

Adaptive Audio as Narrative: Designing a Serious Game for Chagas Disease Awareness

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Abstract. Introduction: This paper presents the ongoing development of a mobile-first serious game inspired by a science theater production addressing Chagas disease, a neglected tropical disease with significant social and health impacts in Brazil. Rather than relying primarily on textual explanations or instructional mechanics, the project adopts a “Show, Don't Tell” design philosophy in which narrative meaning emerges through environmental storytelling, non-verbal interaction, and adaptive audio. **Objective:** The primary objective is to investigate how adaptive audio can function as a narrative device within a health-focused serious game. The project employs environmental storytelling and audio-centered design to represent themes related to Chagas disease through sensory experience rather than direct exposition. A central technical objective is the implementation of an adaptive audio architecture using FMOD integrated with Godot Engine, enabling dynamic sound behaviors that respond to gameplay states and narrative progression. **Steps:** The development process follows an iterative workflow beginning with greybox prototyping and validation of core gameplay systems. The proposed audio architecture is organized around gameplay states associated with different narrative and physiological conditions. Through FMOD middleware, adaptive sound behaviors are controlled using spatial audio cues, Real-Time Parameter Controls (RTPCs), and state-based audio management to support navigation, symptom representation, and narrative transitions. Current development includes a functional prototype validating FMOD integration, directional audio guidance, and RTPC-driven sound behavior. **Expected Results:** The project aims to investigate how adaptive audio and environmental storytelling can enhance immersion, narrative comprehension, and emotional engagement. Planned evaluation activities include usability sessions and qualitative feedback discussions with participants associated with the science theater initiative that inspired the project. The study will examine how players interpret environmental and auditory cues and understand disease-related narrative progression without relying on explicit textual explanations.

Keywords: Serious Games, Technical Audio Design, FMOD, Chagas Disease, Environmental Narrative.

1. Introduction

Chagas disease remains a significant public health challenge in Latin America due to its long-term progression, social impact, and association with historically neglected populations [Laporta et al., 2024]. While educational initiatives often focus on communicating biomedical information, conveying the lived experience of the disease

and its broader social implications remains a complex challenge.

Serious games are promising health communication tools, combining learning, engagement, and interactive exploration. However, many rely on explicit instructional strategies like quizzes and textual explanations. While effective for knowledge transfer, such approaches offer limited experiential engagement.

This paper presents the development of a mobile-first serious game, chosen for its high accessibility in Brazil [IBGE, 2025], inspired by the science theater production *Coração em Chagas* [Guimarães and Chagas, 2024]. The project investigates how adaptive audio and environmental storytelling communicate themes of illness, vulnerability, and social neglect through non-verbal interaction. Guided by a "Show, Don't Tell" philosophy, the game employs adaptive sound design to represent disease progression and emotional states through changes in the player's auditory experience.

The main contribution of this work is the proposal of an audio-centred narrative approach that positions adaptive audio not merely as feedback, but as a primary vehicle for storytelling and thematic communication within a health-focused serious game.

2. Related Works

2.1 Environmental Storytelling and Adaptive Audio

Environmental storytelling uses space, atmosphere, and interaction rather than direct exposition to convey narrative meaning. Games like *Gris*—a primary inspiration for this project—demonstrate how audiovisual transformation communicates emotional and narrative progression through player interpretation. Adaptive audio extends this approach by dynamically reacting to gameplay states, reinforcing narrative interpretation through sensory experience.

2.2 Serious Games for Health in Brazil

Serious games are widely used for health education and science communication in Brazil, as demonstrated by initiatives like *Detonando a Dengue* [Santos and Carvalho, 2013]. However, many health-focused games rely on explicit instructional strategies such as quizzes and textual explanations [Thallisson et al., 2019]. This project proposes an alternative by utilizing adaptive audio and environmental storytelling to communicate aspects of Chagas disease through non-verbal interaction, fostering reflection over direct instruction.

3. Audio-Centered Narrative Design

The proposed game explores Chagas disease through a narrative approach centered on sensory experience rather than direct instruction. Inspired by the "Show, Don't Tell" principle, the project seeks to communicate the physical, emotional, and social consequences of the disease by translating clinical symptoms and psychological states directly into environmental cues and adaptive audio behaviors.

3.1 Environmental Storytelling and Disease Representation

The narrative is structured around thematic chapters inspired by different social and historical contexts associated with Chagas disease.

Environmental storytelling serves as the primary narrative framework, communicating social conditions and emotional states through exploration of everyday and dreamlike spaces. This approach encourages players to interpret narrative meaning from the surrounding environment rather than from explicit exposition.

A central narrative transition occurs between ordinary environments and fever-induced sequences. While everyday spaces emphasize routine and environmental observation, febrile sequences introduce perceptual distortions and altered sensory experiences that reflect disease progression from the character's perspective.

3.2 Audio as a Narrative Device

Audio was selected as the project's primary narrative medium because many symptoms associated with Chagas disease can be represented through changes in perception rather than direct visual depiction. Fatigue, disorientation, anxiety, cardiac irregularities, and loss of spatial awareness are translated into modifications of ambience, rhythm, spatialization, filtering, and sound density.

The audio system communicates narrative information through environmental sounds, physiological cues, and adaptive musical elements that reflect changes in the character's condition. As symptoms intensify, the soundscape gradually transforms, allowing players to perceive disease progression through auditory experience and reinforcing the project's "Show, Don't Tell" philosophy.

