

SAE Institute London

Major Project

A Living Forest:
an adaptive narrative
ambience system

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Abstract

'*A Living Forest*' is an application that was built for the purpose of examining the role of ambient sounds in open-world video games. It explores the potential of ambient sounds to contribute to the narrative within the game, provide player feedback and create character perception, while maintaining a satisfactory level of audio-visual correspondence. The design of the application was based on the input from multiple game sound designers, all of which were interviewed exclusively for this research. In the interviews they explain that, in open-world games, ambient sounds are difficult to use for the purposes stated above due to the unpredictability in player behaviour.

Taking this into account, the application uses an adaptive ambience system that is designed to be able to minimise the risk of producing unwanted sounds; sounds that have the potential to cause distraction to the player or cause clashes with any music tracks.

By trying out different settings in the ambient sound system and testing them in different virtual environments, the research comes to the conclusion that ambient sounds are a powerful and flexible tool in informing narrative, providing player feedback and creating character perception in open-world games. It suggests further experimentation and play testing to assess the effectiveness of the solutions it proposes, and promotes a game audio approach with a smaller focus on music and a broader role for ambient sounds.

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Some concepts and what is meant by them in this paper

Ambience / ambient sounds

a sound layer that gives the listener a sense of physical and emotional space

Environmental sounds / sonic environment

a sound layer that gives the listener only a sense of their physical surroundings

Narrative

the way in which a story is brought to the listener/viewer/player

Narrative game design

story-driven game design

Narrative tone

the 'tone of voice' under which the story is brought to the listener/viewer/player

Diegetic - Non-diegetic

whether something is part of the story world (diegetic), part of the narrative (non-diegetic)

Trans-diegetic

when events show diegetic as well as non-diegetic elements in interactive media

Player feedback

a user system of video game giving the user/player information or confirmation about something they have done

Player character perception

the interpretation of in-game events and surroundings by the story character that the player is controlling

Open-world

a type of level design and story design in video games that allows the player to choose where to go and what to do in their own preferred pace and order

Adaptive vs. static ambience

whether the audible ambience in a video game responds to actions of the player (adaptive) or not (static)

INTRODUCTION

Since their first appearance in the late 20th century, video games have changed significantly in their overall aesthetics and complexity. From pixelated, 2-dimensional games of skill, they have become enveloping, cinematic experiences with complex storylines and vast worlds to explore. With games looking more and more like films, comparisons between the two creative media types have understandably often been made amongst critics and academics.

When looking at the use of ambient sounds in both media types, it appears that films make a much stronger use of ambiances to set the tone for a scene, create enveloping atmospheres and provide character perception. This research paper raises the question why ambiances are not used more often by game developers to set emotional tones in their games. Especially in the context of a stronger growing tendency towards open-world level designs, it seems logical to use a higher level of area based player feedback that lets players know what they can expect in the different areas in the world, while at the same time creating a stronger sense of narrative in the game.

This research attempts to find out how ambiances in open-world video games can be used to inform narrative and provide player feedback, and what the present-day ideas and common practices are regarding the use of ambiances in open-world video games. It explores what an 'adaptive narrative ambience system' could look like and how useful it could be in story-driven, open-world games.

This will be done by performing some academic research on video games and films as forms of creative media, conducting interviews with industry leading game sound designers, designing an 'adaptive narrative ambient sound module' and running this sound module in a virtual environment to experiment with the idea of 'adaptive narrative ambience'.

CONTEXTUALISATION

To create an appropriate academic framework for this research, this section will firstly discuss present-day video games as a creative medium. A comparison will be made with cinema, since they are both media forms that deal with on-screen audio-visual experiences. It will look at the overlapping and distinguishing features between the two. Secondly, there will be a brief assessment of the use of ambient sounds in films to see what can be learned from this. Lastly, this section will present parts of a series of interviews that were conducted with 4 industry leading game sound designers in West Europe, about their use of ambient sounds in video games. These interviews were given exclusively for this research and are meant to provide meaningful insights into present-day ideas and common practices in the game industry.

Video games: not videos - an important note

In order to say anything about the role of ambient sound in video games, it seems worthwhile to look at the extensive body knowledge and insights found in film sound studies. Indeed it must be noted that in a lot of ways, over the past 20 years or so, game studios have been aiming for more cinematic experiences through the use of wide, eye pleasing shots, cut-scenes, orchestral music and story-driven gameplay. In *Red Dead Redemption 2* (RockStar Games, 2018) for example, cut-scenes are accompanied by black bars at the top and bottom of the screen to create a wide-screen ratio that, in combination with the North-American scenery, reminds of old western movies. By subtly and gradually moving the bars in and out of the screen while transitioning from gameplay to cut-scene and back, the developers play with the idea of the player being part of a movie, more than a video game.



fig.01 - Cut-scene from *Red Dead Redemption 2* (RockStar Games, 2018)

Although the comparison between the two media types is easily made and the growing similarities have led to beautiful and successful productions, it also comes with the risk of approaching video games *merely* as an interactive version of cinema. This has repeatedly led to annoyance of some within the gaming community (thegamer.com, 2020), because it can take away from the gameplay elements in the game and give the player the feeling they walk from one cut-scene to another. This paper wishes to emphasise that cinema, as a creative medium, is fundamentally different from video games in its nature. This is to say that game designers should always first be concerned with the playability of their games before anything else (Rouse, 2001, p.385), whereas film directors have a lot more freedom to play with the perception and attention of the viewer (Sonnenschein, 2001, p.5). More on this will be discussed later, but for now it suffice to say that this difference also demands for a fundamentally different role from the creator in both media types.

Of course, this doesn't mean that the lessons that can be learned from cinema are of no value. They most certainly are. However, the above means to illustrate that using cinematic techniques in video games requires precise care and a nuanced understanding of the two media types. Therefore, the following chapters will dive deeper into both cinema and video games as individual forms of creative media.

Video games: interactive user systems

A major difference between sound for film and sound for video games, as pointed out to us by Karen Collins (2013, p.32) and later also by Kristine Jørgensen (2007), lies in the interactive nature of the medium. They explain that sound in video games does not only serve the purpose of communicating what is happening in the fictional world and how those events should be interpreted (like in film), but also function as a key element of gameplay, by giving the player cues about what they should do and where they should go. Jørgensen (2007) states that in essence, video games are '*computer-based user systems*' in which information is continuously flowing from the user to the system and back. This ongoing process of user-input and system-output, she states, is needed in order to be able to play the game. Auditory cues are extremely helpful in this, allowing the system to let the player know that they have performed an action successfully or not, or drawing their attention to something that requires their input.

