Autoethnography of a Hard of Hearing Traveler

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ABSTRACT
Travel experiences offer a diverse view into an individual's interactions with different cultures, societies, and places. In this paper, we present a 2.5-year autoethnographic travel account of a hard of hearing individual—Jain. Through retrospective journals and field notes, we reveal the tensions and nuances in his travel, including the magnified difficulty of social conversations, issues with navigating unfamiliar environments and cultural contexts, and changes in the relationship to personal assistive technologies. By exploring the longitudinal travel experiences of a single individual, we uncover evocative and personal insights rarely available through participant-based research methods. Based on these lived experiences and *post hoc* reflections, we present two design explorations of personalized technology the autoethnographer created for aiding his travel. Finally, we offer reflections for customized travel technologies for deaf and hard of hearing users, and methodological guidelines for performing first-person research in the context of disability.

Author Keywords
Deaf; hard of hearing; autoethnography; autobiographical design; travel; accessibility; personalized technology.

CSS Concepts
• Human-centered computing ~ Accessibility.

INTRODUCTION
Travel offers adventure, challenge, and the opportunity to learn about other cultures, places, and ourselves. Compared to hearing people, deaf or hard of hearing (DHH) travelers may have different experiences while interacting with strangers, navigating unfamiliar environments, and using communication technologies. In this paper, we provide an autoethnographic account of recreational travel experiences of a hard of hearing individual: Jain (first author). We document the impact of his deafness on the travel experience, including navigation strategies, communication experiences, and interactions with technology and built environments. Building on this rich, personal, and unique perspective, we then reflect on avenues for customized assistive technologies (AT) to support Jain's needs in different contexts.

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Prior work in accessible tourism has largely investigated experiences of people with visible disabilities [33,35,44] (where external cues such as blindness or a physical impairment signify a disability)—culminating in travel guides [20,35,40], policy guidelines [20,35,40], and technology recommendations [33,40]. In contrast, only a few studies have focused on the DHH population [18,27,51], of which most focuses on social interactions in multinational conferences [18,51]. We found only two examples that examine more varied contexts: Kusters' [27] field observation of social spaces of DHH travelers in Mumbai intercity trains and Zajadacz *et al.*'s [56] survey of 191 Polish DHH backpackers about their travel activities. These works helped uncover social motivations for travel (*e.g.,* ability to interact with other DHH people) and infrastructure barriers (*e.g.,* lack of visual guides) to travel in specific areas [27,56].

In contrast, we offer a complementary perspective: a longitudinal exploration of travel experiences from a highly personal view, generating rich and evocative insights rarely available through more traditional participant research methods. We chose autoethnography as a method to amplify Jain's first-person voice as a hard of hearing person and as an HCI researcher in an attempt to diversify the points of views in current accessibility research. Autoethnography is a qualitative research method where the researcher becomes a participant and uses a reflexive account of personal experiences to connect their story to wider social and cultural meanings [10,17]. Using this method, we examine nuances of different contexts, experiences over time, and the myriad factors that impact disability [2,57,58].

While Jain has traveled extensively in the past few years, we decided in June 2018 to explore his experiences from an autoethnographic lens. To capture a diversity of experiences, we investigated two distinct travel periods from Jain's life: his 15-month backpacking trip to 21 countries (Jun '16 - Aug '17) and a 16-month period of occasional travel as a PhD student (Sep '17 - Dec '18). To document his experiences, Jain used two methods. First, using pictures, social media, and emails to aid recall, he created *retrospective accounts* [16] of his travels from Jun '16 to May '18 (*i.e.,* the period before we started autoethnographic research). Second, from Jun '18 to Dec '18, Jain created *fieldnotes* [47] of his travel experiences. Through thematic analysis, we reveal themes related to Jain's experience as a hard of hearing individual, such as tensions with disclosing disability to other people, communication complexities and coping strategies used, and how travel changed his interactions with personal ATs.

Jain then critically reflected on these experiences to investigate two technology explorations for aiding his travel: a speech-to-text translator exploration to access important announcements (*e.g.,* in flights), and a customized quote speaking exploration to facilitate social conversations. Jain used these explorations for 18 travel events (*e.g.,* car trips, flights) in Dec 2018. We show how these explorations nudged Jain to adapt his communication to access essential information, support social interaction, and facilitate play, thus accommodating his needs, expertise, and personality.

In summary, the primary contributions of our work include: (1) five themes that emerged from a 2.5-year autoethnographic account of a hard of hearing traveler, (2) reflections and design guidelines for customized travel technologies for DHH users, and (3) methodological implications for first-person research to complement more traditional research methods in the accessibility community.

RELATED WORK

We provide background on DHH people and recreational travel as well as situate our work within accessible tourism.

Cultural Background of DHH People

For many DHH people, the degree of hearing loss is only a small aspect of their disability and does not determine their language preference or choice of accessible solutions [7,26,36]. To understand what factors affect inclusion, researchers have composed three models of deafness: medical, social and cultural [7,55]. In the medical model, a person with hearing loss is seen as wanting to restore normal hearing. In the social model, a DHH individual is considered as needing to integrate into the society of hearing people. Finally, in the cultural model, a DHH person is viewed as part of a culture or community with a distinct visual language. Usage of these models depends on the research goals [7,26]. For example, to develop hearing aids and cochlear implants for (partially) restoring hearing, researchers primarily embody the medical model [7]. Here, we adopt social and cultural models; we examine Jain's interaction with people, cultures and environments to arrive at design considerations for future infrastructures and ATs.

Within the cultural model, an individual can identify as deaf, Deaf (capital 'D') or hard of hearing. The term Deaf refers to people who belong to a Deaf culture with common language, values and practices (see [7,28,36] for details). In contrast, the terms deaf and hard of hearing indicate someone for whom deafness is primarily an audiological experience and who refrain from membership to a particular community [7,36]. Individuals who identify as 'deaf' or 'hard of hearing' do not have a distinct cultural identity of their own, and they may choose to interact with either hearing or Deaf people based on their comfort [7,36]. Yet, these individuals often struggle to integrate in both hearing and Deaf worlds [28,36]. In this paper, we examine tensions in Jain's travel due to his interactions with both the hearing and Deaf worlds.

Communication Strategies and Technologies

DHH people rely on visual communication strategies such as facial expressions and body language (called *speechreading* [54]), sign language and gestures [12,19,54]. When communicating with oral partners, DHH individuals may use *adaptive* (to adapt to a conversation) or *maladaptive* (to avoid or inhibit conversation) strategies [12]. Maladaptive tactics include dominating conversations to avoid listening, ignoring the conversation, and avoiding conversation with strangers [12]. Adaptive tactics can be verbal or non-verbal, such as asking to repeat or simplify an utterance, repositioning to improve one's view of the speaker, and explaining one's hearing loss [12]. Environmental conditions such as background noise, no direct line of sight, and poor lighting may also affect how these strategies are used [24]. We reflect on Jain's adaptive and maladaptive behaviors in different contexts and situations experienced while traveling.

Besides low-tech strategies, DHH people increasingly adopt communication technologies, albeit slowly due to negative attitudes around these technologies (see [7] for a historical perspective). Some widely used technologies among DHH people include hearing aids, cochlear implants, teletypewriters, videophone, and speech transcribers [7,11,45]. While these tools may enhance travel by increasing independence, social participation and inclusion [31], they have also been criticized as visible signs of disability which could hinder social acceptance of the users [41,50]. Onlookers and communication partners may also incorrectly perceive assistive technology as eliminating disability, thus making communication even more difficult [50]. Yet, some people, including Jain as we discuss below, view personal assistive technologies *"as expressions of identity, as fashion items and indicators of technical prowess"* [49]. Regardless of these opposing views, the advent of more mainstream technologies such as emails and two-way messaging have *"leveled the playing field"* between hearing and DHH people in some contexts [31].

