A music player user interface based on head-gestures and 3D audio feedback

by

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Abstract

Music applications on smartphones makes listening to your favourite music accessible and mobile. Although the possibility of listening to music at any time and place immediately seems like a positive development this could introduce other challenges. E.g. biking and controlling a music application will conflict in the sense that biking demands hands on the handlebars and eyes on the road, and a smartphone application demands hands (or at least one hand) and eyes for navigating resulting in an increase of the users cognitive load.

At the same time emerging accessories with built in sensor hardware e.g. Google Glass or Intelligent Headset (http://intelligentheadset.com/developer/) offer alternate ways of using gestures in form of GPS location, rotation, acceleration, speech etc.

Encouraged by the biking scenario challenge and todays emerging and accessible mobile technology - alternative ways of controlling a music application should be explored. In this project an alternative way of navigating using head gestures and audio feedback is explored.

Results?...

Conclusion?......

Acknowledgements

The acknowledgements and the people to thank go here, don't forget to include your project advisor…

Contents

List of Figures

List of Tables

Abbreviations

LAH **L**ist **A**bbreviations **H**ere

Chapter 1

Introduction

1.1 HCI in mobile environments

Mobile and wearable devices has been a growing area in computing in recent years. Compaired to desktop computers these devices have introduced new standards for when and how people interact with especially mobile applications. Suddenly people are able to check the news, navigate via interactive maps, post social messages, listen to music, etc., while they are on the move. At the same time emerging hardware in mobile devices and wearable computing expands application complexity and interaction possibilities.

This mobility factor introduces challenges when interacting with these devices. Although screen resolutions and physical sizes of mobile devices are increasing, the visual work space is limited i.e. screens easily becomes cluttered with information and the input keyboard can be an interaction challenge when moving. More importantly, when moving around e.g. in the traffic, interacting with a mobile device at the same time can create cluttering in form of distractions e.g. "eyes off the road" or "hands occupied" and in the worst case cause accidents. Motivated by this problem fines are introduced (in Denmark) for people interacting with their mobile device while biking [1].

Solutions for these cluttering challenges could lie in the interaction between users and mobile devices. The emerging hardware (e.g. sensor technology) and software opens up for alternative input modalities e.g. head gestures, gaze tracking, speech recognition making hands-free interaction possible. At the same time output modalities such as audio and haptic feedback could liberate the eyes from the screen.

1.2 Problem statement

Considering mobile interaction cluttering challenges, this project will be based on the concrete scenario where people are biking while listening to and controlling their music libray. As biking requires eyes on the road and hands for steering the input/output modalities should preferrably not include eyes and hands. Instead head gestures for input and 3d audio for output will be evaluated.

More specifically the following questions should be answered:
Can a user interface based on head gestures and 3d audio compete with existing user interfaces for music players (e.g. touch and vision-based) with respect to for instance a) navigation and control efficiency b) learnability, c) general usability (cognitive/perceptive load), c) suitability to real-world hands-occupied situations.

With the chosen combination of input and output modalities, there is a high risk for the system to misinterpret normal everyday actions performed by the user as commands for controlling the system (”behavioural cluttering” (Janlert et al., in press)). How can features in the user interface prevent unwanted manipulation of the system?

1.3 Method

Use triangle framework for HCI design [2]

1.4 Project structure

...

1.5 Limitations

...

Chapter 2

Background

This chapter presents first different research areas and topics related to this thesis. Then in the second part related works are presented and compaired.

2.1 Research areas

To get an overview of the topics of this project the research can be divided into three areas; Gesture based interaction, eyes-free interaction and sound localization. This project will mainly include the common topics of these areas but also specific topics in each area. A comparison of these are presented in a venn diagram 2.1.

2.1.1 Eyes-free interaction

Several work on both audio [3–7] and haptic [8, 9] displays use the term eyes-free which refers to controlling the state of a system without visual attention. This kind of interaction has shown to be desirable in some situations [10, 11] and even improve efficiency compaired to traditional visual displays [6].

2.1.2 Gesture based interaction

...

