Understanding the urban experience of people with visual impairments

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Summary

One of the major issues visually impaired people face in everyday is the difficulty to navigate the city independently, which has implications for their wellbeing and health. As part of a research collaboration with the Guide Dogs for the Blind Association and Future Cities Catapult, we have employed mobile Electroencephalography (mEEG) to study the urban experience of visually impaired people. Our pilot study demonstrates the potential of such methods to provide insights both through the analysis of data, but also by using the visualisation of emotional experience of the city as a tool for empathy.

KEYWORDS: mobile EEG; Emotiv; urban mobility; pedestrians; visual impairment.

1. Introduction

According to recent RNIB figures[1], in 2011 there were 1,865,900 people living with sight loss in the UK -- of which 223,500 live with severe sight-loss (blindness) -- a number which is expected to rise to a total of 2.4 million in the next twenty years. Visual impairments can have significant effects on physical, mental and emotional wellbeing of individuals and it is essential to maintain an independent and active life. In this context, as part of the Cities Unlocked project, our project with Guide Dogs for the Blind Association (henceforth Guide Dogs) and Future Cities Catapult applies novel research methods to investigate urban mobility and the experience of the city of blind and partially sighted individuals. The aim of this report is to present some key aspects of the ongoing study and highlight early results.

Walking and navigating in outdoor environments, including town or city centres, is a major part of an active lifestyle, but involves significant physical, mental and emotional challenges for visually impaired people: negotiating traffic, obstacles and street crossings, locating points of interest and mitigating difficulties. Secondary accessibility barriers also include the lack of appropriate signage or even

[1] RNIB Sight Loss Data Tool, version 2. Available at: www.rnib.org.uk/knowledge-and-research-hub-key-information-and-statistics/sight-loss-data-tool/Sight_Loss_Data_Tool_Version 2.0.xls

architectural features such as spatial or urban legibility. On a first level, this study aims to tie the cognitive, emotional and functional (usability) dimensions of urban mobility to contribute insights for the development of new designs and services. On a second level, using data and visualisations to portray the similarities and differences in the experiences of sighted and visually impaired people, aims promote understanding, empathy and perspective taking among designers, stakeholders and citizens in general.

Exploring these questions, this study applies a battery of novel sensing technologies, such as mobile Electroencephalography (EEG) using the Emotiv EEG (Mavros et al., 2012; Aspinall et al., 2013), measurement of skin conductance as an indicator of psychophysiological arousal, as well as activity and location tracking using smartphone devices. These sources of data were combined with qualitative methods, such as established questionnaires tapping on emotion (Matthews et al., 1990), wellbeing (Tennant et al., 2007) and spatial cognition (Hegarty et al., 2002; Pazzaglia and Debeni, 2001) as well as semi-structured interviews.

