

***Using a video game of your choice, play the game and outline all of the different types of audio components in a grid. Taking into consideration the table you created, in what ways do you think that the audio implementation was successful?***

## **Introduction**

Ng & Nesbitt (2013, p.2) argue that having fewer resources and less dedicated sound design expertise means that small-sized game developers tend to create games with lower quality, less effective audio. This essay interrogates that claim by analysing the success of audio implementation within the Indie game Celeste (Matt Makes Games, 2018). To the contrary of Ng & Nesbitt's claim, we will find that Celeste's audio is accomplished and effective. In the appendices to this essay are two tables for the reader's review. Firstly, a table listing the implementation features analysed within the essay (Appendix A) and secondly a table of types of audio components, requested as part of this assignment's brief (Appendix B).

We will begin by outlining three of the general purposes of audio within games: to entertain, immerse and inform (Sinclair, 2020, p.8). To understand how these might apply in the specific context of Celeste, we will outline the game's story and metaphor underlying it; noting also its structure as well as its basic game mechanics. We are then able to pose three specific questions for audio within Celeste which, in the main part of this essay, we will proceed to respond to in our technical analysis. After a conclusion which summarises this essay and offers some final thoughts on Ng & Nesbitt's claim, we will comment upon the lessons Celeste offers to the game audio designer.

Sinclair (ibid) states that the purposes of audio within games are to entertain, immerse and inform and "the role of the sound designer...is to pursue and attain these goals". Firstly, audio should entertain by being "exciting...and original". Secondly, it ought to immerse the player within the gameworld, "both in terms of mechanics and situational awareness". Finally, audio should inform the gamer of "essential information and data [to] navigate the game" (ibid). To understand how

these purposes ought to be served within Celeste, we will now sketch out its central story, structure and game mechanics.

Celeste is a 2D platform game where the player controls a character Madeline as she tries to summit 'Celeste Mountain'. Importantly, as Celeste's designer Thorson (2017) explains, Madeline's climb is a metaphor for overcoming her inner struggles. For this reason Badeline, Madeline's "demon doppelganger" enemy (Gleich, 2018) is not a separate person but rather a projection of Madeline's own self-doubt, fear and anger. Knowing the thrust of Celeste's story tells us a crucial way in which its audio should *entertain* us: it should communicate and engage us in Madeline's emotional journey as we play (Thorson, 2017).

Zdanowicz & Bambrick (2020, p.47) assert that audio ought to establish and maintain the structural features of a game. Celeste's particular structure was explained by Thorson at the Game Developers Conference 2017, who presented the following slide:



Fig 1. *Level Design Workshop: Designing Celeste*. A screenshot of a recorded presentation by Thorson at the GDC 2017 Conference (GDC, 2018)

Within the game are Chapters (referred to above as 'Areas') which are intended to tell a "story within the story" of the game (Thorson, 2017). Indeed, it is clear when

playing Celeste that a distinctive look and feel is given to every Chapter; each of which contains a key development in Madeline's story. What follows from the structure of the game is that its audio should help the player to feel *immersed* in the gameworld in each of its Chapters.

If we are to consider how Celeste's audio *informs* the player, it is important first to note the game's central mechanics. Celeste contains three key mechanical elements: jumping, climbing and air dashing. The player must become familiar with the use of these mechanics in order to progress through the game. Game learning within Celeste is both iterative - in that it requires trial and error - as well as progressive, in that skills learned are built upon and applied in new areas of gameplay, as elements are introduced into the game (Thorson, 2017). Audio's role in informing the player therefore is to provide information and feedback that helps them to reflexively learn about the game environment and how their actions affect and are affected by it.

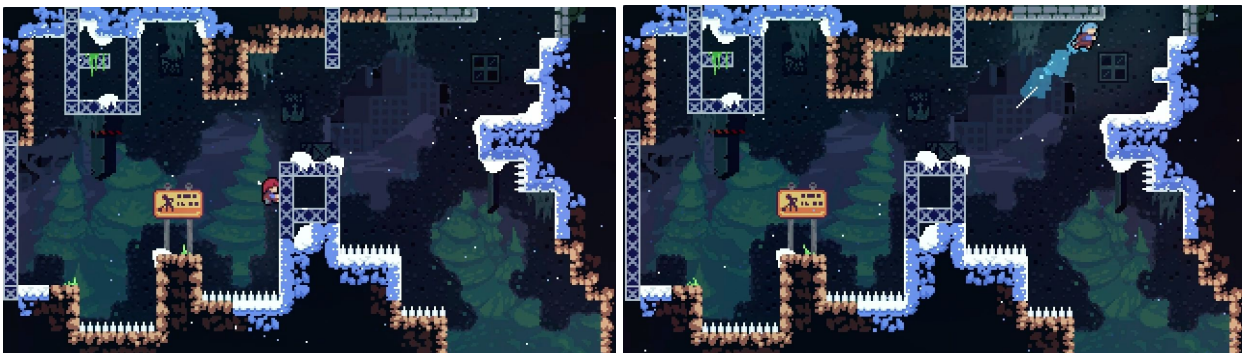


Fig 2. Chapter 1 (Forsaken City), Madeline climbing (Games Without Music, 2020)