Jørgensen proposes the term '*trans-diegetic space*' to refer to a layer of communication between the system and the player. She refers to the term *diegesis*, which was first mentioned by Plato in 373 BC to describe a type of storytelling that consists of two layers, one of the story and one of the narrator. The terms *diegetic* and *non-diegetic* (or *extra-diegetic*) have later been used in modern-day literature and film studies by Bordwell & Thompson (1997, p330) and Chion (1994, p47) to describe events or sounds that are either part of the story, or part of the narrating layer that is bringing the story to the viewer. As Jørgensen describes it, the trans-diegetic space lies somewhere in between the diegetic and non-diegetic spaces of the medium.

What makes this phenomenon of trans-diegetic space so exclusive to video games, is that it is the layer in which the sound designer communicates with the player, rather than to them. In this space, as Jørgensen puts it, the game is a user system and a story at the same time. This happens in two distinctive manners:

1. Diegetic sounds get exaggerated to communicate things to the player from within the game world, e.g. to inform them about an action they have to perform. This is called *internal transdiegetic* sound.
2. Non-diegetic sounds end up having an effect on the course of events within the game world, e.g. music that indicates danger could make the player turn around. This is what she calls *external transdiegetic* sound.

With this in mind, the question about the role of ambient sounds in open-world video games could be looked at as to whether they should live in the *diegetic space* or the *trans-diegetic space*. Simply put, the moment ambient sounds start providing the player with feedback about their surroundings that could result in them altering their decisions, the sound has jumped from the *diegetic space* to the *trans-diegetic space*.

What ambiances in film can teach us

Looking at sound design for film, we find that ambiances have the potential to play a major part in an extensive array of things. Reading the work of Michel Chion (1992) and David Sonnenschein (2001), two of the most leading scholars in the field, the following four understandings of the role of ambient sounds in film become apparent. Although some of them may show overlapping aspects, they all have their own distinctive functions.

Establishing time continuity

Chion (p13) explains how background noise helps to establish the sense of a continuous timeline. This is especially important in film - and cutscenes in games - where camera angles change all the time. Continuous background noise tells the viewer that the jump only happened in space, not in time.

Creating atmosphere that envelops and stabilises

Especially acousmatic ambient sounds (source not visible on screen) have the power to serve as a '*comfortable bedding*' or to '*provide the ear a stable place*' (Chion, p85). Sonnenschein (p47) adds to this by writing that '[a]mbience and music can [...] create a space within which the audience can be enveloped'.

Creating physical and narrative space

Sonnenschein (p5) emphasises that creating a sense of reality is only part of a sound designer's job and urges his readers to first look for the subtext that an environment may lend to the development of the story and its characters. For example, he explains that with the right use of

reverb, an environment can be made to sound light and spacious, or dense and claustrophobic (p86). Chion (p149) describes ambient sounds as ‘...*giving life to narrative space*’.

Provide character perception and focus

As Sonnenschein (p9) explains us, sound design for film largely revolves around translating the character’s feelings - and perception of their surroundings - to the viewer. He urges sound designers to ask themselves what the characters in the film would be hearing, considering that their attention is likely to be more prone to one aspect of their environment than to another. Chion (p89) describes this as *subjective sound*. He gives the example of how suppressing ambient sounds can create the sense that we are entering into the mind of a character, absorbed by their personal story.

As it seems, Chion and Sonnenschein argue that ambient sounds have a large role in creating *narrative spaces* and *character perception*, at least in linear media. And though it would seem logical to apply these uses of ambient sounds in a similar way to present-day video games, the interviews in the next chapter explain that this might not always be the best idea.

Usage of ambient sounds in video games - Interviews with leading industry professionals

Although different scholars in the field of game studies and other interactive media have echoed the lessons of Chion and Collins - or have described similar phenomena - a surprisingly low number of them discusses the role of ambience. So in order to get meaningful insights in some of the present-day ideas and common practices regarding the use of ambient sounds in video games, three interviews were conducted with game sound designers in West Europe. They are:

Jef Aerts - Sound designer at Ubisoft in Germany, currently working on *Avatar: Frontiers of Pandora* (Ubisoft, -).

Harm-Jan Wieggers - Sound designer at PitStop Productions in the UK, who has worked on *Lego Star Wars: The Skywalker Saga* (Warner Bros. Interactive Entertainment, 2022).

Anton Woldhek and **Jan van de Laar** - Lead sound designer and audio producer at Guerrilla Games in The Netherlands, who have recently released *Horizon: Forbidden West* (Sony Interactive Entertainment, 2022).

While having the conversations about how they see the role of ambient sounds in their work, it becomes clear that things like *narrative space* and *character perception* are, although genre dependent, generally not on the top of their list. When asked why not, a couple of issues come to the surface:

1. predictability of setting: *open-world design* vs *linear design*
2. potential clashes between *ambient sounds* and *music*
3. possible confusion between *ambient sounds* and *other audio cues*

1. The problem with open-world designs

When asked if they considers their ambient sounds to be part of the narrative of the games they work on (e.g. by conveying emotional qualities), their response is mixed, but they all agree on the following - playing with ambient sounds is much easier in games that follow a linear progression, meaning the game always dictates in which order the player goes through the different areas and different events in the game. In these kinds of games, all the circumstances are predictable and designable in pretty much every moment the player experiences. Open world game design, on the other hand, complicates the dynamic between the different sonic elements that get activated while the player is moving through the game world. Simply put, the creator has less control over *what happens when* and *in which context*. For example, sometimes the player might walk through an area on their way to something, other times while running away from something.

Anton Woldhek: *“Conveying feelings through ambiances is a great idea in films, or in video games that follow a linear design. In open-world games, like ‘Horizon’, you never really know where the player is going and why. This makes it hard to define how areas should feel to the player. Keeping the ambience natural is just a safer approach. When we were creating ‘KillZone’ on the other hand, which is a linear game, we used a lot more elements in our ambiances that were meant to stir the feelings of the player”*

Harm-Jan Wiechers: *“It really depends on the type of game and the overall goal and play style of the game. Horror games, games that are very story-driven, or games that follow a more linear progression allow sound designers to do a lot more with ambience. [...] An example is a game like ‘Little Nightmares’: linear and with a strong focus on the atmosphere of the levels. There are a lot of acousmatic sounds, because the fear of “What will I find in the next room?” is what you want to accomplish.”*

Jef Aerts: *“In linear games, you have much more control over which sound elements get triggered in combination with each other. This allows for more specific sound design choices compared to open-world games and makes it easier to design the over-all sonic experience of the player.”*

When asked if they think open world games require a higher level of area-based player feedback, for example to inform the player about how dangerous an area is, they all respond approvingly, but also doubt that ambiances are the right instrument for this.