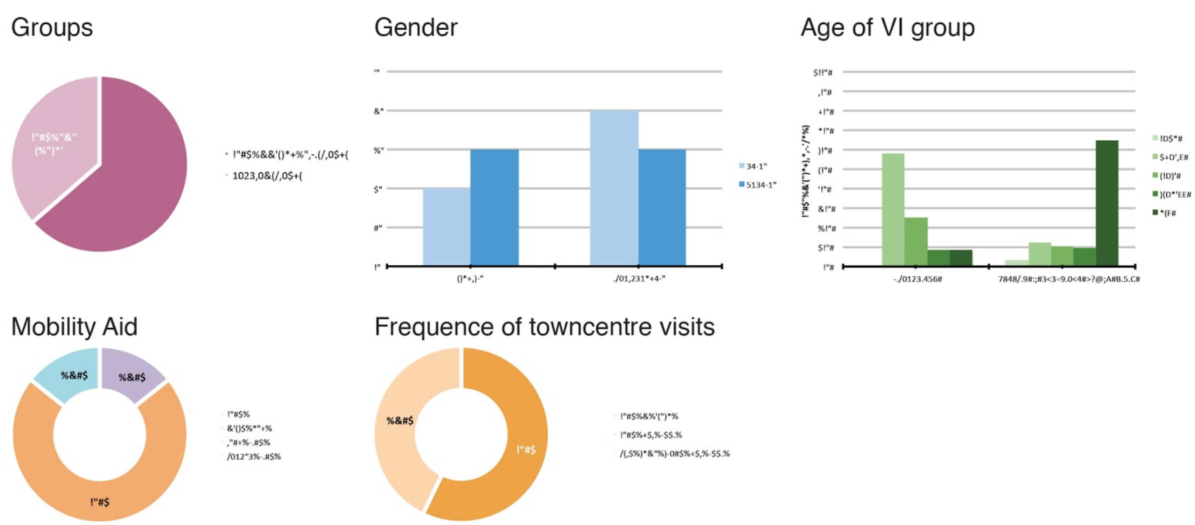

Figure 1: Basic elements of the study

2. The experiment

To understand how a visit to a familiar town centre environment (Bentzen et al., 2004) might affect people, twelve (12) sighted, partially sighted and blind volunteers (figure 1) were asked to complete various everyday mobility tasks, using their preferred mobility aid (long cane, symbol cane or guide dog) and then tell us in detail about their experience. Participants completed a circular, 1.8 km long ‘experimental route’ in central Reading. The route was designed to lead them through a variety of typical and everyday urban environments, such as streets with and without shops, a small park, narrow and wide pedestrian areas, like Broad Street, and use various controlled with various accessible pedestrian signals, as well as uncontrolled crossings (figure 2).

