RESEARCH | STACY M. BRANHAM

Overview

My research sits at the intersection of **Human-Centered Computing and Health Information Technology, exploring how technologies mediate colocated interpersonal relationships, specifically in regards to how they affect the physical safety and well-being of marginalized people**. The findings of my work support corporations seeking to build accessible, universal technologies that reach diverse market segments. They also support the United States government's interest in creating a more inclusive, equitable, and economically resilient society.

When we consider how technology mediates interpersonal relationships, we tend to foreground communication technology (e.g., Skype) that connects people across a distance [4,5]. There is increasing interest, however, in the ways technology *not intended for interpersonal communication* (e.g., your phone's alarm clock) mediates *colocated relationships*—people in the same town, in the same room, or on the same sofa. **How do increasingly pervasive technologies change our interactions and relationships with family, friends, colleagues, strangers, and even ourselves?** This question captured my interest in graduate school and still drives my work today.

My doctoral and ongoing work address the above question in multiple contexts for multiple user populations. I have explored technology mediation in the home [4,5,8], the workplace [7], and public spaces [1,2,13,19] within both the transgender and disabled communities. I have also studied assistive technology fabrication [9] and mobile interaction techniques [18]. Another line of inquiry focused on ethics in design research, for which I co-organized a series of workshops [6,24-26] that culminated in a guest-edited Special Issue [17]. My early work includes technology-aided knowledge capture and reuse of video media [10], whiteboard images [3], and design rationale [15,22,23]. I publish primarily within the ACM SIGCHI, SIGACCESS, DIS, and CSCW communities.

Current Research:
Colocated technology mediation of blind and sighted individuals

Funded by: NSF EAGER (IIS-1353312, $164,982, postdoc)
                Toyota Engineering and Manufacturing America ($190,000, Co-PI)

Published in: [1,2,7,8,16,18]

Nearly 285 million people worldwide [27] and 6.8 million people in the United States [12] have a visual disability. In recent decades, technological advancements have enabled people who are blind and low-vision to live and work *independently*. However, there has been relatively little progress towards addressing *social and interpersonal* needs of this population as regards technology. This line of research asks: **how do technologies support or hinder relationship maintenance and social well-being, particularly between people with different visual abilities?**

Building from my doctoral research on technology use by couples, I ran a study [8] to understand technology use within romantic relationships where one partner is blind. The study demonstrated that inaccessible activities in the home often caused conflicts. Further, they made it difficult to carry out joint leisure activities (e.g., watching a movie together) or do favors for each other (e.g., order a gift online). Inaccessibility in the home made it harder for partners to connect. A follow-on study [7] in workplace settings revealed that even technologies specially designed to be inclusive of people with vision impairments (e.g., screen readers) were sources of social isolation (e.g., by requiring headphone use) and unfairly projected incompetence onto blind workers.

I have recently been working with Toyota to inform the design of a novel wearable navigation aid. An exploratory study [19] identified route features blind individuals include in directions they email to each other. Some directions described features not currently available in navigation apps, including warnings about the accessibility of a destination's entryway (e.g., "the revolving door spins quite fast"). Another study [1] considered how inevitable errors made by the device might impact adoption. Notably, the error itself was often less concerning than the reactions of sighted passersby, who might cause discomfort or even put the user in harm's way. Most recently, I presented work [2] that uncovered blind individuals' desire to know about other *people* on the navigation route (as opposed to route or architectural features) to assess physical safety threats (e.g., "she's holding a gun"). I currently have a MIPS grant proposal ($80,000, PI) in submission with TRX, Inc. to continue this work. I am also in talks with Toyota to fund a spin-off project on navigation aids for people with disabilities in disaster scenarios.

The core contribution of this body of work is the revelation that assistive technologies pose threats to the emotional and physical health of people who are blind, yet also have high potential to empower users in relationship and personal safety management if appropriate measures are taken during design.

Future Research Direction 1:
Designing technologies for relationship management in blind households

Funding Opportunities: NSF: CISE - IIS - CHS
SBIR/STTR (w/ companies building domestic technologies, e.g., Amazon Echo)

People with disabilities are less likely to get married and more likely to get divorced than people without disabilities [11]. In my previous research [2], I encountered people who are blind who disclosed that their marriage faced more obstacles because their partner was sighted; the technologies and activities they wanted to do together were simply not accessible to them both. I plan to investigate opportunities for technologies to better support relationship maintenance in households in which one or more family members is blind. In addition to studying adult partners, I plan to study how parents and children with different abilities play games and engage in learning activities together. My goal is to identify opportunities for promoting family connection, build assistive technology prototypes, and run field evaluations. I have an NSF CRII grant proposal ($165,000, PI) in submission to fund this work.

Future Research Direction 2:
Designing Personal Safety Management technologies for trans-identified individuals

Funding Opportunities: NIH (e.g., PA-18-169)
NSF: CISE - IIS - CHS
Social networking companies that use gender recognition technologies (e.g., Facebook)

Computer vision algorithms are increasingly used for Automatic Gender Recognition (AGR) based on images of faces, torsos, bodies, and clothing. My prior work [2] revealed that some people who are blind believe this would be a useful technology. One use case is assessing the threat level posed by strangers (e.g., "am I alone in the alley with a man, or a woman?"). But a new study [13] run with my MS thesis student documents reactions of the transgender community to the advent of AGR technology, ranging from "discomfiting" to "terrifyingly dangerous." People who are gender-nonconforming are already at higher risk of being victims of violent crime [14]. This line of research will explore how transgender people conceptualize the impact of current and futuristic AGR technologies to their mental and physical safety. This research will additionally explore how software engineers who develop AGR algorithms conceptualize gender and embed these notions into the software they build. My goal is to provide methodological guidance for the user-centered design of machine learning algorithms that have high potential to impact marginalized communities.

Future Research Direction 3:
Empowering people with disabilities in interactions with emergency responders

Funding Opportunities: NIH: NIMHD or NIDCD
NSF: CISE - IIS - CHS or SBE - SES - LSS
DOJ: COPS

My recent study [2] found that people who are blind desire access to visual information to more effectively communicate with police officers. The US Department of Justice outlines numerous challenges that arise when police encounter people with disabilities [21], who comprise nearly 20% of the US population [20]. As an example, police may interpret someone who is blind or hard of hearing as uncooperative if they do not respond to visual or aural commands. The 2015 Final Report of the President's Task Force on 21st Century Policing notably calls for new law enforcement policies prohibiting discrimination based on disability, officer trainings that confront implicit bias and systemic deficiencies in the way police interact with people with disabilities, and adoption of new technologies that will help police better serve people with disabilities [28]. In response to this need, this research will explore communication breakdowns between people with disabilities and emergency responders—including law enforcement and emergency medical technicians. My goal is to design and build novel technologies that support effective communication during high-stakes interactions to reduce physical safety threats to people with disabilities.

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