Soundcrumbs – Hansel and Gretel in the 21st century

Charlotte Magnusson, Björn Breidegard, Kirsten Rassmus-Gröhn
Department of Design Sciences, Lund University
P.O. Box 118, 221 00 Lund, Sweden
charlotte@certec.lth.se, bjorn@certec.lth.se, kirre@certec.lth.se

ABSTRACT
This paper presents a novel application which implements a way of adding sound breadcrumbs to the environment. We report results from initial user tests which suggest that this type of design could be useful for a wide range of mobile location based applications.

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Audio, tactile, navigation, GPS.

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION AND RELATED WORK

Many GPS services today allow users to track their positions in a way that is described as leaving a band of breadcrumbs behind. And one can follow these back if one gets lost. The normal way to present these breadcrumbs is to show them visually as a sequence of dots on a map.

On screen presentation of location information has been extensively studied (eg. [1], [2]), while there are fewer studies directed at auditory navigation. In general, non-visual interaction has been studied most extensively for persons with visual impairements (eg. the Swan project [3] which looks at different ways of sonifying route and contextual informationfor visually impaired persons). In [4] an Audio GPS intended to be used by sighted persons was explored. In gpsTunes [5] the music a person listened to was modified in order to provide bearing and distance information. In [6] different animal sounds were used to guide visitors in a zoo. In [7] a concept of how very precise location information might be used to generate and experience sound trails in the environment is presented – although this is more of a mock up (Wizard of Oz) to illustrate the idea. Except for the last, all these systems use spatialized audio which makes it necessary for the user to use headphones. [7] appears not to make use of spatial audio, but in this concept the trails are given as lines and not as “crumbs”. In the present small study we are interested in making use of mono sound for the interaction in order to explore how this works for the presentation of a sonified breadcrumb trail.

SOUNDCRUMB IMPLEMENTATION

The soundcrumbs applications is implemented so that a user can attach different sounds to locations on his or her trail. We have implemented the program in c++ and it runs on Windows Mobile phones (HTC Touch Diamond and Sony Ericsson Xperia have been tested). To get a compass heading we use the magnetometer in a SHAKE device [8] which is connected to the phone through Bluetooth. The sounds used in this first version are recordings of both musical loops and environmental sounds, but in the future we envision that the user could select the sounds himself/herself. Each sound is centered in a 20m circle around the selected GPS position. To test the concept we used ten fixed sounds which were compiled into the application. The visual presentation of where the crumbs are located can be seen in figure 1. The scale is different in the different circles, so the inner circle contains points 0-30 m around your position, the next segment contains the distances 30-100 m and the outer segment contains the range 100-500 m. Points further away than 500 m are shown on the outer circle. For testing purposes the screen also displays the distance from the first crumb in the sequence.

Figure 1. The on screen interface

To place a sound in the environment the user presses a button on the device. Since only ten sounds are available one starts over again on the first sound after having placed the tenth (this will be changed in future versions). By walking, the user will hear the sound of a crumb if he is close enough to the crumb location. The volume is zero 20 m from the point, and increases linearly towards the center where the maximum volume is heard (this is in contrast with [4] where a Geiger counter metaphor is used). You begin to hear the sound weakly at around 16 m, and inside a

circle of 5 m you hear it quite well. To get a bearing towards the next crumb the user can press a button and use the device to scan for it. As long as the button is pressed the sound of the next crumb is played but the volume depends on how you point the device. When you point the device towards the position of the next crumb you get the maximum volume (the angular span is +/- 15 degrees). Outside this (between +/- 45 degrees) the volume is 40% and up to +/- 90 degrees the sound is played at a 20% level. The user can choose to go forwards or backwards along the sequence. The crumb positions are saved to a file, which can be read by the application later. This makes it possible also to record a trail and use it at a later time.

TESTS

This implementation has been tested informally by one sighted person and one blind person. The test with the sighted person showed that the basic functionality worked as intended. It was also interesting to note that although the sound played was in mono, the fact that the sound feedback was changed by the movements made by the user gave rise to a spatial effect – they user reported having felt as if walking through "spheres of sound". Suggestions that this could be used for creating spatialized musical compositions or for games (and also geo caching) were made. The sighted user tested the scanning function, but in most cases preferred to make use of the visual interface for figuring out which direction to go.

The blind user tested to follow a pre designed trail. This test showed that it was in general possible for this person to follow the trail (also when the trail led across a lawn instead of along the foot path) although there was some problems at some points with weak sounds and GPS update. Still, the user was able to follow the trail and return to the starting point, and expressed that this was a "cool" experience – and that she would like to share such trails with friends.

CONCLUSION

In this small study we have implemented an application which allows the creation of audio breadcrumbs or "soundcrumbs". The application has been tested informally with two users and shows great potential both for creating spatialized sound experiences and for practical navigational use (particularly in less structured environments). Some points of interest for future work:

The fact that the audio was modified by physical movement created a spatial experience – the user reported that it felt as if walking through spheres of sound.

The granularity of the sound feedback was well adapted to the GPS accuracy. Exact statements such as "turn here" often annoy people when they come at the wrong position, but here the sound design allowed for GPS inaccuracies (except in one case during the test with the blind user when the GPS stopped updating for a few minutes).

The fact that sounds and not speech is used creates an experience which is described as "cool" – something with could be used both for creating artistic experiences, gaming experiences as well as more enjoyable practical navigational experiences. As an example of this a short demo for a group of mobility teachers resulted in the comments on how this would make mobility training much more fun.

Finally, this type of interaction works well in more exploratory or wandering situations. With soundcrumbs you don't get lost – and you can wander while still being able to get back to where you came from.

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