Fig 3. Chapter 1 (Forsaken City), Madeline dashing (Games Without Music, 2020)

So far we have outlined three basic elements of game audio (to entertain, immerse and inform) and considered how they apply to particular aspects of Celeste. This leaves us in a position to be able to pose three questions, which through answering we will be able to judge the success of the game's audio implementation. They are as follows:

1. Does audio communicate the emotions associated with Madeline's metaphorical journey up the mountain?
2. Does audio help to immerse the player in the gameworld?
3. Does audio support the player to master the skills required to progress through the game?

1. Does audio communicate the emotions associated with Madeline's metaphorical journey up the mountain?

To address this question, we will review Chapter 2 (Old Site). This Chapter is a significant point in Madeline's emotional journey, as it is when she first meets Badeline. After giving an overview of the Chapter, we will comment upon the use of music and two particular parameters in FMOD (Power Up Audio, 2018). Finally, we will comment on the implementation of character dialogue within Celeste more broadly, as it produces a means by which characters' emotions are expressed.

**Section 1: Exploration (*section feel: easy, freeform, dreamlike, becoming more tense*)**

Gentle and pondering music accompanies the player as they begin to explore the Chapter. When the player discovers *dreamblocks* (a game element that boosts the distance of their dash, see Fig 5.) a layer of drums is added (Gleich, 2018), increasing the excitement and a sense of anticipation. As Madeline approaches her first confrontation with Badeline, the music pauses to build tension (ibid).

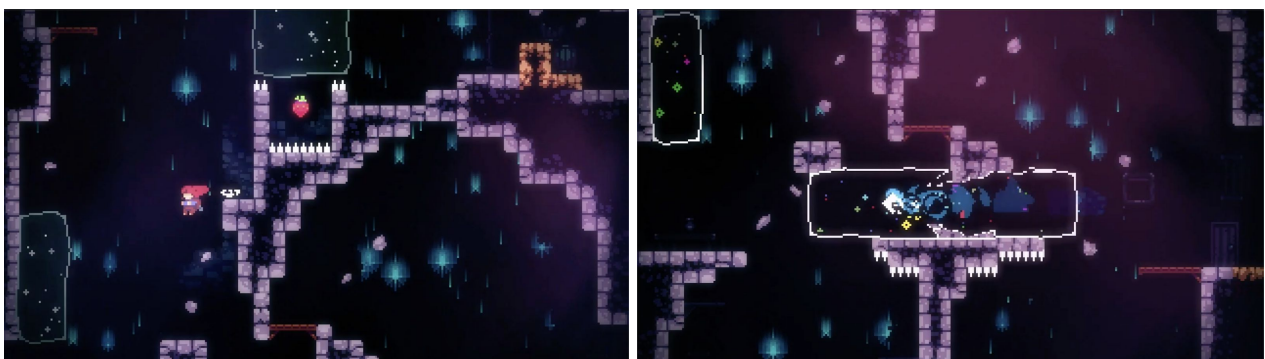


Fig 4. and Fig 5. Chapter 2 (Old Site), Exploration (Games Without Music, 2020)

**Section 2: The Chase (*section feel: dream becomes a nightmare, fear, urgency*)**

Following the appearance of Badeline and her first dialogue with Madeline, the music returns at a higher intensity and tempo (ibid). Multiple copies of Badeline begin to chase Madeline across the screen (Fig 6.).



Fig 6. Chapter 2 (Old Site), The Chase (Games Without Music, 2020)

**Section 3. Cooldown (*section feel: relief, safety, coming out of the bad dream*)**

Madeline escapes and the music gradually fades away (ibid), reducing tension whilst the player is free to progress to the next Chapter without danger. Gentle piano music plays to finish the Chapter. The overall soundscape is quieter, reflecting the reduction of action within the game, with less SFX present in the mix.



