GPS-based navigation in the everyday life of blind users

Naomi Justason¹, Jutta Treviranus², Laurie McArthur² and Jorge Silva²

¹Department of Occupational Science & Occupational Therapy, University of Toronto, ²Adaptive Technology Resource Centre, Faculty of Information, University of Toronto

Purpose
The purpose of this study was to explore the benefits and limitations experienced by individuals with visual impairments as they navigate throughout their everyday environments using GPS-based tools.

Background
- Global Positioning Systems (GPS) and GPS-based services are being widely used by blind pedestrians as a means to obtain timely and appropriate information relevant to a particular goal (e.g. reaching a destination).
- Although a number of studies demonstrate the usefulness and accuracy of GPS-based navigation tools for individuals with visual impairments, information on the effectiveness, potential and limitations of such tools in the users’ natural environments is still insufficient.

Method
- 3 participants were recruited under the following inclusion criteria:
  - Over the age of 18
  - Experience blindness
  - Use at least one navigation aid (i.e. white cane and/or guide dog), and
  - Currently use or have used in the past a GPS-based navigation device
- Through an ethnographic study design, the following was carried out with each participant in order to gather a clear understanding of their everyday experiences:
  - An observational trip on a familiar route
  - An observational trip on an unfamiliar route, and
  - A semi-structured follow-up interview
- Information was clarified and confirmed with participants through the process of member-checking during a follow-up interview. Once confirmed, the data was used to identify key benefits and limitations of navigating with a GPS-based device.

Findings
Common themes among all participants:
- GPS-based device is primarily used for:
  - Navigation on unfamiliar routes, and
  - Confirmation of direction and location on familiar routes.
- Identified limitations:
  - Nine metre range of error
  - GPS reception affected by poor weather conditions and tall buildings
  - The set-up and use of a GPS-based device can be difficult for someone who is not experienced in using technology
  - GPS-based devices are unable to detect barriers
  - “Everything will have limitations...it all depends on what device or mobility tool you use.”

Individual benefits:
- The GPS-based device:
  - Provides information on the user’s location and direction which other mobility aids, such as a guide dog or white cane, cannot provide
  - Provides information that would be needed in an emergency situation to direct emergency officials, or to phone for help when lost
  - Assists in familiarizing with a new environment. One participant stated that it was “like a dream” to use the GPS-based device when moving to a new city.
  - Eliminates the need to use compensatory strategies such as counting steps to particular destinations or asking others for direction
  - Provides information on upcoming intersections

Findings (cont)
Preferred features:
- The ability to create a route that provides directions while travelling
- Recognition of streets allowing the user to be sure of the location of points in relation to their current position
- The option of inputting custom points of interest
- All participants recognized that benefits, limitations and preferred features highly relate to the user’s skills and context
- “A limitation is only a limitation if you require it.”

Discussion
- GPS-based devices are beneficial for the user with a visual impairment to provide direction, safety and independence
- Benefits, limitations and preferred features are highly subjective
- When considering a GPS-based device for an individual with a visual impairment, a holistic approach must be taken in considering their environment, lifestyle, needs and skills
- All mobility aids have their limitations and thus the GPS-based device must be used in conjunction with other tools and strategies for navigating safely and effectively
- Further qualitative data is required in order to broaden the understanding of individual experiences of navigating with a GPS-based device in individual contexts with various GPS-based devices

References

Acknowledgements
This study was conducted through the Adaptive Technology Resource Centre (ATRC) with funding provided by Bell University Labs.
Participant recruitment was done in partnership with Synthetic Imaging Research Inc. (SIRI).

For Further Information
Please contact naomi.mitchell@utoronto.ca or jorge.silva@utoronto.ca

Figure 1. Schematic diagram of typical navigation aids used by people with blindness. Seeing-eye dogs and canes are primarily used for object detection and hazard avoidance while GPS gear may be used for location and direction.