Co-Motion

Summary: How can the built environment better support mobility and well-being in later life: mobility scooter pilot project

Background

Co-Motion was a three year project that investigated the links between mobility and wellbeing amongst older people. The project aimed to explore mobility and well-being for older people going through critical but common life transitions. One focus of our study was the impact of urban infrastructure design on older people and how it can affect their mobility. A sub-group who were considered in a pilot project were mobility scooter users. Mobility scooter use in the UK is increasing (RICA, 2014)[1] and whilst not all users are aged over 55 years this particular group may be more vulnerable to issues affecting their health and well-being. This summary highlights some of the main messages from this pilot project on how improvements to the built environment and how future designs of mobility scooters might better support mobility and well-being in later life. Further findings and outputs from the project will be published in the coming months.

Our approach

The aim of this pilot project was to provide an improved basis for understanding the issues faced by mobility scooter users and to obtain new information to enable more detailed studies on mobility scooters in the future that may lead to improvements in their design and operation.

Specifically, the project purpose was to:

- investigate the use of sensors and low cost mobile devices to record physical variables during their journeys;

[1] Research Institute for Consumer Affairs (RICA), 2014, Mobility scooters: a market study. http://www.rica.org.uk/content/mobility-scooter-research

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EPSRC Engineering and Physical Sciences Research Council

Lifelong Health & Wellbeing Research for Healthy Ageing

Funded by the Lifelong Health and Wellbeing cross-council programme.
Grant No. EP/K03748X/1

- measure how the urban environment relates to the well-being of participants; and;
- assess use of new technologies by older people.

The study took place in Leeds and York and used a novel approach mounting sensors on board mobility scooters in order to identify the physical and environmental characteristics and other associated issues faced by scooter users as well as enabling users to record their own experiences. Approximately, 25 journeys were recorded in the two cities made by 10 participants, which provided a baseline set of data for analysis.

Each participant received instructions and training on using the equipment and the survey was carried out over one week. They were invited to complete a post-trial questionnaire and the outcomes were fed back to them.

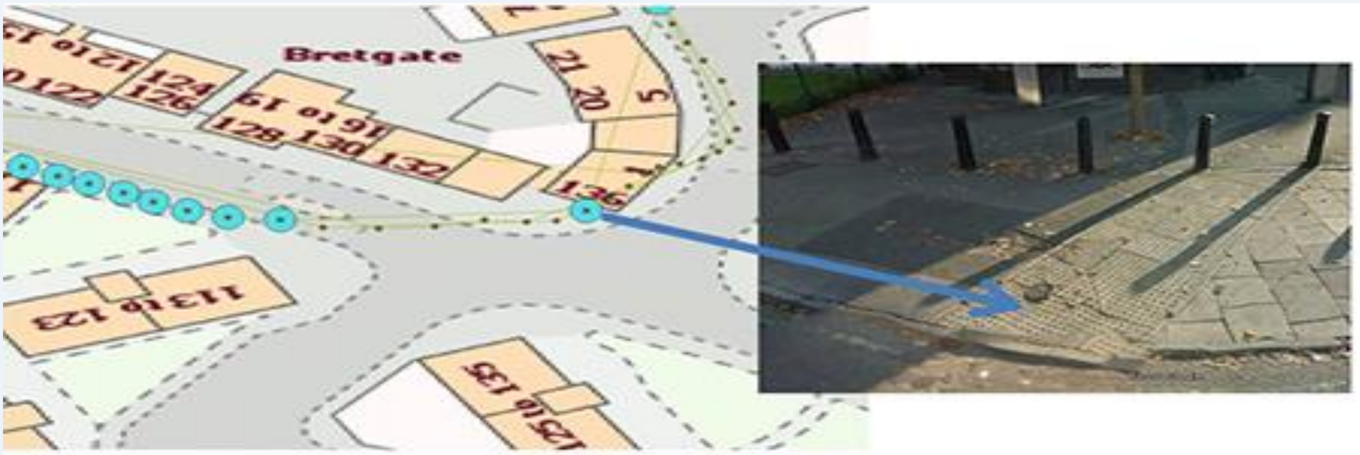
The sensors measured the geographic location of the scooter in order to map the routes taken. Motion was detected using an accelerometer which measures velocity in 6 axes. Air and noise quality data was also recorded using additional sensors. These were packaged in an easy to use battery powered unit that had a simple on-off button to start and end data recording. In tandem with sensing the environmental variables, an app was developed for a tablet which enabled participants to qualitatively record any positive and negative aspects of their journey that they experienced whilst undertaking a particular activity (shopping, meeting friends, trip to the countryside) as well as providing a measure of their well-being (happy, awake, alert) at the start and end of their journey. These provide some measure of the participants' mental and physical vitality and vigour. Preliminary data analysis has sought to ascertain whether a) the information collected by the sensors provides meaningful results on the physical and environmental journey characteristics b) these characteristics can be mapped spatially to identify what features are responsible and c) does the journey they take affect their wellbeing?

