

Sound Design as an accessibility tool in video games

Authors: Janko Zorbas, Dan Pumnea

Thesis: 20 higher education credits

Program and course: Games and Entertainment Technology Programme / Capstone

(SPO2161)

Level: Bachelor

Semester/year: Spring term 2025

Supervisor: Steven Thomas Ford

Submission date: -

Number of pages: - / -

**Abstract**

Capstone Thesis: 20 higher education credits

Games and Entertainment Technology Programme / Capstone

Program and course: (SPO2161)

Level: Bachelor

Semester/year: Spring term 2025

Supervisor: Steven Thomas Ford

Keywords: Sound, design, accessibility, visually impaired,

Purpose: In this project, we are trying to find out how sound design can improve the experience of players with visual impairments. While most of these issues tend to be addressed through visual design, we are exploring what sound can contribute to this regard. We have three research questions that guide our approach to this project: How does audio design affect the experience of players in video games? What is the best approach to deliver information using sound? What sound design elements can offer accessibility solutions that cannot be solved through visuals?

Project: We are using a mixed-methods approach for research, combining both quantitative and qualitative research methods. This helps provide a more complete understanding of how sound design can improve video game accessibility for visually impaired players. The quantitative part involves a survey to collect general information about visually impaired players’ experiences with sound in games. The qualitative part includes playtesting and interviews, where participants test a game prototype. In addition, we are build a prototype

Evaluation Survey Data (Quantitative Analysis). The survey results will be analyzed using basic statistics to identify which sound features are most helpful. This will help identify the most and least useful sound design element. Playtesting & Interview Data (Qualitative Analysis). The interview responses will be categorized into themes, such as common difficulties or preferred sound features. The goal is to find patterns in how players experience and interact with sound design.

Key Finding: TBD

Transparency in Contributions: TBD

1. Introduction

Video games are growing and with that growth, the demand is growing as well. There is an emerging need for games to be accessible for different people with different needs and capabilities. Including people with disabilities is always good and one area which could be talked about is sound design. For people with visual impairments, sound design could help retain those players who would otherwise have to rely on visuals to help them or would stop playing all together. Sound design as a tool is not just about music and sound effects, it's so much more. It is about carefully considering the player's needs and then tailoring that so we can help the player in understanding the game mechanics and other elements of the game in an immersive way.

Most of the time, the difficulties faced by players with visual impairments tend to be solved through visual techniques. This includes color palettes, contrasts, and adding more visual elements. Often, this is not enough, and with the addition of too many visual elements, the content can become overwhelming for players. Through this project, we are not trying to replace visual elements that help visually impaired players with sound elements, but we want to find ways of improving accessibility through sound that cannot be solved with visuals.

2 Related Work

Krol et al. (2024) developed an accessibility tool that uses automatically generated musical soundscapes to help people who are blind or have low vision enjoy visual art. Their system creates music based on the emotion of a painting and adds sound effects to give more context, like setting and objects. In a study with blind and low vision participants, the soundscapes were found to make the experience more enjoyable and engaging. The authors suggest that adding narrative elements, using accurate sounds, and allowing users to adjust the experience are important. While the tool works best when combined with other methods like audio descriptions, it shows strong potential for making art more accessible in a scalable and creative way.

Agrimi et al. (2024) provide a detailed review of how games can be made more accessible for people with visual impairments, looking at both digital and tabletop formats. They cover a variety of methods to improve accessibility, such as sonification, haptic feedback, screen readers, and audio-based interfaces. The paper also looks at how machine learning can be used to support features like object recognition and adaptive sound cues, especially in online board games. One of the main takeaways is that while there are many helpful tools and ideas out there, they’re not always used effectively in real games. The authors stress that accessibility should go beyond just meeting basic requirements—it should be designed with the player’s experience in mind. They argue that customizable, user-centered design and feedback systems are key to making games that are not only playable but also enjoyable and meaningful for visually impaired players.

Dunbar (2023) looks into how video game music can be made more accessible for visually impaired players. The study points out that most game music focuses on setting the mood or creating atmosphere, but often misses the chance to help players by giving useful gameplay information. Dunbar explores what visually impaired players actually want from game music and suggests ways to improve it—like using specific musical cues to signal things such as nearby characters, low health, or changes in the environment. The research also stresses the importance of keeping the music clear and well-layered so that important sounds don’t get lost. Overall, the findings show that when music is designed with accessibility in mind, it can become a valuable part of gameplay—not just something in the background. It can help blind and low-vision players better understand what’s happening in the game while also staying immersed in the experience.

Westerholm et al. (2024) explore how game music can do more than just create atmosphere—it can also help blind and visually impaired players access important gameplay information. Using a design-based research approach, they interviewed both blind and sighted players and composed three custom music tracks for the game *Returnal*. Each track had a different purpose: one was purely atmospheric, one was informative, and one combined both elements. The study found that while many blind players usually see music as secondary to sound effects, they responded positively when music was designed to give useful information—like hints about health, enemies, or the environment. The track that mixed emotional atmosphere with informative cues was rated the highest in both accessibility and enjoyment. The results suggest that when music is carefully designed with accessibility in mind—and players can adjust how they hear it—it can be a powerful tool for both gameplay and immersion.