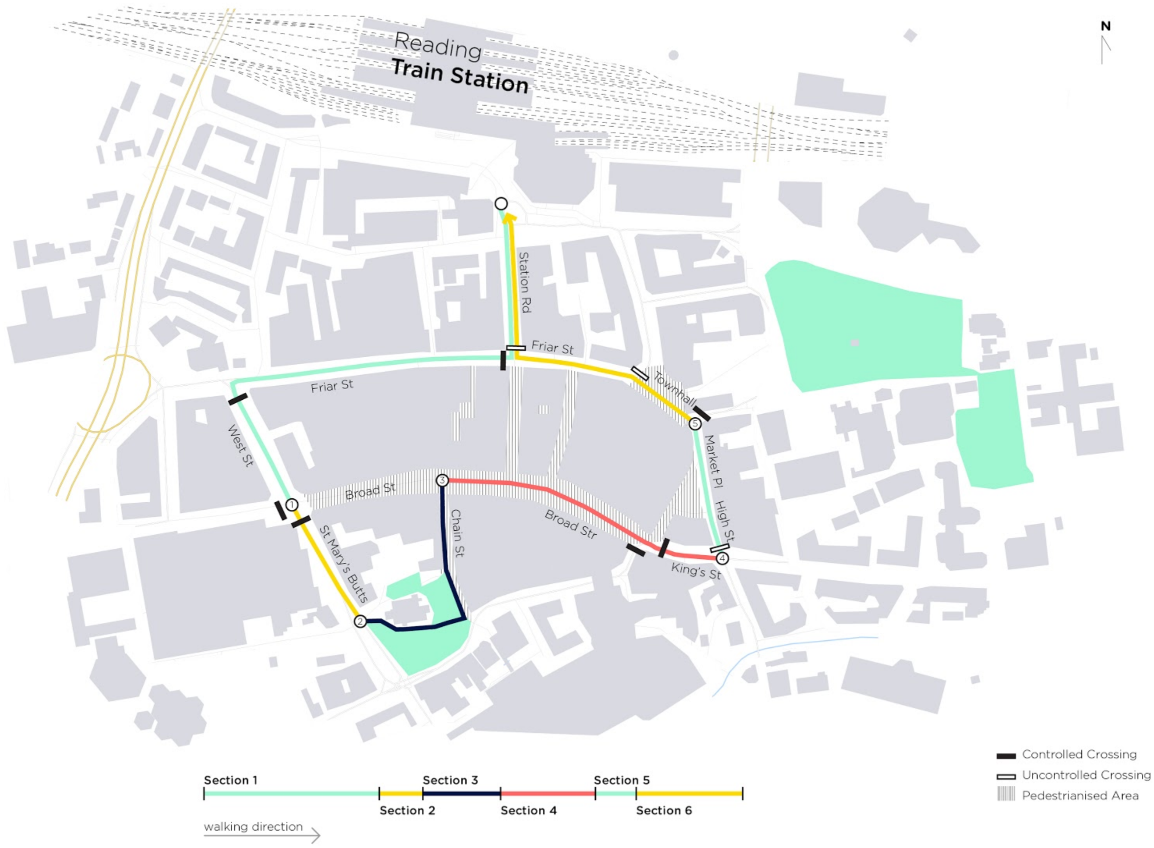

Figure 2: Map of the 1.8km experiment route. Participants were asked to walk a cyclical route starting and ending at Reading train station, through a series of instruction points (numbered). Black bars indicate the direction of controlled junctions, while empty bars indicate uncontrolled junctions that were traversed by participants.

3. Localising the urban affect

Initial analyses of participants' electrophysiological data (EEG) based on Emotiv's emotion detection algorithms, demonstrate the potential of these methods. Figure 3 shows maps of emotional states of visually impaired participants, aggregated per street, and allows us to explore the affective component of environmental conditions (e.g. motorised and pedestrian traffic) or the impact of open pedestrian areas. Further, figure 4 is a map visualising only the peaks of 'excitement', an EEG derived measure of arousal, and illustrates that crossing junctions as well as moments of verbal interaction with participants, stand out from the walking experience and can be easily distinguished through the data.

Further analyses will focus on the experience of streets segments versus junctions, and also compare the routes of the visually impaired and control group.

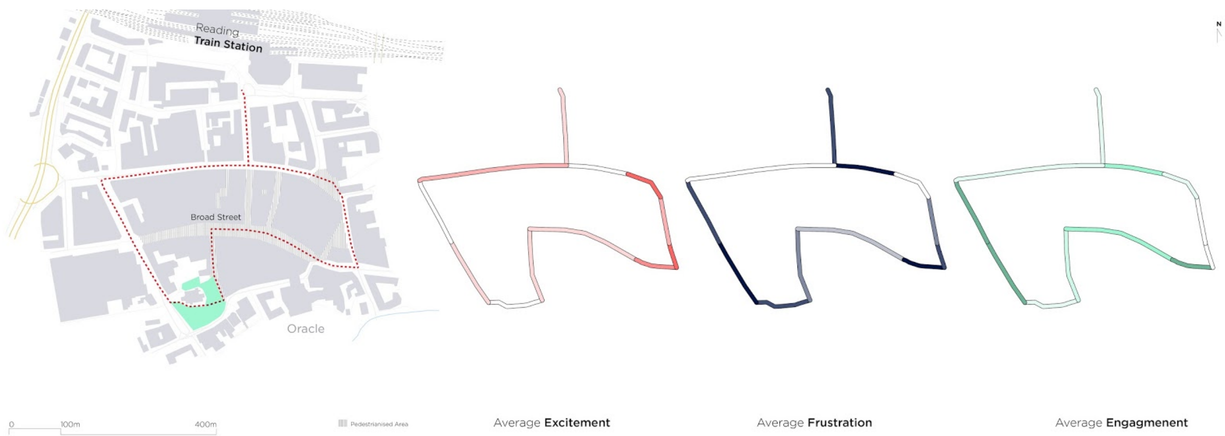

Figure 3: Emotional states of the visually impaired group of participants, aggregated by route segment.