Main findings from the study

The pilot study recorded sufficient information across the two study areas to provide the basis for an initial understanding of the journey characteristics faced by the mobility scooter users. Some technical issues were experienced by mobility scooter users who were reluctant to record their journey experiences by using a tablet whilst moving. Instead they preferred to provide this information post completion of their trip.

Surface Roughness / Bumpiness

Pavement and road surfaces are one of the major factors affecting scooter user journeys. Poor quality and badly maintained paths do not provide enjoyable trips and can exacerbate other health issues that are often faced by scooter users such as chronic back pain. Potholes and broken paving slabs are also major hazards for scooter users. The cambers on roads and pavements also caused users to feel unsafe especially crossing driveways. The sensors employed on board the scooters were able to detect where these were geographically by comparing the data with Google Earth imagery.



Identification of rough surfaces (broken paving slabs) detected using sensor

In York, the historical infrastructure, which is inherent across the city, is not always conducive to scooter use. The Shambles for instance is a cobbled street, popular with tourists, but is comprised of a cobbled thoroughfare which is flanked by two narrow pavements crowded with tourists. Whilst from a historic conservation perspective there is little that planners might be empowered to change but for scooter users it would be a route that is best avoided. On the other hand planners can make differences (even in historic settings) as demonstrated by the newly paved area next to York Minster. The flat even surface here provides a nice experience for scooter users.

Distances

There were differences in the range that scooters users travelled. This depended on the person rather than their home location and depended on their needs and confidence in using the mobility scooter. For example, where they had access to local services such as shops their journeys tended to be shorter and quicker. In some cases the scooter user only felt confident doing the journey that they knew well and did not venture along new routes.

Weather

Weather played an important factor in the trial but is also one reason why some scooter users do not go out so frequently. There are often concerns about the pavements covered with leaves which can be a slip hazard to users as the wheels of the scooters often do not have enough grip. This is experienced more frequently on slopes (up and down). During the study in Leeds the inclement weather meant fewer trips were taken by some of the participants. Scooter users are often at the mercy of the weather and can be a barrier for them going out, especially during the winter months where snow could cause the scooter to become stuck; ice a major skid hazard; leaves reducing tyre grip, and, a lack of protection from the rain.

Air quality

A separate air pollution sensor (Dylos) on-board the scooter was used to measure particulate matter (PM2.5, PM10) to give a relative measure of air quality. Along the journey, the sensor counted the number of particles in the air at the same level as the scooter user indicating their exposure. The sensors calculated the number of particles every second and the data was geo-referenced and mapped to provide a relative measure of which locations along the route had better or worse air quality. Results showed where counts of air particles where higher so that hotspots could be identified. These naturally occurred along major roads and in particular where there was standing traffic. In York, a major hotspot was at York railway station where bus, car and taxi traffic is concentrated at this important interchange.

Noise

A noise sensor was incorporated in the unit mounted on the scooter. This measured relative noise (loud/quiet) not actual loudness values (e.g. decibels). These values were also geo-referenced and thus could be mapped. The York study clearly shows a difference between the pedestrianised area and one of the major roads running through the centre of York. Louder noise from passing traffic was identifiable especially along main transport routes and also at junctions where there was standing traffic. However, the sensor also recorded louder noise when the scooter went over bumpy surfaces.

App development

A bespoke app was developed for the project which enabled users to record perceptions about their journey and about their wellbeing in situ as they were actually taking their trip. The study showed that some older users were more conversant with the technology and happy to use it or were willing to embrace the use of technology, whilst others were more reluctant as they had not used apps before. The information recorded by the app was time-stamped so it could be synchronised with the data from the sensor. Ideally, participants would record information as they were moving (or stopped briefly to enter data in situ) so that this qualitative information could be geographically matched to the environmental data recorded by the sensor unit.