Harm-Jan Wiechers: *“There is a crossover between ambient sounds and ‘spot’ sounds. If there is a monster or point of interest and you apply a large falloff distance [from how far away it can be heard] to the sound it creates, and you blend it in nicely with the ambience track, then it sort of becomes part of the ambience? But the sound is then still linked to a specific object that the player can find and investigate. I see ambience tracks as something separate that is not emitted by specific objects.”*

Anton Woldhek: *“The ambient sounds in ‘Horizon: Forbidden West’ do respond to the presence of robots [enemies], but this is definitely not meant as a means of player feedback. [laughing] I find it highly unlikely that even one single player will have ever noticed this feature. The idea is that the environment is responsive to different circumstances like weather conditions and time of day, but it always follows these conditions and is never meant to be foreshadowing.”*

He adds:

“I guess it would be possible to use ambient sounds for this purpose, but Horizon is not ‘open’ enough to do so. There are too many enemies and interactable things in the world, and they are too close together, to have the environment constantly inform the player about them.”

Jan van de Laar: *“There are separate levels in Horizon called ‘cauldrons’, where a lot more effort has been made by their sound team to make the whole surrounding sound ominous. But I agree with Anton, that this was possible because the levels are separate from the main world and follow a much more linear setup. The player moves through them under very predictable circumstances, with a single goal, which is to get to the end of the level.”*

Jef Aerts: *“I definitely think it is possible to use ambient sounds for this. Games have done it before. A good example is ‘Alien: Isolation’, where the player is trapped on a spaceship and has to hide from an enemy that is out of sight for most of the time. Ambient sounds on the ship evoke fear and tell the player to quickly move to another area. So your idea is not new, but it is also not very common.”*

2. Clashes between ambient sounds and music

The second issue that was identified during the interviews, is the risk of ‘clashing elements’. For example, if sound designers take too much freedom in giving their ambiances an emotional quality, they are likely to turn to rhythmical and tonal elements that might not go well with the music that will be layered on top. This is especially challenging within larger game studios,

where sound design and music are generally seen as two separate departments that operate largely individually.

Jef Aerts: *“I think it is easier for smaller indie game studios to be more expressive with their ambiances, because there is generally a closer collaboration between all the people that are working on the different aspects of the game. Sometimes there are only one or two people in each department, or the sound designer is also the composer. Also, clashing elements are much more easily identified and corrected in smaller projects. Larger game companies often do not have the chance to constantly test the suitability of every single thing they build. Therefore it is just safer to keep ambiances ‘neutral’ and leave emotional colouring to music.”*

Harm-Jan Wiechers: *“Evoking emotions is something that works particularly well in combination with music. I suppose you could take elements from the music track, turn them into ambient drones and blend those in with your ambience, that would be really cool.”*

3. Confusion between ambient sounds and audio cues

A last concern that was mentioned, is the potential confusion ambient sounds can create when they are too expressive. This can happen in games where the player is always listening for audio cues to know where they can expect enemies or points of interest. If ambiances are too detailed, they can accidentally give the player the impression that there is something in their surroundings that requires their attention. Depending on the type of game, this can become highly distracting. This links back to Harm-Jan’s remark about ‘spot’ sounds.

Harm-Jan Wiechers: *“If you take a game where players are searching for enemies in an open-ended level, a bit like Generation Zero or something similar, then you have to take into account that players will investigate every area (or not) based on what they hear. An enemy could be around the corner, so was that little rustling sound an enemy or just something that was baked into the ambience track?”*

He adds:

“The same goes for more abstract ambient sounds like drones. In these kinds of games, sound is predominantly used to communicate with players, not to evoke emotions. The emotion is, in the first place, a natural result of the game play itself. All sound design must be done in service of that.”

And concludes:

“It is a common “problem” in sound design, especially in open-world levels where you have to find the right balance for your ambient sounds. Make them interesting and emotion evoking and they are likely to cause distraction and confusion. Or make them ‘neutral’ and less interesting, but also less intrusive. Ambience could get a higher priority in these kinds of games, if there is a good system that manages this balance. So your idea is good! I

don't know how many sound designers have thought about this in regards to their own work, but for open-world games, I often end up with ambiances that are as little intrusive as possible."

Music-heaviness

An interesting point that also came forward during all three interviews, is the extensive use of music in modern-day video games. Despite all those that were interviewed saying that, in open-world games, emotional colouring is better left to music, Anton, Harm-Jan and Jef all share the opinion that the projects they have recently worked on are overall too music-heavy.

Jef Aerts: *"Yes, I personally agree with this notion. Although this doesn't only go for video games, but for all media. If you look at/listen to all bigger present-day tv-series and films, it is often wall-to-wall music. It's too bad really... I know that with 'Avatar', which is open-world, we are trying to break with this tendency by trying out different approaches. Still, every time the player discovers something, or something important is about to happen, there is music. It is a bit of a shame indeed, because it takes away the element of surprise. [...] Having said that, music is a really important emotional driver. Replacing its foreshadowing role with sound design is definitely possible, but it will eventually have the same effect."*

Harm-Jan Wiechers: *"This was indeed a gigantic problem with 'Lego Star Wars'. Every level, every segment, always music... no moment of rest."*

Anton Woldhek: *"In the settings menu of 'Horizon', players have the option to set loudness levels of ambient sounds and music to their own taste. This way everyone can enjoy the game the way they want to. Personally though, I would like to see a 'music intensity' setting added, that lets me decide how often the game is accompanied by music. I think the music is great, but it is quite a strong emotional driver. As a player, I do not necessarily wish to be dictated all the time on how to feel about playing the game."*

A different take - RockStar Games

Interestingly enough, although there seems to be a consensus between all the four interviewees, not all leading game studios take the same approach towards open-world game ambiances. Over in the US, in contrast to Guerrilla Games' and Ubisoft's neutral approach in ambient sounds, audio director Jeffrey Whitcher, who was responsible for the sound in Rockstar Games' *Red Dead Redemption* (2010), explains something very different in an online interview with Miguel Isaza (designingsound.org, 2010):

Jeffrey Whitcher: *'Every area in the world was looked at from an ambience perspective – what kind of place is this? Is it foreboding? Is it serene?'*

He gives the following example:

'One area in particular for me, an area I relished crafting the ambience, was Thieves Landing. My instruction was to make this place creepy; the kind of place in which you do not want to be. That afforded me some artistic license with some of the wildlife to think outside the box. You take the staple elements you need at a swamp – insects, frogs, etc – and then you add some off-putting sounds. What was that? Is that a bird? Or a bug? Whatever it was, it freaked me out! That type of audio work is always great fun.'