Recreational Travel

The reasons for recreational travel differ by individual [29,34]. Prior work suggests that those who deliberately travel alone (*i.e.,* "solitary traveler by choice") weigh internal personal values (*e.g.,* sense of accomplishment, personal development) higher than external personal values (*e.g.,* sense of belonging, companionship) [34]. However, possessing a disability induces tensions around these values [20,40]. For example, a study on travel motivations of 30 Taiwanese DHH backpackers found that independent DHH travel was motivated by past negative experiences in group tours and a desire to demonstrate self-reliance to family and friends [20]. Though Jain's personality reflects that of a solitary traveler by choice, *i.e.,* internal values of personal development, flexibility, solitude, self-exploration and challenge are more important to him than social values, we discuss how deafness limited his social participation and caused tensions in his external personal values such as sense of belonging and social self-esteem.

Accessible Tourism

Research in accessible tourism has traditionally regarded people with disabilities as a homogenous group, articulating the importance of standard universal design principles such as flexibility in use and tolerance for error [33,35]. However, Darcy and Buhalis [6] recognized that the spectrum of disability is wide, and while some principles are common to all travelers with disabilities, there is a need to separately analyze disability for more specific and useful design considerations. Thus, in the past decade, disability-specific research has resulted in suggestions to better adapt tourism products and services for people with disabilities, such as slower sightseeing for wheelchair users, and adapting buildings and public spaces to provide greater independence for visually impaired users [20,33,35]. Yet, this research has focused more on visible disabilities (*e.g.,* [33,35,44]), with limited work on the DHH population [18,20].

As mentioned in the Introduction, most studies with DHH travelers focus on international conferences [18,37,51], with exceptions of travel on Mumbai sub-trains [27] and Deaf tourism in Poland [56]. In the context of the sub-trains, Kusters [27] employed participant observation and case studies to uncover social factors (*e.g.,* strategically boarding trains, coordinating using mobile phones) and environmental factors (*e.g.,* availability of reserved compartments) involved in creation of Deaf spaces in Mumbai trains, and how these spaces generated social networks beyond trains in the wider Mumbai Deaf community [27]. For Deaf tourism in Poland, Zajadacz *et al.* [56] compiled summative data from 191 Deaf travelers and articulated important attributes to strengthen Deaf travel, such as providing disability discounts, using visual guides (*e.g.,* symbols, texts), extending use of ICTs, and changing attitudes of the government and people.

Beyond the research literature, personal blogs (*e.g.,* [59]) and travel websites (*e.g.,* [60,61]) offer information for DHH travelers, lists of apps to facilitate communication with service providers and with other Deaf people, and custom guides and tour packages to surmount language barriers and provide a Deaf community experience.

We extend the above works by offering an autoethnographic account of a hard of hearing traveler. Because we focus on a single individual, our approach allows for longitudinal exploration of travel experiences from within, yielding situated and expressive personal insights.

METHOD

We provide background on autoethnography in HCI, Jain's biography and travels, and our research methods.

Autoethnography in HCI

Our research uses autoethnography, a qualitative research method in which a researcher adopts the role of participant and uses *"self-reflection and writing to explore their personal experience and connect this autobiographical story to wider cultural, political, and social meanings and understandings"* [17]. Autoethnography draws its roots from the 'crises of representation' period in sociology (the mid-1980s) due to *"the calls to place greater emphasis on the ways in which the ethnographer interacts with the culture being researched"* [21].

In HCI, researchers have used autoethnographic methods in different stages of the design process to inform user study design [24], test a preliminary prototype [23], and as a lightweight method in the iterative design cycle [43]. Recently, this method has been increasingly employed to examine themes beyond usability, efficiency, and functionality [13]. For example, Lucero used this method to examine how long-term mobile phone detox introduces tensions in his social relationships, work life, navigation and safety [30]. Höök investigated horseback riding as a way to learn about bodily experiences and connected them to design considerations for bodily interactions [22]. Finally, Sengers' reflections on IT and pace of life raise general questions about experiences of time and work in a technology dominated world [48].

In summary, autoethnography investigates the lived experience from within, generating rich personal insights not often available through other research methods in HCI [13,38]. HCI researchers who have used the method described it as being valuable to investigate questions around embodiment [14], interplay between people and things [4], object-oriented ontology [14], cultural experience [32], and temporality [48]. However, they cautioned that autoethnography needs to ensure its own sense of validity [13,38]. To judge autoethnography, Lucero [30] suggested establishing: study boundaries (in terms of time, location, project type, point of view), reliability (of the study protocol), plausibility (with respect to research literature), criticality (by offering different perspectives), honesty and transparency (in revealing details about the subject), relevancy (of biographic information to the research goals), and external validity (by sharing drafts and notes with similar population), which we also attempt in our work.

Biography

Jain is a hard of hearing individual with severe to profound bilateral sensorineural hearing loss from birth. His frequency response is from 20Hz to 2000Hz (a common hearing range for young adults is 20Hz to 20,000Hz). Within the audible range, his average decibel loss is 75dB. He wears a 'behind the ear' (BTE) hearing aid in both ears. Because he has high frequency hearing loss, high-pitch sounds (*e.g.,* birds, some female voices) are difficult to discern even with the aids. For communication, he relies on facial cues (*speechreading* [54]) and is able to participate well in 1:1 conversation unless the conditions are unideal (background noise, obstructed face). However, group conversations, and situations with no line of sight (*e.g.,* flight announcements) are difficult.

Jain was born in Delhi, India and grew up in the hearing community. He moved to the US in 2014 to pursue his masters at MIT and is currently a computer science PhD student at University of Washington (UW), Seattle. He began learning American Sign Language (ASL) at UW in March

Figure 1: Travel pictures used to support Jain's retrospective account: (a) Colored houses in Italy, Jan '17. (b) Scuba dive briefing in Egypt, Mar '17 (b) A narrow walking bridge in Costa Rica, Aug '16, (d) Mountains on a drive in India, Jun '16.

2016, just before the backpacking tour. Currently, he is a beginner (level 2) signer. For academic classes and meetings, he uses a real-time, in-person captioner [62], which he only started using after arriving to the US. We note that these captioning services require advanced scheduling and are expensive, thus are not amenable to support travel.

While this autoethnography focuses on Jain's experiences, his co-authors—who have expertise in HCI, accessibility and first-person research—participated in scoping the project, analyzing data, and writing drafts (as described below).

Case Presentation

Traveling for Jain started as a leisure experience for exploration, expanding perspectives and having fun. It was only in June 2018, after discussions with Desjardins (the second author), that he began considering an autoethnography research. We had hoped to contribute to the research community in two ways: using Jain's experience as a way to share the personal everyday travel events in an evocative way and opening a discussion around the design and making of personalized ATs.

For this autoethnography, we focus on Jain's experiences from June 2016 to Dec 2018. This 2.5-year period contains two main travel phases: a 21-country backpacking tour and occasional travel as a PhD student in the US.

Backpacking tour (Jun '16 – Aug '17): After completing his master's degree, Jain embarked on a *solo exploratory* backpacking tour *by choice* [29,34]. In brief, his travel included sightseeing tours, recreational sports, attending academic conferences, visiting family and friends, a scuba instructor course, a research project on a scientific vessel, teaching in educational outreach workshops, and other volunteer opportunities (*e.g.,* hotel staff, restaurant worker, farmer's assistant, videographer). In 15 months, he visited 21 countries: six in Western Europe, five in East Asia, four in Southeast Asia, two in North Africa, South Africa, twp in Latin America, and the United States. He used 39 flight legs and various forms of ground transportation such as buses, trains, cars and two-wheelers. He stayed in several low-cost accommodations—such as, hostels, Airbnb, friends' homes, camps, guesthouses, and budget hotels.

