Blind People Are Power Users: An Argument for Centering Blind Users in Design of Voice Interfaces

Ali Abdolrahmani
Rishin Mukkath
Ravi Kuber
University of Maryland,
Baltimore County
Baltimore, MD 21250, USA
aliab1@umbc.edu
antonyr1@umbc.edu
rkuber@umbc.edu

Stacy M. Branham
University of California, Irvine
Irvine, CA 92697, USA
sbranham@uci.edu

Abstract
Voice interfaces in the form of Voice Activated Personal Assistants (VAPAs)–like Google Assistant and Microsoft Cortana–have rapidly become pervasive technologies. Recent studies reveal that these interfaces are particularly beneficial for older adults and people with disabilities, with relatively high adoption by visually impaired users. However, interviews we conducted with 14 blind VAPA users revealed several accessibility and usability shortcomings. In this position paper, we articulate a research agenda that addresses this hypothesis: blind screen reader users are the "power users" of voice interfaces, and centering them in the design process can generate better tools for a variety of users.

Author Keywords
Voice Interface; Voice Activated Personal Assistant; VAPA; Smart Speaker; Blind Individuals; Disability; Intersectionality; Accessibility; Usability.

ACM Classification Keywords
K.4.2. [Computers and society]: Social issues – assistive technologies for persons with disabilities.

Introduction and Background: VAPAs are Mainstreaming Accessibility

Voice-Activated Personal Assistants, or VAPAs [6], are a subset of Voice Interfaces that are becoming widely adopted both in the home and on-the-go. A 2018 market survey of in-home devices reported 39 million people in the United States own a smart speaker [2], and a 2017 market survey estimated over 41 million unique monthly users of Apple's mobile Siri assistant alone [7].

VAPA technologies provide an unparalleled opportunity to support a broad range people who often must resort to special-purpose assistive devices, particularly older adults and people with visual impairments. In addition to the accessibility benefits of voice interfaces, the mainstream status of VAPAs may support adoption by lowering unit costs and reducing stigma often associated with assistive technologies [4, 10].

HCI researchers have begun to study the user experience of VAPA ownership by sighted individuals [3,5]. Additionally, studies have examined VAPA interaction experiences of more specific populations including senior users [8,12] and people with disabilities [1,9]. A recent study by Pradhan et al. [9] revealed that nearly 38% of Amazon Echo reviews mention visual impairments or blindness, suggesting that these types of non-visual interaction platforms may be particularly useful for this community. Expanding the findings of their work, our recent study [1] explored a variety of VAPA platforms (Amazon Echo, Google Home, and Apple Siri) through extensive interviews with 14 blind individuals.

Insights from 14 Blind VAPA Users: "Siri talks at you"

In our recent study of VAPA use by blind individuals [1], our core finding was captured by one participant who reflected that "Siri talks *at* you." In other words, even though blind individuals want to interact with Siri, the so-called "smart" assistant falls short. We believe that VAPAs as a general class of voice interface have high potential to support blind users, but they must first address myriad usability and accessibility shortcomings. Consider the following scenario, derived from the experience of another participant in our study:

Scenario 1. A blind professional tracks his scheduled meetings with a digital calendar. He prefers to input events through his iPhone's Siri VAPA because it is a non-visual interface. However, when he created a calendar event, he wanted to double check the event's title. When he requested to hear the title read back, Siri misinterpreted the command and announced all the calendar events for today. He therefore had to navigate to the calendar app and perform multiple VoiceOver gestures to find the event and edit its title through time-consuming manual text entry.

This scenario is one of many that supports three key insights we draw out in our paper [1]:

1. Blind users see the potential of VAPAs to do *serious* work. This contrasts with sighted users, many of whom engage VAPAs for entertainment purposes.
2. Challenges exist in performing complex commands, receiving adequate non-visual feedback, and correcting errors through voice input.

The third insight is best demonstrated in light of a second scenario that features a sighted user:

Scenario 2. The last author of this paper tracks her scheduled meetings with a digital calendar. She sometimes creates events through her iPhone's Siri VAPA when she is on-the-go. After creating the event, Siri asks her to confirm. She sees the typo on her screen, taps the screen, and is taken to her calendar app where she can edit the title using her vision.

3. While sighted users have alternative (visual) ways to access services when VAPAs fail, people with vision impairments may not have a usable or accessible alternative.

One strategy for addressing usability and accessibility challenges for blind users is to perform usability testing with them as members of a special population, rather than as the primary target user [11]. However, our previous work and ongoing extensions suggest that there may be merit to the idea of putting blind screen reader users––who we view as "power users" of voice interfaces––at the center of VAPA design processes. In the remaining space of this position paper, we briefly articulate this position and future research directions.

