Demo: Trails for Everyone

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ABSTRACT
In this demo we present an inclusive tourist application that guides users along a forest/nature trail. The user points their phone in different directions and gets vibration feedback when the phone is pointed towards the target. In addition, the vibration feedback provides the user with information about the distance to the target. At a point of interest the user gets information through voice/speech and images. The application also implements accessible buttons that can be used both by sighted and visually impaired users.

Categories and Subject Descriptors
H.5.2 User Interfaces, Auditory (non-speech) feedback, Haptic I/O

General Terms
Design, Human Factors

Keywords
Navigation, multimodal, augmented reality, non-visual, inclusive.

1. INTRODUCTION
The introduction of compasses in more and more hand held devices has opened the way for applications making use of pointing gestures to provide information about objects or locations in the real world. With geo tagged information on a device which knows where it is (through GPS or other means) and also knows in which direction it is pointing (through a compass) it is possible to show the user information on important buildings, restaurants, future or past events etc etc in the direction the device is pointing (http://layar.com). Using non-speech sound or vibration in a handheld device to guide pedestrians in a wayfinding situation has been studied previously but not extensively. One group of proof-of-concept systems make use of spatial audio for navigation purposes and thus require headphones. AudioGPS by Holland et al. [1] displays the direction and the distance to a target uses stereo together with a repeated fixed pitch tone and a repeated varying pitch tone to give the user the directional information. A Geiger counter metaphor is used to convey distance from target (more frequent tone bursts the closer to the target the user is). In gpsTunes created by Strachan et al. [2] the user's preferred music was placed with spatial audio to provide bearing and distance information. As long as the user kept walking in the direction of the goal, the music was played at the desired volume. Stahl's The Roaring Navigator [3] guides visitors at a zoo by playing the sounds of the three nearest animals. The system also uses speech recognition for interaction and speech to display further information about the animals to the user. Jones et al. modify the volume of music stereo playback to guide users toward their destination in the ONTRACK system [4]. Their field trial also showed that visual distraction may interfere with audio guiding.

The AudioBubbles concept by McGookin et al. [5] is similar to AudioGPS, but does not require the use of headphones. The context is somewhat different in that is not specifically targeted to navigation, but to support tourists to be aware of and locate points of interest while wandering freely. The SoundCrumbs application described by Magnusson et al. in [6] enables the user to place virtual spheres of sound in a virtual georeferenced system and locating them again to support finding ones way back to a starting location, or to create virtual trails to share with others. It is possible to locate the next soundcrumb on the trail by pointing - when the magnetometer points in the direction of the next sound crumb, it will be played with adjusted volume, depending on whether the user points directly at the target or beside it.

Instead of using audio as a beacon at the target, tactile feedback such as vibration has also been used. Ahmaniemi & Lantz [8] similarly use vibratory feedback to investigate target finding speed in a laboratory set-up. The Social Gravity system described by Williamson et al. [9] intends to guide a group of people toward a common meeting point, called a "centroid" that adjusts its position according to the individual members of the group, using vibration feedback. In the SweepShake system presented by Robinson et al. [7] the user point in a direction and receives vibratory feedback when the device is pointing at the target. The targets are different in size depending on their information content (a larger target indicates more information content) and the use case described is primarily browsing and selecting geolocated information while standing still. The SweepShake was then evolved to support users' navigation as described in "I did it my way" [12]. The Tactile Wayfinder [13] explores the use of a vibrating belt to give directional information. PointNav [14] gives both orientation and navigation support through vibrations and speech feedback. For more exploratory navigation, different kinds of soundscapes have been created by communities or artists. The Urban Sound Garden [15] and the Tactical Sound Garden [16] are two examples.

As is shown by the "Lund Time Machine" application [17], non-visual augmented reality applications allow users to keep focus on the environment. In addition, the non-visual design approach makes these applications suitable also for persons with visual impairments. While the above mentioned work has been designed for urban environments (streets, open squares, parks etc), all designs that do not rely on routing/street-names could (at least potentially) work also in forest/hiking applications. Because of this we wanted to investigate how the design used in [17] could be used also in the forest/hiking type environment.

