



The Auditory Representation of Power in Video Games

Milko Kurki

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ABSTRACT

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This thesis investigates how sound design in video games influences player perceptions of power dynamics, focusing on the stealth-horror genre. It examines adaptive audio systems, psychological tension, and player agency, exploring how silence, spatial acoustics, and dynamic soundscapes amplify vulnerability, authority, and emotional engagement.

The study combines theoretical frameworks from psychoacoustics and game studies with practical implementation through *Silent Prey*, a custom stealth-horror prototype developed in Unity with Wwise middleware. The prototype integrates adaptive audio mechanics—including real-time parameter control for fear-driven breath and heartbeat, geometry-based occlusion, and procedural soundscapes—to assess how sound shapes player behavior and narrative immersion. Comparative case studies provide insights into industry practices, emphasizing spatial audio, illusory threats, and minimalist scoring.

The findings indicate that audio design is not merely atmospheric but a core gameplay mechanic. Strategic silence, low-frequency monster vocalizations, and dynamic feedback loops reinforce power imbalances, while audio-based tactics heighten narrative stakes. The thesis concludes with actionable strategies for developers, advocating adaptive audio integration, spatial realism, and cross-disciplinary collaboration, underscoring sound's potential to redefine power hierarchies and expand its application across tension-driven genres. The study demonstrates that audio design is crucial for creating immersive, emotionally engaging gameplay experiences.

Key words: sound design, video games, power perception, player experience, game audio, power dynamics, stealth-horror, adaptive audio, player psychology, vulnerability, spatial acoustics

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Milko Kurki — Game design, sound design, AI design, programming

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ABBREVIATIONS AND TERMS

EQ (Equalization): A process that adjusts the balance of frequency components within an audio signal. It is used to enhance or reduce specific frequency ranges to improve clarity and tonal balance.

Compressor: An audio processing tool that reduces the dynamic range of a signal by attenuating loud sounds and/or boosting softer sounds. This helps in maintaining a consistent volume level across the audio track.

Reverb (Reverberation): An effect that simulates the persistence of sound in an environment after the original sound is produced. It creates a sense of space and depth by mimicking the reflections of sound waves from surfaces in a room or hall.

Foley: The reproduction of everyday sound effects that are added in post-production to enhance the audio quality of a media project. In game development, Foley techniques are used to create realistic sound assets that complement the on-screen action.

Distortion: An audio effect that alters the original sound by clipping or modifying its waveform, often adding harmonic content. It is commonly used to create a rough, edgy, or aggressive tone.

RTPC (Real-Time Parameter Control): A feature in audio middleware (like Wwise) that links game variables—such as player fear or monster proximity—to audio parameters (e.g., volume, pitch, reverb). This allows the sound to dynamically respond to gameplay conditions.

C#: A modern programming language developed by Microsoft that is widely used in game development, particularly with the Unity engine, for scripting game behavior and functionalities.

Sound Assets: The collection of audio files used in a game, including sound effects, music, dialogue, and ambient sounds. These assets are essential for building the game's auditory environment.

Delay: An audio effect that records an input signal to a storage medium and then plays it back after a period of time, creating an echo-like effect. It can be used to add depth and rhythm to sound design.

Pitch Shifting: The process of changing the pitch of an audio signal without affecting its duration. This technique is used to modify the tonal quality of sounds.

Time Stretching: A method for altering the duration of an audio signal without changing its pitch. It allows sound designers to fit audio elements into varying time constraints.

Ring Modulation: An audio effect that combines two input signals by multiplying them, resulting in new frequencies that are the sum and difference of the original frequencies. It often produces a metallic or otherworldly sound.

Convolution Reverb: A type of reverb effect that uses impulse responses (recordings of real acoustic spaces) to simulate the reverberation characteristics of that space, providing a highly realistic spatial effect.

Spatialization: The process of placing sounds in a three-dimensional space so that they appear to come from specific locations relative to the listener. This enhances immersion by replicating how we experience sound in a real environment.

Occlusion: A phenomenon in audio design where sound is attenuated or muffled when an object obstructs the direct path between the sound source and the listener, simulating real-world acoustic behavior.

Wwise: A comprehensive audio middleware solution developed by Audiokinetic. It is used in game development to integrate and manage adaptive audio systems, enabling dynamic sound design in response to gameplay events.

Ableton Live 10 Suite: A digital audio workstation (DAW) used for recording, editing, and producing audio. It is widely used in music production and game audio asset creation due to its powerful features and flexible workflow.

Git: A version control system that tracks changes in source code and multimedia assets, facilitating collaboration and iterative development by allowing users to revert to previous versions if needed.

Multi-track Session: A recording technique where individual sound elements are recorded on separate tracks. This allows for detailed editing and mixing, ensuring that each audio element can be processed independently before being integrated into the final mix.

1 INTRODUCTION

In the realm of video game design, where visuals often dominate the discourse, this thesis seeks to illuminate the profound impact of audio on player perceptions of power, focusing specifically on the stealth-horror genre. While graphics provide the immediate spectacle, it is sound that often sets the atmosphere, manipulates emotions, and subtly guides the player's experience. This research delves into the intricate ways in which sound design can evoke feelings of vulnerability, heighten tension, and ultimately redefine the power dynamic between player and game. Utilizing a custom-developed game prototype, *Silent Prey*, as a practical case study, this investigation bridges theoretical framework from fields like psychoacoustics and game studies with the practical implementation of immersive soundscapes. The development of *Silent Prey* provided a unique opportunity to explore these concepts in depth, examining how adaptive audio systems can respond dynamically to player actions, how strategic silence can amplify the impact of key sound events, and how carefully placed auditory illusions can manipulate player anxiety, decision-making and sense of vulnerability in contrast to the game world and its entities. By analyzing the interplay between audio cues, player actions, and observed psychological responses during play testing, this study aims to uncover the underlying mechanisms through which sound shapes the player's sense of agency and control within the game world. The findings presented here not only contribute to a deeper academic understanding of audio's potential in interactive media but also offer practical guidance for game developers seeking to harness the often-underestimated power of sound to create truly immersive and emotionally resonant experiences. The stealth-horror genre, with its inherent focus on atmosphere and psychological tension, provides a particularly fertile ground for exploring these concepts, as the player's vulnerability is often central to the gameplay experience. Through *Silent Prey*, this thesis demonstrates how sound can be used not merely as a complement to visuals, but as a powerful tool in its own right, capable of transforming narrative, shaping mechanics, and ultimately redefining the player's relationship with the virtual world.

OpenAI's ChatGPT model o1 has been used to improve fluency of the written text both in structure and grammar. AI was also used in summarizing larger research papers to allow for more extensive research within shorter timeframe. All summarization endeavours have been fact checked.

2 LITERATURE REVIEW

The literature review examines existing research and theories relevant to the role of sound in shaping the perception of power within video games. This section delves into multiple strands of inquiry, including the history of game audio, the psychology of auditory perception, and case studies of successful implementations of power dynamics through sound design.

2.1 Theoretical Framework

Sound is a multidimensional sensory experience that engages both physiological and psychological processes. In video games, audio design functions not merely as a functional element but as a vital narrative and emotional tool. (Grimshaw, 2010.) The framework posits that auditory cues can evoke strong emotional responses, shape perceptions, and even influence player behavior—key elements for exploring how sound contributes to the representation and perception of power in interactive media.

By integrating findings from prior studies, the theoretical framework establishes a foundation for analyzing how sound elements can be intentionally designed to communicate authority, dominance, and power. These insights inform the subsequent analysis of video game audio and its application in the custom game project, *Silent Prey*, developed for this thesis. Together, they highlight the significance of sound as a determinant in how players experience and interpret power dynamics within digital environments.

2.1.1 Auditory Perception and Emotion

Auditory perception is a fundamental human faculty that processes sound waves into meaningful experiences, engaging both the physiological mechanisms of the ear and the psychological processes of the brain (Oxenham, 2018). The connection between auditory stimuli and emotional response has

been extensively studied, revealing that sound can evoke powerful reactions and shape perceptions of an environment or situation. In the realm of video games, these insights form a crucial basis for designing audio cues that heighten immersion and evoke specific player emotions. (Grimshaw, 2010.)

Key attributes of sound—such as pitch, timbre, volume, and tempo—play a critical role in eliciting emotional responses. For instance, higher-pitched sounds are often associated with excitement or urgency, whereas lower-pitched sounds correlate with feelings of power, dominance, and sometimes fear. (Aung & Puts, 2019.) Timbre, which encompasses the texture or quality of a sound, can evoke a wide spectrum of emotions depending on its harmonic complexity and envelope characteristics. These attributes are especially relevant in video games, where sound design choices must balance immediate emotional impact with sustained player engagement. (Grimshaw, 2010.)

Research demonstrates that sound can affect mood, cognitive processing, and even physical behavior. Studies on auditory-induced emotion suggest that specific sound patterns can stimulate neural pathways associated with reward, arousal, and threat detection. (Armony & LeDoux, 2018.) For example, sharp, discordant sounds may trigger anxiety or alertness, while harmonious and melodic sounds can promote positive emotions by stimulating dopamine release (Raghu, 2018).

In gaming contexts, these findings are leveraged to influence player experiences. Sound design functions as an emotional amplifier, enhancing narrative elements, character development, and environmental immersion. A crescendo in background music can signal an impending challenge or climax, while subtle ambient sounds may elicit tension or tranquility, depending on the game's context. (Grimshaw, 2010.) These auditory cues not only enrich gameplay but also guide players' emotional responses, thereby contributing to the overall perception of power dynamics within the game world.

2.1.2 Psychology of Power Representation

The concept of power representation has deep psychological roots, often shaped by social, environmental, and auditory cues (Favre et al., 2019). Power dynamics are commonly communicated through a confluence of visual, auditory, and contextual elements that trigger innate human responses. Research in evolutionary psychology indicates that lower-pitched sounds are universally associated with dominance and authority, while higher-pitched sounds can signify submission or vulnerability (Aung & Puts, 2019). This evolutionary mechanism stems from the association between low-frequency sounds and larger physical size—historically linked to greater physical power.

Auditory signals play a crucial role in establishing and reinforcing authority across various media forms, including film, television, and video games. For example, the voices of characters with higher social status or physical dominance often exhibit lower pitch and greater resonance, communicating their elevated standing. Soundscapes and effects similarly forge psychological associations with power; thunderous, echoing footsteps may imply a formidable presence, whereas sharp, high-pitched noises can invoke tension or fear.