Travel as a PhD Student (Sep '17 – Dec '18): After the backpacking tour, Jain started his PhD program at UW. During this period, his travel included weekend trips with friends, four holiday trips in the US, four international and domestic conferences, and two trips home to India.

Data Collection

Data collection began in June 2018 and consisted of two stages. First, Jain developed a *retrospective account* [16] of his travel experiences during the backpacking tour and first year of his PhD (Jun '16 - May '18). These retrospective accounts included digital notes of events, experiences and interpretations constructed from memory. To aid recall, Jain referred to photos, emails, videos, social media posts, travel bookings, and consulted family and friends who interacted with him during travel. Second, from June 2018 to December 2018, Jain recorded *fieldnotes* [47], consisting of notes documented within the week of a travel event. These fieldnotes were constructed from brief bullet point notes written on the spot or immediately after the event. In total, the retrospective account and fieldnotes together document 47 travel events in 15,288 words in a Google Doc. Each travel event record—a moment of tension or surprise due to deafness—contains a narrative statement of the event, Jain's personal interpretation, emotions experienced, relevant stakeholders, any communication strategies used, and environmental and social factors involved.

Data Analysis

The experience notes were analyzed using open, axial and selective coding [9] to articulate the social, cultural and personal implications of Jain's deafness as a traveler, the effect of his deafness and various environmental factors (*e.g.,* background noise) on communication, and the role of technology. At the beginning of the analysis, Jain read his experience notes and created 14 initial open codes to summarize the data (*e.g.,* interaction with hearing culture, difficulty in areas with background noise). These codes were shared with co-authors and revised based on critical discussions. Then, Jain split, merged and reorganized open codes to identify common relationships among them (*e.g.,* merging 'interactions with hearing people', and 'interactions with Deaf culture' into a single category). This process generated 10 axial codes, which were again shared with co-authors for reflection. Finally, the axial codes were combined into five overarching themes (cultural, environmental, and social aspects, relationship with ATs, and technology explorations), and example excerpts for each code were collected from the notes. These themes, codes and excerpts form the foundation of this autoethnographic narrative.

In addition, following autoethnographical best practices [16,17], Jain shared his experience notes and paper drafts at different stages of the research with co-authors, friends, and colleagues, two of whom are DHH. By doing this, he gathered alternative interpretations of his experiences and related his experiences to those of other DHH people.

FINDINGS

We discuss tensions due to varying environments and cultures during travel. In this autoethnography [17], we now shift to a first-person singular narrative—*i.e.,* Jain's—to present our findings using a closer and more personal voice. Quotes are drawn from Jain's fieldnotes or retrospective account and are lightly edited for grammar.

Influence of Environmental Factors on Travel

In terms of environmental factors, mobility-related issues were common in my travel—for example, being unable to hear cars behind me on streets, announcements on buses, or having difficulty interacting with others while moving (reaffirming past work [24]). Below, I show how three issues related to my deafness: *insufficient visual cues*, *background noise*, and *high-frequency sounds* shaped my travel, as well as how I coped with these in personal ways.

Insufficient visual cues: As I rely on *speechreading* [54], communication is hard when the speaker's face is obstructed or inaccessible. This situation arose, for example, on phone calls to make reservations, when there was lack of line of sight (*e.g.,* in a car conversation), or with insufficient light (*e.g.,* walking on a street at night). For example,

"I was sitting at the back of a shared vehicle during the journey in the deep mountains (Figure 1d). Since the journey was slow, people were chatting in the car and I wasn't able to speechread. It was frustrating... The journey was supposed to be around 6 hours but multiple road blockages, landslides and stoppages in the Himalayas increased the total time to more than 12 hrs. I felt spatially lost, like having no knowledge of where I am and how much time it would take to arrive at the destination. It felt disorientating and suffocating. I felt trapped." (*Kaza*, Jun'16)

Fortunately, in some cases, I was able to negotiate the communication mode based on my needs and preferences:

"I asked the hotel staff if it would be okay to communicate via email. As the internet connectivity is scarce in the area, I was skeptical whether the owner would be comfortable with this. To my surprise, the owner agreed to go to a nearby cafe every now and then to communicate with me via email!" (Quepos, Aug'16)

Background noise: Secondly, areas with much background noise were harder to communicate in. For example:

"[when I was seated in a window seat on a plane] it was terribly difficult to communicate drinks or food choice. I couldn't hear the attendant very well. [...] And since I can't hear my own voice well, I did not know how loud I was speaking. Thus, the crew also had a hard time understanding me. Somehow, through gestures and repetitions, we made it work but I skipped one meal and compromised with cold water instead of the hot water (which I wanted)." (Flight from Milan to Sharm el sheikh, Mar'17)

Because I can hear partially, areas with high background noise (*e.g.,* a party, restaurants) also cause disturbance when I am trying to focus. However, contrary to hearing people, I could turn off my hearing aids to cut noise when desired:

"The hostel in Costa Rica was a party resort with drink and dance parties every night. Fortunately, I was able to stay in my room and sleep fine with my hearing aids off!" (Arenal, Aug'16)

High-frequency sounds: Finally, because I have high frequency hearing loss, women's voices and other high pitch sounds are difficult for me to hear. For example,

"I went on a short hike in the rocky forest one afternoon in a very remote location. As the destination had many bird nests, I was told by the hotel staff to follow the direction of bird sounds. Naturally, I couldn't hear the bird sounds and [had to] use sun's position as a compass to stay on track (I was told to go East). [Thus,] I kept diverting on the hike…" (Cappadocia, Jun'16)

In certain cases, however, fellow travelers have graciously helped by conveying occurrences of high pitch sounds to me, or acting as intermediaries for soft speakers. For example,

"In my train bunk space, I found two chatty travelers—an older woman who was backpacking alone, and a man on a business travel. The woman's voice was hard to understand [due to the pitch]. Fortunately, the young man understood that and was kind enough to translate and summarize the lady's speech, on that 18 hour train journey." (Train from Delhi to Jaisalmer, Nov'16)

The above environment complexities reduced my willingness to communicate in unideal situations, often leading to a dilemma of whether or not I should initiate a conversation. For example, on a Costa Rica to LA flight:

"…there was some announcement that I couldn't hear. By looking at passenger expressions and the tone and volume of conversations that followed afterwards, I knew something was wrong. But I did not bother asking because it's inconvenient for me to talk in the plane [due to noise].

However, about 30 mins later, the plane started descending. Judging by the journey time and my phone GPS, I knew we haven't even crossed Costa Rica yet. I started worrying [about missing my connecting flight]. So, I asked a co-passenger about what was wrong. It was hard to discern what she was saying, but owing to her kindness, after about three repetitions, I was able to understand that there was some technical issue and that the plane needed to refuel before continuing on the journey.