Prazaru et al. give a broad overview of the main challenges and design ideas related to making games accessible for blind and visually impaired players. They look at different assistive technologies like screen readers, Braille displays, and text-to-speech systems, as well as game-specific features like 3D audio, spatial sound, and sonification that help players interact with games without needing to see. The paper also covers the history of audio games and the variety of genres they include, from racing games to RPGs, while pointing out that accessible games shouldn’t be limited to simple or childish experiences. Based on surveys and interviews with VI players, the authors identify major issues like unreadable text, weak audio feedback, and a lack of customizable interfaces. Many players said they want more immersive and socially engaging games, like MMORPGs, and better sound design that feels as polished as in mainstream titles. Overall, the study shows that future accessibility efforts should focus on high-quality audio, adaptable interfaces, and user feedback to truly meet the needs of visually impaired players.Gelsomini et al. (2021) explore how sound can be used to help blind and visually impaired people understand and navigate mixed-reality environments. They created a system called SoundShift, which uses sound in real time to represent things like where objects are, how close they are, and if they’re moving. This includes techniques like pitch changes, spatial audio, and Doppler effects. The idea is to turn visual information into something users can hear and use without needing sight. In a user study with blind participants, they found that pitch and spatial cues were especially helpful and easy to understand for tracking movement, while Doppler effects were a bit harder to grasp. Overall, the results suggest that sound has real potential to make mixed-reality spaces more accessible when designed with user needs in mind.

Gelsomini et al. (2021) looked into how sound can help blind and visually impaired users better understand and interact with mixed-reality environments. They developed a system called SoundShift, which uses sound changes like pitch shifts, Doppler effects, and spatial audio to give users information about where objects and people are around them, and how they’re moving. The goal was to turn visual information into something users could hear and understand easily. In a study with blind participants, they found that some of the sound cues—like changes in pitch to show how close something is, or using directional sound to show where something is—were easy to understand and helped users track movement. Although Doppler effects were harder to notice, the overall system showed real potential for making mixed-reality spaces more accessible. The study shows how thoughtful sound design can make digital environments more inclusive for people with visual impairments.

Nair et al. (n.d.) explore how to make video games more accessible for visually impaired players by proposing general strategies that could apply across different types of games. Their work includes developing a generalized interaction model, creating two games specifically designed for blind users, and building a text-based client for Second Life called TextSL, which works with screen readers. They also point out that there’s a lack of proper guidelines for evaluating accessibility in games, unlike the standards that exist for websites. In their pilot study with both blind and sighted players, they found that blind users could complete game tasks using TextSL, showing that screen-reader-based interaction can work well in virtual environments. Beyond functionality, the paper also discusses how accessibility should include social and educational experiences, not just gameplay. The authors argue that games should still be fun and engaging, and they encourage future research to apply accessibility across more mainstream game genres and to develop better ways to evaluate how accessible a game really is.

4. Description

This section details how we used the sound as a design and accessibility, as well as a brief description of the FPS MOOD prototype we developed in Unity to test these implementations. Before integrating our sound design, we decided a survey would be a great way to identify common problems visually impaired people face when gaming and make note of their suggestions on how audio cues could potentially better their gameplay experience.

After analyzing the gathered results from the survey and reading existing research on audio-based accessibility in other games, we implemented sound effects which were designed in a way to help visually impaired players play the game more easily. We also implemented regular sounds where we thought those were needed instead of specially crafted sounds tailored for the visually impaired. These features were put into the MOOD prototype and tested by participants from the original survey. We conducted a follow-up survey after playtesting to determine how effective this type of audio design was in improving their experience and to what degree it impacted the player’s ability to play the game. With this approach we aim to explore how sound can be effectively used to create a better gaming experience for everyone.

4.1 Sound Implementation

The process of implementing the sounds was a little different from regular. Instead of just putting in sounds, we had to carefully think how these sounds are going to be perceived by someone who can’t see that well. With that in mind, we had to add some sounds that one might not typically find in a video game.

|  |  |  |
| --- | --- | --- |
| **The sound used** | **The role of the sound** | **Where in the game is the sound used** |
|  | The sound is designed to create ambiance and indicate the type of environment you're in. | It is always playing in the background. |
|  | The sound is designed to help the player understand when he is out of ammo. | It plays whenever the player tries shooting the gun and there are no bullets left. |
|  | The sound is designed to let the player know that he is reloading a pistol. | It plays whenever the player decides to reload a pistol. |
|  | The sound is designed to let the player know that he is reloading a rifle. | It plays whenever the player decides to reload a rifle. |
|  | The sound is designed to alert the player to enemy fire, distinct from the player's shot for clarity. | It plays whenever the enemy is shooting at the player. |
|  | The sound lets the player know he/she is shooting a pistol. | It plays whenever a pistol is shot. |
|  | The sound lets the player know he/she is shooting a rifle. | It plays whenever a rifle is shot. |
|  | The sound is used to help player understand that he/she picked up an ammo box. | Anytime the player picks up an ammo box. |
|  | The sound is used to help the player understand that he/she picked up a keycard. | Anytime the player picks up a keycard. |
|  | The sound is used to help the player understand that he/she picked up a health box. | Anytime the player picks up a health box. |
|  | The sound is used to tell the player a key card has been used successfully. | Anytime the player interacts with a keypad and has a key card on them. |
|  | The sound is used to tell the player a key card has been used unsuccessfully. | Anytime the player interacts with a keypad and does not have a key card on them. |
|  | The sound is used to indicate a gate is being opened. | Anytime the player opened a gate successfully. |
|  | The sound is used to indicate the player successfully defused the nuke. | When the player completes the game successfully. |
|  | The sound is used to indicate the player lost the game. | When the player doesn’t finish the game on time. |
|  | The sound is used to tell the player he/she died. | Anytime the player dies. |
|  | One of many sounds that indicates to the player he/she is moving. | Anytime the player moves. |
|  | One of the sounds that indicate to the player is that the enemy is moving. | This 3D sound plays at enemies’ feet whenever an enemy is moving. It is audible only when the player is close to an enemy |