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

1 INTRODUCTION

Today's accessible games for blind people are mainly games which are directly developed for them (Gonçalves et al. [4]). 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.

One big step forward making mainstream games more accessible for blind people was the game *The Last of Us Part II* (TLOU2) [9, 8]. According to Leite and Almeida [7] the game company *Naughty Dog* implemented more than 60 accessibility features and is considered as the most accessible game ever produced. Additionally, Dale [3] 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 [10].
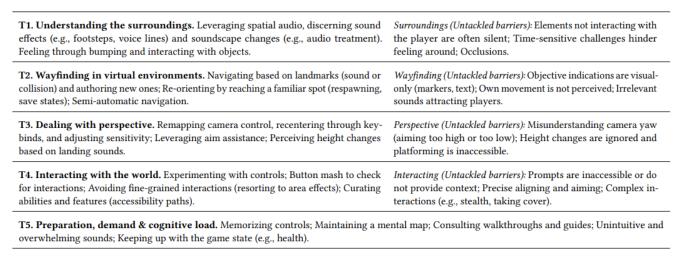
In this work we go deeper into different and potentially new accessibility features as well as what assistant tools blind players use and how software companies implement them. This raises two relevant research questions (RQ):

- RQ1: What new breakthrough accessibility features and tools could enhance the gaming experience for blind players?
- RQ2: How can the development and implementation of these features and tools be standardized within the development cycle of visual-centric digital games?

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. [4] 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.

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. [4])

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 [9]. According to research papers [4, 6, 5, 2] 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. [4] 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. [1] 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 of e.g. PS5-Controllers could indicate when players aim too high or too low and the AI-Tool could provide the player with enhanced audio descriptions 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 the listed features above, their problems and possible solutions, as well as how to improve the overall experience of blind people.

4 THE DETAILS

Subsections for the details section

- Universally accessible game design
- Problems implementing accessibility features in digital games
- Cost effective methods to implement accessibility features
- Improve exploring virtual environments using echolocation

New tools for blind players and newest Accessibility Features software companies using/developing.

Screen Reader Audio Cues and Descriptions Haptic Feedback Customizable Controls Text-to-Speech and Speech Recognition Accessible Menus and Interfaces Echolocation

Provide a detailed explanation of how your idea will be implemented. This section should delve into the technical aspects of your proposed solution and address any challenges or limitations that may arise. Consider including the following information:

The specific features and functionalities of your assistant tools or accessibility features. The technologies or algorithms involved in implementing these features (e.g., machine learning, computer vision). Any hardware or software requirements necessary for your solution to work. How your solution will be integrated into existing digital games or gaming platforms. Any user testing or feedback you have conducted to validate your idea.

5 RELATED WORK

Review existing literature and research related to assistant tools and accessibility features for blind gamers. This section should provide an overview of the current state-of-the-art in this field and highlight any relevant studies or projects. Consider addressing the following points:

Previous research on accessibility features in digital games for blind players. Existing assistant tools or software developed to improve the gaming experience for blind individuals. Studies or projects that have investigated the challenges faced by blind gamers and potential solutions. Any notable advancements or innovations in the field of accessibility technology for blind users. How your research builds upon or contributes to the existing body of work in this area.

6 CONCLUSIONS AND FURTHER WORK

What else could be done, explored deeper or would benefit blind players Summarize the key findings and contributions of your research paper. Reflect on the significance of your proposed idea and its potential impact on improving accessibility for blind gamers. Additionally, discuss any avenues for future research or development in this field. Consider addressing the following points:

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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