We landed on a very small airstrip in the middle of a jungle by the ocean. The pilot made some announcement and I could hear some words (e.g., sorry, time, delay). I did not want to bother my co-passenger again because I thought knowing the status would not change the outcome anyway. But, looking back, I think I should have asked her or the flight crew about the announcement because I kept worrying for the whole journey." (Sep'16)

Though I faced these three issues in all countries, the degree of my difficulty also depended on the differences in available infrastructure in each region. For example, because street lighting was insufficient in the Tibetan mountains, I could not see people's faces while walking at night (thus making conversation difficult). Closed captions—a commonality in the US—were not present at a movie theater in Thailand. Finally, some buses in developing countries did not have LED screens, which I frequently rely on:

"Unlike developed countries, the bus here did not have inside led screens that display the stop information. The bus driver was announcing stops and I couldn't see his face." (Dahab, May'16)

Relationship with Personal Assistive Technology

Travel also affected my use of ATs, particularly my hearing aids. Though I am partially deaf, my mind has unconsciously adapted to the electronic sound of my aids and I cannot process most sounds without them. Consequently, I face difficulties when my hearing aids run out of battery, are accidently misplaced, or cannot be used. Below is an example of my experience during a scuba course:

"Some scuba instruction occurs on the water surface and I cannot wear my non-waterproof hearing aids near water… So, I told my instructor to explain and repeat instructions on land (both before and after the dive). And they tried their best. But, it was hard for them to deviate from the standard procedure both because of force of habit and also because dive policies are very specific about where and how the training is given. Fortunately, my instructor took out extra time for me and had me demonstrate each instruction in a 1:1 session" (Figure 1b) (Dahab, Feb'17)

Moreover, due to being away from my support network at home, I had to be more self-reliant. Thus, my relationship with hearing aids changed because their loss or damage while traveling would have increased discomfort. I became obsessed with ensuring the safety and functionality of my aids: by cleaning them regularly, storing them safety, and keeping enough batteries. As an example, while sleeping in shared dorms, I kept the aids under my pillow and *"woke up multiple times at night to check if they did not drop to the floor or got lost."* Similarly, I panicked when my aids became wet with rain or sweat, and *"stayed up the night with a hair dryer to dry them."*

Another example relates to phone calls. At home, I use a remote transcription service, *InnoCaption* [63], to transcribe calls in real-time. This service is only licensed for use in the US, so I faced trouble when I lost my credit card in Mexico:

"I tried to use the email and online chat service to cancel my card and order a new one, but due to 'security reasons', the agent was unable to do these 'high-stakes' transactions without a phone call. I tried to ask a student from the workshop that I was organizing in Mexico to call for me. The bank agent said, they have to talk to me directly to authorize the student to talk on my behalf. I had to respond to a few questions on the phone. The student started to appear irritated after 15 mins of that call. The bank acknowledged that I would get my card in 10 days but it did not arrive. By that time, I moved to Costa Rica, where I asked the hotel staff to call for me. That did not work because there was a long wait on the phone and the hotel staff had to deal with more tourists that were arriving. The next day, I asked another woman, a fellow tourist to call. That call lasted for 27 mins! And the bank agreed to ship my card." (Mexico and Costa Rica, Aug'16)

Social Complexities

By reflecting on the specific environmental complexities and the modified personal AT use, below, I articulate more deeply how my communication was affected during travel.

Social conversations were limited

First, due to difficulties with talking in areas of background noise and low lighting (which are common on the move), social and "fun" related conversations were limited. An example of how I gave up on a group conversation:

"I once volunteered in a social organization in a rural setting. The organization used to have social gatherings on most nights after dinner to talk about the day. I was never able to converse in the group due to insufficient lighting in the rural areas and because of too many speakers. I tried once or twice but that lead to awkwardness when I couldn't understand people and kept nodding to keep the conversation flowing. Eventually, I gave up and decided to do my own thing after dinners" (near Pai, Apr'17)

These social conversations are important to feel a sense of belonging, enhance self-esteem and improve emotional well-being [1,3], which I routinely struggled with. While I did make efforts to participate in conversations—by explaining strategies that others could follow (*e.g.,* speak slowly, one at a time)—some conversation partners became impatient on realizing that frequent repetitions or clarifications were needed to converse with me. Hence, a common reaction was for them to substitute my active participation with passively informing me of only important messages in a conversation.

Communication strategies

Second, while social conversations were a routine problem, my travel also included situations where exchange of critical information was difficult but necessary and could not be avoided (*e.g.,* asking for directions, ordering food, booking hotels). In an attempt to accommodate those conversations, I used four personal communication strategies:

Augment: In some cases, I augmented communication using repetitions, explanations, confirmations, a technology, or gestures. This strategy usually accommodated the conversation positively. For example,

"I was trying to find a police station to report my stolen wallet. A passerby told me the name of the street [where the police station was located]. I am seldom able to fully understand the names of places when somebody says them to me. But fortunately, Google Maps' autocomplete feature is very helpful in these cases. I understood some phonemes of the police station name and by typing my own spelling [of understood phonemes], and accompanying with keywords such as "police station", using google maps' autocorrect, and by other contextual information given to me by the passerby (e.g., general distance, direction), I was able to locate the police station." (Madrid, Dec'16)

Substitute: In other cases, I used alternative strategies or modalities for communicating (*e.g.,* asking bystanders to help with a phone call, using an intermediary). An example where such substitution resulted in a positive experience:

"I went to a McDonalds. It was very loud, and I would have had trouble communicating with the server. Fortunately, they had kiosks with touchscreens to order food…" (Dublin, Oct'18)

However, substitution also caused negative experiences, *e.g.,*

"Since I could not call, I had to book hotels and transportation in person by walking in the rain and asking door-to-door. It got really hectic and stressful when I had to search for long hours. I eventually stopped booking hotels, bus, train tickets, etc. on the

fly, and resorted to staying in online booked hotels (which were more mainstream and less adventurous). All this made my travel calculated, premeditated, and less exciting. It also decreased my self-esteem because I wasn't able to travel spontaneously like other travelers I know." (Ipoh, Mar'17)

Shift: The third strategy involved changing the conversation time, topic or purpose, which resulted in both positive and negative experiences. Below, the first example had negative outcomes while the second had positive outcomes:

"In the car, fellow travelers and I were planning our subsequent driving trip in Mexico. As I could not hear them much, I kept cutting the conversation to ask my own questions and was a little dominating throughout the whole conversation. That must have been awkward for them." (near Merida, Aug'16)

"We were in the Barcelona metro and my friend asked me about my flight time, so he could drop me at the airport the next day. I could not hear him because of the train noise…. After several repetitions, he dropped the question and gestured, 'later'. We clarified when the train stopped." (Barcelona, Jan'17)

Erasure: Finally, I also avoided or feigned conversations which always resulted in a negative experience. For example,

"I was unable to find the location of my booked hotel and, because I couldn't understand the hotel staff giving directions on the phone, I had to book another hotel." (Porto, Feb'17)

These four communications strategies extend past work [11]: while the erasure category is analogous to a maladaptive strategy [11], by reflecting on my experiences, I identified three other sub-categories of adaptive strategies (augment, substitute, shift). Furthermore, while use of these strategies was situation dependent, I also often tried switching strategies to better support the conversation. For example,

"I tried to hear my friend in car but could not. He said he will tell me later [Shift]. But, I really wanted to know what he said. So, I asked him to type on a phone [Substitute]." (Venice, Jan'17)

Cultural Tensions

Travel exposed me to different cultures but also caused cultural tensions. For example, while praying in a mosque in Egypt, I was instructed to close my eyes, thus making it difficult to follow the priest's words. Further, overly sympathetic reactions from people in an Indian airport (outlined below) affected my mood. Below, I particularly elaborate on tensions around disability disclosure and navigating the Deaf *vs.* hearing worlds.

