Co-designing Inclusive Mobility
With Visually-Impaired and Sighted Children

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ABSTRACT
Children living with visual impairments (VIs) are increasingly educated alongside their sighted peers in mainstream rather than special schools. A challenge that arises in this context is how to design mobility technologies that are inclusive of both children with and without VIs. Here, we advocate an approach to blind navigation that also supports social interaction; emphasising that knowledge of a surrounding environment and how to navigate it should also include knowledge of opportunities for social encounters and engagements. To achieve this, our work combines field work and co-design to understand and address inclusive mobility challenges in mainstream schools.

KEYWORDS
Mobility; Inclusion; Social Navigation, Mainstream Schools; Education

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INTRODUCTION

There are over 25,000 children and young people with visual impairments (VIs) in the UK [8], and 70% are today educated in mainstream rather than special schools [9]. However, despite being physically included with sighted peers, recent research identified persistent issues with participation [11, 12], reduced opportunities for collaborative learning and social engagement [1, 4] and potential for isolation [6]. These challenges are in part due to the technical support that children with VIs receive in mainstream schools. In particular, assistive technologies are often designed to be used by children with VIs alone but not by their sighted peers. This can exacerbate the above issues and bring to the fore further issues of stigmatisation and technology uptake [2, 10]. Recent field work revealed that mobility and navigation feature among the typical issues that contribute to increasing stigma, isolation and reduced opportunities for social encounters in inclusive schools [6, 7]. An open research challenge that emerges in this context is whether and how designing mobility technologies capable of both mitigating a functional limitation and of supporting inclusive social interactions between children with mixed visual abilities could help address these issues. We suggest that a multi-disciplinary effort in the CHI community to address the challenges of blind navigation should also consider the dimension of inclusive interactions and incorporate elements of co-designing with both sighted and visually impaired people. We advocate an approach to blind navigation that places emphasis on supporting social interactions; emphasising that knowledge of a surrounding environment and how to navigate it should also include knowledge of opportunities for potential social encounters.

SOCIAL DIMENSIONS OF BLIND NAVIGATION IN INCLUSIVE SCHOOLS

In a series of interviews with teachers, teaching assistants (TAs), special educational needs coordinators (SENCos) and children with VIs, mobility was often described as “a huge issue”, particularly when children with VIs transfer to a new school where often they are trained only on specific routes [6]. In our experience, mobility issues in inclusive schools are likely to arise both inside and outside of the classroom. Inside classrooms, teachers may plan activities that involve moving around in ways that deviate from routine mobility, which can be challenging for children with VIs, e.g.: “a question is placed in each corner and they have to walk around from poster to poster and answer the questions” (SENCo2). Outside the classroom, there is a tendency of children with VIs to stick to familiar routes, which can lead to reduced opportunities for social encounters and reduced independence, especially at social times, e.g. between lessons and at break-times: “we were taking [a child with VI] over bits of the school that he doesn’t learn in, and he didn’t even know that those bits existed, he had no concept of the upper plateau, there is a huge field up there where pupils meet to hang out and play” (TA2). When probed about the utility of accessing areas outside routine routes, TA2 also highlighted a link between navigating physical space and the sense of safety and security: “it’s a larger space of security, [a child
with VI] feels very safe in school and if we expand that space beyond the corridors then he’s got a bigger space of safety that he belongs in, the sense of safety cannot be underestimated for those with a visual impairment” (TA2). Further, children with VIs may experience difficulties with finding their friends outside classrooms. In one instance, a TA relayed a real ordeal for a child with a VI: “we realised he was hitting quite a low patch and when we looked into it it was because he could no longer find his friend, he thought he no longer wanted to hang with him [... ] what had actually happened was that his friend had a new rucksack and he was looking for the wrong colour, it was such a tiny thing but it was making a huge difference” (TA4). These examples highlight that the challenges of mobility and blind navigation in schools include dimensions of social interaction issues, and that addressing these issues explicitly requires a move beyond traditional functional accessibility solutions to blind navigation.

