Chapter 7
Auditory Feedback in a Computer Game for Blind People

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ABSTRACT

The study presents an adaptation of the Mastermind game for blind users called MasterBlind. The game mechanics were simplified and auditory feedback introduced. The research object was to understand what kind of sounds would work better to help blind people play the game. Three versions were presented to the subjects - pentatonic notes, animal sounds and vowels - to help users recall previous steps in the game. The main hypothesis predicted that blind users would consciously benefit from the auditory feedback provided. The second hypothesis predicted that users would benefit less from the feedback that doesn't provide semantic information- auditory icons versus earcons. The results were congruent with the hypothesis. MasterBlind can be a usable, enjoyable and a challenging experience for blind users as long as it provides semantically significant feedback. However, new developments are in progress to prove our ideas having in mind the inclusion of blind people.

INTRODUCTION

This work aims to discuss the most important aspects related to the development and integration of audio-based educational games as a novel and efficient learning strategy for visually impaired people. Audio games have the potential to promote learning, enhance memory and develop cognitive skills and thus can significantly improve the quality of life of visually impaired people. A review of the literature on the integration of non-speech sounds to visual interfaces and applications from an usability perspective is done.

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Background

Over the past decades video games have become a worldwide phenomenon and one of the preferred leisure options for many people. However, game accessibility remains an unresolved matter, due to its strong visual and interactive nature. Even though the majority of these games also use audio, most (relevant) information is provided through images. This way, it is very difficult for low vision users, and impossible for blind users, to play the games independently. Therefore it is urgent to include new computer interaction techniques for visually impaired people and those with physical disabilities. Most of them rely in controlling the environment with movements and getting feedback via compensatory sensorial channels (for instance, hearing). The majority of the solutions uses sound, touch screens, haptic equipment, and specially designed hardware.

A common approach to help them develop spatial orientation and mobility skills is the employment of audio-based computer games as a practical, interactive and user-centred learning approach. The purpose of audio-based games is to improve knowledge, spatial representation and localization, orientation and mobility, contextual and associative memory and to enhance the ability to perform problem-solving tasks. Miller, Parecki and Douglas (2007) show an approach to develop video games for people with visual impairment using sensory substitution.

A number of virtual environments have been developed for blind people based on different type of audio, from simple sounds to 3-D audio. We can highlight, for instance, AudioMUD (Sanchez & Hassler, 2007) using spoken text to describe the environment, navigation, and interaction. It also includes some collaborative features into the interaction between blind users and includes a simulated virtual environment inside the human body. During the last years different techniques of the use of sounds to represent visual scenes, especially for blind people were proposed. The sonification processes varied from the parameters used to acoustically describe an image, as well as the number of channels and the dimensional complexity of the sonification produced.

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However, new approaches start to appear, for example, the Sonic-Badminton game. It is an audio-augmented badminton game that uses a virtual shuttlecock implied by audio feedback. It uses a real badminton racket and simple stereo sound to guide virtual shuttlecock (Kim, Lee, & Nam, 2016).

The highly immersive and attractive nature of audio games enables blind people to create a spatial representation of their environment that can be assigned to aid performing real-life navigation tasks.

Balan, Moldoveanu, Moldoveanu and Dascalu (2014) make a review and outline the most notable audio-based games in what concerns their usability as an educational tool for the visually impaired students is also presented. These games follow a user-centred design approach; taking into account the cognitive mental model of sensory perception and information processing that is specific to blind individuals. Balan, Moldoveanu and Moldoveanu (2014) proposed a new method of training blind people, consisting in a navigational 3D audio-based game. In this exploratory game the player has to perform route-navigational tasks under different conditions with the goal to exercise and test their orientation and mobility skills, relying exclusively on the perception of 3D audio cues.

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