Tensions in Disclosing Disability

Though I consider myself a socially active person, I am a little reserved about disclosing my disability. During my travel, I constantly struggled with whether and how I should disclose my disability. In some cases, revealing my deafness enhanced the conversation:

"We went in [a chocolate factory] and were looking at some chocolates when the manager greeted us and asked if he could give us the tour of the factory. We agreed and joined the group. [...] I told him that I'm deaf and would appreciate if he speaks slowly to me. And he was very respectful and careful in adhering to my request. He spoke clearly, slowly, loudly (but not with too much emphasis to appear unnatural)." (Heidelberg, Dec'18)

While the example above shows an appropriate response, I have experienced many instances where this delicate balance was not achieved because of possible negative attitudes or a lack of awareness towards deafness. For example, in an Indian airport I received excessive sympathy from travelers:

"I was about to board a flight from Leh. But, because this was a smaller [low-key] airport, there were no clear lanes for boarding. [To accommodate this] often times, passenger names are called in case they get in the wrong boarding lane or separate out from the group. I was patiently standing and waiting for my flight when I heard some people started talking among each other about something that might be relevant to me. I could make out the word 'Jain'. I responded to one group saying I am Jain, and they explained that my name was being called out. Then I raised my hand in an attempt that a flight attendant or an airport officer would notice. Suddenly, I saw an officer coming to me and saying in an angry tone: 'So, you are Jain. We've been calling your name since so long, can't you hear?' I was shocked and explained my hearing loss to him. On hearing this, his mood completely changed. He was very apologetic, shook my hand and escorted me in person to the plane. I received excessively sympathetic service from other flight attendants as well like being apologetic, talking kindly etc. And I was really embarrassed to be given special treatment in front of other people in the crowd who looked amused." (Leh, Aug'17)

In another example, I had a similar situation at a US airport but this resulted in a different reaction from flight attendants:

"[At the airport] I went to the bathroom at the last min. I noticed that the airport announcement was going for a long time. I looked at my watch–it was way past the specified boarding time. I immediately ran to the boarding gate. The attendant at the gate was signaling me: 'No problem, take it easy Sir.' From their unusual reaction, and judging by the fact that I could "hear" an airport announcement in an urgent tone being called out sometime before, I figured they must have been calling my name. I asked the flight attendant to confirm if they were really calling out my name. She appeared unhappy (not knowing that I'm deaf) but said: 'yes, but it's okay.' I figure social niceties somehow conflict with accessibility here. If she had asked, I would have explained my hearing loss." (Boston, Sep'17)

In a third case, I told a hotel staff in Milan (Feb '17) about my deafness and asked her to speak slowly. She reacted by saying: *"I shouldn't travel alone and at night if I am deaf."*

These negative attitudes around disability discouraged me from disclosing my deafness in many instances, thus causing mental tensions:

"[My 4 officemates and I] were coming back from a day hiking trip. I was sitting in the [co-]pilot seat. I couldn't understand people in the car… But, because there was a funny conversation going on, I pretended to understand and laugh to appear involved in the crowd. It would have been embarrassing to get caught. I was afraid that people may know that I am not listening, and it might spoil the mood. I didn't want to disclose that I couldn't hear the conversation. I was afraid of people's pity on me. Sometimes, when the conversation tone got serious, I would look at my phone to appear I am busy when I was not. This way people would not talk to me or ask me a question." (Seattle, Nov'18)

Eventually, I started disclosing based on the urgency:

"I was traveling on a shared car ride on a very tight schedule. I had to catch a bus to a different city at the end of the day, and we were getting really late in returning from the car trip. When I told [other passengers in the car] about my bus, I couldn't hear their confirmation of whether they had heard me [due to car noise]. I was embarrassed to ask again. But, I also had a bus to catch. So, disclosing that I am hard of hearing, I asked them again if they had heard me." (Shillong, Jul'16)

Tensions in Overplaying Disability

On the other hand, I sometimes overplayed my disability by using 'social signifiers' of a profoundly Deaf person (*e.g.,* relying extensively on gestures to communicate) [8] when requesting special services, such as closed captions in a movie theater or disability discounts on public transits. I thought that—deafness being an invisible visibility—if I did not behave in an expected stereotypical manner, people might think that I am falsely fabricating my disability to avail services. For example,

"When I was on the train station buying [a] ticket for the trip to Paris, I asked if there was a disability discount. To do so, I presented to be more deaf than I am [by] using sign language and speaking really slowly in an unnatural manner so the ticket representative would believe me." (Lyon, Jan'17)

Walking the Fine Line between Deaf and Hearing Worlds

Besides tensions of disability disclosure, I struggled trying to integrate into both Deaf and hearing worlds. As mentioned above, I grew up in the hearing world and started learning sign language in March 2016. Thus, at the beginning of my travel, I had a troubled interaction with a Deaf person:

"looking at my hearing aids, one Deaf woman came to me and [tried to] start a signing conversation. I was embarrassed to explain that I do not sign. I really wanted to talk." (LA, May'16)

Now that I am more acquainted with ASL and Deaf culture, I find it easier to socialize with the Deaf people. For example, when attending the ASSETS 2018 conference overseas, I went on several *night-outs* with the Deaf attendees and *"was able to partially communicate in sign and follow Deaf culture practice. I felt very connected and belonged."*

However, I have begun to experience issues in the hearing world now. For example, because I adapted to the visual communication mode of the Deaf world (gestures, sign language) [7,36] during the ASSETS conference, after coming back, *"it was challenging for me to face the communication demands of the hearing world."* Moreover,

"I started exhibiting behaviors such as waving in the middle of the crowd or banging on the table to get [someone's] attention, which were interpreted as rude and childish." (Seattle, Oct'18)

Summary: This autoethnographic report details personal ways in which Jain navigated issues of environment, social and culture during travel. The experiences also highlight his unmet needs, such as magnified difficulty of social conversations, issues with exchanging critical information and problems with disability disclosure. These personal needs and the unique ways in which external and internal =

TECHNOLOGY EXPLORATIONS

We investigate two technology explorations to aid Jain's travel *in-situ*. Following an *autobiographical design* method [39], Jain designed these explorations for his own use, building on his own personal assessment for what he needed—by reflecting on his travel notes, his general communication needs and challenges, his expertise (comfortable with using technology as a computer science PhD student) and by involving in informal discussions with his close colleagues, friends and co-authors.

Jain used these two explorations for 18 events (flights, car trips) in December 2018. The data collection and analysis followed the same procedure as used for the fieldnotes in the travel report: Jain recorded his experiences in the field, then analyzed them using open, axial and selective coding in consultation with the co-authors. Below, we detail these two explorations, their use cases, and early reflections from their exploratory use in first-person voice.

Exploration 1, a speech-to-text translator: The first exploration used a collar microphone [64] placed near my interlocutor and paired with my iPhone X. The speaker spoke into the mic and the speech was recognized by Siri. I used this exploration during my leisure travel to India for in-flight announcements (6 cases), conversing with the flight crew (3 cases) and immigration staff (1 case), all of which involved situations with high-background noise where critical information was necessary. Within these cases, two flights were taken with family and the remaining cases were solo travel. On flights, I asked the cabin crew to wear the mic for initial cabin announcements. In the air, I held the mic near a cabin speaker for automatic and captain announcements.

