Assistant Tools and Accessibility Features for Blind People Playing Visual-Centric Digital Games

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ABSTRACT

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CCS CONCEPTS

• **Applied computing** → **Computer games**; • **Human-centered computing** → **Accessibility**; • **Human computer interaction (HCI)**;

KEYWORDS

blind, accessibility, gaming, digital games, navigation, tools, AI

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1 INTRODUCTION

Today's accessible games for blind people are mainly games which are directly developed for them (Gonçalves et al. [7]). While these games are enjoyable, mainstream games are a serious challenge for blind people because they consist of complex environments, mechanics and interactions with *Non-Player Character* (NPC) players or even real players in *Player versus player* (PvP) games.

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One big step forward making mainstream games more accessible for blind people was the game *The Last of Us Part II* (TLOU2) [13, 12]. According to Leite and Almeida [11] the game company *Naughty Dog* implemented more than 60 accessibility features and is considered as the most accessible game ever produced. Additionally, Dale [6] described that the game can be played all the way through with audio cues and navigation aids. It includes preset accessibility options for common disabilities like hearing or vision impairments. It also introduces accessibility menus when the game is first started, making it easier for players with disabilities to adjust settings. To top that, *Naughty Dog* released a remastered version of TLOU2 in 2024 with a reworked *Cinematic Audio Descriptions* feature [14].

Implementing accessibility features is much needed in digital games to ensure that everyone can enjoy gaming. However, game developers in general face various problems in the process of developing games, some of them are:

- Diverse Needs
- Technical Challenges
- Design Compromises
- Standardization

In this study, we explore different and innovative accessibility features and tools, including haptic feedback which is a major technical challenge, design compromises and their associated problems and the need for standardization. This raises two relevant research questions (RQ):

- RQ1: Which innovative accessibility features and tools can enhance the gaming experience for blind players?
- RQ2: In what ways can haptic feedback enhancements improve the game experience for blind players?

2 THE PROBLEM

Blind players encounter many different barriers when playing visual-centric digital games which often rely greatly on graphical interfaces and visual cues. To top that, the collection of those mainstream games have different perspectives such as top-down, first-person, and third-person views, where all three views give the player unique challenges in

navigating game environment, understanding game objectives and interacting with in-game elements like players or objects. Building on that, the authors of Gonçalves et al. [7] have categorized seven themes and identified unresolved barriers (see Figure 1) which still represent a great challenge for both players and developers.

Figure 1 gives a great overview what accessibility features and assistant tools are still missing and in which direction the gaming industry should focus.

3 MY IDEA

The gaming industry came a long way from no accessibility features and assistant tools at all to implementing more than 60 accessibility features in one game [13]. According to research papers [7, 9, 8, 3] some of the most important accessibility features for blind people in visual-centric games include:

- Audio Cues and Descriptions
- *Text-to-Speech* (TTS) and Voiceover
- Navigation Aids and Wayfinding Tools
- Comprehensive Audio Design
- Customizable Controls and Inputs
- Tactile Feedback and Controller Design

Some of these have already been implemented to a certain extent in some games, but as Figure 1 notes, there are still problems. Especially when it comes to the environment, pathfinding, perspective and interacting with the world, blind players face major challenges, which according to Gonçalves et al. [7] could mean they stop playing these games because they simply can not find the right way to play.

To address the environment and pathfinding problems, one new technology was introduced in 2018 by Andrade et al. [2] to use echolocation to explore a virtual environment which could drastically improve navigation in it. As for perspective (camera) and interacting with the world, hardware solutions like haptic feedback or AI assistant tools could be a solution when developed and integration further. Whereas the haptic feedback [4] of for example PS5-Controllers [1, 5] could indicate when players aim too high or too low while the AI-Tool could provide the player with enhanced audio descriptions and how to interact with the world.

In summary, it can be said that the game industry already takes into account the most important accessibility features, yet most modern visually-centric digital games are still a major challenge for blind players. In the following section we will delve deeper into some of the listed features above, their problems and possible solutions, as well as how to improve the overall experience of blind people.

4 THE DETAILS

In this section, we delve into enhancing accessibility in digital games for blind players. Firstly, we aim to explore previously mentioned developing problems, from universally accessible game design affecting diverse needs followed by technical challenges. Secondly, we propose enhancements of already existing accessibility features in the theme environment navigating. Lastly, we explore various types of feedback which are essential in enhancing of accessibility in digital games and focus on haptic feedback as well as further possibilities to use that to improve the experience in digital games for blind players.

4.1 Universally accessible game design

Test

4.2 Navigate a virtual environment using echolocation

Test

4.3 Assistive haptic feedback

Short introduction into feedback variants and where it is used "visual perception (sight), haptics (tactile) and aural (hearing)". [10]

4.4 Further possibilities to use haptic feedback

Test

5 RELATED WORK

Accessibility in visual-centric games is getting more important and the game industry have to keep up implementing them. The research paper Gonçalves et al. [7] has shown us that there are still major challenges to improve and further enhance existing accessibility features in various themes. In 2008 Grammenos [8] developed a game called *Game Over!*, which is the first universally inaccessible game showing people how it is if a game is unplayable. Additionally, in 2018 Andrade et al. [2] described a new method to explore a virtual environment by using echolocation. This section provides a deeper insight into these studies, how they approached the topic and what results they achieved.

5.1 Echolocation in games

Test

T1. Understanding the surroundings. Leveraging spatial audio, discerning sound effects (e.g., footsteps, voice lines) and soundscape changes (e.g., audio treatment). Feeling through bumping and interacting with objects.	*Surroundings (Untackled barriers):* Elements not interacting with the player are often silent; Time-sensitive challenges hinder feeling around; Occlusions.
T2. Wayfinding in virtual environments. Navigating based on landmarks (sound or collision) and authoring new ones; Re-orienting by reaching a familiar spot (respawning, save states); Semi-automatic navigation.	*Wayfinding (Untackled barriers):* Objective indications are visual-only (markers, text); Own movement is not perceived; Irrelevant sounds attracting players.
T3. Dealing with perspective. Remapping camera control, recentering through key-binds, and adjusting sensitivity; Leveraging aim assistance; Perceiving height changes based on landing sounds.	*Perspective (Untackled barriers):* Misunderstanding camera yaw (aiming too high or too low); Height changes are ignored and platforming is inaccessible.
T4. Interacting with the world. Experimenting with controls; Button mash to check for interactions; Avoiding fine-grained interactions (resorting to area effects); Curating abilities and features (accessibility paths).	*Interacting (Untackled barriers):* Prompts are inaccessible or do not provide context; Precise aligning and aiming; Complex interactions (e.g., stealth, taking cover).
T5. Preparation, demand & cognitive load. Memorizing controls; Maintaining a mental map; Consulting walkthroughs and guides; Unintuitive and overwhelming sounds; Keeping up with the game state (e.g., health).	
T6. Automation & difficulty. Settings automating or reducing the challenge; Playing a game differently but able to participate.	
T7. Playing with others. Sighted co-players and spectators describing the surroundings, menus, and controls; Co-piloting by distributing controls; Collaborating and gaining autonomy; Latency and cumbersome assistance.	

Figure 1: Seven themes and respective unresolved barriers (Source: Gonçalves et al. [7])

6 CONCLUSIONS AND FURTHER WORK

A recap of the problem addressed and the proposed solution. The implications of your research for the gaming industry and the broader accessibility community. Any remaining challenges or unanswered questions that need to be addressed. Suggestions for future research directions or enhancements to your proposed idea. How your work contributes to advancing the state-of-the-art in accessibility technology for blind individuals playing digital games.

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