In video games, the psychology of power representation extends beyond character voices to encompass environmental audio and interactive sound effects. This interplay allows developers to craft immersive experiences that convey hierarchy and influence—even without explicit narrative exposition. For example, ambient soundscapes in action-adventure games frequently integrate low-frequency rumbles or dynamic crescendos to foreshadow the approach of significant events or powerful entities. Such cues actively shape players' perceptions, guiding both emotional responses and in-game decision-making.

The psychological association between sound and power also influences player behavior. Studies indicate that auditory feedback—such as a weapon's resonant firing sound or a character's deep vocalizations—can heighten a player's perception of in-game prowess and intensify engagement (Rogers, 2020). Consequently, sound design emerges as a critical lever for conveying power and authority within interactive media.

In the context of this thesis, insights from the psychology of power representation inform the selection and implementation of sound design techniques that amplify player immersion and emotional impact. By leveraging evolutionary cues, cultural associations, and proven auditory strategies, game developers can craft audio experiences that resonate with players and effectively convey a sense of power and influence.

2.1.3 Sound in Media and Power Dynamics

Sound in media functions as a deliberate instrument for shaping audience perception and eliciting specific emotional responses (Ma & Thompson, 2015). In narratives where power dynamics are crucial, audio elements—such as soundtracks and sound effects—are often carefully designed to portray the perceived authority or vulnerability of characters and settings. Through both subtle and overt manipulations, sound serves as a conduit for expressing abstract concepts like dominance, control, and hierarchy.

Media practitioners employ soundscapes to construct atmospheres that underscore power structures. For instance, a leader's speech might be accompanied by swelling music to highlight their command, while deliberate silence or minimalist audio can magnify moments of vulnerability or submission. These sonic choices direct audience emotions and profoundly shape the narrative experience. Likewise, sound effects such as reverberating footsteps or resonant mechanical noises reinforce the strength and dominance of specific entities within a story's universe.

Interactive media like video games amplify these dynamics further by placing users in real-time, decision-making roles (Rogers, 2020). Powerful characters often receive commanding voice lines or impactful sound effects to underscore their elevated status. Auditory feedback—derived from weapons, environmental reactions, or enemy encounters—plays a key part in establishing the player's relationship with the game world, influencing how they perceive and navigate power hierarchies.

Sound mirrors societal attitudes toward power. Protagonists and antagonists typically exhibit audio profiles aligned with culturally ingrained symbols of authority or vulnerability—whether through pitch, tone, or rhythmic elements (Ko et al., 2014). This deliberate mirroring heightens relatability and emotional investment for audiences.

2.2 Sound Design in Video Games

Sound design in video games is a multifaceted discipline that encompasses sound effects, music, character voices, and ambient audio. Each component serves a specific function—whether to communicate information, evoke emotion, or enhance player immersion—yet all are interwoven to create a coherent sonic landscape. (Grimshaw, 2010.) In the context of power dynamics, well-crafted audio can highlight a game’s thematic focus on dominance or authority, transforming raw data (e.g., a weapon’s firing rate) into meaningful auditory cues that shape player perception (Ng et al., 2015). This section explores the role of sound effects and music, discussing how both elements converge to reinforce power structures within virtual worlds.

2.2.1 Role of Sound Effects and Music

Sound effects (SFX) and music are often considered the cornerstones of game audio design (Pitkänen, 2013). Sound effects serve as direct feedback mechanisms, signaling interactions with the environment, objects, and characters. They range from subtle ambient noises—like footsteps or rustling foliage—to dramatic cues—such as explosions or spell-casting effects. By manipulating pitch, volume, and complexity, sound designers can emphasize power or vulnerability, guiding players’ emotional and cognitive responses. A booming explosion, for example, conveys a sense of impact or dominance, whereas a faint or muted sound might imply fragility or stealth. (Grimshaw, 2010.) These auditory cues also align with the psychology of power representation, where lower-pitched, resonant sounds are typically perceived as authoritative or menacing.

Music, on the other hand, shapes the overarching emotional tone of a game and can subtly direct the player's experience of power and tension. Video game music often shifts dynamically based on gameplay events—such as the arrival of a boss enemy, the activation of a special ability, or a transition into a critical narrative scene. This adaptive quality allows composers and audio teams to match musical intensity with on-screen action, thereby amplifying the perceived stakes or grandeur of a situation (Smith, 2020.) A heroic orchestral theme might evoke empowerment, while ominous, low-frequency drones may instill dread or reverence for an imposing antagonist.

Beyond emotional resonance, music can also serve as a narrative device, reinforcing specific story arcs or character traits. In games centered on power struggles, thematic motifs may recur whenever a key character or faction appears, signaling their influence within the game world (Smith, 2020). Repetition of certain leitmotifs can deepen players' associations between musical themes and characters' hierarchical standing, effectively embedding power cues within the sonic identity of the game.

Both SFX and music intersect to create a unified audio experience that underscores power dynamics. A well-timed musical swell might coincide with an impactful sound effect—like a sword clash or a magic spell—to magnify the feeling of authority or dominance. Conversely, the strategic use of silence or sparse soundscapes can heighten tension, emphasizing moments of vulnerability or submission. (Grimshaw, 2010.) By carefully choreographing these elements, audio designers transform simple interactions into immersive experiences that reflect and reinforce the game's power structure.

2.2.2 Character Voices and Ambient Sounds

Character voices represent a powerful medium for conveying personality, status, and emotional states within video games. Voice acting can communicate a character's confidence, vulnerability, or authority through intonation, pitch, and delivery style (Fish, 2003). For instance, a deep, resonant voice may suggest

power or command, whereas a trembling, higher-pitched tone might indicate fear or subordination. This strategic use of vocal qualities aligns with broader psychological insights, where lower-pitched sounds tend to be perceived as more dominant and imposing (Aung & Puts, 2019). The choice of voice actors, the script's linguistic nuance, and even the pacing of dialogue can reinforce a character's position within the game's hierarchy, subtly guiding player perceptions of who holds power within the narrative (How to Write a Video Game Script, 2013).

Beyond individual voices, ensemble voice design can influence the perceived dynamics of group interactions. Characters who speak in synchronized or harmonious tones may appear united and formidable, while dissonant or chaotic voices can reflect internal strife or a breakdown of authority. This collective vocal identity extends to non-playable characters (NPCs) as well, where seemingly minor dialogue lines or background chatter establishes social hierarchies or tensions. Through these vocal layers, developers can embed narrative clues about authority figures, subordinate roles, or impending conflicts that shape player expectations of power struggles within the game world.

Complementing character voices, ambient sounds play a similarly important role in establishing context and mood. Ambient audio encompasses natural environmental noises—such as wind, water, or wildlife—as well as man-made or fantastical soundscapes, like distant machinery hums or eerie echoes in alien landscapes (Grimshaw, 2010). These underlying sound textures can elevate the sense of scale, grandeur, or danger in a particular setting. For example, in a sprawling fantasy castle, the subtle reverberation of footsteps in a cavernous hall can communicate both architectural vastness and the formidable power of its occupants (Brodey, 1965). Conversely, the absence of ambient sound or use of sparse, minimalistic audio may heighten tension and vulnerability, underscoring a player's lack of control or authority in a hostile environment.

By combined use of character voices and ambient soundscapes, sound designers create a cohesive auditory tapestry that underlines the perception of power in video games. From the thunderous voice of a final boss to the eerie silence of a haunted corridor, every auditory element influences how players interpret so-

cial hierarchies, narrative stakes, and emotional tensions. (Toprac & Abdel-Meguid, 2010.) This synergy between voices and environmental sound is particularly evident in narrative-driven games, where powerful figures may dominate not only the dialogue but also the acoustic space—through booming echoes or dynamically triggered audio events that mark their presence. These layers of vocal and ambient cues deepen player immersion and reinforce the intricate power structures at the heart of the interactive experience.

2.2.3 Case Studies of Power Representation

Analyzing specific video game titles provides tangible examples of how sound design can effectively convey power and dominance. By examining various genres and studio approaches, these case studies highlight the creative strategies that underscore authority, intimidation, and emotional weight through audio elements. Below are select examples illustrating diverse implementations of power representation:

- **God of War (Series)**

The God of War series, particularly its 2018 installment and the sequel Ragnarök, employs a bold orchestral soundtrack and deep, resonant character voices to emphasize Kratos's imposing persona. Percussive drum beats often intensify combat sequences, underscoring Kratos's might with driving rhythms. Cinematic crescendos coincide with major narrative revelations, further blending narrative significance and auditory impact. In this context, both music and voice acting reinforce the protagonist's status as a demigod, instilling a sense of epic grandeur in the player experience (see Appendix 2).

- **Elden Ring**

Contrasting the direct, forceful style of God of War, the Elden Ring series utilizes minimalistic ambient soundscapes and sparse musical cues to create a profound sense of dread and vulnerability. Boss battles, however, deviate from this subdued approach by incorporating grand, choral-driven scores that signal the immense power of these adversaries. The dramatic shift from haunting silence to towering orchestral pieces not only startles the player but also reinforces the bosses' authoritative, almost divine presence. This contrast exemplifies how selective use of music and sound effects amplifies the perceived hierarchy between player and foe (see Appendix 3).

- **Overwatch**

Blizzard's team-based shooter Overwatch weaves character-specific sound design into its core gameplay to distinguish each hero's abilities and status. For instance, Reinhardt—a towering knight equipped with a massive hammer—features a low-pitched, metallic footstep and a reverberating hammer swing that convey his formidable stature. In contrast, lighter heroes, such as Tracer, employ higher-pitched and rapid sound effects, suggesting agility and a less imposing presence. This variation in auditory profiles not only aids players in quickly identifying heroes but also shapes their perception of each character's power and role within the team dynamic (see Appendix 4 and Appendix 5).

- **The Elder Scrolls V: Skyrim**

Skyrim's open-world environment uses an evolving ambient soundscape that transitions from tranquil, nature-infused areas to ominous dungeons where low-frequency drones intensify a sense of peril. Dragons—symbolic apex predators—command the sky with roaring vocalizations and thunderous wing flaps. These cues signal their dominance over the landscape, making each dragon encounter a potent demonstration of power. Likewise, the game's iconic "Dragonborn" theme features forceful choral chanting that aligns the player character with an aura of ancient might (see Appendix 6).

- **Alien: Isolation**

Alien: Isolation employs a carefully crafted audio design to amplify the Xenomorph's intimidating presence. Low-frequency stingers and atmospheric drones evoke an oppressive tension, while the player's own footsteps and equipment noises can alert the adaptive AI. This heightened responsiveness cultivates a power dynamic where the Xenomorph appears constantly in control, reinforcing the feeling that one misstep can lead to a swift, terrifying encounter (see Appendix 7).