I found that I could access a range of information that was previously inaccessible (*e.g.,* flight safety briefings, information about destination such as weather and sightseeing details, information about in-flight service such as food and drinks). For example, on traveling to a high-altitude region with family:

"I saw a range of info. For example, I saw that they said to wear sunglasses because the sun is brighter at higher altitudes—I never knew this! The app transcribed 70-80% clearly and the rest I could understand from context and guesses. I also noticed that even knowing the topic of announcements was good, because then I could ask other passengers if it seemed like an important thing being said." (Leh, Dec'18)

In three cases, the exploration also helped my co-passengers, who *"peeked into my phone when they couldn't discern some announcement words—[thus,] empowering [some] hearing people!"* Finally, in one case, the exploration transformed into a playful interaction: *"my younger brother, delighted by the technology, started using it to talk to me, singing poems, songs and what not."*

However, while one-sided information was easier to access, the transcription delay made two-way conversation (*e.g.,* conversing with flight crew, immigration staff) unnatural:

"The transcription, though accurate, was delayed and [thus,] the conversation was unnatural. So, I wondered whether or not to use [the exploration] in future..." (Dubai, Dec'18)

Moreover, to hold the mic near the cabin speaker for automatic and captain announcements, I either had to pay close attention to listen for an occurrence of announcements or rely on notification from my co-passengers. Finally, one crew member was not supportive of the extra work needed and offered to explain the announcements in person, but instead *"showed me a 3-4 word written summary on a piece of paper thinking that this would be enough."*

Exploration 2, a topic moderator: I also explored using the iPhone *Notes* app to help prepare for and prompt conversation. This exploration included a portable speaker connected to my phone and was used in car rides—a scenario with moderate background noise where line of sight may not be present. Before the ride began, I predicted topics that would be of interest to all parties in the car, including general topics like the destination, journey, and weather information. These parties included friends and family members (for whom the interests was known beforehand, 4 cases), or Uber riders and drivers (where Uber profiles were used, 4 cases). I then typed some topical quotes in the *Notes* app on my iPhone. Example quotes included: based on a topic of interest "movies" (*"Aquaman had a very successful opening"),* the journey (*e.g., "bad traffic on [this road]"*), the destination (*e.g., "temperature in Leh is -21°C"*) and the weather (*e.g., "rainy weather for the whole week"*). Finally, during the ride, I waited for long pauses in the conversation, assessed the situation (*e.g.,* to verify if the driver is not involved in high-attention tasks), and used the iPhone's text-to-speech engine to emit the quote from the speaker. The aim was to seamlessly prompt social conversations around the topic of the quote because I was uncomfortable with disclosing my disability upfront (as noted earlier). Also, knowing that topic in advance would likely help me to understand the speakers.

I found that, in most cases, this exploration increased my social participation because I was able to infer words from the conversation topic. However, this exploration required support from other people who were not always willing:

"[The] Uber driver was friendly and willing to participate. But, the co-passenger [(a stranger)] reacted as if the quote from the speaker was weird and gave a funny look." (Seattle, Dec'18)

These negative reactions, however, were minimized because I could observe and use my judgment as to whether people were willing to communicate before playing the quote.

In addition, this exploration shifted the overall conversation focus from me to other people:

"I usually dominate these car conversations because I cannot hear. Now, other people could talk and I could make out what they were saying [from context]." (Delhi, Dec'18)

Further, in some cases, the exploration projected that a DHH person wants to communicate, making others more supportive:

"Since my family knew the quote came from my speaker, they realized that I seriously wanted to communicate, and were more careful about involving me by speaking slowly." (Leh, Dec'18)

While helpful, this exploration did not completely eradicate the need for facial cues, and, when sitting in the car front seat, I had to *"use the mirror in the sunshield to look at people sitting behind or turn back occasionally."* Finally, while I was comfortable using the setup for a short period, the logistics of carrying the speaker and preparing the quotes in advance might dissuade me from longer-term use.

Summary: These explorations show personal and situated ways in which Jain could diversify how he communicates in two scenarios (announcements in flights and social conversations in cars). Usage of these explorations seem to support a shift from erasure (avoiding the conversation) to substitute (using text instead of speech in Exploration 1) and from erasure (avoiding conversation) to augment (confirmations, using contextual cues in Exploration 2).

DISCUSSION

This autoethnography provides a rich, first-person account of a hard of hearing person's travels, revealing tensions and thought processes, and emotions that are difficult to obtain through more traditional participant research methods, and that are key to understanding the socio-cultural experiences from within [13]. Some of our findings extend prior work examining travel experiences [18,51] and general challenges [12,19,24] of DHH people, such as issues with background noise, line of sight, high frequency noises, and the cultural challenges that arise in navigating both hearing and Deaf worlds. However, our personal and longitudinal account of a DHH traveler across a diverse range of situations has also highlighted unique tensions, such as changes in the relationship to personal AT, the magnified difficulty of social conversations, and issues of navigating disability disclosure in unfamiliar environments and cultural contexts.

Our research is inspired by a growing movement in HCI to study the diverse personal experiences of users, with the goal of arriving at more inclusive designs that are adaptable to changing contexts of use and to individual user abilities [53,65]. We hope that, motivated from our autoethnographic case as an example, other researchers with disabilities will also expose their expansive personal accounts, thus revealing how diverse scenarios and contexts affect them and their relationship with ATs, potentially using these insights for designing personalized ATs. Here, we discuss implications from our findings as well as the benefits and challenges that arose in using an autoethnographic method.

Reflecting on the Travel and Technology Explorations

Based on Jain's experience with travel and technology explorations, we reflect on some specific points for future examination within the accessibility community. First, our findings highlight personal ways in which Jain interacted with technology and design environments. In particular, being far from his support network at home changed his relationship to the personal ATs (hearing aids and

InnoCaption app). Future work should further investigate how diverse scenarios and contexts affect other disabled people, their relationship with personal ATs, and their interactions with other technology and design environments.

Second, the varied environmental conditions encountered during travel (*e.g.,* background noise, obstructed faces) impacted Jain's communication. While he was able to use adaptive strategies to acquire essential information in some cases, an alternative might be considered: How might ATs adjust to different settings? As an example, some hearing aids allow users to keep 'profiles' for different contexts [42]. However, these profiles are pre-configured by a specialist and do not fine tune based on conditions encountered. With recent advances in machine learning, how might ATs be designed to automatically adjust to the surroundings? And, how might users calibrate their ATs themselves in the field?

Finally, Jain's explorations of off-the-shelf technologies supported access to essential information, social participation, and play—thus satisfying his needs, personality traits, and preferred communication modalities (visual, gestural, auditory). In contrast, a growing trend in the HCI community has argued for open source, DIY solutions to enable end-user customization, collaboration and play [5,52]. Although Jain enjoys building DIY solutions, he feared that these preliminary solutions might be cumbersome to carry, and could fail during travel. Instead, through discussion with friends and colleagues, he opted for quickly assembling and repurposing robust commercial technologies (iPhone, lapel mic, portable speaker) that are more reliable yet allow space for fine-tuning and play. Researchers should capitalize on this alternate process of self-exploration with commercial products, to innovate robust personal technologies that also support end-user personalization.

Reflecting on the First-Person Research Method

We encourage the accessibility community to add autoethnography [10] and autobiographical design [39] to the existing array of research methods given their clear value in eliciting intimate lived experience of a disability. For these first-person methods to reach a high degree of quality and honesty, we offer some considerations below:

Benefits of the first-person method: First-person research methods (*e.g.,* autoethnography, autobiographical design) can strengthen the array of methods used in the ASSETS community. Compared to field deployments, which require robust and established prototypes, autobiographical design allows for early stage, less formal, and fast iterative prototyping [13,39]. The designer/maker is also likely to be more motivated and patient to examine a prototype than an external participant, thus minimizing the impact of minor usability and finishing issues. Compared to participatory design, which may occur over a finite number of sessions, autobiographical design is always evolving from self-tuned adaptations in the field [39]. Finally, compared to the short reports in the ASSETS Experience Reports track, rigorous first-person research has the potential to make more in-depth contributions that reflect on a person's cultural and social interactions in the field. These combined advantages of first-person research methods stem from epistemological commitments to reliability, criticality, and external validity (see Method section) and from the use of data collection methods such as *retrospective accounts* [16] and *fieldnotes* [47] (as opposed to usability testing [25,46] or a simple reflexive summary [15]).