Jefferey also mentions the balance between ambient sounds and music, as well as the impact of animal sounds on the narrative:

"Also, ambiences were used to set the tone and vibe for each area. While there is ambient music, and it is wonderful music through and through, we also wanted to have the wildlife dictate the tone of each place. An easy example is the use of flies around all of the out houses. Obviously, flies sell stench and decay. By putting a rooster in the morning hours at the ranch house, you paint a tranquil audio picture. Venture out a little ways and start hearing crows or jackdaws and you're not quite sure what to expect....could be trouble. The overall idea was to always have something going in the ambient world to keep a sense of "life" throughout the world."

At the end of his explanation, he concludes:

'Everything was always organic in the ambience, but it was crafted in such a way to trigger an emotional reaction'.

To sum up

It seems that there are quite different ideas about the narrative and emotional evoking role that ambiences can play in open-world video games. A couple of things stick out.

The role ambience can play is largely dependent on the type of game. Factors that are brought forward are genre, open vs linear level design, the use of music and the use of audio cues. Open-world designs tend to complicate the use of narrative elements in ambiences because of unpredictability in storyline, game state and which sounds are combined at a given point. The interviewed game sound designers share an overall opinion that a lot of present-day video games are too music focussed. At the same time, they show reluctance to make their ambiences more expressive. In some game types, a system that balances ambient sounds with audio cues could prove to be useful.

As was mentioned by Harm-Jan Wiechers, games that are built strongly around gameplay elements that are fast and action-driven, like multiplayer shooters, sports games and racing games, might naturally have a lesser need for narrative and emotion to be communicated to the

player, because the gameplay itself already evokes emotions. With this in mind, it should be re-mentioned that this research focuses mainly on video games that are open-world in their design and at least for a large part story-driven and cinematic in their character.

METHODOLOGY

To explore the use of narrative ambiances in open-world game environments, the practical element of this research consists of:

- a virtual test environment in which a player can walk around.
- an adaptive ambient sound system that gets utilised by this environment, which is capable of
 - setting a narrative tone per area.
 - setting a narrative tone as a result of a player triggered event/interaction.
 - easily switching on/off unwanted elements in the ambience.

General aims

The general aims of this practical work are

1. Exploring the use of ambient sounds in an open-world environment as a means to:
 - set a narrative tone for the scene.
 - provide player character perception.
 - provide feedback to players about areas and game states.
 - do all the above while maintaining audio-visual correspondence.
2. Examining some of the creative challenges sound designers say they deal with when using emotional qualities in ambient sounds.
3. Experimenting with different ways to deal with these challenges through sound design and interface/system design.

Method

To examine the role of ambience and what it does to the player experience, the practical work and the analysis thereof will consist of three consecutive stages.

stage 1

Test environment: here, the player can listen to the ambient sound system in a 3-dimensional virtual space. This space itself is neutral; there is no visual representation of audible ambience. This stage is all about the ambience itself. The idea is to test its effectiveness in inducing emotional qualities and set narrative tones, regardless of any visual confirmation.

stage 2

Plain environment: here, the space shows visual correspondence with the environment type that the player hears (city/desert/forest/..). However, the space is homogeneous; changes in the

ambience can be triggered by walking into different areas or by interacting with activation points, but there is no visual representation of the change.

The idea is to examine to what extent the same environment is experienced differently by altering the ambience. It will also provide general insights about the audio-visual relationship between the ambient system and the environment it inhabits.

stage 3

Visual correspondence: here, the ambiances that the player hears in different areas correspond to visually distinctive attributes in the environment. When interacting with action points, the change in ambience is also represented by a visual change in the surroundings. Optionally, the ambience can be made static, so that it does not change in accordance with the player entering areas or triggering events.

The idea is to examine the role that ambience can have in supporting events that happen on screen. Comparisons can be made by freezing the narrative tone in the ambience, changing it from adaptive to static. In this stage, the input from the interviewed game sound designers in the contextualisation section will be assessed as well.

What about music

Based on the notion of some game sound designers that present-day games could do with overall less music, the system aims to provide a soundscape that is rich enough to not rely on music for narrative support and player feedback. Eventually, this is of course an artistic choice that game developers will have to make for their own games, but the practical aims to demonstrate the full potential of ambient sounds in this regard.

Sound design techniques

Here is a list of possible techniques that were considered for weaving in narrative meanings with ambient sounds, derived from the sources discussed in the contextualisation section:

- **tremolo** - according to Chion (1994, p20), this technique is traditionally used in opera and symphonic music to create a feeling of dramatic tension, suspense, or alarm; although it could of course be argued that this is more appropriate to consider in a music track.
- **rendering** - subtly rendering sounds over the ambience that are associated with particular meanings and feelings, usually done with animal sounds. Chion (1994, p109) explains how this can unconsciously incite feelings with the spectator. Sonnenschein (2001, p61) seconds this practice. Jeffery Whitcher says in his interview that he uses this technique by adding 'off-putting' sounds. The challenge here, is to avoid tonal and rhythmic elements as much as possible for reasons discussed earlier.
- **harmonising layers** - using intervals that are known to carry an emotional quality or tension. Sonnenschein (2001, p179,121) explains some applications of this technique,

providing a table with harmonic intervals and their associated emotional characteristics according to “...*musicologists and sound therapists*”. Again, there is a risk here of elements clashing with the music track.

- **reverb** - can give a psychological sense of spaciousness vs. claustrofobia, or public/crowded vs. private/alone (Sonnenschein 2001, p47)
- **animal archetypes** - which types of animals are generally associated with particular emotions/ideas? Also, what is their language, what are their signals for ease/stress/pain/alarm/dominance/fear? Jeffery Whitcher (designsound.org, 2010) explains he used this extensively.
- **proximity and saturation** - how close are the sound sources to the player, how sudden and how often do we hear them?

Some games that were brought forward as reference material by the game sound designers that were interviewed are:

- Alien: Isolation and (SEGA, 2014)
- Dear Esther (The Chinese Room, 2008)
- Little Nightmares (Bandai Namco Entertainment, 2017)
- The Last of Us (Sony Computer Entertainment, 2013)

These games have also been used as inspiration in creating the ambiances for this project.

CONTENT

Project overview: 'A Living Forest'

The practical part of this research was built with a 'forest-like environment' in mind. The choice for the environment type '*Forest*' is motivated by its rich cultural heritage in European lore (e.g. Grimm, H.C.Anderson) and its to-present-day extensive use in popular media (J.R.R.Tolkien, J.K.Rowling, etc.) to serve as a backdrop for scenes in fantasy and action-adventure games and films. The name of the project is '*A Living Forest*', referring to the environment's ability to respond to the player's presence and their encounters within it.

For its flexibility and ease of use, the sound module has been built in AudioKinetic's Wwise (2022), a piece of middleware that is widely used amongst game sound designers throughout the global game industry to create, amongst other things, adaptive ambient systems. The creation of the virtual environments and interface was done in Unity (2020).