4. Adaptive Audio Architecture and Middleware Integration

Adaptive audio serves as the primary narrative mechanism of the proposed game. Rather than functioning solely as feedback for player actions [Collins, 2008], the audio system is designed to communicate environmental context, disease progression, emotional states, and narrative transitions. Through the integration of Godot Engine and FMOD Studio, gameplay events are associated with dynamic sound behaviors that evolve throughout the player's experience.

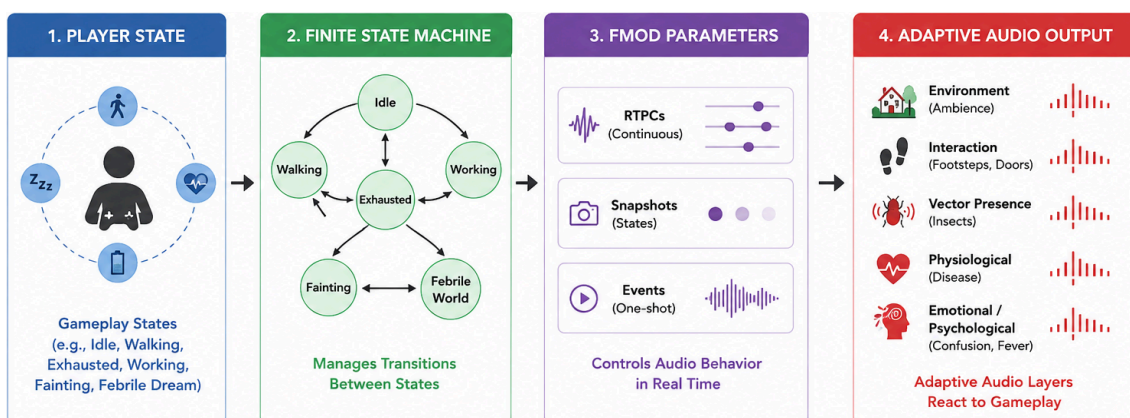


Figure 1. Adaptive Audio Architecture in the Game

The relationship between gameplay states, FMOD parameters, and adaptive audio layers is illustrated in Figure 1, while Figure 2 summarizes how these elements evolve across the narrative progression of the first chapter.

4.1 State-Based Audio Management

The proposed audio architecture is organized around gameplay states representing distinct narrative and physiological conditions experienced by the player. Gameplay states representing exploration, fatigue, fever episodes, and dream sequences are associated with distinct audio behaviors. State transitions modify ambience and sound density, allowing narrative progression to be communicated through sound.

4.2 Spatial Audio and Environmental Guidance

Spatial audio supports both navigation and environmental storytelling. In exploration sequences, localised insect sounds serve as narrative foreboding while guiding players toward relevant locations. Changes in perceived proximity and stereo positioning reinforce the presence of disease vectors without requiring interface markers.



Figure 2. Narrative Progression of Chapter 1

4.3 Disease Representation and Narrative Transitions

As illustrated in Figure 2, disease progression and narrative transitions are represented through adaptive audio parameters associated with fatigue, stress, and perceptual changes. Variations in ambience, filtering, physiological cues, and auditory clarity allow symptoms and key narrative events—including infection, fever episodes, awakening sequences, and loss of consciousness—to be experienced through listening rather than explicit exposition. These transformations help distinguish ordinary reality from altered perception while supporting emotional engagement and disease representation.

5. Current Development Status and Planned Evaluation

The project is currently in an early prototyping stage, with development focused on validating the adaptive audio architecture and its integration with gameplay systems. To distinguish completed features from planned functionality, the current implementation status is summarized below.

5.1 Current Implementation Status

Core gameplay systems, including character movement, collision detection, and camera control, have been implemented and validated within greybox environments representing the first chapter. These environments cover key locations from the first chapter, including exploration and febrile-world sequences.

From an audio perspective, the integration between Godot Engine and FMOD Studio has been successfully established. FMOD integration supports dynamic event and parameter control within the prototype.

A functional prototype of the spatial audio system has also been implemented. Through the `Insect_Proximity` parameter, directional insect sounds dynamically respond to player movement and proximity, allowing the audio system to guide player attention without interface markers. Preliminary internal tests confirmed the expected behavior of navigation cues, spatial sound perception, and FMOD integration.

Several gameplay and narrative systems remain under development, including character animations, dream sequences, disease-related effects, and additional adaptive audio parameters associated with symptom progression and narrative transitions.

5.2 Planned Evaluation

Formal user evaluation has not yet been conducted. Once a playable prototype becomes available, 20 participants recruited through the science theater initiative that inspired the project will play the first chapter individually during exploratory usability sessions, combining gameplay observation with qualitative feedback discussions.

Evaluation will focus on four dimensions: narrative interpretation, audio-guided navigation, immersion, and disease representation. Quantitative measures will include participant ratings regarding immersion, audio cue clarity, and overall experience, while qualitative data will be collected through observation and semi-structured discussions.

The collected data will be analyzed to identify recurring patterns in player interpretation and interaction, particularly whether participants can recognize narrative progression, disease-related changes, and emotional transitions without relying on explicit textual explanations. Future work will also include the implementation and validation of additional chapters, disease progression systems, and rhythm-based gameplay encounters within the febrile world.

6. Conclusions

This paper presented the ongoing development of a serious game that employs adaptive audio and environmental storytelling to communicate themes related to Chagas disease. By positioning sound as a primary narrative device, the project explores alternative approaches to health communication through experiential design. Future evaluations will investigate how effectively adaptive audio supports narrative comprehension, immersion, and disease representation.

7. Acknowledgements

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