Fig 7. Chapter 2 (Old Site), Cooldown (Games Without Music, 2020)

## Music

Music within the Chapter is straightforwardly implemented. Different loops and stingers are placed in separate FMOD events, which are triggered based on Madeline's location in the game (Regamey, 2018). As the Chapter is mostly linear, the simplicity of the implementation helps the Chapter segue effectively between different levels of challenge and threat.

### ***Chaser\_count* parameter**

Badeline's main character sounds, such as *jump* and *dreamblock* movement, have a common ***chaser\_count*** parameter in FMOD (Regamey, 2018). This parameter is used during Section 2 of the Chapter (ibid). The values 0-4 correspond with the different on-screen copies of Badeline, 0 being the closest to Madeline and 4 being the one furthest away (Fig 6.). A volume curve is attached to this parameter (Fig 8.), meaning that Madeline's closest pursuer has the loudest sound, as they chase Madeline through a *dreamblock*, whereas subsequent pursuers sound progressively quieter (ibid). This technique reinforces the immediacy of the threat

Badeline poses to Madeline, given it is the closest copy of Badeline that will catch her. The effect, in terms of emotional impact, is to help the player to feel Madeline's anxiousness and urgency to escape.

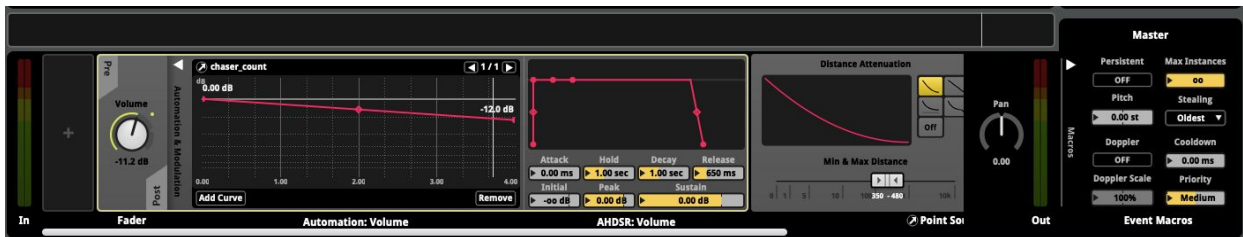


Fig 8. *Chaser\_count* parameter in FMOD (Power Up Audio, 2018)

The use of the *chaser\_count* parameter strikes a balance between the sounds relevant to Madeline escaping (her own movements as she dashes and jumps away) and ones that would precede her getting caught (related to Badeline's movements). Without this parameter, a cacophony of sounds would disperse the player's attention across the screen (ibid). Instead, the parameter helps to keep attention at the emotional and physical edge of the action: the space in front of Madeline, as she propels forward to escape, and behind her (in the space between her and her closest pursuer). Hearing the closest Badeline most clearly also has the useful function of the player not needing to look away from Madeline to get a sense of how close the enemy is. This in turn helps the player feel more instinctively in control of Madeline at this tense point of the game.

### **Escape parameter**

A second implementation feature, relevant to communicating Madeline's emotions during the Chapter, is the **escape** parameter (Fig 9.) which resides within an event containing the music during The Chase. Towards the end of this section, different effects are manipulated (EQ, reverb) according to the player's position (ibid). The result is that when Madeline escapes from danger, the music gradually 'washes away' (ibid). The use of this parameter makes the sound of the game congruent with the reduction in tension Madeline feels, having escaped from Badeline.

