based codesign," where the participants were able to engage and interact with a related technology prior to the co-design workshop, allowing for more insightful brainstorming when co-designers can "draw inspiration" from their actual experience with a related technology (p.8). The two different, prototype case studies—one storytelling based, the other exercise instruction based—provide a broader sense of older adults' design priorities for health-related voice agents.

Twenty older adults, age 60 and above, were recruited via email listservs, and were compensated $20 for their time. The studies took place in university lab spaces. Each codesigner briefed on codesign as a method and given a printed prompt with a paragraph of text about a health condition or exercise. Older adult codesigners were equipped with the printed prompt, sketching paper, lined paper, markers, a whiteboard, sticky notes, colored pens, pencils, and access to the device (a Google Nest Mini) (Figure 1).

Figure 1

Image of codesigner with markers, white board, pens, and paper visible.

To expand beyond emulating either prototype, codesigners were asked to imagine their ideas for an ideal interaction with an expert voice agent and encouraged to go in other directions. Codesigners were instructed to describe their voice agent's persona, write out scripts, diagram potential features and content, or pursue other tactics for ideation. In debrief, codesigners were asked to reflect on the experience.

The codesign sessions were documented using field notes, audio recordings, photographs, and copies of participant drawings and writings. Thematic analysis (Braun & Clarke, 2006) was then used to consolidate themes across the 20 individual codesign sessions to characterize the

sessions, distill 3 key design priorities, and to here share recommendations for specific codesign strategies.

FINDINGS

Older adults' perceptions of codesign.

Transformative. Of the 20 codesigners, 14 viewed the codesign experience as transformative, in that the experience changed their overall perceptions of voice agents (VAs) and VUI devices more broadly. For one participant it increased the value they placed on the technology, participant two [P2], and for other participants, codesigning allowed them to see more complex uses, possibilities, and directions for using voice agents [P4, P5], beyond asking "what's the weather today?" [P6]. The codesign experience was described as having provided space for older adults to explore an application of VUI that they had not previously considered [P2, P8, P13, P18], while also learning about the limitations [P6, P7].

Enjoyable. Twelve of the codesigners specifically described the codesign experience as fun, with one codesigner describing the codesign session as their "first chance to play" and explore new features, ideas, and directions the VA could explore [P3]. All participants also expressed interest in returning to the study in longitudinal form to engage with the codesign-informed agent or taking part in another codesign session.

Educational. All participants indicated that they understood voice agents better having engaged in designing a specific VA, with 16 of 20 indicating it was a very strong "learning experience for them too" [P9]. The codesign method was helpful for the codesigners to consider how VAs work on a granular level, when needing to think through each step of an information interaction scenario between a VA and an imagined user [P5].

Useful. Five participants also explicitly discussed the utility of the codesign experience for designing tools that older adults actually want to use [P2, P4, P5, P13, P17].

Recommendations for engaging older adults in codesign.

Transition from expert to facilitator. To transition to the role of facilitator in codesign with older adults who were not familiar with information systems (VA) design, the most important strategies were asking questions of the older adult codesigner rather than offering solutions, expressing interest and excitement, and letting the codesigner decide the direction of the VA design session. Other important strategies included giving codesigners a moment for ideation on their own before beginning discussion, and surrounding the codesigners with sketching paper, lined paper, the printed prompt, markers, a whiteboard, sticky notes, colored pens, pencils, and the device all within reach, and instructions that they can take multiple approaches to writing or diagramming their design ideas. Another useful strategy discovered through trial and error was to provide dictation for the older adult codesigners if desired, so the codesigner could focus on their ideas. 16 of 20 participants took advantage of varying levels of dictation by the researcher. 5 codesigners wrote out scripts for interactions between imagined

users and their expert VA (Figure 2), 4 compiled lists of imagined user questions or VA answers, 2 diagrammed the prompt text itself (Figure 3), 4 drew branches for multiple question

Figure 2

Image of a codesigner's written script for a voice agent interaction.

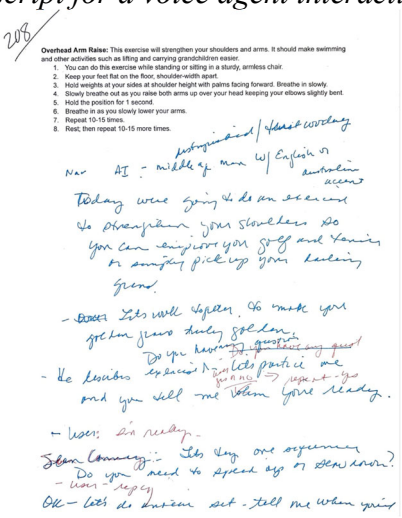
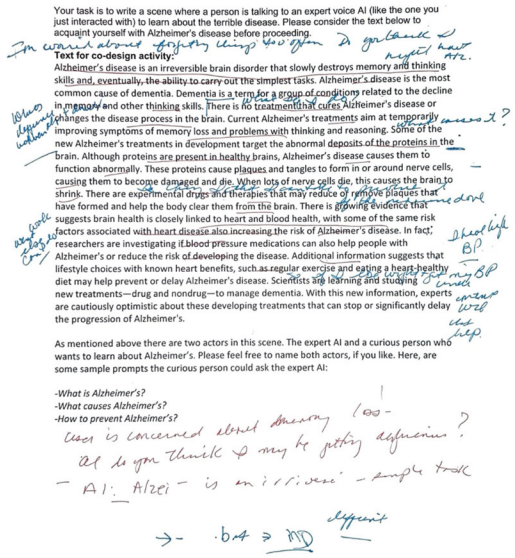


