AI for Accessibility: An Agenda for the Global South

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AI technologies have the potential to improve the quality of life for marginalized populations, including people with disabilities. However, a majority of these AI solutions are designed for people in the Global North and so far, have marginalized the needs of people with disabilities in the Global South. Yet, the increased proliferation of AI across the world suggests that this trend will change. This prompts the question: What are key considerations for the design for AI solutions that center the needs of people with disabilities in the Global South: contexts often marked by poverty, limited resource availability, lack of accessible support structures and indifferent societal attitudes towards people with disabilities? In this position paper, we begin to answer this question. To do so, we draw upon a case study of designing a novel AI solution to support the indoor navigation practices of people with visual impairments. We provide guidance to HCI, AI, and Accessibility researchers and practitioners to aid in their quest to design more inclusive AI technologies.

ACM Reference Format:
Vaishnav Kameswaran, Jerry Robinson, Nithya Sambasivan, Gaurav Aggarwal, and Meredith Ringel Morris. 2023. AI for Accessibility: An Agenda for the Global South. 1, 1 (September 2023), 3 pages. https://doi.org/10.1145/nnnnnnn.nnnnnnn

1 INTRODUCTION

It is estimated that there are more than 1 billion people with disabilities worldwide and more than 80% of them live in the developing world or the Global South [Organization 2020]. The living conditions of people with disabilities in the Global South are very different from those in Global North such as the USA [Grech 2016]. People with disabilities in the Global South face several structural barriers that impede their social and economic inclusion. For instance, fewer people with disabilities in the Global South have access to educational institutions and employment opportunities [Kameswaran et al. 2018]. Likewise, indifferent societal attitudes have also impeded their social mobility [Ghai 2019]. Technology can play a significant role in the lives of people with disabilities in the Global South, often by helping them circumvent these structural barriers [Kameswaran et al. 2018; Kameswaran and Hulikal Muralidhar 2019]. For instance, prior research has demonstrated that technologies have provided this demographic with increased access to educational institutions [Vashistha et al. 2014], transportation services [Kameswaran et al. 2018] and financial infrastructures [Kameswaran and Hulikal Muralidhar 2019]. Novel AI technologies may also have similar or greater impact on such groups by scaling technology deployments and creating more personalized experiences. Yet, a majority of these solutions center the needs of people with disabilities in the Global North. Such an approach risks exacerbating the AI digital divide and minimizing the social impact of AI solutions. It is imperative to address these concerns by taking a bottom-up approach to the design of novel AI-based Assistive Technologies (ATs). In this paper, we offer guidance to HCI and AI researchers and practitioners on how to do so by drawing from a case study examining the design of a novel AI solution to assist people with visual impairments in India with indoor navigation.

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XXXX-XXXX/2023/9-ART $15.00
https://doi.org/10.1145/nnnnnnn.nnnnnnn

2 METHODS

We draw upon a two-part qualitative study to inform our findings. First, we conducted semi-structured interviews with eleven (n=11) people with visual impairments in India [Kvale 2008]. In the interviews we asked them about their everyday navigation practices, Orientation and Mobility (O&M) training experiences, challenges they encountered in navigation environments in India and strategies they used to circumvent the same. The interviews contained narrative, conceptual, and scenario-based questions [Kvale 2008]. In addition, we also conducted a video-based diary study with a subset of six (n=6) participants from the interview study. As a part of this phase of the study, participants sent us short video clips of themselves navigating indoor environments. We recruited a buddy of the participants (often a family member or friend who accompanied people on their travels outside their home) to help record the videos. The objective of these videos was to capture micro-interactions and unstated details which often go amiss in interviews but could nonetheless be critical (e.g. in generating design implications). Data was analyzed inductively through a multi-stage coding process [Saldaña 2015].