- **Resident Evil (Series)**

From its early entries to modern remakes, the *Resident Evil* series relies on carefully orchestrated soundscapes to instill dread and underscore the power wielded by monsters or bio-organic threats. Subdued background music and unsettling ambient effects—such as creaking doors and distant groans—prime players for sudden auditory shocks. These sharp audio cues not only heighten jump-scare moments but also emphasize the formidable nature of enemies, making each encounter feel perilous (see Appendix 8).

Through these case studies, it becomes evident that sound design choices are integral to establishing and reinforcing power dynamics in video games. Whether by leveraging booming orchestral scores, carefully calibrated ambient soundscapes, or character-specific audio cues, developers strategically manipulate auditory elements to evoke feelings of authority, vulnerability, or tension. By comparing diverse approaches across genres, we see how sound plays a pivotal role in shaping player experiences of power, both narratively and interactively.

3 METHODOLOGY

This chapter outlines the methods employed to investigate how audio influences power perception within a custom-developed game. By combining theoretical analysis with practical prototyping, the study rigorously examines established principles in a controlled, interactive environment. The following sections detail the overall research approach, the game prototype development process, and the evaluation of the implemented audio design.

3.1 Research Approach

The research methodology combines a comparative analysis of industry practices with hands-on prototyping to empirically assess how audio cues shape player perceptions of power. Building on the theoretical groundwork established in previous chapters, the study examines notable examples from the survival-horror genre—such as *Amnesia: The Dark Descent*, *Resident Evil*, and *Alien: Isolation*—to identify key audio-driven attributes. These include dynamic music systems, voice acting, ambient effects, and player feedback mechanisms, which serve as benchmarks for the audio implementation in *Silent Prey*.

Central to this approach is the prototype's integration and development. *Silent Prey* was built in Unity, selected for its robust community support and flexibility, and incorporates Wwise to manage adaptive audio behaviours, real-time parameter control, and spatialization. Sound assets were created using Ableton Live 10 Suite and version-controlled via Git, enabling iterative refinement through on-going play testing and design feedback.

The methodology also emphasizes iterative testing and analysis. Multiple builds of *Silent Prey* were evaluated to determine how effectively the audio elements elicited tension and reinforced the monster's perceived power. Internal play testing facilitated adjustments in various parameters such as volume, pitch randomization, and event triggers, while qualitative comparisons with the case studies provided insights into best practices. Special attention was given to psychologi-

cal impact, with a focus on breathing mechanics, environmental cues, and monster vocal ranges to align with player responses related to fear, vulnerability, and empowerment.

Finally, the study establishes evaluative criteria for power dynamics, examining the immediacy and intensity of auditory feedback, the effectiveness of the audio design in conveying dominance and unpredictability, the influence of sound elements on player agency, and the emotional resonance of key audio events. By merging theoretical inquiry with practical iteration, this research approach validates how various facets of audio can be orchestrated to convey specific power relationships within a game environment. Subsequent sections detail the development and analysis processes in *Silent Prey*, illustrating how these strategies manifest in both design choices and user experience outcomes.

3.2 Game Prototype Development

This section details the development process of the game prototype *Silent Prey*. The prototype was designed as a stealth-driven survival horror experience that leverages audio cues to shape player perceptions of power and vulnerability. The development process encompasses the conceptual design, the integration of tools and technologies, and the creation of custom sound assets. Together, these components establish a framework in which gameplay mechanics and audio-driven tension entwine, providing a practical context for the study's theoretical insights. The following sub-sections elaborate on the design overview, technical implementation, and asset creation processes.

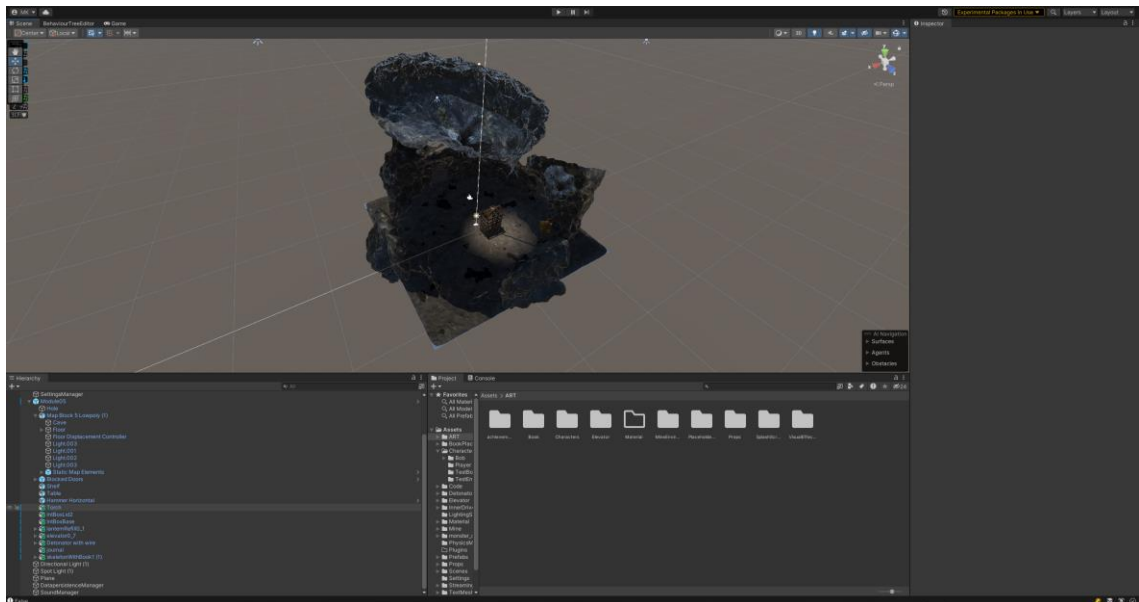
3.2.1 Concept and Design Overview

Silent Prey was conceived as a stealth-driven survival horror experience that examines how audio cues can influence player perceptions of power and vulnerability. Building on themes from the literature review—particularly the role of sound in evoking tension and dominance—the game's core mechanics empha-

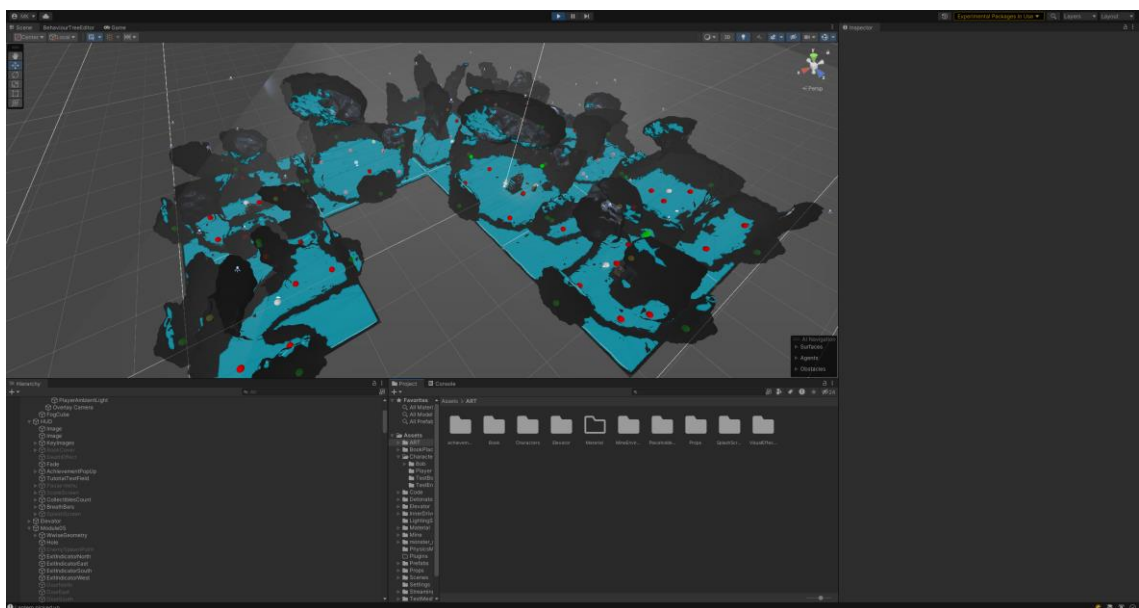
size careful movement, strategic noise management, and heightened auditory awareness within a dangerous subterranean environment.

The narrative unfolds within an abandoned mining complex where the player character crashes onto a battered mining elevator deep in an expansive, dilapidated mine. Environmental storytelling elements, such as scattered journal, tools, and debris, establish the setting as a once-functional operation now overrun by an unseen threat. The opening chamber serves as both a narrative introduction and a tutorial stage, where players learn essential interactions including opening containers, picking up a lantern, lighting torches, and detonating rubble to progress. A miner's journal hints at the looming menace, setting a tone of pervasive dread. The overarching objective—to repair the damaged elevator by retrieving three missing components scattered throughout the cave system—drives the narrative forward, with each retrieval deepening the player's immersion into an environment where every action carries risk.

Gameplay is structured around a procedural loop designed to enhance replayability and unpredictability. Randomized cave layouts ensure that resource locations, dead ends, sound sources, and monster patrol patterns vary with each playthrough (PICTURE 1, PICTURE 2). As players explore and scavenge for elevator parts and other survival items like rocks and oil, they must contend with the inherent risk of generating noise. Strategic actions—such as throwing rocks to distract the monster or carefully navigating to minimize footstep noise—are crucial to avoid detection and underscore the game's emphasis on auditory management.



PICTURE 1. Screenshot from Unity, showcasing the starting room module inside Unity editor, before the level generation has taken place (Picture: Milko Kurki 2025).



PICTURE 2. Screenshot from Unity, showcasing generated level with visible monster patrol area and item spawn locations. (Picture: Milko Kurki 2025).

Central to the design is the monster, whose behavior is driven by sound rather than sight. Programmed with highly sensitive auditory perception, the creature responds to even subtle cues like the player's breath or heartbeat, especially when anxiety levels rise. Its adaptive behaviors—ranging from following scent trails to initiating rapid pursuits—are communicated through a distinct audio profile that transitions from distant echoes to aggressive snarls, effectively convey-

ing its proximity and emotional state. This design choice not only reinforces the inherent power imbalance but also cultivates a persistent atmosphere of tension and vulnerability.

