Understanding Experiences of Blind Individuals in Outdoor Nature

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ABSTRACT

Research shows that exposure to nature has benefits for people's mental and physical health and that ubiquitous and mobile technologies encourage engagement with nature. However, existing research in this area is primarily focused on people without visual impairments and is not inclusive of blind and partially sighted individuals. To address this gap in research, we interviewed seven blind people (without remaining vision) about their experiences when exploring and experiencing the outdoor natural environment to gain an understanding of their needs and barriers and how these needs can be addressed by technology. In this paper, we present the three themes identified from the interview data; independence, knowledge of the environment, and sensory experiences.

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CCS CONCEPTS

• **Human-centered computing** → **Accessibility technologies**; *Accessibility systems and tools*; • **Applied computing** → **Psychology**.

KEYWORDS

Assistive technologies; visual impairment; nature

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INTRODUCTION

There is growing evidence that spending time in outdoor natural environments such as parks and woodlands can have a positive impact on the mental and physical wellbeing and improve symptoms of stress, anxiety, and depression [9]. Furthermore, research shows that the digital augmentation of natural environments can encourage exploration and learning [8][6][1] about the plant and animal wildlife. However, the majority of existing HCI research on interaction with nature has focused on participants without visual impairments. There is a need to understand the experiences of blind and partially sighted individuals (BPSI) in nature and how they use technology to navigate, explore, and experience outdoor natural spaces to further investigate the role of technology as a facilitator for nature-based interactions for BPSI.

Instead of focusing on supporting experience in the natural environment, the focus of existing assistive technologies (AT) for BPSI has been to facilitate independent navigation in built indoor and outdoor environment [2][7]. Whilst these AT may be adapted for use in natural environments, their design does not support independent exploration. This narrow focus of technology for BPSI calls for a better understanding of what BPSI need, especially in an environment where exploration and enjoyment of the surrounding is the aim. While many of the sensor-based systems are in prototype stage, GPS navigation apps such as Apple maps, Google maps, Blindsquare, and Microsoft Soundscape have been used by BPSI to determine routes and information about their surroundings in unfamiliar urban environments with varied level of success. Barriers to using these apps, include the lack of accessibility information, inaccuracy of GPS location [10] [4].

In this paper, we present findings from an interview study with blind individuals which aimed to understand the experiences of blind people in natural environments and investigate how their engagement, learning, and exploration is facilitated by technology. The participants had severe (had

Table 1: Participants characteristics

	Gender	Age	Visual function
P1	Female	30-40	totally blind
P2	Male	40-50	totally blind
P3	Male	50-60	totally blind
P4	Female	20-30	light perception, colour contrast
P5	Female	20-30	light perception
P6	Female	20-30	light perception
P7	Female	20-30	light perception, colour contrast

light perception and could perceive shadows of large shapes) to total blindness (no light perception). The long-term aim of this research is to develop a technology to facilitate exploration and learning in outdoor natural environments.

METHOD

Interviews

To gain in-depth understanding of the experiences of totally blind individuals in open natural environments and how assistive technology can aid in improving that experience, we conducted interviews with seven individuals [P1 - P7] with congenital and acquired blindness, as referenced in Table 1. The interviews were conducted over the phone and Skype for convenience, but also to encourage interest from people outside London to participate in the study. Two of our participants were from the US, one from Northern Ireland, three from London, and one from South England. Semi-structured interviews were chosen to obtain in-depth insights about respondents' motivations and preferences for leisure activities in nature and barriers experienced. Respondents were asked generic questions about their experiences and further probed to think about specific experiences that encouraged curiosity and exploration of their environment and what they learned about their environment from these experiences. The interview data was transcribed and analysed using thematic analysis method [3] to elicit emergent themes.

RESULTS

Three main themes were identified from the interview data: Independence, knowledge of the environment, and sensory experience. Quotes from participants are presented in the sidebar referenced using anonymised participant identifiers [P1 - P7].