Collaboration opportunities: First-person research differs from other methods with respect to *who* is making the design decisions, *which* design ideas are implemented, and *how* these decisions relate to the genuine needs of an individual [39]. Although the roles may differ by project [39], the autobiographer is at the center of the documentation and design process. Nevertheless, other actors (*e.g.,* colleagues, professors, family) can play various roles as testers, critics, end-users or advisers. In our case, Jain's family participated in his technology explorations, his co-authors contributed to the data analysis and paper writing, and his friends helped brainstormed his explorations. While we celebrate the presence of other actors in the design process, we equally emphasize the importance of respecting an individual's personal interest, motivation, and signature to make space for the more personal, intimate and complex questions needed for the first-person research [13,39].

Moreover, balancing 'authority' in these interactions is essential. Graduate students performing autoethnography may be intimidated to share their extremely personal experiences with their advisors, co-authors, and general readers. Because of the power relationship, the responsibility comes to their advisors for supporting their needs and ensuring a healthy, constructive environment to promote a generative flow of original thought and expression. In our case, Jain had pre-established trust with two professor co-authors (Findlater and Froehlich), whom he has known for about five years. This allowed them to use pre-existing forms of communication and free expression.

Privacy vs. transparency: Effective first-person research requires a high degree of transparency and honesty [13,38]. However, disability is complex, personal and often stigmatized [41,50]. Disabled researchers performing this research may feel compelled to hide facts and nuances that could negatively affect them, their immediate family members, and their colleagues. While hiding intimate facts may be appropriate and necessary in some cases, fine-grained and evocative insights only result when subtleties are disclosed and discussed [13,38]. Hence, we encourage individual researchers to take the time to assess (and reassess as they move along this process) what balance between disclosure and privacy makes them comfortable.

CONCLUSION

We present a 2.5-year autoethnographic account of a hard of hearing traveler, examining his interactions with different cultures and environments, his relationship with assistive technology, and his usage of two self-designed technology

explorations to enhance his travel. Using our case as an example, we also motivate the need and offer considerations for accessibility researchers to conduct first-person research. In closing, we call to other researchers with disabilities to contribute their rich personal accounts, and use these insights to design personalized assistive technologies.

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REFERENCES

[1] Sumit Basu, Tanzeem Choudhury, Brian Clarkson, and Alex Pentland. 2001. Towards measuring human interactions in conversational settings. In *Proc. IEEE CVPR Workshop on Cues in Communication*.

[2] Cynthia L. Bennett and Daniela K. Rosner. 2019. The Promise of Empathy: Design, Disability, and Knowing the 'Other.' In *ACM Conference on Human Factors in Computing Systems*.

[3] Barbara Bodner-Johnson. 1991. Family conversation style: Its effect on the deaf child's participation. *Exceptional Children*.

[4] Ian Bogost. 2012. *Alien phenomenology, or, what it's like to be a thing*. U of Minnesota Press.

[5] Leah Buechley, Daniela K Rosner, Eric Paulos, and Amanda Williams. 2009. DIY for CHI: Methods, Communities, and Values of Reuse and Customization. In *CHI '09 Extended Abstracts on Human Factors in Computing Systems* (CHI EA '09), 4823–4826.

[6] Dimitrios Buhalis and Simon Darcy. 2010. *Accessible tourism: Concepts and issues*. Channel View Publications.

[7] Anna Cavender and Richard E Ladner. 2008. Hearing impairments. In *Web accessibility*. Springer, 25–35.

[8] Elizabeth Christie and Geraldine Bloustien. 2010. I-cyborg: Disability, affect and public pedagogy. *Discourse: Studies in the Cultural Politics of Education* 31, 4: 483–498.

[9] Juliet M Corbin and Anselm Strauss. 1990. Grounded theory research: Procedures, canons, and evaluative criteria. *Qualitative sociology* 13, 1: 3–21.

[10] Sally Jo Cunningham and Matt Jones. 2005. Autoethnography: a tool for practice and education. In *Proceedings of the 6th ACM SIGCHI New Zealand chapter's international conference on Computer-human interaction: making CHI natural*, 1–8.

[11] Jesper Dammeyer, Christine Lehane, and Marc Marschark. 2017. Use of technological aids and interpretation services among children and adults with hearing loss. *International journal of audiology* 56, 10: 740–748.

[12] Marilyn E. Demorest and Sue Ann Erdman. 1986. Scale Composition and Item Analysis of the Communication Profile for the Hearing Impaired. *Journal of Speech Language and Hearing Research* 29, 4: 515–535.

[13] Audrey Desjardins and Aubree Ball. 2018. Revealing Tensions in Autobiographical Design in HCI. In *Proceedings of the 2018 Designing Interactive Systems Conference* (DIS '18), 753–764.

[14] Paul Dourish. 2004. *Where the action is: the foundations of embodied interaction*. MIT press.

[15] Yao Du, LouAnne Boyd, and Seray Ibrahim. 2018. From Behavioral and Communication Intervention to Interaction Design: User Perspectives from Clinicians. In *Proceedings of the 20th International ACM SIGACCESS Conference on Computers and Accessibility* (ASSETS '18), 198–202. https://doi.org/10.1145/3234695.3241480

[16] Margot Duncan. 2004. Autoethnography: Critical Appreciation of an Emerging Art. *International Journal of Qualitative Methods* 3, 4: 28–39.

[17] Carolyn Ellis, Tony E Adams, and Arthur P Bochner. 2011. Autoethnography: an overview. *Historical Social Research/Historische Sozialforschung*: 273–290.

[18] Michele Friedner and Annelies Kusters. 2014. On the possibilities and limits of" DEAF DEAF SAME": Tourism and empowerment camps in Adamorobe (Ghana), Bangalore and Mumbai (India). *Disability Studies Quarterly* 34, 3.

[19] Richard S Hallam and Roslyn Corney. 2014. Conversation tactics in persons with normal hearing and hearing-impairment. *International journal of audiology* 53, 3: 174–81.

[20] Chia-Huei Ho and Hsi-Hsiang Peng. 2017. Travel motivation for Taiwanese hearing-impaired backpackers. *Asia Pacific Journal of Tourism Research* 22, 4: 449–464.

[21] Nicholas L Holt. 2003. Representation, legitimation, and autoethnography: An autoethnographic writing story. *International journal of qualitative methods* 2, 1: 18–28.

[22] Kristina Höök. 2010. Transferring qualities from horseback riding to design. In *Proceedings of the 6th Nordic Conference on Human-Computer Interaction: Extending Boundaries*, 226–235.

[23] Dhruv Jain, Bonnie Chinh, Leah Findlater, Raja Kushalnagar, and Jon Froehlich. 2018. Exploring Augmented Reality Approaches to Real-Time Captioning: A Preliminary Autoethnographic Study. In *Proceedings of the 2018 ACM Conference Companion Publication on Designing Interactive Systems*, 7–11.

[24] Dhruv Jain, Rachel Franz, Leah Findlater, Jackson Cannon, Raja Kushalnagar, and Jon Froehlich. 2018. Towards Accessible Conversations in a Mobile Context for People who are Deaf and Hard of Hearing. In *Proceedings of the International Conference on Computers and Accessibility (ASSETS)*.

[25] John J Kelway, Anke M Brock, Pascal Guitton, Aurélie Millet, and Yasushi Nakata. 2018. Improving the Academic Inclusion of a Student with Special Needs at University Bordeaux. In *Proceedings of the 20th*

International ACM SIGACCESS Conference on Computers and Accessibility (ASSETS '18), 52–56. https://doi.org/10.1145/3234695.3241482

[26] Ines Kožuh, Manfred Hintermair, and Matjaž Debevc. 2016. Community building among deaf and hard of hearing people by using written language on social networking sites. *Computers in Human Behavior* 65: 295–307.

[27] Annelies Kusters. 2017. When transport becomes a destination: deaf spaces and networks on the Mumbai suburban trains. *Journal of Cultural Geography* 34, 2: 170–193.