Note about the scope:

This research focuses specifically on the use of ambient sounds to produce narrative tones in story-driven open-world video games. Even though building the ambient sound module has led to many useful insights into designing effective ambient systems in general, its aim is to demonstrate some of the creative dilemmas that sound designers experience in doing so and to explore potential ways to overcome them. This means that not every aspect of creating the ambiances will be discussed in this section, but only the aspects that relate to the project's effectiveness in the formerly outlined challenges.

Themes

These are the themes that will be focussed on in this section.

- **interface/system**: which aspects of the ambience can be controlled by the developer (or the game engine) and what happens under the hood?
- The ability of the ambience module to
 - set **narrative tones**
 - provide **player character perception**
 - provide **player feedback**
 - maintain **audio-visual correspondence**
- Creative challenges identified in interviews
 - **distraction** from audio cues
 - **clashes** with music
 - unpredictability of **open-worlds**

Interface/system

One of the most fundamental aspects of the design process has been creating an effective interface that lets the developer set narrative tones easily from within the game engine. Ideally, the system should simplify the creative process for its user while maximising the versatility of its output. A few different interfaces have been considered, based on the following criteria:

-
- | | | |
|--------------|---|--|
| Scalability | - | can the settings be changed gradually or quantised, ideally both |
| Transparency | - | is it clear to the user what the sliders actually do |
| Simplicity | - | most of the work should be done by the system, making it easy to use and ready to go from the start this means as little sliders as possible |
| Versatility | - | how many different 'narrative tones' can be produced using the interface |
-

Here is an image that shows what the eventual interface in the application looks like:



fig.02 - 'A Living Forest' interface

Two slider system

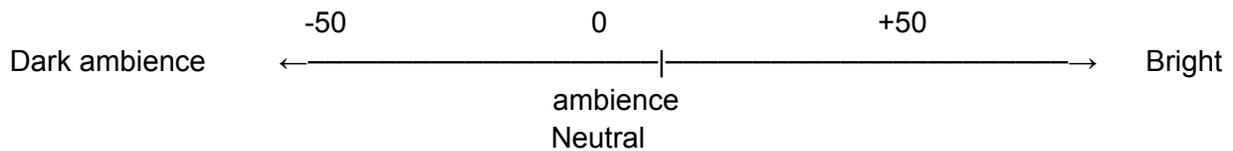
To dictate the narrative tone of the ambience, a system was thought out that uses two sliders. By combining them in different ways, they produce a multitude of outcomes.



fig.03 - 'A Living Forest' interface - Tone and Intensity sliders

Slider one: Tone

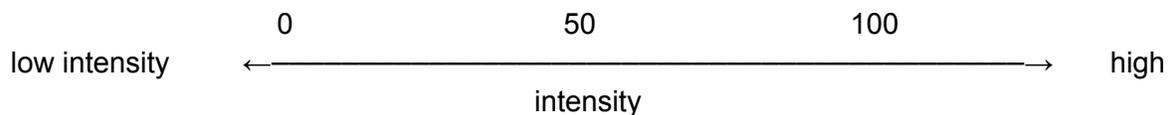
The *Tone* slider is the most important element of the design. It controls a single parameter to which a lot of aspects of the system are linked. The slider ranges from 'dark' to 'bright'. Based on the *Tone* parameter, the system will produce different types of sounds.



Slider two: Intensity

The *Intensity* slider is the second most important element. It controls a parameter that makes the system produce more sounds and different sounds as it increases. In doing so, it provides the ability to bring out a more nuanced interpretation of the narrative tone that is set by the *Tone* slider. This parameter controls the liveliness of the environment by

- increasing the saturation of sounds; how much sound does the player hear
- making audible sounds sources more expressive (e.g. wind intensifying, animals more expressive)



6 Narrative modes

Combining the two parameters in an XY-configuration results in the following diagram. This diagram will be used as a basic playing field wherein all the ambient sounds find their place and meaning. Six different modes (not including neutral) are derived from the possible combinations between the parameters *Tone* and *Intensity*:

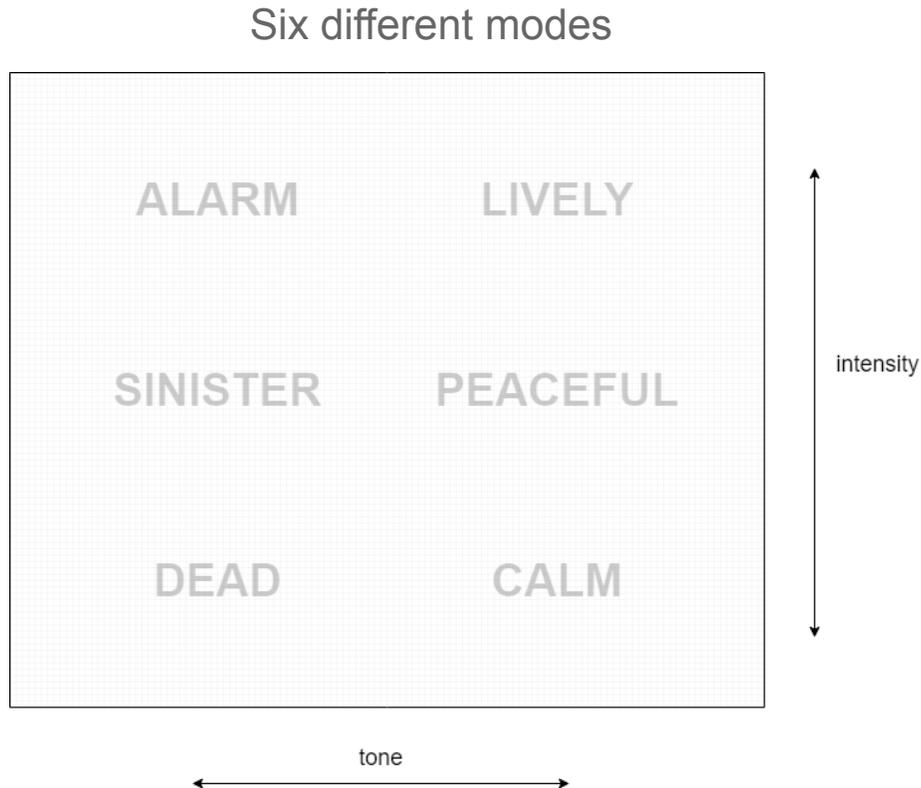


fig.04 - Tone vs Intensity diagram empty

Moving the sliders around through the different zones in the diagram, triggers all kinds of different sounds. The system does this in two different ways:

- **gradually**; it gradually changes the volume of looping sounds such as crickets or wind or drones. In some cases it also increases/decreases the trigger rate of sounds, causing them to be played at longer/shorter intervals.
- **step-wise**; by activating and deactivating sound groups that correspond to a particular mode in the ambience system when the parameter surpasses a certain threshold.