Blind Screen Reader Users Are Power Users of Voice Interfaces

Consider a third scenario to briefly illustrate this claim:

Scenario 3. The first author of this paper has been using a screen reader for 10 years. He uses his computer for a variety of document editing tasks. When he is reading a document for comprehension, he adjusts the verbosity of his screen reader to a minimum level. He adjusts his screen reader voice output speed down to 40-50 out of the maximum speed of 100. However, when he proofreads documents for camera ready submission, he increases verbosity to announce formatting and punctuation. Additionally, he increases the voice output speed to 80 out of 100 to increase time efficiency.

Some indicators that our first author is a super user of screen readers are: (1) he has been using this software for an extended period of time, (2) he dynamically adjusts the settings from default values to suit his task, (3) novice users would not be able to understand the screen reader interactions.

We can imagine that the VAPA user from Scenario 1 could benefit from similar interaction techniques as demonstrated by the first author in Scenario 3. Wouldn't blind VAPA users prefer to adjust verbosity output levels to, for example, include error checking? Wouldn't these same users also prefer to select a synthetic voice and adjust the voice output speed according to the task? Finally, are there any scenarios in which sighted individuals might also benefit from these advanced options in VAPA interfaces? We hypothesize that the answers to these questions are "yes." We further believe that if blind users are centered in the VAPA design process, mainstream users will have more advanced interaction possibilities.

Future VAPA design research opportunities

- How can we design VAPAs so that they support more users in more contexts?
- How can we leverage blind users as power users when designing of Voice Interfaces?
- How can current VAPA design guidelines integrate serious, complex tasks?
- How can we increase rather than decrease user accessibility as we begin to introduce visual

displays to VAPAs (e.g., Echo Show, Lenovo Smart Display)?

- How can we leverage existing research on accessible voice menu systems and screen reader applications to improve design of VAPA interfaces?

Are voice interfaces considered as a DIY platform? How can users develop serious, complex routines and functionality using voice and commands?

It is common that interfaces are designed first for general population and then layers of accessibility are added to serve the needs of individuals with special needs. This approach may eliminate the opportunity of equal access to the interfaces for different individuals. In contrast, if guidelines/approaches used in the development of the solutions provide of adequate knowledge on how to respond to a wider range of users with varying abilities, the final outcome better serves target users.

References

1. Abdolrahmani, A, Kuber, R., and Branham, S. 2018. "Siri Talks at You": An Empirical Investigation of Voice Activated Personal Assistant (VAPA) Usage by Individuals Who Are Blind. In ASSETS '18. (to appear)
2. Bhardwaj, P. and Gal, S. 2018. Siri owns 46% of the mobile voice assistant market — one and half times Google Assistant's share of the market. Retrieved September 4, 2018 from https://www.businessinsider.com/siri-google-assistant-voice-market-share-charts-2018-6
3. Cowan, B.R., Pantidi, N., Coyle, D., Morrissey, K., Clarke, P., Al-Shehri, S., Earley, D., and Bandeira, N. 2017. "What can I help you with?": infrequent users' experiences of intelligent personal assistants. In MobileHCI '17, 43:1–43:12.
4. Kane, S.K, Jayant, C., Wobbrock, J.O., and Ladner, R.E. 2009. Freedom to roam. In ASSETS '09, 115.
5. Luger, E. and Sellen, A. 2016. "Like having a really bad PA": The gulf between user expectation and experience of conversational agents. In CHI'16, 5286–5297.
6. Moorthy, A.E. and Vu, K.-P.L. 2015. Privacy concerns for use of voice activated personal assistant in the public space. IJHCI, 31, 4: 307–335.
7. Perez, S. 2018. 29 million Americans now own a smart speaker, report claims. Retrieved September 4, 2018 from https://techcrunch.com/2018/01/12/39-million-americans-now-own-a-smart-speaker-report-claims/
8. Portet. F., Vacher, M., Golanski, C., Roux, C., and Meillon, B. 2013. Design and evaluation of a smart home voice interface for the elderly: acceptability and objection aspects. In PUC, 17, 1: 127–144.
9. Pradhan, A., Mehta, K., and Findlater. L. 2018. "Accessibility came by accident": use of voice-controlled intelligent personal assistants by people with disabilities. In CHI '18, 459:1–459:13.
10. Shinohara, K., and Wobbrock, J.O. 2011. In the shadow of misperception. In CHI '11, 705.
11. Shinohara, K., Wobbrock, J.O., and Pratt, W. 2018. Incorporating Social Factors in Accessible Design. In ASSETS '18. (to appear)
12. Wulf, L., Garschall, M., Himmelsbach. J., and Tscheligi, M. 2014. Hands free - care free: elderly people taking advantage of speech-only interaction. In NordiCHI '14, 203–206.