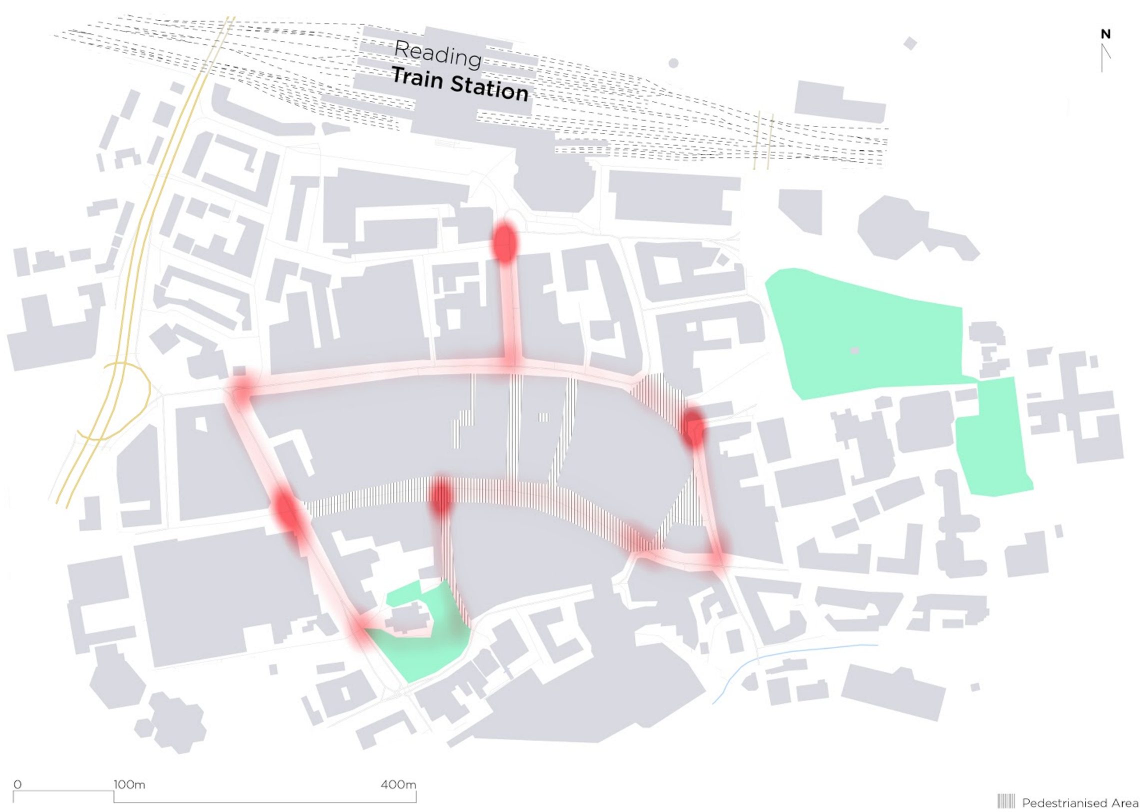

Figure 4: Aggregated peaks of 'excitement' of the visually impaired group of participants, occur at junctions and street crossings as well as points of social interaction (verbal communication, obstacles).

Analysis of the self-reported data, on the other hand, highlight other aspects of the mobility. Both groups seem to ‘agree’ that walking through a green area, reduces perceived stress, inline with theories about the restorative qualities of green and natural environments. However, in contrast to the control group, when walking through a large pedestrianised area, such as Broad street, visually impaired participants reported higher perceived stress. This could be explained by the increased numbers of pedestrians and lower number of tactile paving (drop kerbs, tactile paving) that can act as cognitive landmarks.

Further, observational and interview data confirm the stress-inducing nature of everyday incidents, such as negotiating unpredicted obstacles on pavements, including overhanging branches, cyclists or parked cars blocking crossings. Other factors, include inconsistencies in urban infrastructure, e.g. junctions that include both controlled and uncontrolled sections, or unexpected deviations from familiar walking routes, e.g. due to roadworks or bus stop changes. These factors need to be addressed by relevant stakeholders as they are known to contribute to feelings of stress, anxiety and spatial confusion, that often lead visually impaired people to limit their levels of independent activities (Kitchin et al., 1998).

4. Discussion

To conclude, our initial analyses of the data suggest that novel methods such as mobile EEG and emotion analysis can capture the multiple facets of exploring the city, highlighting significant points during our participants walks, such as street crossings and verbal interactions. Data from our longitudinal study demonstrate the potential of quantified-self applications, like activity tracking to capture the extends and diversity of mobility patterns. For our presentation at GISRUK we will include a fine grained and statistical analyses of the various collected data will seek to reveal spatial and temporal patterns, issues, similarities and differences in the experiences of multimodal urban mobility.

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6. Biography

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