For example, most of the bird sounds are activated in a step-wise manner. This is where they can be found in the diagram:

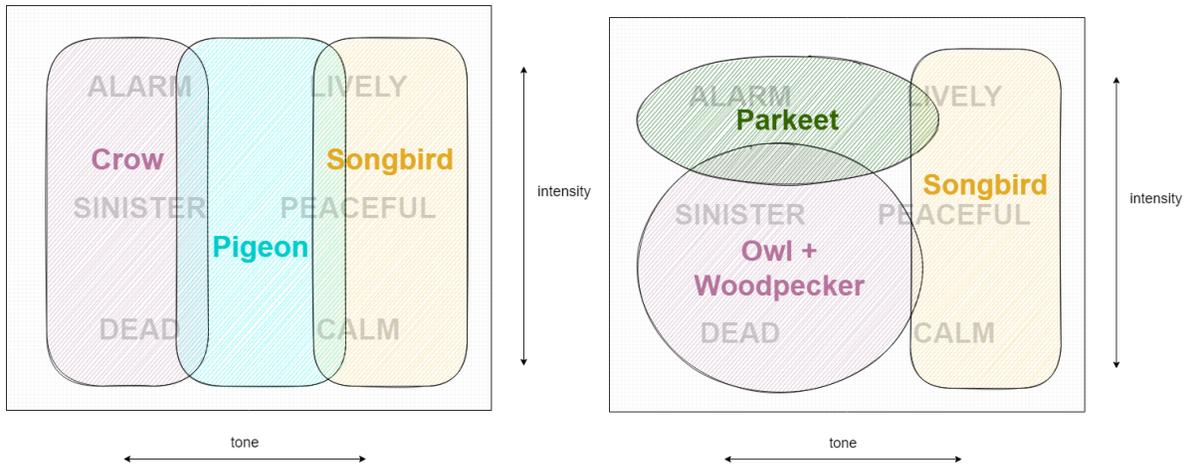


fig.05 - Tone vs Intensity diagrams with birds

This is how the gradual and step-wise changes get set within Wwise, by linking the *Tone* parameter to a sound volumes and to a 'switch-group':

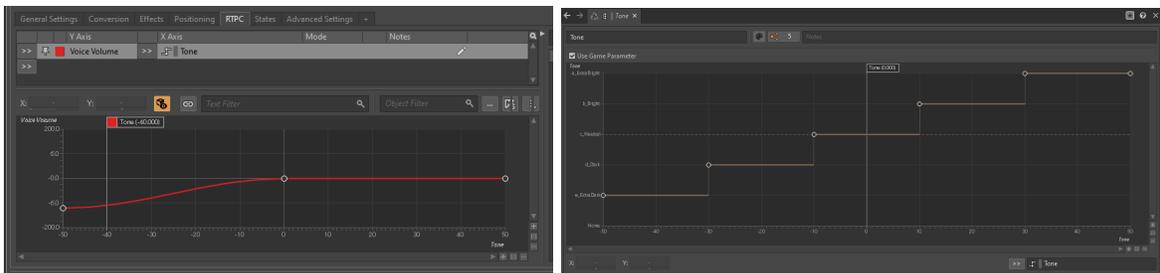


fig.06 - Wwise - Parameters induce gradual and step-wise changes

As can be seen, the range of the *Tone* parameter is divided into 5 bands, allowing for a neutral band in the middle, dark and bright bands on the sides and bands in between that allow for overlapping areas. This corresponds to the 5 bands that can be distinguished in the left diagram in **fig.05**.

Level mixer

All sounds are divided into mixer-groups. They are:

- **Background noise**; this provides the ambience with a comfortable layer of overall worldly presence. As discussed before, Chion describes this as '*providing the ear a stable place*' (1994, p85).
- **Birds** (or other vocal animals); this group gives an overall feel of 'livelines'.
- **Insects**; just something that can be mixed in to taste
- **Movement**; rustling leaves, squeaking wood, falling branches, wind, birds flying off; basically any sound the forest makes, or the sounds of animals moving.
- **Extra sounds**; sounds that are not present in the environment but are purely meant to evoke feelings (e.g. drones). It is a *non-diegetic*, or *external trans-diegetic* layer that can be blended in.

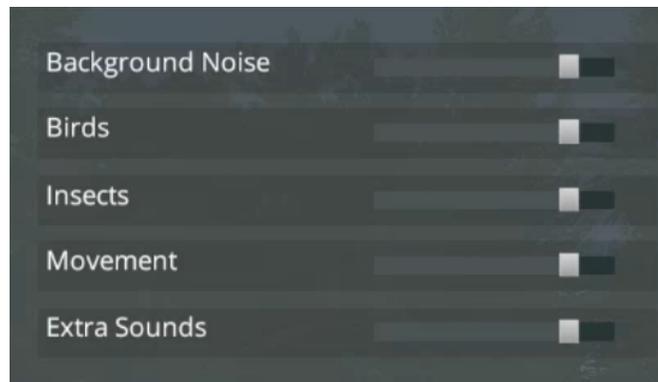


fig.07 - 'A Living Forest' interface - Ambience mixer

Giving the developer access to the ambience mixer from within the game engine has proven to be very helpful in creating audio-visual correspondence between the ambience and the environment, as will be demonstrated in the video material.

Disable distracting and tonal elements

Keeping in mind the creative challenges that were brought up during the conducted interviews, the system was designed to easily let developers activate or deactivate particular sounds that have the potential to:

- cause confusion with sound cues or
- cause clashes with any separate music track.

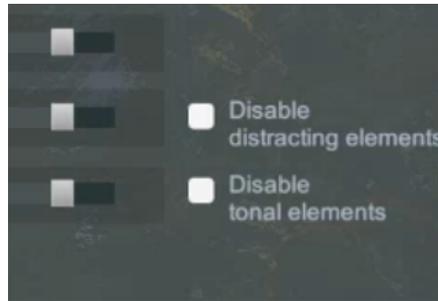


fig.08 - 'A Living Forest' interface - Disable settings

Since the most distracting sounds reside in the 'Movement' mixer group and all of the tonal sounds in the 'Extra sounds' mixer group, this is where the checkboxes are placed in the menu. Activating these settings only stops the unwanted sounds from being triggered, while still leaving the other sounds in these mixer groups active. For example, falling branches and tonal drones would get deactivated, while wind in the trees and noise based drones would still be audible.