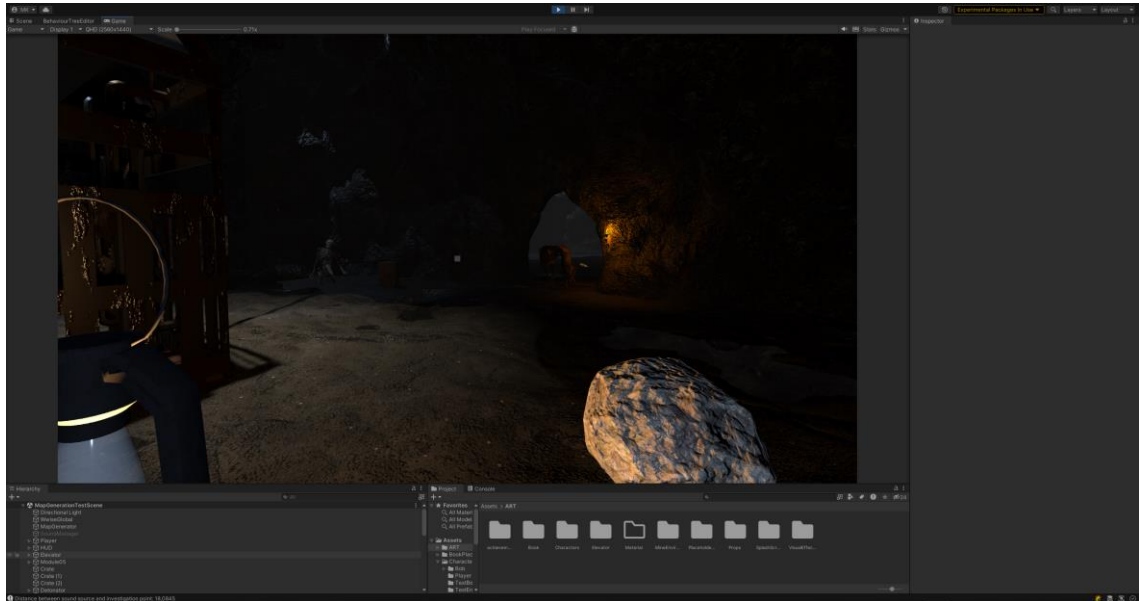
Audio-centric mechanics further amplify the game's thematic focus. For example, the lantern and torch system serves a dual purpose: while providing necessary illumination for navigation, the act of lighting torches introduces a psychological tension by suggesting potential noise, despite not being registered by the monster's AI. Similarly, the interplay of breathing and heartbeat cues functions as both a gameplay signal and an emotional trigger, escalating as the monster nears. Context-sensitive voiceovers add narrative depth, guiding players through objectives while reflecting the protagonist's mounting dread.

3.2.2 Tools and Technologies Used

The development of *Silent Prey* relied on a structured pipeline of complementary tools and technologies, each addressing a critical aspect of game development and audio integration. This cohesive workflow enabled rapid iteration and collaborative refinement, which were essential for achieving the game's immersive stealth-horror experience.

3.2.2.1. Unity Game Engine

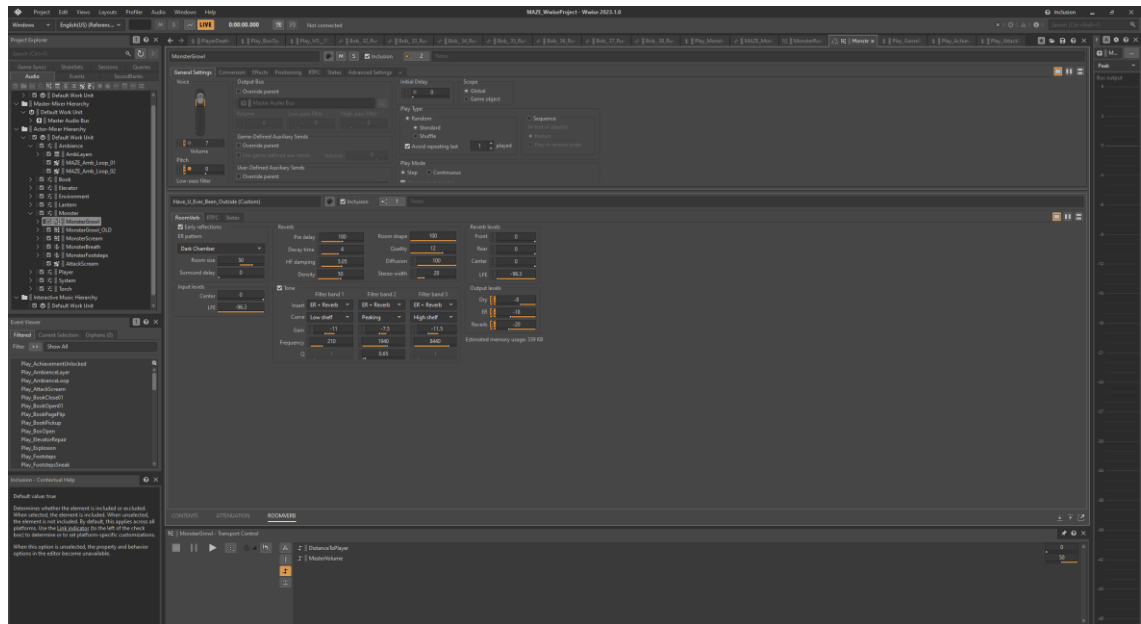
Unity served as the core platform for *Silent Prey*, managing game logic, level geometry, and interactive systems (PICTURE 3). Its extensive documentation and robust community support provided access to a wealth of tutorials, plugins, and third-party extensions that accelerated development and streamlined troubleshooting for procedural generation and physics-based interactions. The engine's modular architecture allowed for a clean separation between audio, visual, and AI systems—ensuring that updates to one component (such as lighting adjustments) could be made with minimal impact on others. Custom scripts further enhanced Unity's capabilities by dynamically assembling cave layouts, thereby introducing variable sonic challenges with each playthrough.



PICTURE 3. Screenshot from Unity editor while testing the game (Picture: Milko Kurki 2025).

3.2.2.2. Wwise Audio Middleware

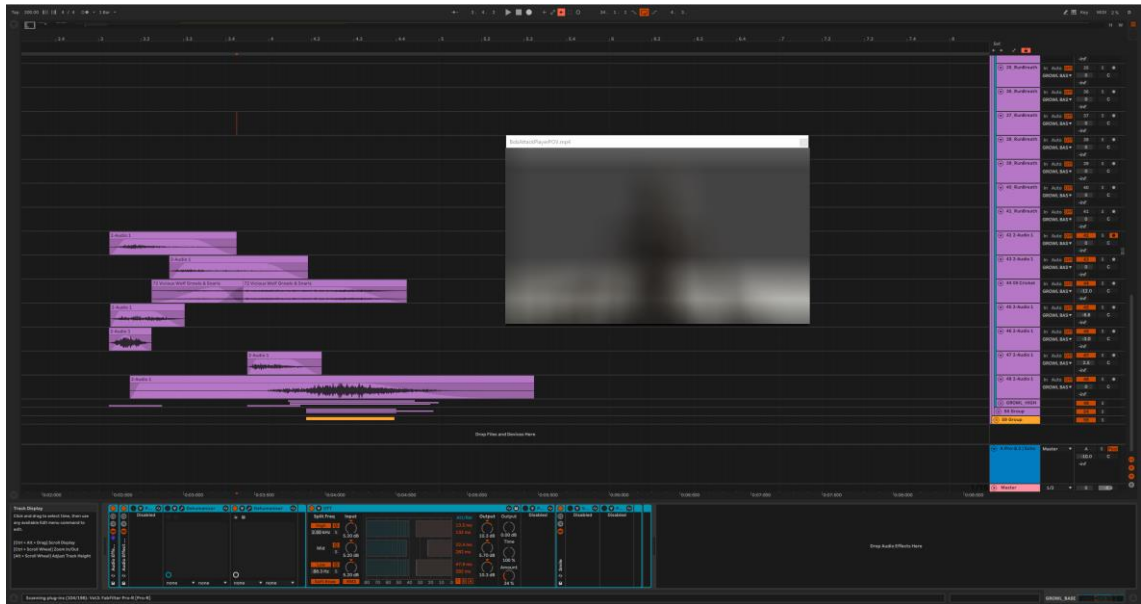
To bring *Silent Prey*'s adaptive and atmospheric soundscapes to life, Wwise was integrated as the audio middleware (PICTURE 4). Its event-driven architecture enabled Unity to trigger specific audio events—such as “monster footsteps” or “player breath”—with only adding play event calls to the core code (AudioKinetic, 2024a). Wwise's real-time parameter control (RTPC) features were extensively employed to mirror in-game variables in the audio domain. For instance, the monster's vocalizations would dynamically adjust in reverb, pitch variance, and intensity based on its movement speed and proximity, while the player's breathing intensity would increase with rising fear levels. (AudioKinetic, 2024b.) Additionally, Wwise's advanced spatialization and occlusion tools ensured that environmental effects, such as monster screams, reverberated realistically through the cave's geometry (AudioKinetic, 2024c).



PICTURE 4. Screenshot from Wwise editor showcasing general settings view of a sound asset (Picture: Milko Kurki 2025).

