Are We There Yet?
Developing a device to help people with vision impairments navigate indoor facilities

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Abstract
People with vision impairments have a hard time traveling indoors and usually require a companion. Technology could help people with vision impairments travel more independently while enjoying their experience. We are investigating what are the optimal features of a navigation device for people with vision impairments in indoor facilities.

1. Introduction
Travel is extremely difficult for blind people. Independent travel in a new environment for blind people is at best stressful and at worst dangerous or impossible. Sighted people constantly receive information visually, but blind people do not have access to that information. Identifying a service worker, reading a menu, and locating a restroom are relatively simple tasks for sighted people but are extremely difficult for blind people. Blind and sighted people navigate very differently, and often sighted people do not give the proper instructions to help blind people navigation [1].

Technology could provide auditory information, so that blind people could travel independently, safely, and confidently in new facilities. There are GPS devices that can provide auditory information to get from one place to another. Technology has been able to help people with vision impairments through more accurate orientation, obstacle detection and avoidance, and real-time and virtual wayfinding [2]. However, this technology still does not help people navigate inside a building. For this new indoor navigation device, it is important to know what and how much information is optimal. The device should not bombard the user with unnecessary information but should give useful information that the user would like to receive. We are researching what is the optimal type and amount of information the device should provide.

2. Methodology
Before participants begin the study, they will be asked to complete an online survey about their typical day, their usual navigation habits, and their technology usage. The study will take place at the Gallery at Harborplace.

Figure 1. Gallery at Harborplace

The study is a "Wizard of Oz" study, meaning the participants believe they are using the actual programmed device, but a researcher is really controlling the output. This enables us to test the main features of the device before the product is finalized. We are simulating the device in order to determine what are the best features to go into the actual product.

Participants will be told that they are testing a prototype of the device. The device will actually be a researcher communicating through an iPad. Participants will first travel to certain locations while testing only the navigation features of the device. Then, they go to several other locations while receiving navigation instructions and information about the surroundings. After these two sessions, there is a check-in where the researcher asks them questions about their experience with the device. When the check-in is finished, participants do travel to several other locations and only receive navigation instructions unless they ask the device for more information. There are also several tasks that the participants attempt while using the device, including throwing a coin in a fountain and buying a water bottle. There is a final interview at the end of the study to see what they thought about the device.

Figure 2. Pilot Participant

There is a lot of technology used to simulate the device and record the study. We used an app called Proloquo2Go to generate speech for the device. Using transmitters and receivers, two researchers are able to hear the participant and Proloquo2Go in real-time. One researcher (the observer) can hear the participant and Proloquo2Go via the recording device that has receivers connected to both the wireless microphone on the participant and the iPad. That researcher is also wearing a GoPro camera and has it fixed on the participant at all times. The other researcher (the wizard) controls Prolquo2Go and hears the participant via a receiver to the wireless microphone and the iPad via headphones connected to a splitter. The splitter enables the iPad to use a transmitter for other people to hear the Proloquo2Go and the wizard to hear the iPad. All of the audio and visual data is later compiled into one movie file that includes split screen videos of the two different views.

3. Conclusion

We have run several participants in this new study and found overwhelmingly positive results. The participants love the device and repeatedly express how much independence it would give them. They would use the current device as it was presented to them. There were certain tasks that were difficult for them to accomplish using the device, but it was still worth it for them to gain independence. Participants often went to the wrong side of the escalator, so it took them longer than it would take sighted people to get on. While using the device, it also took the participants longer that it usually takes sighted people to find the elevator buttons and the basket with water bottles. However, even with these challenges, the main concern the participants had was cost. They definitely wanted to buy the device but some were not sure they could afford it. Thus, technology has to continue to make such a device more affordable or health insurance would have to cover it.

4. Future Work

Generally, people like the device a lot, but so far there was a small sample size. More participants should be tested to determine the kinds of questions participants ask the device and obtain more feedback about the features the device should have. Additionally, researchers should look into how to make certain tasks easier. For example, participants might like to know heights of certain objects to make it easier to find them. The technology also has to continue to develop. Facial recognition and the ability to read are features that would be extremely helpful, so the software for these capabilities should be improved.

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