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# Interactive Voice Technologies and the Digital Marginalization of Older Adults

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## ABSTRACT

The sociotechnical approach to the design of interactive systems has been seen as a means of acknowledging and understanding the benefits and risks of emerging and innovative technologies. However, implementing such an approach in practice is easier said than done, especially for technology that is as ubiquitous as mobile technologies. Yet, this is a worthwhile challenge as this approach may strengthen our understanding of users' perceptions and subsequent adoption of such mobile technologies. My previous research has indicated that there may be a link between information studies theory and the digital interface design practice surrounding mobile technologies. I plan to build upon this work by further developing and evaluating methods, practices, and approaches to bridge information theory and design practice. I am seeking advice and feedback on my research in terms of the development and evaluation of new practices of mobile design work. The implications of the sociotechnical approach to mobile voice interface design are discussed.

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## KEYWORDS

Sociotechnical Systems; User Experience Design; Conversational UI; Voice UI; Chatbots; Voice Assistants

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1. How have sociological and information theories been mobilized in the past to produce positive practical outcomes in the design of technology?
  2. How might sociological and information theories become better mobilized in the design of interactive voice technologies to produce positive practical outcomes?
  3. How might sociological and information theories become better mobilized in the design of interactive voice technologies to prevent the digital marginalization of older adults?

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Table 1: Research Questions

## INTRODUCTION

When designing and building technologies, matters of usability and small-scale issues of user experience (UX) are brought to the forefront, with matters of user trust and adoption being left to chance. Yet, emerging technology and innovations have both enabling and marginalizing potential. With every product or service that is launched into the world, there is a risk of digitally marginalizing people [1]. This is especially the case with those involving mobile technologies, as any problems that exist in the design with respect to trust and adoption become further amplified due to the ubiquity and availability of mobile devices. The resulting impact may be extreme and cost lives.

A sociotechnical approach to design factors in equally the technological and societal factors of technology. Using this approach to may be an effective means to develop technology that is not digitally marginalizing. Yet, taking a sociotechnical approach can be both difficult to do and overwhelming [3]. In order to successfully incorporate a sociotechnical approach, designers need to be involved in the design and building of the technology from start to finish and an attitude of patience must be adopted while they are “muddling through” the development phase [2, 3]. Along the way, designers must continuously think about practical, cultural, social, economic, and political issues. This leaves a big question of “how?”

## RESEARCH GOALS, QUESTIONS, AND APPROACH

Drawing from information studies and their frameworks of human behaviour may be a way towards a sociotechnical approach to design to prevent digital marginalization. Information studies is a rich and established field of study developed by information studies specialists and human-computer interaction (HCI) specialists alike. This field's concepts have had many applications in HCI (e.g. in information and computer systems). These include topics of information behaviour, exploratory search, and information retrieval. Furthermore, the use of models and frameworks optimizes for the fact that designers are human and prefer simple answers that result in a lower cognitive load so that they can put their attention to other details.

As of today, information studies remain an untapped resource to design. My goal with my thesis, “Interactive Voice Technologies and the Digital Marginalization of Older Adults”, is to explore the ways in which topics in information studies can help inform design and design approaches that do not digitally marginalize users. My research will be situated in the space of mobile-systems based interactive voice technologies (IVTs), which are becoming increasingly present on mobile devices and span voice user interfaces (VUIs), conversation user interfaces (CUIs), chatbots, and voice assistants. IVTs are an emerging technology that has been seeing an increase in commercial spaces, as can be seen in discussions at CHI 2019. Furthermore, my research investigates research questions (Table 1) applying to mobile IVTs as applied to older adults (OAs), which is a user group that can benefit from using mobile IVTs but can also be marginalized by them due to barriers that include but are not limited to physical and cognitive impediments.

### **Potential Contributions**

My work intends to provide empirical contributions through studies run as part of my development of mobile IVT prototypes over the course of my research. This research will help to strengthen and validate the theoretical models of information studies as applied to the design of mobile systems and interfaces. My work will also contribute to theoretical knowledge of design work of information systems that use mobile interfaces.

### **STUDIES/RESEARCH CONDUCTED SO FAR**

The research will be carried out in three phases. Phase 1 is in progress and has a goal of investigating opportunities to use sociotechnical lens in design practice. To this end, I have been studying what can be drawn from the literature related to in sociotechnical systems theory and CUIs (e.g. [8]). This work has informed my recent project [5], with aspects as discussed in my recent Late Breaking Work at CHI 2019 [7]. This project's findings suggested an interplay between design elements and users' information context, reinforced the need for a sociotechnical lens to be applied to the design of mobile-based VUIs and CUIs. The findings have also prompted me to explore ways in which information behaviour would factor into design and informed my current work on digital marginalization (which includes my work at and knowledge from the CHI4Evil Workshop at CHI 2019 [6]). I have also been exploring the role of design education in the sociotechnical approach to design, and to this end I have attended HCI education events such as the EduCHI Symposium at CHI 2019, where I was also a paper session chair.

### **REMAINING RESEARCH PLANS**

What remains is the conclusion of Phase 1 and the completion of Phases 2 and 3. The remainder of phase 1 is to investigate, through ethnographic-like approaches such as interviews, surveys, and observations, the approaches designers have already taken to incorporate concepts like information architecture, search, and retrieval to their design of technology, both involving mobile IVTs and otherwise.

Phase 2 will focus on developing approaches, such as design guidelines and frameworks, to apply information studies to design practices (as a theoretical contribution) as well as testing these approaches (serving as an experimental contribution) and validating them, such as by analyzing participants' feedback against the Technology Acceptance Model (TAM) [9], which models users' adoption, trust, and perceived risk of technological systems. This will allow me to formally evaluate, with OA users, the developed design approaches and apply them to my design and construction of mobile IVT prototypes.

Phase 3 aims to validate the ecological validity of the guidelines in realistic settings. Based on the findings from Phase 1 and 2, I will refine the design approach and mobile IVT prototypes. To inform user-centered design, I will conduct inquiries, interviews, and participatory design with OAs to understand the technological challenges they face when interacting with IVTs. I will deploy

these IVTs with OAs “in-the-wild” and gather, over months, OAs’ perceptions of the IVTs, using similar methods as in Phase 2. This will allow me to evaluate the sociotechnical impact of the design approaches on OAs’ acceptance of the IVTs.

### **FUTURE STEPS AND ADVICE SOUGHT**

My current future steps are to complete the aforementioned phases as well as strengthen my knowledge base, background, and connections in the areas of mobile interfaces (e.g. through involvement in MobileHCI), IVTs (through involvement in CUI 2019), information studies (through my local involvement where I am based, which is the iSchool of the University of Toronto), and the UX design industry.

My research is still in its preliminary stages and there are a number of challenges ahead for me. As such, I hope the consortium at MobileHCI can share advice, stories, or insights related to the following:

- Other attempts to connect theory and practice in the field of design of mobile technologies, especially with regards to taking a sociotechnical lens.
- If there are any other appropriate methods, aside from the ethnographic-like methods that I am using, to test and validate my results, especially in the area of mobile interface design that considers sociotechnical contexts.
- Methods to test for the validity of my research outputs (design guidelines, frameworks, etc.) in terms of the sociotechnical components. How might I best test for this in my own research involving IVTs and much in a mobile context through phones and tablets? Are there methods of evaluation besides the TAM?

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