3.2.2.3. Ableton Live 10 Suite

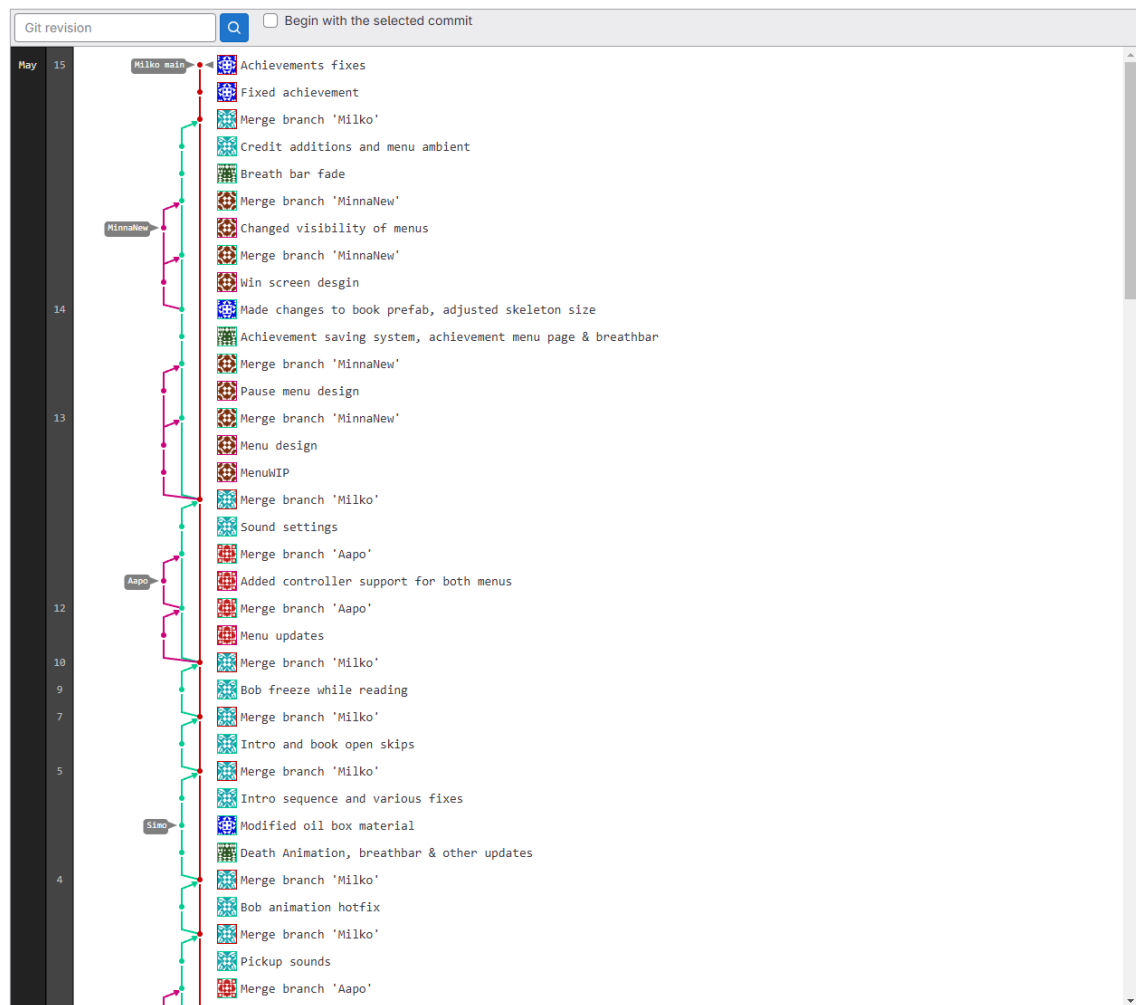
The creation and refinement of custom sound assets were managed using Ableton Live 10 Suite (PICTURE 5). Use of Foley libraries provided raw audio materials that acted as base resources on the asset creation process. Ableton's exporting tools guaranteed that final assets met standardized criteria for bit depth, sample rate, and normalization—ensuring seamless integration with Wwise (Ableton, 2018).



PICTURE 5. Screenshot from Ableton Live 10 Suite showcasing a general view of the monster vocalization project with a video preview window open (Picture: Milko Kurki 2025). Monster blurred by the request of the author

3.2.2.4. Git Version Control

Git was employed to manage both source code and multimedia assets throughout development (PICTURE 6). By using branching strategies, the team minimized merge conflicts and facilitated parallel development. Frequent commits enabled iterative refinement, allowing team members to revert changes if a new audio parameter, piece of code or asset underperformed in playtests. Storing all Unity project files, Wwise configurations, and Ableton exports in a unified repository maintained synchronized project states, while scheduled build routines ensured new versions of the game build were available as major changes were made—accelerating the overall feedback loop.



PICTURE 6. Screenshot from GitLab providing a glance into the Git repository graph (Picture: Milko Kurki 2025).

3.2.2.5. Custom Scripts

In addition to the commercial tools, bespoke C# scripts were developed to handle specific project requirements. Custom logic for module-based cave generation processed structural data (such as doorway positions and module sizes) and fed it into Wwise for dynamic occlusion modeling. Similarly, AI scripts governing the monster's auditory perception factored in proximity, intensity, and line-of-sight occlusion (PICTURE 7). By leveraging Wwise's RTPC, these scripts modulated the creature's hearing capabilities, vocal profile, and footsteps in response to changing environmental conditions.

```

8 public class Listen : ActionNode
9 {
10     1 reference
11     void ListenForSounds()
12     {
13         GameObject loudestSoundEmitter = null;
14         float loudestPerceivedVolume = -99f; // Start with a very low volume
15
16         // Check sounds only if sounds are playing
17         if (soundManager.activeEventsByPlayingID.Count == 0)
18         {
19             return;
20         }
21
22         // Check for sounds
23         foreach (var eventPair in soundManager.activeEventsByPlayingID)
24         {
25             GameObject soundEmitter = eventPair.Value.EmitterGameObject;
26             bool trackedByEnemy = eventPair.Value.TrackedByEnemy;
27
28             // Actual Wwise measured volume level fetched from the SoundManager
29             float volumeLevel = eventPair.Value.VolumeLevel;
30
31             if (soundEmitter != null && trackedByEnemy)
32             {
33                 float distanceToSound = Vector3.Distance(context.transform.position, soundEmitter.transform.position);
34                 float perceivedVolume = CalculatePerceivedVolume(distanceToSound, volumeLevel, soundEmitter);
35
36                 if (perceivedVolume > loudestPerceivedVolume)
37                 {
38                     loudestPerceivedVolume = perceivedVolume;
39                     loudestSoundEmitter = soundEmitter;
40                     distanceToLoudestSound = distanceToSound;
41                 }
42             }
43
44             if (loudestSoundEmitter != null && loudestPerceivedVolume > hearingThreshold)
45             {
46                 blackboard.SetValue<Vector3>("LoudestSoundPosition", loudestSoundEmitter.transform.position);
47                 blackboard.SetValue<float>("DistanceToLoudestSound", distanceToLoudestSound);
48                 loudestSoundUpdated = true;
49                 debugTrackedObjectDisplay.SetTrackedObject(loudestSoundEmitter.transform);
50             }
51         }
52     }
53
54     1 reference
55     float CalculatePerceivedVolume(float distance, float volumeLevel, GameObject soundEmitter)
56     {
57         // Calculate the intensity ratio using the inverse square law.
58         float intensityRatio = distance > 1 ? 1 / (distance * distance) : 1;
59
60         // Convert the intensity ratio to decibels for attenuation.
61         float attenuationDb = ConvertIntensityToDecibels(intensityRatio);
62
63         // Calculate the occlusion multiplier based on direct and surrounding obstructions.
64         float occlusionMultiplier = CalculateOcclusionMultiplier(soundEmitter);
65
66         // Adjust the attenuation based on the occlusion effect.
67         float occludedAttenuationDb = attenuationDb * occlusionMultiplier;
68
69         // Combine the original volume level with the occluded attenuation.
70         // Assuming volumeLevel is in dB.
71         float perceivedVolume = volumeLevel + occludedAttenuationDb;
72
73         return perceivedVolume;
74     }
75 }

```

PICTURE 7. Screenshot of a portion from the enemy's sound detection logic script (Picture: Milko Kurki 2025).

3.2.2.6. Synergistic Workflow and Impact on Game Quality

The integration of these tools fostered a highly iterative, cross-disciplinary workflow that significantly enhanced *Silent Prey*'s overall quality. Rapid prototyping was achieved as I adjusted monster AI thresholds or revised footstep volumes in Wwise, while level builders rearranged cave elements in Unity—each team observing immediate updates in new builds. This dynamic interplay supported holistic immersion: a custom procedural approach generated unpredictable en-

vironments, and Wwise's event-driven mixing adapted the soundscape in real time, reinforcing both replayability and an ever-present sense of dread. Standardizing the asset export process in Ableton and versioning all changes via Git ensured that, despite multiple iterations and remote collaboration, the game maintained a coherent, high-quality sonic signature throughout development.

3.2.3 Sound Asset Creation Process

Crafting the audio assets for *Silent Prey* required a deliberate, iterative workflow in which every sound—from the subtle ambient noises of the cave to the monster's terrifying roars—was carefully tailored to support the game's suspense-oriented stealth mechanics. As the sole audio designer, I sourced and recorded raw sounds before carefully processing and layering them to create immersive elements that evoke tension, vulnerability, and a constant sense of looming danger.

The process began with detailed planning and the establishment of clear sound requirements. Based on the game's design concepts, I compiled a comprehensive list of essential sound categories, including those for player actions, environmental cues, and monster vocalizations. This pre-production phase ensured that each audio asset had a distinct purpose, whether to signal interactivity, build atmosphere, or reinforce the threatening presence of the monster. I further refined my approach by analyzing classic stealth and horror games to understand how specific audio cues, such as footsteps and growls, prime players for dread, setting a goal of heightening tension without overwhelming gameplay feedback.

A significant aspect of the workflow involved leveraging Foley libraries and advanced layering techniques. To achieve a broad sonic palette, I drew on a variety of organic sounds from Foley libraries, using each sample as a foundational layer that I would then manipulate and combine with others. For example, creating a rich cave ambience involved blending multiple ambient soundscapes together and spicing it up with randomized one shots instead of just sourcing a pre-made cave ambience from a SFX library. Extensive editing—using tools

such as EQ, reverb, delay, compression, pitch shifting, time stretching, and distortion—ensured that every asset possessed a unique character, thereby avoiding the pitfalls of generic, out-of-the-box sounds.

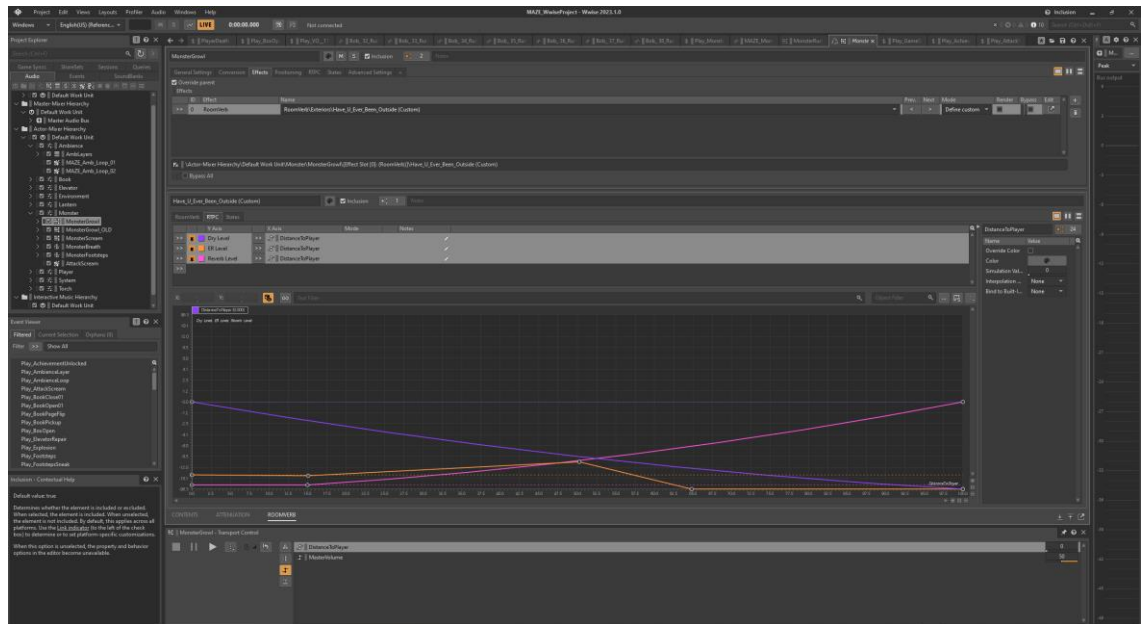
Monster vocalizations were handled with particular care. All such sounds originated from my own recordings, capturing multiple takes of guttural growls, breathy snarls, and sustained wails in a controlled environment to cover a range of emotional expressions from anger to predatory excitement. Once imported into Ableton Live 10 Suite, these recordings were transformed through pitch shifting (to emphasize power or evoke an otherworldly quality), layering additional high-frequency textures and sub-bass drones (to add depth), and applying distortion and modulation (using techniques such as ring modulation and convolution reverb) to create an inhuman and intimidating sonic signature.