Figure 3

Image of a codesigner's diagramming of the codesign prompt and imagined user questions.



progressions, and 1 participant drew an illustration of the VA. Dictation via researcher to paper or the whiteboard was also a way for the researcher to express interest and reassure the codesigners, as many worried, that their design ideas were "good."

Experience-based questions. Another strategy when codesigners stalled or were unsure of what to consider next was to ask questions about the positive and negative experiences the codesigner had previously described in the interview portion of the studies. Reaching back to their recent experiences with a voice agent allowed for the codesigners to generate design ideas

to address the challenges they faced or to reiterate what they liked about the prototype. In the first case study, while half of the codesigners did incorporate storytelling in their VA codesign—imagining family stories, historical fiction, and stories from real patients—and almost all included features similar to the prototype (repeat, checkpoints, instructions, comprehension questions), all codesigners developed design ideas branching far off from emulating the prototype. In the second case study, all codesigners designed a kind of step-by-step exercise interaction, with similar stop, instructions, check-in questions, and go-to-exercise features, but codesigners also branched out into gamification, agents as companionship day-to-day, and diverse directions from emphasizing meditation to enthusiastic physical exercise.

Probing questions for deeper design ideation and priorities. The codesigners eagerly described their varied preferences for the VA's persona—a doctor, a friend, a professor, an instructor, a counselor, a person experiencing a health condition, a librarian—and their agent's voice, gender, nationality, and personality. Codesigners tended to focus on naming the agent and describing the VA's demeanor, such as calm, authoritative, or encouraging. Follow-up and probing questions were a strategy for deeper thinking about the VA design, for example asking codesigners what features they might implement to achieve the VA characteristics they most wanted to see.

For example, one recurring theme across the case studies was the design priority of *the credibility and appropriateness of information and exercises*. To achieve this priority by using probing questions, codesigners created introductory statements for their VAs, citations for the health information shared, and opportunities for the user to hear about specific studies supporting the exercise regimens or retrieved health information.

Another top theme across the case studies was the design priority of *creating VAs that express compassion and encouragement.* To achieve this, via probing questions, codesigners created solutions like encouraging and reassuring statements, sharing the everyday benefits of exercise, offering everyday, lay, or patient-oriented advice rather than medical jargon, offering options for different amounts of information and difficulties of exercise, and creating non-judgmental repeat, check-in, and question for comprehension options. Other ideas were to have celebratory statements, rewards like music or trivia, reflective questions, and logging interactions as motivation-building for users to keep engaging with the VA, learning, and exercising.

Many codesigners wanted to see more diverse and accessible options to support different user information needs and interests, such as having a menu of types of stories or possible exercises. A recurring theme across all codesign workshops was the design priority of *accessible options to personalize the VA interaction experience*, leading to many ideas for ideal interactions.

Big ideas by imagining ideal interactions. Another strategy employed to create opportunities for design thinking was to ask codesigners what they would design if they had unlimited time and money outside of this 30-minute codesign session. Some of the stand-out ideas included ways to increase imagined users' comfort by having the agent respond to different sentiments and stress levels of users, thereby sharing information with different tones [P3, P9], offering a wider range of information retrieval based on the users' primary concern [P1, P6], and aiding users in developing questions to ask their doctors to increase patient empowerment [P6]. Other big ideas included creating decision trees to help the agent aid users in making decisions, such as when to call a medical professional or how to choose what exercises are most appropriate

for their bodies [P10, P12, P13], offering routes to more related sources [P2, P3, P4, P15], and creating a more educational exercise experience where users could learn pre-set workouts and why different exercises are appropriate [P11, P13]. Having the agent seem "more human" and like "it is listening" by saving data across multiple interactions with the VA was goal shared by many codesigners [P4, P6, P11, P12, P14, P18, P20], and some designed reminder features to encourage users to re-engage with the VA [P12, P14, P17].