Independence

Independence emerged as an overarching concept. All participants emphasised the need to be independent in their daily lives when outdoors and while at home. In the context of outdoor nature, participants described feeling independent and free when in open natural space [S5] which inspired them to explore and get immersed in the environment without fear of traffic or colliding with other people [I1]. Participants reported that they preferred to explore the space without holding on to their sighted companion [I3]. Independence was also important in social settings. Participants described that being able to discover things on their own and sharing that with people around them was akin to equal contribution to social interactions [I4]. Within 'independence' the following sub-themes were identified: route learning and navigation and barriers to independence.

Sidebar 1: Quotes from participants

Independence:

I1: *"I like to be in front, so I don't have to worry about tripping anybody with my cane and I get to enjoy finding the path myself."*, P1

I2: *"On parts of the walk where it was flat and open ground, I let go of my guide and walked a few steps behind them so I could walk on my own following the sound of their footsteps."*, P6

I3: *"What I particularly like, is going out and exploring things on my own, not necessarily being guided by somebody."*, P2

I4: *"You rely on other people to tell you things all the time rather than discovering things and then may be telling them."*, P2

I5: *"It would just be liberating and fantastically independent. It would enable you to inform other people about things and have better conversations with those around you that can see. So, you can join in a bit more."*, P2

Route learning and navigation:

R1: *"I use echolocation. To me its invaluable. I use it all the time, every day. That's how I navigate because it helps me hear changes in the surface, where a wall ends, and when a tree or lamp post is coming up. If it's large enough and it's quiet enough, it works. If it's too noisy then echolocation doesn't really work."*, P3

R2: *"You ask your guide to point things out that might be clues [..]and there's a really nice big bush or something on the other side of the pathway which would actually be a much better clue for you to know that once you find that bush, within 10 meters you need to turn right or something."*, P2

Barriers to independence:
B1: *"The worst environment for a blind person is the wide-open space because of no point of reference to guide you. That can be quite demanding."*, P3

B2: *"Sometimes canes are highly annoying in grass because they'll get stuck and you end up hurting yourself with your cane and that's highly annoying for me."*, P5

Knowledge of the environment:
K1: *"I create a map in my mind in relation to myself and where I am. I think I do it subconsciously a lot because I didn't think about it. I even do it even in settings like in my house. There are environments that I'm familiar with but that's because I've mapped them out in my mind."*, P5

K2: *"I can usually get a feel of a place but sometimes I ask what kind of flowers are there? What kind? What colour are they? I've never seen colours, but I would probably ask what colour it is more than anything. I just like to get as much information as I possibly can."*, P5

K3: *"Other people really see what's in the distance and scenery and I like them to describe that to me."*, P1

K4: *"I do like to learn about the history of the place when I visit and if I know where I'm going, I try to find information online."*, P7

Route learning and navigation: Participants used various techniques when learning routes including echolocation - identifying nearby objects through sound echoes, tactile landmarks and clues on the ground while using long canes [R1], and audio descriptions from sighted guides. When visiting an unfamiliar place, participants asked their sighted companions or guides to describe the environment and indicate landmarks and clues such as rocks, trees, benches, and stream, which would be helpful in memorizing the route [R2]. Participants also discussed that a wayfinding technology would not only give them more confidence to independently explore the natural environment but also make social interaction with their companions more meaningful [I5].

Barriers to independence: Participants reported that the lack of landmarks and clues in open spaces such as outdoor natural environments make it difficult for them to confidently navigate the space [B1]. Another critical barrier was not being able to effectively use the long-cane to navigate the grassy area. Participants reported that the green space lacked the tactile sensation they need to navigate and was disorientating as they didn't know the correct direction to proceed and the ground itself was uneven and made it difficult to walk [B2].