The editing and mixing workflow relied on multi-track sessions in Ableton Live, where each sound element was refined on separate tracks for layering, effects, and automation (PICTURE 8). This non-destructive setup allowed for flexible experimentation while preserving earlier versions of each asset. Maintaining the appropriate dynamic range was critical; for example, footsteps had to remain sufficiently audible for realism without compromising the overall suspense. Compression and EQ were applied to balance clarity and subtlety, while ambient loops were carefully crossfaded to ensure seamless playback. Additionally, producing multiple variations for frequently triggered effects such as container interactions, torch lighting, footsteps, and rock throws and impacts helped minimize auditory fatigue during repetitive gameplay.



PICTURE 8. Multi track session view captured from Ableton Live 10 Suite with several plugins open along with a video window of screaming monster from the game (Picture: Milko Kurki 2025). Monster blurred by the request of the author.

Final integration into Wwise involved normalizing each track to ensure consistent levels across categories (monster vocals, environmental sounds, player cues, etc.), which facilitated precise volume mixing within Wwise’s adaptive framework. Key actions, such as throwing a rock and footsteps, were mapped to specific Wwise events with built-in variations, ensuring that repeated actions produced slight sonic differences for enhanced realism. Real-time parameter controls (RTPC) and spatialization techniques were linked to gameplay variables (for instance, monster proximity and player fear level) so that the audio dynamically adapted to in-game scenarios—altering the monster’s roaring intensity and the reverberation accordingly (PICTURE 9).



PICTURE 9. Screenshot from Wwise showcasing three different RTPC curves for various aspects of monster growl reverberation based on the monster’s distance to the player’s location (Picture: Milko Kurki 2025).

Throughout development, extensive playtesting and cross-disciplinary feedback from programmers and level designers were crucial. Updated builds were evaluated to determine whether the integrated sounds met gameplay requirements, often necessitating tweaks—such as adjusting the pitch of a distant roar or enhancing the clarity of footsteps in puddles. As the cave layout and monster AI evolved, I revisited and retuned certain sounds to maintain consistency and heighten tension during faster chase sequences.

Every aspect of the sound creation process was designed to emphasize the core power dynamic of *Silent Prey*: an overwhelming, formidable monster pitted against a resourceful but fragile human. Through layered Foley techniques, meticulous vocal transformations, and careful mixing, the game’s audio continuously weaves an atmosphere of unease, ensuring that the player is always aware of the monster’s presence—even when it remains unseen—while reinforcing the high stakes of every encounter.

3.3 Technical Analysis of Audio Integration

This section evaluates how the finalized audio elements in *Silent Prey* perform within the actual game environment. Building on the detailed discussions of the conceptual framework, development pipeline, and sound asset creation, the analysis examines how players experience and interpret audio cues in the context of stealth, survival, and power dynamics. The focus is on three interrelated aspects: the real-time behavior of dynamic audio systems, the psychological impact of the soundscape, and the synergy between audio cues and gameplay mechanics. Together, these factors reveal how the audio design shapes player perception and interaction within the game.

3.3.1 Integration of Audio into Gameplay

While previous sections on asset creation and technical methodology have detailed what was built and how it was implemented, this subsection focuses on where and why these audio elements manifest in the gameplay experience of *Silent Prey*. It examines the in-engine interactions among audio triggers, player actions, and monster AI states, highlighting how each sound event contributes to the stealth-horror mechanics and underpins the player's sense of power—or lack thereof.

At the core of the integration are real-time audio triggers and event management. Key gameplay actions, such as throwing rocks, opening containers, or lighting torches, invoke corresponding Wwise events that signal states of heightened risk or progression. In parallel, the monster's behavior scripts continuously assess sound intensity and proximity, triggering audio cues—like deep growls or sprinting footfalls—that evolve with the AI's aggression level. For example, when the player steps into a puddle, Unity notifies Wwise that the surface is water, resulting in a slightly louder footstep enriched with a water texture. Simultaneously, if the monster is within a certain hearing radius, its AI may shift from an “idle” to an “investigating” state.

The synergy between environmental and player-centric audio further reinforces gameplay tension. As the monster draws near, the player's fear level increases, and Wwise's RTPC parameters dynamically link this "fear" variable to adjust the volume and crossfade between the player's breathing and heartbeat sound effects. This creates an escalating tension loop that alerts the player to imminent danger, even as uncertainty lingers over whether the increased noise will attract the monster. Similarly, subtle audio cues associated with lantern and torch sounds, although not directly triggering the monster, instill caution in the player. A well-timed torch-lighting sound effect, for instance, may elevate anxiety sufficiently for the player to delay or forgo lighting additional torches, thereby deepening the sense of vulnerability.

Adaptive mixing and occlusion in the cave environment also play critical roles. The winding layout of the cave ensures that the monster's screams or footsteps echo from multiple directions. Wwise employs geometry-based occlusion to modulate how much sound passes through walls and geological formations, offering the player directional feedback. In a scenario where a monster roar is triggered while the creature is two corridors away, the player may hear a muffled, reverb-heavy sound that reinforces distance and dread; as the monster closes in, the occlusion values update, rendering the roar clearer and louder despite the shifting layout.

Feedback loops between the player and the monster further enhance the gameplay experience. Every time the player interacts with the environment—whether by opening a container, throwing a rock as a distraction, or picking up an elevator part—Wwise generates a corresponding sound event. The monster's AI, in turn, references these loudness thresholds to decide whether to pursue the noise, creating a delicate "risk versus reward" dynamic. When the player opts to hold their breath, the audio amplitude of their breathing momentarily drops, reducing the likelihood of detection; however, this can only be maintained briefly before an amplifying heartbeat signals the need for a release. For example, if the player picks up an elevator part and hears a metallic clang, the sound event may trigger the monster's investigative mode. Recognizing the impending threat through intensified monster footsteps, the player might hold

their breath and sneak towards the elevator, carefully balancing the need for stealth against the urgency of movement.

Dynamic voice-overs and narrative reinforcement further integrate audio into gameplay. Certain triggers in Unity prompt Wwise to play short voice-over lines when the player picks up vital components or observes key environmental details. These voice-overs not only convey narrative context—such as reminding the player “Only one left” upon retrieving the second elevator part—but also mirror the protagonist’s anxious tone, subtly warning of nearby danger. In moments where fear levels peak, repeated phrases like “Hold your breath...” may activate, heightening the emotional stakes and nudging the player forward despite their trepidation.

Finally, the overall impact on perceived power dynamics is evident through the contrast between the monster’s dominant, booming audio cues and the player’s fragile, strategic stealth sounds. The monster’s loud, abrupt roars and rapid footfalls continuously broadcast its looming threat, while the nuanced audio cues associated with player actions—such as quieter footsteps and controlled breathing—offer only limited, fleeting moments of tactical advantage. A successful distraction, like a well-timed rock toss, can briefly invert this power dynamic by drawing the monster’s attention away, yet every subsequent action risks re-exposing the player’s vulnerable position.

Preliminary observations from playtesting underscore the critical importance of precise tuning, psychological leverage, and real-time mix management. Even minor shifts in decibel levels can drastically alter gameplay balance, confirming that the interplay between immersive audio triggers, adaptive spatialization, and dynamic voice-overs is essential in unifying gameplay actions with an ever-present sense of risk. In this way, every sound event—from the subtle crunch of a footstep to a sudden, jarring roar—serves both narrative and mechanical purposes, cementing the monster’s role as a dominant force and continuously reminding the player of the fine line between survival and fatal discovery.

3.3.2 Evaluation of Sound Effects and Atmosphere

Final section of the methodology chapter evaluates how *Silent Prey*'s sound design—encompassing ambient cues, character vocalizations, and monster audio—shapes the overall atmosphere and supports the power dynamic integral to the game's stealth-horror genre. While the previous subsection addressed the functional integration of audio cues, here the focus shifts to qualitative measures of how these sound elements resonate emotionally with players and fulfill the design objectives of tension, vulnerability, and a menacing sense of threat.

3.3.2.1. Core Criteria for Evaluation

To assess the sound design's effectiveness, several core criteria were established. First, immersion and believability were examined to determine whether the cave ambience, player sounds, and monster vocalizations convincingly evoke a grim subterranean world. The auditory environment should ensure that every distant drone and roar aligns with the game's setting and propels the narrative context. Second, the emotional response elicited by the sound design was evaluated—specifically, whether the audio sustains the horror genre's emotional beats (anxiety, dread, and the relentless feeling of being hunted) over time. Third, the design's capacity to enhance stealth and risk perception was scrutinized. In a game built around stealth mechanics, it is crucial that auditory feedback continually reminds players of the consequences of noise production. Finally, the evaluation considered the degree to which the sound design conveys a power imbalance—whether the monster's roars, footfalls, and idle growls are sufficiently intimidating to validate its perceived dominance.

3.3.2.2. Atmospheric Efficacy

The overall atmosphere relies heavily on the effective use of ambient textures. Layered cave drones and various randomized one-shot sound effects were specifically designed to evoke claustrophobia and a constant state of unease.

Preliminary observations indicated that many players reported feeling “on edge” even when the monster was not present. Moreover, the decision to forgo continuous background music in favor of subtle atmospheric loops proved effective; the relative silence in certain sequences amplifies minor sounds, thereby fostering paranoia about the monster’s potential approach. Wwise’s advanced occlusion and reverb features further enhance realism by simulating natural cave acoustics—echoing footstep trails and distant monster wails frequently induced moments of hesitation, lending the environment an unpredictable, almost “alive” quality.