Taking a stance of humility and care. Last, strategies for codesign were most successful when they created comfortable space for codesigners to imagine and design. Literally, this meant moving from hosting the codesign session in an intimidating, austere conference room originally to a much more welcoming lab with a round table, easier to reach white board, and more comfortable seats, the furnishings of a personal office, and over time, more colorful materials. Increasing comfort also included "making space" (Spiel, 2020, p.2) for codesigners' ideas by carefully facilitating questions without jumping in with solutions or the researcher's perspectives, and by restating codesigners' ideas and asking clarifying questions to check the researcher's understanding and avoid imposing researcher interpretations or priorities. A example of an assumption by the researcher occurred in the opening statement on the exercise codesign prompt. The prompt stated that a benefit of the exercise was greater ease "lifting and carrying grandchildren"—which many codesigners quickly pointed out should be replaced with something more generalizable, as not everyone above the age of 60 has grandchildren.

Care was also embodied through active listening, open body language, clear interest and excited notetaking, and taking note of codesigners' hesitancies, anxieties, and indications of stress. Methods that emphasized connection, and, at times careful personal disclosure by the researcher, allowed some codesigners to more comfortably draw design ideas from their own personal lived experiences, while dispelling discomfort around codesigning with or feeling 'tested by' a younger, seemingly able-bodied LIS student. For other codesigners, the most effective strategy to encourage comfort in design thinking was to ask questions about how an imagined *other* older adult user might want to interact with their VA.

CONCLUSION

Overall, putting extra time and care into getting to know the codesigners outside of their design ideas created a more encouraging and comfortable space for codesign. Viewing codesign less as a tool for the 'extraction of ideas' from older adults, and more as relationship-based sessions with shared goals was arguably more generative, especially when the researcher was willing to follow the trajectory of codesigners' ideas and 'play' rather than sticking to a strict set agenda. We hope that through this presentation, other researchers and students interested in designing information technologies for specific populations will consider including codesign elements in their research to bridge the gap between LIS researchers and those for which we hope to design— and feel more comfortable doing so through these examples from two case studies and hands-on recommendations for strategies to make codesign a successful and generative process for everyone involved.

REFERENCES

Auxier, B. (2019). 5 things to know about Americans and their smart speakers. *Pew Research Center*. https://www.pewresearch.org/fact-tank/2019/11/21/5-things-to-know-about-americans-and-their-smart-speakers/

Bardzell, S. (2010). Feminist HCI: Taking stock and outlining an agenda for design. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 1301–1310. https://doi.org/10.1145/1753326.1753521

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Costanza-Chock, S. (2020). *Design Justice: Community-Led Practices to Build the Worlds We Need*. The MIT Press. https://library.oapen.org/handle/20.500.12657/43542

Harrington, C. N., Wilcox, L., Connelly, K., Rogers, W., & Sanford, J. (2018). Designing health and fitness apps with older adults: Examining the value of experience-based co-design. In *Proceedings of the 12th EAI International Conference on Pervasive Computing Technologies for Healthcare*. https://doi.org/10.1145/3240925.3240929

Harrington, C. N. Garg, R., Woodward, A. & Williams, D. (2022). "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* (CHI '22), 1–15. https://doi.org/10.1145/3491102.3501995

Magee, R., Townsend, K., Cahill, M., Long, B., Adkins, D., Farmer, L., ... & Zalot, A. (2022, October). Youth Services: Empowering Community, Inclusion, and Active Citizenship through Libraries. In *Proceedings of the ALISE Annual Conference*. https://doi.org/10.21900/j.alise.2022.1084

Nesset, V., & Stewart-Robertson, O. (2021). Rethinking participatory design research in virtual environments: A case study. In *ALISE 2021 Conference Proceedings, ALISE 2021 Works-in-Progress Showcase.* https://hdl.handle.net/2142/110880

Pradhan, A., Jelen, B., Siek, K. A., Chan, J., & Lazar, A. (2020). Understanding Older Adults' Participation in Design Workshops. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems,* 1-15. https://doi.org/10.1145/3313831.3376299

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* 27(4), 1-27. https://doi.org/10.1145/3373759

Spiel, K. (2020). Thinking around humility as a stance for participatory design. In *Proceedings of the Mensch Und Computer 2020 Workshop on Partizipative & Sozialverantwortliche Technikentwicklung.* https://doi.org/10.18420/muc2020-ws109-365

Subramaniam, M., St Jean, B., Taylor, N. G., Follman, R., & Casciotti, D. (2014). Tweens HackHealth: Working with school librarians to engage disadvantaged youth in health entrepreneurship. In *Association for Library and Information Science Education (ALISE) Conference,* Philadelphia, Pennsylvania. https://digitalcommons.usf.edu/si_facpub/366

Subramaniam, M., Waugh, A., Clegg, T. (2018). Co-designing the next generation of education for children and youth librarians: a research-practice partnership. In *Proceedings of the 2018 ALISE Annual Conference,* 25-30. https://hdl.handle.net/2142/99018