3 KEY FINDINGS

3.1 Cultural constructs underline technological expectations

People with visual impairments expected and sought assistance from others to navigate indoor environments. Societies in India, like in much of the Global South, are community-driven and value interdependence [Grech 2016]. This is in contrast to the Global North where societies privilege autonomy and individualism [Brisenden

1986; Grech 2016; Reindal 1999]. Our finding resonates with prior research that suggests that help, for people with visual impairments in India, is a legitimate way to facilitate access [Kameswaran et al. 2018]. As a result, participants in our study wanted future AI technologies to help them identify people who could help them navigate indoor environments. This is in contrast to prior indoor navigation technologies where fostering independence as self-reliance is the goal and as a result, attempts to enable people to navigate indoor environments on their own [Guerreiro et al. 2019; Sato et al. 2017].

Women participant experiences in particular were reflective of gender dynamics inherent in Indian society. Women only preferred seeking assistance from other women and here, expected AI technologies to assist them with identifying the right person to help. Additionally, when navigating with people who were not of the same gender, women desired technologies to help them avoid physical contact with their guide. Providing navigational assistance entails the guide holding people (e.g., by the elbow) which in public spaces can be perceived as a display of physical intimacy, which is frowned upon in Indian society [Karusala and Kumar 2017].

What can researchers and practitioners do: *Critically engage with cultural constructs (e.g. religious underpinnings and gender dynamics) that shape people's everyday experiences to design grounded AI solutions.* To do so, we echo prior HCI research that cites how engagement with critical disability studies scholarship can provide HCI and Accessibility researchers with a sensitizing frame to design more user-centered technology experiences [Mankoff et al. 2010; Spiel et al. 2020]. However, despite increased interdisciplinary work at the intersection of HCI and disability studies in the past few years, critical engagement with disability scholarship situated in the Global South remains limited [Ghai and Reddy 2020]. Engaging with such scholarship will ensure that future AI solutions are based in people's everyday realities.

3.2 Infrastructural constraints shape people's everyday experiences

Structural inaccessibility was rampant in the Indian context. Indoor environments were crowded, cramped, lacked architectural standards, and had no accessibility support. This is reflective of infrastructures in broader Global South contexts where the provision of accessible infrastructures is complicated by resource constraints and historical legacies [Grech 2016]. Indeed, this lack of structural support was a key reason why people sought help; they viewed help as a way to circumvent the challenges posed by indoor environments. There are several assumptions made about indoor environments in prior work examining indoor navigation solutions such as the presence of wide spaces and corridors and low crowd density, which are not attributes of environments in India [Guerreiro et al. 2019; Sato et al. 2017]. Moreover, these papers suggest that when inaccessible these environments can be sufficiently modified to enable accessibility (e.g. through installation of bluetooth beacons) which can be difficult to achieve in a context like India for reasons outlined above. This structural inaccessibility is not limited to indoor environments and as highlighted previously, is a common feature of Global South contexts (e.g. financial infrastructures [Kameswaran and Hulikal Muralidhar 2019; Kameswaran and Marathe 2023], educational institutions [Vashistha et al. 2015], workplace environments [Pal et al. 2011], transportation services [Kameswaran et al. 2018, 2019] have all been shown to be inaccessible).

What can researchers and practitioners do: *Uncover how AI can identify and address structural accessibility barriers.* Such an approach would resonate with the social model of disability which states that disability is socially constructed. A majority of research in HCI and Accessibility have centered the design of personal technology solutions for people with disabilities and in doing so, have focused less on understanding how they might address structural barriers. However, solutions like Project Sidewalk outline a path forward by demonstrating how a focus on addressing such structural barriers can broaden the impact of technology [Saha et al. 2019]. Needless to say, designers of future AI solutions should also be mindful that such technologies don't perpetuate and deepen existing structural inequities.