2.1.3 Sound localization

(Spatial audio, Head Related Transfer Function)...
Good reference for 3d sound [12]

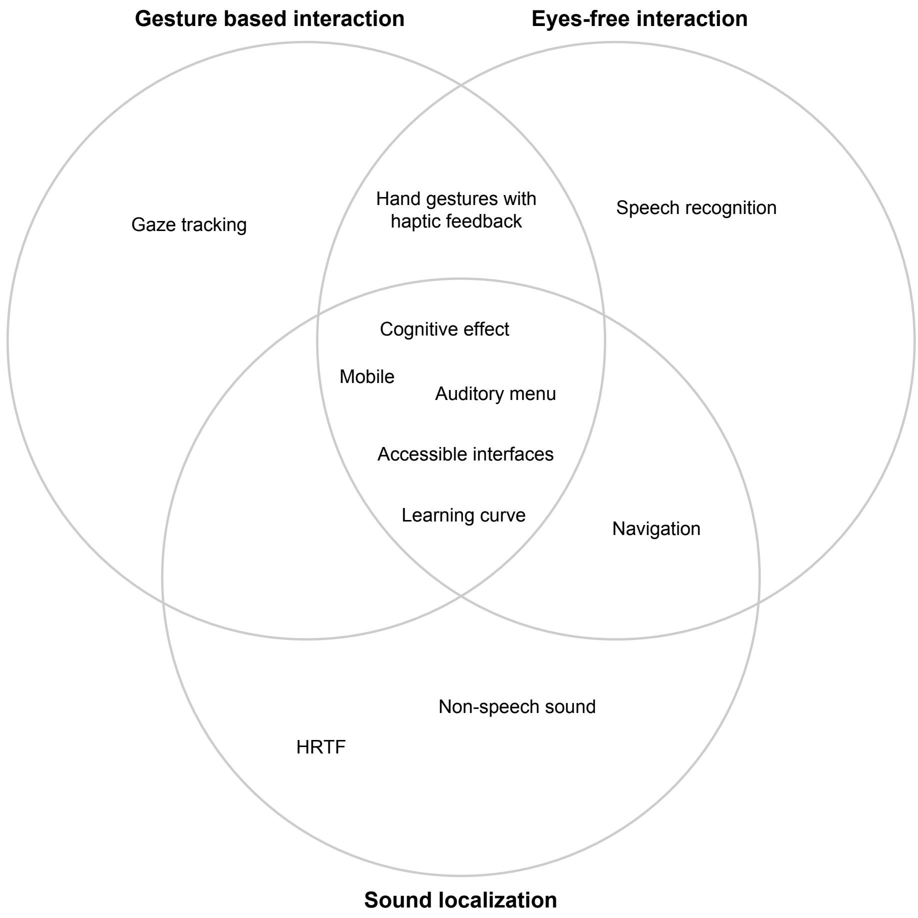

FIGURE 2.1: A comparison of thesis topics

2.2 Related work

Based on the theories mentioned this section presents the research areas related to this thesis, the more specific related works in these areas and finally a sum up of the properties of the related works and this thesis.

Pascoe et al. investigated HCI issues when people are on the move and trials showed that a vital factor was to minimize the amount of distraction for interaction modes [13].

Much of the interfaces work in wearable computing tends to focus on a visual head-mounted displays [14] e.g. Google Project Glass. Visual displays can be obtrusive and hard to use in bright daylight, plus they occupy the users visual attention [15].

By compairing visual and audio feedback when pushing buttons on the same GUI, Brewster showed that it was difficult for users to devote all their visual attention to an interface while walking, running og driving and that the interaction workload decreased with audio feedback [16].

William W. Gaver, a pioneer in audio interfaces, has explored several aspects of using sound in interfaces including the intuitiveness of presenting complex information to users in the form of audio [17]. Similarly Graham explores the advantages in reaction time when using auditory icons [18]. In [19] Gaver presents the use of spatial sound icons. In doing so, he draws forward the unutilized potential of creating natural interaction through spatial audio.

Kajastila and Lokki has done a user study comparing auditory and visual menus controlled by the same free-hand gestures where the majority of the participants felt that an auditory circular menu was faster than a visual based menu [20].

Work has shown that non-speech audio is effective in improving the interaction with mobile devices [21, 22]

Brewster et al. showed that novel interaction techniques based on sound and gesture can significantly improve the usability of a wearable device in particular under "eyes-free" mobile conditions and that head gestures was a successful interaction technique with egocentric sounds the most effective [5].

2.2.1 Summing up: Project focus

Table: Summing up references that handles specific research areas...

Chapter 3

Design

3.1 Interaction model

Horizontal 180 degrees head movement, nod/shake...

3.2 Sound design

Several studies show that circular auditory menus are the way to go because of horizontally positioned sounds , HRTF, 3D audio...

Chapter 4

Implementation

SDK's, APIs, Processing sensor data...

Chapter 5

Evaluation

...

Chapter 6

Discussion

Other scenarios e.g. visual impaired people, car driving...

Chapter 7

Conclusion

...

Appendix A

An Appendix

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