3.3.2.3. Effectiveness of Key Sound Cues

Specific sound cues were critical to both gameplay and the emotional tone of the experience. For instance, variations in footstep sounds—from wet and gravelly textures to softer, sneaking variations—provided essential feedback that supported the stealth mechanics. Although some initial feedback indicated that the footstep volume was overly pronounced, subsequent adjustments resulted in a more balanced risk-reward dynamic. Similarly, the rising intensity of the player’s breath and heartbeat near the monster served as a clear signal of danger, effectively inducing both emotional tension (with players noting a quickened pulse) and mechanical tension (by heightening the fear of detection). In addition, monster vocalizations—particularly snarls and roars whose volume and reverb dynamically responded to proximity—were repeatedly described by testers as “genuinely unsettling,” consistently reinforcing the impression of an overpowering adversary.

3.3.2.4. Psychological and Behavioral Observations

Internal playtesting provided valuable insights into the psychological and behavioral impacts of the sound design. Players often paused in corridors or sought cover behind obstacles upon hearing distant roars, and some even refrained from lighting additional torches, fearing that the resulting noise might trigger detection—even though this was an intentional misdirection. The tension generated by sounds such as footstep noise and container interactions led many players to adopt more cautious, risk-averse exploration strategies. Although these behavioral adaptations sometimes slowed progression, they underscore the effectiveness of the sound design in shaping a stealthy, suspenseful play style.

3.3.2.5. Alignment with Power Dynamics

The sound design's ability to articulate the game's core power dynamics was consistently evident. Nearly all test participants agreed that the monster exuded an unmistakable aura of superiority, largely attributable to its dominating, layered vocal profile and the unpredictable nature of its approach. At the same time, the player's limited capacity to manipulate sound—through actions such as throwing rocks or holding their breath—provided only fleeting moments of tactical advantage, reinforcing the inherent imbalance between the formidable monster and the vulnerable protagonist. In climactic encounters, the combined effect of the monster's roars, the player's frantic heartbeat, and environmental echoes produced an auditory crescendo that perfectly encapsulated the game's cat-and-mouse dynamic.

3.3.2.6. Limitations and Future Considerations

Despite the overall success of the sound design, several limitations were identified. The current evaluation is based primarily on internal team feedback and a limited pool of external testers; broader demographic sampling could yield deeper insights into how different players respond to the same auditory stimuli. Additionally, achieving an optimal balance between quiet stealth moments and

sudden, loud threats remains challenging. This is partly due to the monster's reliance on overall loudness rather than discrete trigger points. Furthermore, there is a risk of psychological saturation if players become overexposed to intense audio cues—such as repeated monster roars—which may dull their shock value over time. Future iterations might incorporate more in depth variable cool down mechanisms for these cues to preserve their impact and minimize audio fatigue.

3.3.2.7. Overall Assessment

Overall, *Silent Prey*'s sound effects and atmospheric design consistently elevate the game's stealth-horror tone, fueling both immediate tension and sustained dread. The interplay of carefully mixed environmental loops, adaptive monster cues, and subtle illusions about what might or might not attract the creature fortifies the central theme of power imbalance. By carefully orchestrating each sonic element to stress vulnerability, the audio design encourages players to weigh every footstep, breath, or interaction against the looming threat of a relentless predator—a testament to how critical sound can be in defining both the emotional arc and gameplay dynamics of a stealth-horror experience.

4 FINDINGS AND DISCUSSION

This chapter synthesizes the insights and data gathered from the development, testing, and analysis of Silent Prey’s audio design. It evaluates the system’s performance under real gameplay conditions and discusses how the implemented sound strategies shape player perceptions of power, vulnerability, and tension. In doing so, this chapter bridges the technical and experiential aspects of the prototype, highlighting both successes and areas for refinement.

4.1 Analysis of Game Prototype Audio Design

Drawing on insights from development and playtesting, this section examines both the technical performance and the user experience of the audio design.

4.1.1 Technical Effectiveness

The audio system reliably triggered key events—such as footsteps, monster vocalizations, and environmental interactions—by leveraging real-time parameter controls (RTPCs) to adjust volume, pitch, and reverb according to in-game conditions (e.g., monster proximity and player fear levels). Spatialization and occlusion mechanisms enhanced the subterranean ambiance by providing accurate directional cues, reinforcing the need for silence in confined spaces. Although internal testing confirmed stable performance with efficient resource usage, further testing on a broader range of hardware is recommended.

4.1.2 Experiential Effectiveness

The sound design played a pivotal role in inducing tension and anxiety. Dynamic elements such as escalating heartbeat and breathing cues effectively signalled imminent danger, while the absence of continuous background music allowed discrete sound events to carry significant emotional weight. Players reported that even subtle cues—like the noise from torch lighting or a muffled

footstep—heightened their awareness of vulnerability. These audio cues not only guided in-game behaviour, prompting cautious movement and noise management, but also contributed to a persistent psychological state of alertness.

4.1.3 Emergent Patterns and Overall Impact

Beyond individual technical and experiential components, the audio system emerged as an active gameplay mechanic. Players frequently adapted their strategies in response to evolving sound cues, with moments such as successfully distracting the monster via thrown rocks offering fleeting reversals of the power imbalance. Nonetheless, the overall data indicate that the monster's dominant auditory profile and the player's constrained sound options effectively reinforce the intended stealth-horror dynamic. In summary, *Silent Prey*'s audio design successfully creates a tense, immersive environment that underlines the game's core themes of power and vulnerability.

4.2 Influence of Audio Design on Power Perception

In any game that leverages tension as a central mechanic—especially within the horror or stealth genres—sound design plays an important role in steering how players perceive control, threat, and vulnerability. In *Silent Prey*, the emphasis on auditory cues as both a strategic and psychological factor provides a practical window into how audio can actively shape power dynamics.

4.2.1 Elevating the Monster's Dominance

The monster's audio profile is engineered to evoke a sense of overwhelming presence. Deep frequencies, layered distortions, and adaptive spatial cues work together to create guttural roars and heavy footsteps that suggest both physical mass and lethal capability. The dynamic modulation—such as sounds that echo faintly when distant and intensify as the creature nears—reinforces an unpredictable and omnipresent threat. Adaptive indicators like the escalating intensity

of breath and heartbeat cues during close encounters, further underline the monster's image as a deadly force.

4.2.2 Underscoring Player Vulnerability

A sparse sound environment ensures that every minor noise stands out. Without continuous background music, subtle cues—each footstep, object interaction, or even the player's own breathing—gain heightened significance. This minimal sound budget forces players to remain acutely aware of their auditory footprint, emphasizing the inherent risk in every action. In such an environment, even necessary actions (like opening a container or lighting a torch) carry the danger of exposure, reinforcing the player's fragile position against a dominating adversary.

4.2.3 Strategic Reversal of Power

Despite the monster's formidable auditory presence, the design includes moments that allow players to briefly shift the balance. Tactics such as throwing rocks to misdirect the monster provide fleeting opportunities for control. Additionally, the fluctuating nature of the soundscape—shifting from moments of intense pursuit to brief periods of calm—enables players to exploit temporary windows of relative safety. These instances of transient empowerment, though short-lived, offer critical tactical advantages that momentarily offset the overall power imbalance.

4.2.4 Psychological and Emotional Resonance

Beyond its mechanical role, the audio design serves as an emotional catalyst. The interplay of ambient sounds and strategic silence keeps players in a state of heightened vigilance and anticipation. By forcing players to "fill in" the silence with their own anxiety, every discrete sound event becomes laden with meaning, intensifying the overall atmosphere of dread. This constant state of auditory

alertness shapes player behaviour, compelling cautious, measured actions and deepening the immersive experience.

4.2.5 Emerging Themes

Several key themes emerge from the analysis of *Silent Prey*'s audio design:

- **Dominant Entities Project Audible Force:** The use of low frequencies and sudden volume spikes effectively communicates the monster's overwhelming might.
- **Silence as a Strategic Element:** Deliberate negative space in the soundscape acts as both a moment of respite and a trigger for tension, as players become hyper-aware of any new sound.
- **Transient Empowerment:** Occasional opportunities for players to manipulate sound—such as through distraction tactics—offer brief moments of control in an otherwise precarious situation.

4.3 Comparison with Case Studies

Having established how *Silent Prey* leverages sound to shape player perceptions of power and vulnerability, we can compare and contrast the game's audio strategies with established case studies in horror and stealth titles. By identifying parallels and distinctions, we can situate *Silent Prey* within a broader industry context, validating its methods and highlighting innovative or diverging approaches.

4.3.1 Influence of Classic Horror Titles

- **Resident Evil (Early Entries)**
 - **Tension via Sparse Music:** Like the original *Resident Evil* games, *Silent Prey* forgoes continuous background music in favour of ambient tones, ensuring that any sound event—like a creaking container or a distant roar—carries more weight.

- **Footstep Signifiers:** Both titles rely on prominent footstep audio to evoke unease. However, Resident Evil often uses pre-rendered camera angles and scripted stingers to deliver jump scares, whereas Silent Prey emphasizes dynamic stealth detection. Despite this difference, the principle of “making every step matter” remains consistent.
- **Amnesia: The Dark Descent**
 - **Emphasis on Player Breathing:** Amnesia popularized the concept of linking the protagonist’s breathing and heart rate to in-game terror. Silent Prey extends this mechanic by making the player’s breath audibly detectable by the monster, turning a purely atmospheric element into a tangible gameplay constraint.
 - **Perceived vs. Actual Threat:** Both games exploit “fear of the unseen,” allowing audio cues—groans, footsteps, distorted echoes—to seed paranoia. The key divergence is Amnesia’s reliance on sanity meters for visual/auditory hallucinations, whereas Silent Prey focuses on actual monster AI triggered by sound.

4.3.2 Stealth Mechanic Comparisons

- **Alien: Isolation**
 - **Xenomorph AI and Player Noise:** Alien: Isolation is lauded for its adaptive AI, which reacts to player-created sounds (e.g., footsteps, weapon fire). Silent Prey similarly ties the monster’s response to auditory triggers, though on a smaller scale. Whereas Isolation features advanced patrol algorithms and a wide array of player tools, Silent Prey keeps interactions minimal and grounded—rocks, breath control, and stealth movements. Both, however, use immersive spatial audio to reinforce the monster’s omnipresence and unpredictability.
 - **Minimal HUD and High Stakes:** By limiting the player’s knowledge of the enemy’s exact location (and intensifying reliance on audio cues), Alien: Isolation aligns with Silent Prey’s design ethos. Both

games highlight how partial sound information can be a powerful driver of tension, eliciting a heightened sense of vulnerability.