Make static

This option freezes the *Tone* and *Intensity* values by deactivating all the triggers in the game world. The values can still be set from within the menu. This lets the user find the right combination of values for each area and turn the adaptability of the system off during particular moments in the game whenever that is required.



fig.09 - 'A Living Forest' inter- Make static setting

Runtime...! (critical evaluation)

This section will perform a critical evaluation of the project 'A Living Forest'. The project provides testing in 3 different stages. The stages 1 to 3 were built and experimented with in chronological order. The insights that were provided by one stage, would lead to building the next one. This evaluation will go through these stages and insights they provided in chronological order.

A video capture of the application was added to this document, which goes over all the relevant insights. However, it is strongly encouraged to play the application itself, which is also attached to this document, in order to actually experience the interactivity of the sound module!

It is recommended to wear headphones or listen over a good pair of speakers!
Some sounds are mixed in quite subtlety and might go unnoticed if not listened to at adequate volume. (So crank it up!)

stage 1 - test environment

The test environment lets the player walk around on a grid that represents the XY-diagram. Each band consists of a row of tiles;

5 bands for *Tone* (width) x 3 bands for *Intensity* (depth)

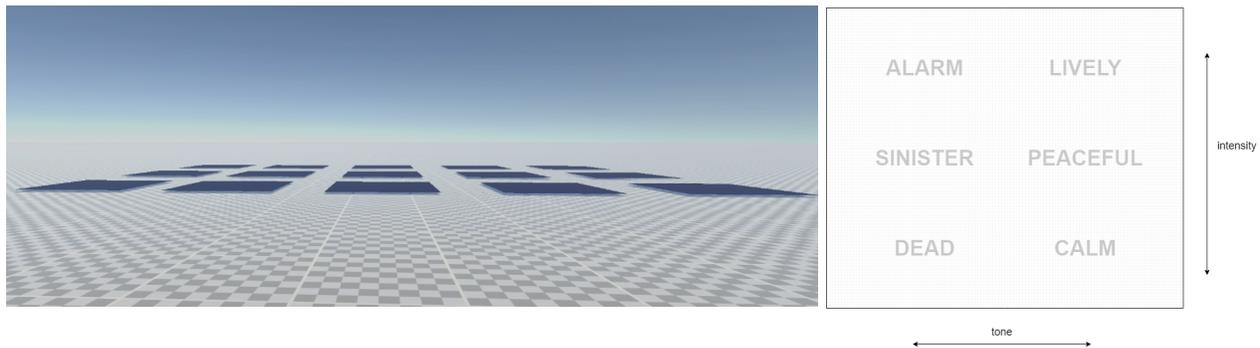


fig.10 - 'A Living Forest' (stage 1) - tiles trigger different Tone and Intensity values

The tiles further to the left trigger a darker *Tone* value, the ones on the right a brighter *Tone* value. The tiles in the row closest to the player trigger low *Intensity* values, the ones further away trigger high *Intensity* values.

Focus	Observation		video timestamp
narrative tone	01	Yes, overall, the grid-triggered ambience definitely provides an array of emotional qualities. The ambiances really sound like they could be used to support the narrative of a story.	00.00 - 01.20
player character perception	02	Maybe, but without any visual surroundings it is hardly convincing, because there is nothing to be perceived. Perception of what?	00.00 - 01.20
player feedback	03	Yes, the 'feel' of the ambiances triggered by the tiles, tell the player something about their surroundings. It definitely feels like there are 'good' places to reside in and 'bad' places too.	00.00 - 01.20
	04	The first two tiles that the player steps on produce an uneasy sounding ambience which could potentially be used to manage the players expectation of a particular area.	00.12
	05	When the player walks to the far end of the grid (high <i>Intensity</i> values), it appears that something might have happened that set off the crows.	00.35

Overall insights

Especially the tiles with the higher *Intensity* values seem suitable for indicating events rather than areas. Specifically the tile on the far left seems to indicate a sense of danger quite well. The next stage was built with this insight in mind, using the 'high' *Intensity* bands for event-triggered changes and the 'mid' and 'low' *Intensity* bands for area-triggered changes.

The tonal elements and the distracting elements in the ambience could become a problem for some games. At the same time they prove to be a large contributor to the effectiveness of the ambience. It was at this stage that it became apparent that a solution needed to be found to prevent the sounds from causing problems, while at the same time keeping them in the project.

stage 2 - Plain forest

Visually, the plain forest is fairly homogeneous; there are no visual cues that signal a change of area to the player, other than some places being slightly denser populated with trees than others. However, there are two areas that trigger a change in the ambience.



fig.11 - 'A Living Forest' (stage 2) - sphere colliders that trigger 'bright' and 'dark' areas

The player's start position is somewhere in between the two areas. Whenever they are not in either of the two, the values are set to neutral. This happens when the environment is loaded and when the player leaves either of the two areas.

The areas trigger the following values:

Bright	Tone = 45	Intensity = 40
<hr/>		
Neutral	Tone = 0	Intensity = 20
<hr/>		
Dark	Tone = -45	Intensity = 40

Inside the two areas are action points the player can interact with by walking through them. The action points both set the *Intensity* value to maximum (100), giving the player audible confirmation.



fig.12 - 'A Living Forest' (stage 2) - on of the action points that triggers an event

Focus	Observation		video timestamp
narrative tone	06	The ambiances still sound as if they could support the narrative of a story.	01.20 - 03.20
player perception	07	Yes, overall the changes in ambience have the ability to simply make the forest 'feel' different, or make the player feel different about the forest. <ul style="list-style-type: none"> - walking into 'dark' area - walking into 'bright' area 	01.20 - 03.20 01.40 02.40
player feedback	08	Yes, the area-triggered changes tell the player they can expect different things in both areas. Yes, the event-triggered changes clearly confirm an action <ul style="list-style-type: none"> - trigger 'bright' event - trigger 'dark' event 	01.40 02.40 02.05 03.05
audio-visual correlation	09	Throughout the video fragment, it sounds as if there are a lot of birds and rustling bushes within close proximity of the player, but they are not visually represented. This somehow breaks the audio-visual contract and makes the experience hardly very convincing.	01.20 - 03.20

Overall insights

There seems to be an overall mismatch between the visual forest and the audible forest. This compromises the credibility of the experience. This happens mostly with very specific sounds within close proximity. It was at this stage that the need for an in-game ambience mixer became apparent, which would allow the user to set loudness levels in correspondence with the visual surroundings

stage 3.1 - Audio-visual correspondence

In this stage, changes in ambience are visually represented. The areas have elements that correspond to a 'bright/dark' scene. The triggered events show visual confirmation in the surrounding environment.



fig.13 - A Living Forest' (stage 3) - 'Bright' (left) and 'dark' (right) areas

Audio-visual

To improve the audio-visual correlation, the whole world is now filled with grass, bushes and flying birds. On top of that, the ambient sound mixer was added to the menu in this stage, which also helps to improve audio-visual correlation.