3.3 Socio-economic realities dictate technology access

A majority of our participants had limited access to technology. They mostly used smartphone devices and had limited access to computer technology such as laptop machines. Prior research has highlighted how even smartphones people with visual impairments have access to in India are typically low-end Android phones with limited memory and processing capabilities and poor battery capacity [Pal et al. 2017]. Affordability is a major factor that dictates the choice that people make about technologies [Pal et al. 2017] and as highlighted before, people with disabilities in the Global South are socio-economically less well off than people in the Global North [Grech 2016; Organization 2020]. Indeed given the importance of technologies to their everyday lives without which they cannot accomplish tasks on their own, smartphones often are one of their more expensive possessions.

What can researchers and practitioners do: *Design affordable AI solutions that are easy to access.* Future AI solutions should be mindful of the socio-economic realities of people with disabilities in the Global South where a large percentage of people with disabilities are illiterate and unemployed. Thus, there is a need to prioritize the affordability of future AI solutions to ensure that people's needs are indeed centered.

3.4 Societal attitudes towards disability result in diverse technology needs

People expected technology to assist with combating indifferent societal attitudes towards disability. They did not just expect AI to help them navigate indoor environments but also wanted technologies to help them demonstrate their competence and capabilities to others [Garfinkel 1967; Kameswaran et al. 2018]. This, to an extent, will help them fight the stigma of being disabled. Indeed, this finding too resonates with prior research which finds that people with disabilities are often viewed as dependents and feel independent when they help others including people with disabilities and non-disabled people (e.g. sighted family and friends) [Kameswaran et al. 2018].

What can researchers and practitioners do: *Focus on value-driven technology needs of people in addition to functional needs.*

Technologies which focus on these values might indeed create additional incentives for people to adopt and continually use them. Indeed, engaging with disability scholarship can inform people about some of the more culturally situated values or how otherwise universally constructed values might be interpreted differently in varied contexts.

4 CONCLUSION

As the breadth of AI expands beyond Global North contexts, it is imperative to consider the diverse nature of contexts it will perpetuate and the lived experiences and living conditions of people in them. Grounding designs in these contextual conditions will enable such AI solutions to maximize their impact while also mitigating the likelihood that they create or aggravate existing inequities. In this paper, we reflected on a case study of the indoor navigation needs of blind people in India, which revealed physical infrastructure differences and cultural preferences that were starkly different than in the Global North. Drawing on the experience of conducting this case study, we provide some guidance for HCI and AI researchers on how they achieve this “grounding", particularly with regard to designing for one marginalized group: people with disabilities in the Global South.

REFERENCES

Simon Brisenden. 1986. Independent living and the medical model of disability. *Disability, Handicap & Society* 1, 2 (1986), 173–178.

Harold Garfinkel. 1967. Studies in Ethnomethodology. (1967).

Anita Ghai. 2019. *Rethinking Disability in India.* https://doi.org/10.4324/9781315734064

Anita Ghai and Vidhya Yella Reddy. 2020. Assistive Technology Research and Disability Studies in the Global South: the Need for Synergy. (2020).

Shaun Grech. 2016. Disability and Poverty: Complex Interactions and Critical Reframings. In *Disability in the Global South.* https://doi.org/10.1007/978-3-319-42488-0_14

João Guerreiro, Dragan Ahmetovic, Daisuke Sato, Kris Kitani, and Chieko Asakawa. 2019. Airport accessibility and navigation assistance for people with visual impairments. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*. 1–14.

Vaishnav Kameswaran, Jatin Gupta, Joyojeet Pal, Sile O’Modhrain, Tiffany C Veinot, Robin Brewer, Aakanksha Parameshwar, Vidhya Y, and Jacki O’Neill. 2018. ‘We Can Go Anywhere’: Understanding Independence Through a Case Study of Ride-hailing Use by People with Visual Impairments in Metropolitan India. *Proc. ACM Hum.-Comput. Interact.* 2, CSCW (nov 2018), 85:1—-85:24. https://doi.org/10.1145/3274354

Vaishnav Kameswaran and Srihari Hulikal Muralidhar. 2019. Cash, Digital Payments and Accessibility: A Case Study from Metropolitan India. *Proc. ACM Hum.-Comput. Interact.* 3, CSCW, Article 97 (Nov. 2019), 23 pages. https://doi.org/10.1145/3359199

Vaishnav Kameswaran and Megh Marathe. 2023. Advocacy as Access Work: How People with Visual Impairments Gain Access to Digital Banking in India. *Proceedings of the ACM on Human-Computer Interaction* 7, CSCW1 (2023), 1–23.