Knowledge of the environment

All participants recognised the need to be accompanied by a sighted companion when outdoors in nature to spend time with friends and family who also acted as sighted guides. The social interaction between the participant and their companions included discussing common interest topics unrelated to the physical natural environment as well as the sights and occurrences around them [K3]. Participants were interested in knowing about the visual occurrences around them and inquired about the details such as size, colour, and distance in response to auditory and olfactory stimuli [K2]. P2, suggested that these descriptions are valuable in developing mental images and making the space and experience memorable. In addition to visual descriptions, participants were also interested in the historical significance of the places, specifically when visiting heritage sights [K4].

Sensory Experiences

Sensory experiences in natural environments assisted in sense-making and relaxing experiences for participants. The tactile and auditory changes in the walking surface, the sounds of flowing water, and the touch of breeze and sunshine on the skin helped in understanding the changes in the environment and served as navigation cues [S1, S3, R1]. Participants also reported as relaxing and provided relief from the busy urban environment [S2]. Participants highlighted the sounds of walking on the leaves and the grass, flowing water and of birds chirping above in the trees [S2, S3, S4] the feeling of fresh breeze and sun light on their skin as they walked between shaded and open areas. Additionally, participants also associated the experience of being in nature as rejuvenating and gratifying [S5].

Sensory experiences:
S1: *"I used to be able to see and I can't, there's things I never did see because I was never in these places. But I try to picture them so that I have a picture of the environment and the audio and tactile really adds to the experience."*, P1

S2: *"You hear the birds and there are no car noises, it was beautiful."*, P6

S3: *"When I first went to [place], it in the autumn, so the leaves were crunchy and I enjoyed listening to the sound as I walked."*, P7

S4: *"I love water, I love the sound of water, any sound of water [..] I would just sit by and, you know, it's [like] a lullaby."* P1

S5: *"It's [the] feeling [of being] in touch with the planet, a sense of freedom. It's about getting out into the weather really. So, you are experiencing rain and sunshine, the breeze and it just makes you feel alive, I suppose. And, it reminds you of the beauty and enormity of the planet and being in touch with real things. And it's very refreshing and relaxing and just to enjoy the variety of everything on this planet."* P2

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DISCUSSION

The findings from this study highlight a gap in the existing technology and HCI research in facilitating a meaningful experience for BPSI in outdoor natural environments. Consistent with the findings from existing HCI literature [1][5], the need for independence in outdoor natural environments was common across all participants. Participants regularly used navigation apps such as Apple maps, Google maps, BlindSquare, and Microsoft Soundscape to do their journeys in built environment. However, without accessible wayfinding information and lack of landmarks and clues commonly found in built-environment, participants found natural environments to be more physically and cognitively demanding and avoided visiting these places by themselves.

Beyond the need for independence, in natural environments, participants also highlighted the need for acquiring knowledge of the environment and sensemaking through sensory experiences. These needs were met by their sighted companion who described visual elements of the experience to facilitate learning about the environment but did not support independent engagement and exploration. Digital augmentation using sensor-based ubiquitous technologies has been found to be useful in encouraging people without visual impairments to explore and interact with natural environments [8][6]. These technologies predominately make use of the sense of sight, and an interesting opportunity exists for HCI researchers to think about way other senses can be used within the augmentation process, especially when sight is not present. Such solutions could be developed to encourage independent exploration and engagement with the natural environment for BPSI.

CONCLUSION AND FUTURE WORK

This paper extends our understanding of how BPSI experience outdoor nature and the barriers that limit these experiences. The results from the interview study highlight the need for independence, strategies to explore and learn about the environment, and the opportunities for technology to enhance engagement with nature. We are conducting more interviews and observations to further investigate the role of sighted companions in enhancing outdoor experiences for BPSI in addition to delivering audio descriptions. We are also designing a prototype to guide BPSI to landmarks such as trees, rocks, etc. to facilitate exploration and route learning which will be tested by BPSI participants in-situ. Through this research we aim to develop technology to facilitate independent exploration and learning for BPSI in outdoor natural environments.

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