2. Application design

The guide application is based on the Lund Time Machine app (developed for Android 2.3). It uses GPS positioning and compass orientation to guide a tourist along a trail by tactile guiding (vibrations), and displays relevant information at the points of interest. When arriving within 15 meters of a point of interest, an information screen is displayed and a sound file with recorded speech plays automatically. An example of such an information text:

There is a legend about the "well-man". He was said to be a small, elf/goblin like figure who made sure there was fresh water in the well. He would get angry if the well was flooded, and could hit kids who got too close to the well. A boy born 1942 was warned about the well-man by his mother – and in addition the boy was told that if he swore he would grow horns and a tail. That boy pictured the well-man as a small devil. The well-man is now nearly extinct – he is almost forgotten!

The text is accompanied by a picture (Figure 1). To get to the next point the user either presses the "next point" button or shakes the phone. The application allows for multiple choice questions related to the place (results are given at the end of the trail).

Figure 1. Images from different parts of the trail. Geography, biology, history as well as fairy tale content is used.

By using the mobile phone as a scanner (pointing with it in different directions), the participant will get feedback in which direction to walk (Figure 2). When the phone is pointing in the direction of the next point of interest, within an angle of 60 degrees as recommended in [18], the phone vibrates with 3 short bursts. As the user gets closer to the target, the pulse trains of 3 bursts are repeated more often. The pattern of 3 bursts is always played until its end, to avoid getting borderline effects when exiting the 60 degree target angle. The pattern starts anew when the user goes outside the target angle and then re-enters it again. The calculations of the frequency of bursts is based on the actual distance to target, but also on a distance zone, so that the frequency increase in part becomes "stepwise" in the three zones *near, middle* and *far*. The vibration pattern design has been iteratively and systematically evaluated before the reported work [19]. The application allows the playing of ambient sounds at locations along the trail, something which can be used to enhance the environment with sounds from the past.

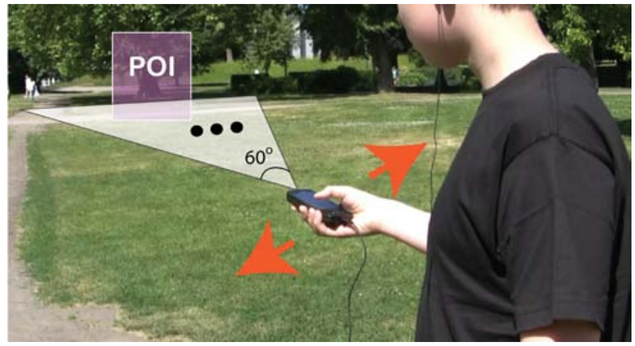

Figure 2. Pointing the phone in the right direction provides vibration feedback

The application also has an accessible button design which is designed for both sighted and visually impaired users (in contrast with the iPhone voice over). These buttons are described in the next section.

3. ACCESSIBLE BUTTONS

The application makes use of the HUI buttons available in the HaptiMap toolkit (http://www.haptimap.org/downloads.html). These buttons are based on the design used and tested already in the PointNav application [14]. In a screen with such buttons you slide your finger over the screen. When you pass over a button border you feel a vibration, and when you are on a button you will hear the name of it. Selection occurs when the finger loses the connection with the screen (select on release). This implementation works seamlessly for a sighted user – touching buttons the usual way selects them, but also allows a visually impaired user to use the interface.

4. CONCLUSION

This demo presents an inclusive guide app that takes a person along a hiking/nature trail. The basic design concepts have been tested in [14] in a park environment showing that it is possible for a blind person to use this type of design to locate goals and also to make use of the accessible buttons. The current trail will be tested during the summer of 2012 by groups of tourists visiting the trail area. Preliminary tests with children (5-6 years of age) showed that the application has attraction also for young kids, although they use it differently: they were not interested in the content, but used it in a treasure hunt fashion – as soon as they reached the point they considered this "mission accomplished" and shook the phone to go to the next point (not stopping to listen to the voice telling them about the place). Although the trails have not yet been tested by very many persons, the preliminary testing done indicates that these types of trail applications can be used to create inclusive trails that appeal to a wide variety of users.

5. ACKNOWLEDGMENTS

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