Vaishnav Kameswaran, Maulishree Pandey, Michigan Josh Guberman Hrishikesh Rao, and Michigan Sile O’Modhrain. 2019. Experiences of mobility in the Global South: Lessons from People with Visual Impairments in India.

Naveena Karusala and Neha Kumar. 2017. Women’s safety in public spaces: Examining the efficacy of panic buttons in New Delhi. In *Proceedings of the 2017 CHI conference on human factors in computing systems.* 3340–3351.

Steinar Kvale. 2008. *Doing interviews.* Sage.

Jennifer Mankoff, Gillian R Hayes, and Devva Kasnitz. 2010. Disability studies as a source of critical inquiry for the field of assistive technology. In *Proceedings of the 12th international ACM SIGACCESS conference on Computers and accessibility*. 3–10.

The World Health Organization. 2020. 10 Facts about Blindness and Visual Impairment. https://www.who.int/features/factfiles/blindness/blindness_facts/en/

Joyojeet Pal, Manas Pradhan, Mihir Shah, and Rakesh Babu. 2011. Assistive technology for vision-impairments: anagenda for the ICTD community. In *Proceedings of the 20th international conference companion on World wide web*. 513–522.

Joyojeet Pal, Anandhi Viswanathan, Priyank Chandra, Anisha Nazareth, Vaishnav Kameswaran, Hariharan Subramonyam, Aditya Johri, Mark S Ackerman, and Sile O’Modhrain. 2017. Agency in assistive technology adoption: visual impairment and smartphone use in Bangalore. In *Proceedings of the 2017 CHI conference on human factors in computing systems.* 5929–5940.

Solveig Magnus Reindal. 1999. Independence, dependence, interdependence: Some reflections on the subject and personal autonomy. *Disability & Society* 14, 3 (1999), 353–367.

Manaswi Saha, Michael Saugstad, Hanuma Teja Maddali, Aileen Zeng, Ryan Holland, Steven Bower, Aditya Dash, Sage Chen, Anthony Li, Kotaro Hara, et al. 2019. Project sidewalk: A web-based crowdsourcing tool for collecting sidewalk accessibility data at scale. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*. 1–14.

Johnny Saldaña. 2015. *The coding manual for qualitative researchers.* Sage.

Daisuke Sato, Uran Oh, Kakuya Naito, Hironobu Takagi, Kris Kitani, and Chieko Asakawa. 2017. Navcog3: An evaluation of a smartphone-based blind indoor navigation assistant with semantic features in a large-scale environment. In *Proceedings of the 19th International ACM SIGACCESS Conference on Computers and Accessibility.* 270–279.

Katta Spiel, Kathrin Gerling, Cynthia L Bennett, Emeline Brulé, Rua M Williams, Jennifer Rode, and Jennifer Mankoff. 2020. Nothing about us without us: Investigating the role of critical disability studies in HCI. In *Extended Abstracts of the 2020 CHI Conference on Human Factors in Computing Systems.* 1–8.

Aditya Vashistha, Erin Brady, William Thies, and Edward Cutrell. 2014. Educational Content Creation and Sharing by Low-Income Visually Impaired People in India. In *Proceedings of the Fifth ACM Symposium on Computing for Development (ACM DEV-5 ’14).* ACM, New York, NY, USA, 63–72. https://doi.org/10.1145/2674377.2674385

Aditya Vashistha, Edward Cutrell, Nicola Dell, and Richard Anderson. 2015. Social media platforms for low-income blind people in india. In *Proceedings of the 17th International ACM SIGACCESS conference on computers & accessibility.* 259–272.