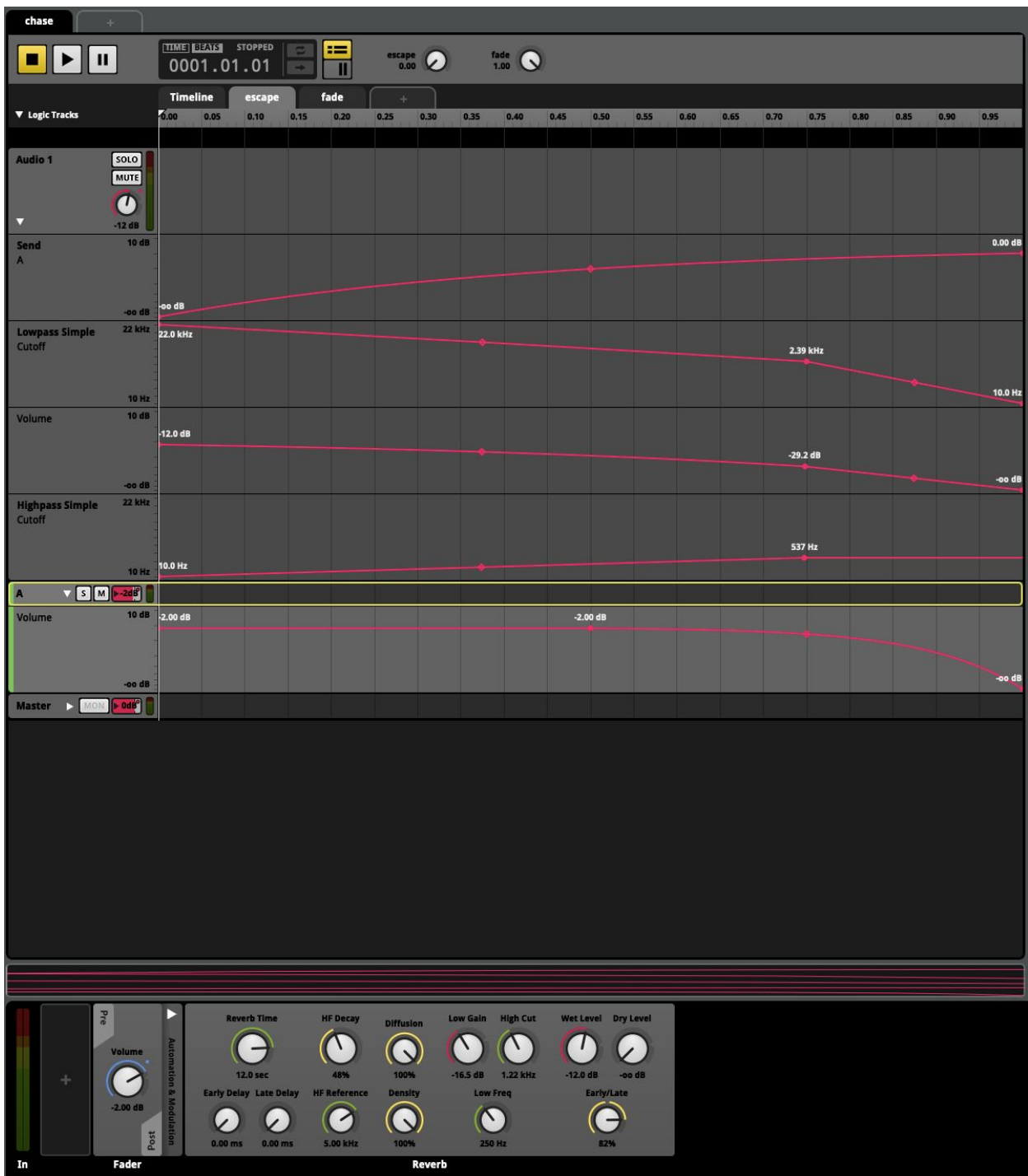


Fig 9. Escape parameter in FMOD (Power Up Audio, 2018)

The use of long reverb time means that the music sounds eerie as it fades away. This creates the sense of Madeline exiting a strange and uncomfortable dream (Thorson, 2017); evocative of the truth that Madeline's struggle is actually staged within her own mind. To express the reality that the threat to Madeline from Badeline is not truly escaped from, *Asymmetrical seek speed* is applied. This



makes the chase music quickly return if Madeline moves backward to the level where the chase took place (Regamey, 2018).

## Dialogue

To address the role dialogue plays in giving emotional impact to the game, we will first detail the way in which it is achieved from an audio implementation perspective. In the Celeste FMOD project (Power Up Audio, 2018), we see how each character has their own unique synthesized voice, contained within a dedicated event (Regamey, 2018). Below, for example, is Badeline's.