Focus	Observation		video timestamp
audio-visual correlation	10	Bringing down the birds and the movement sliders improves audio-visual correspondence. It makes them sound slightly further away, which fits the scene better.	03.50
	11	Overall, seeing birds around helps to make the world more convincing, since the player also hears them. Same goes for the grass and bushes.	04.28 05.20

	12	The visual representation of areas and events certainly helps to make the whole experience make more sense. <ul style="list-style-type: none"> - 'dark' area/event - 'bright' area/event 	04.13 - 05.00 05.11 - 05.46
narrative + perception + feedback	13	Doing the same run with static ambience shows how strong the added value is of the adaptable ambience system	05.47 - 07.18
clashes with music	14	Disabling the tonal elements in the 'Extra sounds' mixer group (drone/metallic scrapes) does reduce the uneasy feeling of the environment significantly. However, the ambience still holds enough elements to make the forest sound uneasy. The only sound that remains in the mixer group is that of slow breathing, though it could be brought up in the mix a bit more.	07.17 - 08.20
distracting elements	15	Disabling the distracting elements in the 'Movement' mixer group (flapping birds/cracking branches/rustling bushes) does make the forest feel slightly less alive and takes away their startling effect. It seems like this could be a helpful feature for games that focus more on gameplay and less on story and narrative.	08.24 - 09.30

Overall insights

The combination of the changes in ambience with the changes in the visible surroundings work quite well. Together they show a convincing backdrop for a story and allow narrative to arise naturally from them.

The functionality of the checkboxes seems moderately promising, although more extensive testing is required to assess and optimise their effectiveness. Keep in mind that all these functionalities can be accessed by the game engine. This makes it possible to toggle their state during gameplay whenever that is required, based on conditions set by a developer.

Open-world unpredictability

It remains difficult to say anything yet about the open-world issue mentioned in the interviews. The system would have to be experimented with in an actual game to gain more insights in this. The 'Make static' feature does show the potential to change the way the ambient system behaves from within the game. In-game conditions could for example be used to dictate whether or not the system should respond (is the player in the middle of a mission or roaming freely? Are they in combat state or not?)

CONCLUSION

While in a lot of ways games have been showing more and more similarities with films, it is clear that the role of audio in the two media types is still very different. Aesthetically they may show more overlap in visuals and sound than they ever used to, but the joy players experience in the freedom of video games has led to immense popular use of open-world designs. In this regard, video games seem to have diverted away from films, in the sense that a lot of games are now less linear in their progression. This has led to challenges in sound design that are specific to the medium. There is a notion amongst sound designers that ambient sounds can not be made too expressive in open-world games. The unpredictability in player behaviour in open worlds is pointed out as the main contributor to this notion, since creators have no control over which sounds - and music tracks - get triggered when and in which combination. Also, a particular emotional tone in the ambience might not at all be adequate for the situation the player is actually in at that given moment.

The use of ambient sounds to convey emotions and support narrative in games is not a new idea. It has been used in many games before, although all games mentioned by the sound designers during the conducted interviews in this regard, are linear in nature. There are exceptions, RockStar Games does not seem to share this notion, as explained by the audio director of one of their games in an online interview.

The application that was built for this research has shown to be capable of using ambient sound design techniques found in film sound and make them responsive so they can be used in open world games. It has tried to take into account the involved challenges that were addressed by 4 industry professionals that work in game audio. The application's success in overcoming these challenges is up for debate. Some solutions seemed quite straight forward, like disabling tonal elements in the ambience whenever a music track gets started. Other solutions the application suggests require further experimentation, like the disabling of distracting sounds. Play testing would be needed to optimise this feature and to find out its overall usefulness. Naturally, the usefulness of a system like this is also very game dependent. While an 'adaptive narrative ambience system' might work really well for certain open-world games, it just might not be useful for others.

Nonetheless, the application has shown to be capable of successfully using ambient sounds to support narrative, provide player feedback and create character perception, all while maintaining a satisfactory level of audio-visual correspondence. As explained in the conducted interviews, game studios usually tend to lean towards the music department to establish these things within their games. This can lead to music heavy game experiences that leave little breathing space and feel dictative in their emotional stirring. All of the interviewed sound designers mentioned that the games they work on are often too music heavy in their own opinion. In this light, this research paper would like to put the application forward as an example to promote an overall stronger focus on ambiances, to thereby reduce the extent to which

games rely on music for the above mentioned purposes. As became clear in one of the interviews, this is in line with some industry leading studios today that are trying out different approaches to reduce the need for ever present music in their games.

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Appendix

CMN6100 Ethical Approval Form for CMN6301/2 Major Projects

All students are required to complete parts 1 and 2 of this ethical approval form and include it as an appendix to their Major Project Proposal in CMN6100. Please note the following:

- It is essential that you have an understanding of ethical considerations central to planning and conducting research. Please refer to the Code of Practice on Research Ethics for further information.
- Approval to carry out research does not exempt you from ethics committee approval from institutions within which you may be planning to conduct the research, e.g. hospitals, NHS Trusts, local education authorities, HM Prisons Service, etc.

Part 1: Questionnaire

Please answer each of these questions by clicking in the Yes or No column

	Question	Yes	No
1	Have the project proposal and ethical considerations been checked by your potential supervisor?	X	
2	Will the project involve an intervention or change to an existing situation that may affect people and/or an evaluation of outcomes of an intervention?		X
	If yes, have you shared with your supervisor any information sheet you may have provided, or intend to provide? (Attach a copy of any information sheet, written in easily understood language)	N/A	
3	Will any person's position, treatment or care be in any way prejudiced if they choose not to participate in the project?		X
4	Can participants freely withdraw from the project at any stage without risk or prejudice?	X	
5	Will the project involve working with or studying minors (ie persons under 16 years of age)?		X
	If yes, will signed parental consent or <i>in loco parentis</i> be obtained?	N/A	
6	Are there any questions or procedures likely to be considered in any way offensive or inappropriate?		X
7	Have all necessary steps been taken to protect the privacy of participants and the need for anonymity?	X	
	Is there provision for the safekeeping of written data and video/ audio recordings of participants?	X	
8	If applicable, is there provision for debriefing participants after the intervention or project?	X	
9	If any specialised instruments, for example psychometric instruments are to be employed, will their use be controlled and supervised by a qualified practitioner eg a psychologist?	N/A	
10	Will you need to put your proposal through an ethics committee related to your professional work?		X

Part 2: Ethics Release Form

Student's name: Koen Schram

Name of Supervisor: Jamie Stonehouse

I confirm that the information provided on the ethical approval form is correct:

Signature of student:

Given the information provided, I support the approval of this proposal on ethical grounds:

Signature of Supervisor:

Any further comments:

.....