However, many users were reluctant to do this. The main issue here was the confidence in getting the tablet out whilst en-route to record information either for safety reasons i.e. not wanting to stop due to their position (on a busy street or at a junction) or for security reasons (fear of theft).

Use of the app to record user's journey experience

Future Research Directions

The pilot study identified a number of key areas of future research into improvements to urban planning as well as mobility scooter design that could provide solutions for improved wellbeing and mobility for scooter users. These have been categorised under three broad headings: technology, safety and accessibility.

Technology

There is great potential for improving mobility scooter users' experiences by developing and incorporating technology which could serve a number of purposes. Firstly mobility scooter technology which improves comfort and safety – collision detection, improved pneumatics and suspension, battery efficiency, and scooter stability. This kind of technology is often related to improvements seen in the automobile industry for example parking sensor technology which could be used for assessing potential collisions.

Secondly, technology can provide mobility scooter users with information about the accessibility of the areas in which they live in the form of maps identifying scooter friendly routes. These could include: the location of, and routing to, key services e.g. health services; notifications of where potential impediments to accessibility might be located e.g. steps; together with positive aspects of urban spaces where scooter friendly shops or buildings are located.

This information could be provided by an advanced dashboard which is linked to a range of location-based information providers as well as to social media channels which could act as a support network for users identifying areas to avoid such as crowded areas.

A dashboard would also be able to display information measured from sensors attached to the scooter which could include the status of the vehicle such as battery charge, range, and servicing required e.g. brakes. Other safety information could also be displayed e.g. for many scooters there is a 'maximum gradient' which is the steepest slope that they can safely be used on.

Safety

There is no legal requirement for scooters to be serviced and often users do not take into account how roadworthy their vehicle is when using it. Brakes and tyres (grip, pressure) are potential causes of accidents. As scooter users are not required to service their vehicles they are potentially unaware of any defects or faults in them. This is an important issue as there is a large second hand market for mobility scooters which is unregulated.

There is often little knowledge about the law on the permissible speeds for scooter users and where they are able to go (Rica 2014). UK legislation restricts the speeds that mobility scooter can travel depending on the type of vehicle and whether they are travelling on road or pavement. Typically, this is 4 miles per hour (mph) on pavements and 8 mph on roads. On many scooters these maximum speeds can be selected via a switch on the scooter steering column but relies on the user switching this on.

Accessibility

During the Co-Motion project respondents reported on a number of barriers to movement such as advertising boards, street furniture and other negative features such as bollards and barriers which are placed to deter motorcycle users. Pavements are sometimes difficult to navigate due to the location of dropped kerbs. Often, a corresponding dropped kerb is not found on the opposite side of the road and as a result forces the scooter user onto the road which is both inconvenient but also a safety issue.

It is also apparent from the study that scooter users' knowledge about accessible routes take time to evolve and this is gained with experience. However, this knowledge is not always easy to share. For instance, routes taking scooter users away from congested areas (both pedestrians and road vehicles); routes which are accessible where scooter users don't end up at a dead-end or are faced with a steep slope to ascend or descend; and routes which have particularly sloping cambers. In the study users often identified accessible routes by taking the route with another person (walking) to check that it is suitable or through sheer adventure and going as far they could before coming to dead end or some other physical barrier.

The sensors on board the scooters have been able to identify where surfaces can be a problem for scooter users. Whilst this is based on only a small number of journeys it demonstrates the potential for creating route maps for scooter users to avoid the worst areas. This could be incorporated with the noise and air quality sensor data to provide additional layers to plan routes.

Metropolitan and local authority planning departments and highways agencies need to consider the increasing number of mobility scooters in the future. For example town centre re-development should use suitable surface materials that are safe and hard-wearing. They should provide better signage to indicate whether routes are suitable for different types of users (of all ages) not only mobility scooters. They need to re-assess the location of traffic restriction and pedestrian furniture to enable scooter user access.

About this Study

Led by the Centre for Housing Policy, the research Consortium includes the Departments of Computer Science and Health Sciences and the Stockholm Environment Institute at the University of York, as well as partners at the University of Leeds; Newcastle University; Northumbria University; and the Bradford Institute for Health Research. The Co-Motion project commenced in 2013 and finished in January 2017.