[28] Paddy Ladd and Harlan Lane. 2013. Deaf ethnicity, deafhood, and their relationship. *Sign Language Studies* 13, 4: 565–579.

[29] Christian Laesser, Pietro Beritelli, and Thomas Bieger. 2009. Solo travel: Explorative insights from a mature market (Switzerland). *Journal of Vacation Marketing* 15, 3: 217–227.

[30] Andrés Lucero. 2018. Living Without a Mobile Phone: An Autoethnography. In *Proceedings of the 2018 Designing Interactive Systems Conference* (DIS '18), 765–776.

[31] Michella Maiorana-Basas and Claudia M Pagliaro. 2014. Technology use among adults who are deaf and hard of hearing: A national survey. *Journal of deaf studies and deaf education* 19, 3: 400–410.

[32] John McCarthy and Peter Wright. 2004. Technology as experience. *interactions* 11, 5: 42–43.

[33] Bob McKercher and Simon Darcy. 2018. Re-conceptualizing barriers to travel by people with disabilities. *Tourism Management Perspectives* 26: 59–66.

[34] Muhamet Mehmetoglu, Graham M S Dann, and Svein Larsen. 2001. Solitary Travellers in the Norwegian Lofoten Islands: Why Do People Travel On Their Own? *Scandinavian Journal of Hospitality and Tourism* 1, 1: 19–37.

[35] Eleni Michopoulou, Simon Darcy, Ivor Ambrose, and Dimitros Buhalis. 2015. Accessible tourism futures: the world we dream to live in and the opportunities we hope to have. *Journal of Tourism Futures* 1, 3: 179–188.

[36] Matthew S Moore. 1992. *For Hearing people only: Answers to some of the most commonly asked questions about the Deaf community, its culture, and the" Deaf Reality"*. Deaf Life Press.

[37] Joseph J Murray. 2008. Coequality and transnational studies: Understanding deaf lives. *Open your eyes: Deaf studies talking*: 100–110.

[38] Carman Neustaedter and Phoebe Sengers. 2012. Autobiographical Design in HCI Research: Designing and Learning Through Use-it-yourself. In *Proceedings of the Designing Interactive Systems Conference* (DIS '12), 514–523.

[39] Carman Neustaedter and Phoebe Sengers. 2012. Autobiographical design: what you can learn from designing for yourself. *interactions* 19, 6: 28–33.

[40] Tanya L Packer, Tanya L Packer, Bob Mckercher, and Matthew K Yau. 2007. Understanding the complex interplay between tourism, disability and environmental contexts. *Disability and rehabilitation* 29, 4: 281–292.

[41] Phil Parette and Marcia Scherer. 2004. Assistive Technology Use and Stigma. *Education and Training in Developmental Disabilities-September 2004*: 217–226.

[42] Erin M Picou, Todd A Ricketts, and Benjamin W Y Hornsby. 2013. How Hearing Aids, Background Noise, and Visual Cues Influence Objective Listening Effort. *Ear and Hearing* 34, 5.

[43] Sebastiaan Pijnappel and Florian Mueller. 2013. 4 Design Themes for Skateboarding. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '13), 1271–1274.

[44] Yaniv Poria, Arie Reichel, Yael Brandt, D Buhalis, and S Darcy. 2011. Blind people's tourism experiences: An exploratory study. *Accessible tourism: Concepts and issues* 45.

[45] Mary R Power, Des Power, and Louise Horstmanshof. 2006. Deaf people communicating via SMS, TTY, relay service, fax, and computers in Australia. *Journal of deaf studies and deaf education* 12, 1: 80–92.

[46] Abi Roper, Ian Davey, Stephanie Wilson, Timothy Neate, Jane Marshall, and Brian Grellmann. 2018. Usability Testing - An Aphasia Perspective. In *Proceedings of the 20th International ACM SIGACCESS Conference on Computers and Accessibility* (ASSETS '18), 102–106. https://doi.org/10.1145/3234695.3241481

[47] Ulrike Schultze. 2000. A Confessional Account of an Ethnography about Knowledge Work. *MIS Quarterly* 24, 1: 3–41.

[48] Phoebe Sengers. 2011. What I Learned on Change Islands: Reflections on IT and Pace of Life. *interactions* 18, 2: 40–48.

[49] Kristen Shinohara and Jacob O Wobbrock. 2016. Self-Conscious or Self-Confident? A Diary Study Conceptualizing the Social Accessibility of Assistive Technology. *ACM Trans. Access. Comput.* 8, 2: 5:1--5:31.

[50] Kristen Shinohara and JO Wobbrock. 2011. In the shadow of misperception: assistive technology use and social interactions. *SIGCHI Conference on Human Factors in HCI*: 705–714.

[51] Per Koren Solvang and Hilde Haualand. 2014. Accessibility and diversity: Deaf space in action. *Scandinavian Journal of Disability Research* 16, 1: 1–13.

[52] Joshua G Tanenbaum, Amanda M Williams, Audrey Desjardins, and Karen Tanenbaum. 2013. Democratizing Technology: Pleasure, Utility and Expressiveness in DIY and Maker Practice. In *Proceedings of the SIGCHI Conference on Human*

Factors in Computing Systems (CHI '13), 2603–2612.

[53] Jacob O Wobbrock, Shaun K Kane, Krzysztof Z Gajos, Susumu Harada, and Jon Froehlich. 2011. Ability-Based Design: Concept, Principles and Examples. *ACM Trans. Access. Comput.* 3, 3: 9:1--9:27.

[54] Bencie Woll. 2012. Speechreading Revisited. *Deafness & Education International* 14, 1: 16–21.

[55] Alina Zajadacz. 2015. Evolution of models of disability as a basis for further policy changes in accessible tourism. *Journal of Tourism Futures* 1, 3: 189–202.

[56] Alina Zajadacz and Joanna Sniadek. 2013. Tourism Activities of Deaf Poles. *Physical Culture and Spots Studies* LVIII: 17–32.

[57] Why I won't "try on" disability to build empathy in the design process (and you should think twice…. Retrieved April 18, 2019 from https://blog.prototypr.io/why-i-wont-try-on-disability-to-build-empathy-in-the-design-process-and-you-should-think-twice-7086ed6202aa

[58] Liz Jackson's keynote - Interaction 19 – 3-8 February 2019 • Seattle, WA. Retrieved April 18, 2019 from https://interaction19.ixda.org/program/keynote--liz-jackson/

[59] Deaf Travel | Must-Read Tips For Hearing Impaired Globtrotters. Retrieved January 16, 2019 from https://jessieonajourney.com/deaf-travel/

[60] Deaf Friendly Tourism - Epoca360. Retrieved January 16, 2019 from https://www.epoca360.com/en/tailored-travel/deaf-friendly-tourism

[61] Deaf Travel – cestovatelský průvodce pro neslyšící. Retrieved January 16, 2019 from http://www.deaftravel.cz/

[62] What is real-time captioning? | UW DO-IT. Retrieved December 13, 2017 from https://www.washington.edu/doit/what-real-time-captioning

[63] Real Time Mobile Captioning For Hearing Loss - InnoCaption. Retrieved January 16, 2019 from https://www.innocaption.com/

[64] Amazon.com : Hey Mic! Bluetooth Microphone. Retrieved January 16, 2019 from https://www.amazon.com/gp/product/B075K3K8M3/ref=ppx_yo_dt_b_asin_title_o01__o00_s00?ie=UTF8&psc=1

[65] How Design for One Turns Into Design for All - The New York Times. Retrieved January 16, 2019 from https://www.nytimes.com/2018/01/24/arts/design/cooper-hewitt-access-ability.html