- **Thief (Series)**
 - **Noise Sensitivity:** The Thief series underlines stealth mechanics through footstep volumes, surface types, and ambient soundscapes that influence enemy detection. In a similar vein, Silent Prey capitalizes on varied terrain (e.g., puddles, gravel) and item interactions to signal danger.
 - **Player Agency in Sound Generation:** Thief provides players with choices in how to approach missions (e.g., quieter weaponry, water arrows), while Silent Prey offers distractions (e.g., tossed rocks) and silent movement techniques (breath-holding, sneaking). Both approaches underscore sound as a core gameplay resource that can be skilfully managed or misused.

4.3.3 Divergent Approaches and Innovations

- **No Dedicated Soundtrack**

Unlike some horror games that employ composed music to cue the player's emotional state (e.g., ramping violins during chase sequences); Silent Prey relies on ambient loops and stingers. This design diverges from the norm, leaning heavily on environmental sound design to maintain pressure.
- **Illusion vs. Actual Detection**

Many stealth titles make all actions quantifiably noisy. Silent Prey introduces a deliberate illusion mechanic, where certain sounds (like torch lighting) do not affect the monster's AI. This tactic manipulates player psychology, encouraging caution even when it's not strictly necessary—a notable twist compared to the more binary detection systems in other stealth-horror games.

- **Breath-Holding Mechanic as a Core System**

While *Alien: Isolation* and others allow limited options for noise reduction (e.g., hiding in lockers), *Silent Prey*'s breath-holding is both a mechanical and emotional anchor. This feature directly ties the player's bodily state to stealth success, adding an extra layer of vulnerability and tension.

4.3.4 Assessing Efficacy in Relation to Industry Trends

By drawing parallels with prominent horror and stealth titles, *Silent Prey* appears to embrace many proven audio strategies—spatial sound, adaptive cues, tension-building environmental loops—while adding unique flourishes, such as the breath-holding mechanic and intentional audio misdirection. The combined result is a distinctive stealth-horror experience that leverages core industry lessons while simultaneously pushing certain boundaries of sound-driven gameplay.

These comparisons highlight the evolution of audio-centric design, suggesting that the fundamentals of stealth and horror—heightened tension, player fragility, adaptive enemy cues—remain a potent formula. *Silent Prey* fits into this continuum by delivering an environment where every sound has meaning, risk, or both. However, its conscious choice to omit continuous background music and blend illusions of noise punishment exemplifies how even small deviations from the norm can significantly reshape the player's psychological landscape and the perception of power within a game world.

4.4 Implications for Game Audio Design

Drawing on *Silent Prey*'s development insights and its alignment with broader industry practices, several key takeaways emerge for those aiming to harness audio to convey tension, vulnerability, and shifting power dynamics in interactive media.

- **Positioning Audio as a Core Mechanic**
 - **Gameplay Relevance:** Rather than treating sound as background flavour, design elements like footstep volume, proximity-based roars, or breath-holding can directly impact gameplay decisions.
 - **Risk–Reward Balancing:** When every noise potentially attracts danger, players must weigh immediate benefits (e.g., searching a container) against stealth preservation—an approach useful in horror, stealth, or any genre emphasizing tension.

- **Adaptive Sound to Convey Power and Vulnerability**
 - **Dynamic Parameters:** Real-time adjustments to volume, pitch, or reverb—linked to in-game factors like distance and fear—heighten the sense of ever-present threat.
 - **Emotional Resonance:** By mirroring player anxiety (e.g., louder heartbeat or erratic breathing), sound design underscores power imbalances and invites deeper immersion.

- **Leveraging Psychological Tactics**
 - **Illusory Consequences:** Certain audio cues can be purely perceptual triggers, encouraging caution even when they don't actually affect AI behaviours. This cultivates tension through perceived rather than only real risks.
 - **Negative Space:** Intentional silence—devoid of background music—amplifies isolated sounds, magnifying their emotional impact and prompting heightened vigilance.

- **Spatial Immersion and Procedural Interaction**
 - **Environmental Storytelling:** Accurate occlusion, positional audio, and reverb management can transform a game world into a living acoustic environment, guiding players with realistic sonic cues.
 - **Procedural Adaptability:** When level layouts or enemy patrols change dynamically, sound systems should also adapt, offering fresh, unpredictable experiences each playthrough.

- **Iterative Collaboration and Testing**
 - **Holistic Integration:** Close alignment between audio designers, programmers, and level designers ensures cohesive interplay between sound events and game mechanics.
 - **Frequent User Feedback:** Quick iteration cycles—especially in stealth-horror setups—help refine volume levels, pacing, and the emotional pacing of key sound triggers.

By combining audio systems deeply with core gameplay loops, developers can craft experiences where players keenly feel every shift in dominance—be it the monster’s echoing footfalls or the hush of a cautious breath. These design strategies, tested and validated in *Silent Prey*, can equally inform broader genres and future technologies, underlining audio’s central role in shaping tension, agency, and the nuanced perception of power in games.

5 CONCLUSION

This thesis set out to explore how audio design—specifically the interplay of sound effects, music, voice-overs, and ambient soundscapes—affects perceptions of power and vulnerability within video games. By examining the bespoke prototype *Silent Prey*, the research demonstrated that audio elements are not merely aesthetic enhancements but core drivers of player experience and in-game dynamics. The findings reinforce the notion that sound is a potent tool for establishing tension, guiding player behaviour, and emphasizing imbalances in power, particularly within the horror and stealth genres.

Throughout this study, theoretical frameworks on auditory perception and the psychology of power were integrated with practical case analyses of modern video game audio. Comparing *Silent Prey*'s methods to established industry examples underscored both universal principles—such as the impact of spatial audio on immersion—and unique design choices, including the use of illusory sound cues to manipulate player anxiety. Ultimately, this research highlights audio's potential to transform how players interpret their relative strength or vulnerability, inviting designers to think more strategically about how sound can shape both narrative and mechanics.

One of the most prominent insights is that audio need not be relegated to the background. In *Silent Prey*, sound is integral to both gameplay and storytelling, with actions like torch-lighting, lantern management, container interactions, and footstep pacing directly affecting stealth strategies. By tying these actions to specific sound events and intensities, players are forced to weigh risk against reward, demonstrating how audio actively governs pacing and decision-making. The study also validated the hypothesis that audio cues can significantly influence a player's sense of vulnerability. In *Silent Prey*, environmental silence and subtle ambient loops magnify the impact of every new sound—particularly the monster's menacing footsteps or growls—cultivating a persistent anxiety that supports the game's power imbalance. The data indicate that strategic silence, periodic stingers, and layered spatial effects all foster an enduring perception of danger and subjugation.

The research further contributes to game audio design by demonstrating adaptive sound strategies. By linking audio parameters to in-game variables such as monster proximity and fear level, *Silent Prey* showcases how adaptive systems can elevate tension and realism. This aligns with broader industry movements toward context-sensitive sound design and reinforces the importance of real-time parameter control (RTPC) for creating immersive experiences. The findings affirm that adaptive audio techniques are accessible to smaller-scale projects with the right tools and methodologies. Additionally, the deliberate use of “false alarms”—for example, incorporating audio cues that do not actually affect enemy AI like torch-lighting—illustrates how exploiting player psychology can prompt cautious behaviour and enhance suspense. Such innovations in perceived danger reveal that carefully placed auditory illusions can shape player behaviour and emotional responses as effectively as tangible threats.

However, the study is not without limitations. Due to time and resource constraints, only a relatively small group participated in systematic internal playtesting. Although their feedback provided valuable qualitative data, a larger, more diverse audience would yield a broader range of reactions and increase the generalizability of the findings. Moreover, external user testing with participants unfamiliar to the development team might uncover overlooked issues or unexpected responses, refining the reliability of the results. The focus on a single prototype—*Silent Prey*, which represents one specific subgenre of horror-stealth—also limits the scope of conclusions, as games with different mechanics, art styles, or thematic contexts might employ audio in ways that challenge or contradict these observations.

Looking ahead, future research should involve larger-scale and longitudinal testing to solidify these conclusions. Extended playtests with diverse participant pools over multiple sessions could help determine how familiarity affects player anxiety and whether audio cues retain their efficacy over time. Additionally, exploring these principles in cross-platform and XR environments—such as virtual reality (VR) and augmented reality (AR)—could further validate the adaptability of sound-driven mechanics, with immersive 3D audio pipelines potentially intensifying the psychological impact of audio illusions.

In summary, this thesis emphasizes audio's capacity to alter perceptions of power in interactive media. By weaving adaptive sound design into core gameplay mechanics—particularly within stealth-horror frameworks—developers can craft deeply engaging, emotionally resonant experiences. The lessons extracted from *Silent Prey* are widely transferable, suggesting that when executed thoughtfully, audio can remain an unsung hero in both expressing—and, at times, upending—power hierarchies across a variety of game genres.

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7 APPENDICES

Appendix 1. Silent Prey – Technical Audio Overview Video

In depth technical audio overview video of the Silent Prey game prototype can be watched from the following link:

https://www.youtube.com/watch?v=5PdbIsPL_Bg

Appendix 2. God of War Ragnarök - Kratos meets Thor & Odin for the first time (4K)

A video footage of Kratos meeting Thor and Odin for the first time in God of War Ragnarök (cutscene and a gameplay sequence of Thor boss fight) can be watched from the following link:

<https://www.youtube.com/watch?v=Me4iof6AW1M>

Appendix 3. Elden Ring - Godrick the Grafted Boss Fight (4K 60FPS)

A video footage of Godrick the Grafted boss fight from Elden Ring can be watched from the following link:

<https://www.youtube.com/watch?v=c9akEr9y7XA>

Appendix 4. Reinhardt Ability Overview | Overwatch

A video footage of Reinhardt ability overview from Overwatch can be watched from the following link:

<https://www.youtube.com/watch?v=zLFbm6YckoU>

Appendix 5. Tracer Ability Overview | Overwatch

A video footage of Tracer ability overview from Overwatch can be watched from the following link:

https://www.youtube.com/watch?v=_SvYmsNCWsw

Appendix 6. The Elder Scrolls V: Skyrim - Official Trailer

The official trailer of The Elder Scrolls V: Skyrim can be watched from the following link:

<https://www.youtube.com/watch?v=JSRtYpNRoN0>

Appendix 7. Alien Isolation: Close Calls

A gameplay clip of cat mouse dynamic from Alien Isolation can be watched from the following link:

<https://www.youtube.com/watch?v=fQXzxf9jJHs&t=155s>

Appendix 8. RESIDENT EVIL 8 VILLAGE Giant Baby Fetus Monster Boss Fight 4K ULTRA HD

A video footage of Giant Baby Fetus Monster boss fight from Resident Evil 8 can be watched from the following link:

<https://www.youtube.com/watch?v=pjdG5CImm34>