CO-DESIGNING INCLUSIVE MOBILITY

We advocate the use of co-design as an approach to engage children with and without VIs and educators in the conception of novel inclusive mobility technologies. To do this, we developed a set of activities inspired by bodystorming [3], navigation with robots, and multisensory crafting.

Bodystorming

With bodystorming, children and their educators moved through school premises and reflected on challenges and potential solutions to blind and social navigation. The aim of these activities were to both engage children in a common design goal, and to educate sighted children about VI while fostering connections with the VI children [6, 7]. A key component was to centre the VI children as experts at sharing their own experiences to keep the immersion positive, safe, and respectful of everyone’s abilities. At times, sighted children would put on a blindfold and partner with a VI child who served as a human guide (Figure 1). The children toured the school environment, alerting sighted partners to sounds, textures, and spatial cues they use to navigate and play with the other children. The tours showed the sighted children that their VI peers could complete a task successfully, and it helped to demystify some of the specific techniques that children with VI have developed to navigate their surroundings. E.g. sighted peers discovered how to use echolocation and tactile exploration of floor textures as well as sounds produced by other children in the playground to navigate efficiently.

Navigation With and Through Robots

To explore the accessibility of maps and support the transfer of learning about spatial navigation from maps to the school environment, we ran a series of workshops using fictional inquiry [5] and activities with small educational robots called Ozobots (https://ozobot.com) (Figure 2). During the workshops, we engaged visually impaired and sighted children and their educators in experimenting with the Ozobots, with two main objectives: i) to learn about robots in general and Ozobot’s technology in
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In particular; ii) to explore how Ozobot could be redesigned and used for learning about spatial navigation in and out of classrooms. Children impersonated robots, drew schematics of imagined spaces and playground layouts and learned about path following, obstacle avoidance and sharing navigation instructions. In follow-up sessions, they customised these technologies to learn about space, planets and orbital paths to explore large scale conceptual navigation.

Multisensory Crafting

We combined bodystorming activities and interactions with and through robots with low-fi prototyping activities using multisensory crafting (Figure 3). Children and their educators crafted mobility technology that combined wearables in the form of bracelets and badges, walkie-talkies, and augmenting parts of the school with sensors, tactile flooring and interactive buttons. One group designed a bracelet that displays audio when the user encounters items and people of interest. Another group designed bracelets that included multisensory feedback of vibration, lights and smells, in response to items and people encountered in the environment. A third group decided to design vibrating wristbands that respond to sensors placed on items of interest around the school. They also designed olfactory buttons and a walkie-talkie device that can be worn as a badge and emits auditory guiding beacons to find friends. With Ozobots, children modified maps to include textured stripes, scented landmarks, as well as augmented robots with more features, e.g. ears so that they can “hear their master’s instructions”, with Lego blocks to be able to “add more stuff to them, like new super powers”, and with “woolly hats to avoid the cold” and to follow the robots’ movement by holding a hand above it. Overall we found that it was important for groups with mixed visual abilities to have multisensory prompts to trigger collaborative discussion and generation of ideas. These examples show the kinds of inclusive mobility technologies that children with and without VIs and their educators are interested in creating to address some of the challenges of blind and social navigation in mainstream schools.

CONCLUSION

There are interesting challenges when designing support for blind navigation in contexts of close encounters between visually-impaired and sighted people. In inclusive schools, our view is that it is important to move beyond considerations of functional support for blind navigation to consider support for social interactions, and to account for engaging social encounters around mobility technologies. In our work, we explore how co-design and multisensory interaction could be used to engage both children with and without VIs, as well as their educators, in the design of novel inclusive mobility technologies of this sort. We argue that our methods supported children with and without VIs to jointly lead design processes and to effectively conceptualise designs that reflect considerations for mixed visual abilities with potentials to bridge social disconnects in their shared learning environments.

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REFERENCES