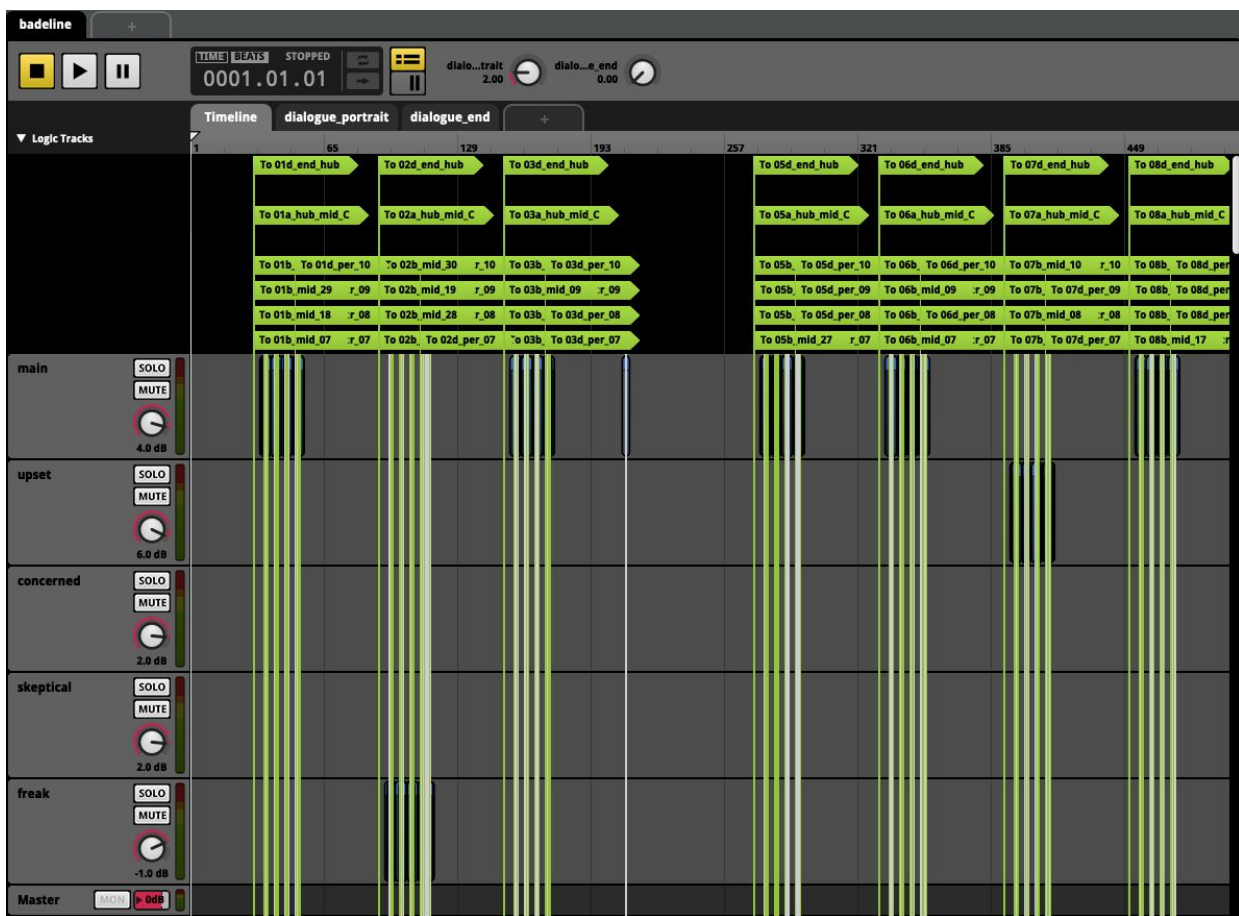


Fig 10. *Badeline* dialogue event in FMOD (Power Up Audio, 2018)

On the timeline, we find multiple short audio files. Each file is a small vocal blip imitating a syllable. These blips, when played quickly in sequence, simulate speech. The blips are grouped into different emotions, which are controlled by the

**dialogue\_portrait** parameter. What drives the *dialogue\_portrait* parameter is the character's portrait being visible on the screen (Fig 11. and Fig 12.).



Fig 11. Badeline's portrait (Games Without Music, 2020)



Fig 12. Badeline's portrait - 'freakout' (Games Without Music, 2020)

Each parameter value corresponds with a different emotion (Fig 13.). At 0, the character is not speaking and the event is set to loop silence while another character speaks (ibid). A complex system of transitions randomizes the playback of blips as they play out real time in the game. The playback is structured so that from time to time a syllable of a particular subgroup is triggered to simulate 'emphasis' (or accent). The effect is to mimic the change of pitch of the human voice when finishing a sentence, making the synthesized speech more organic and natural (ibid). Through this innovative way of achieving dialogue, blips become their own type of 'wordless' language and speech.

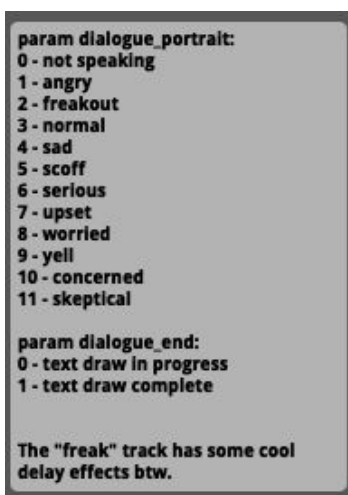


Fig 13. *Dialogue\_portrait* parameter values with corresponding emotions for *badeline* dialogue event in FMOD (Power Up Audio, 2018)

Some characters have additional effects applied, unique to them or particular situations. For example, in Chapter 6 (Reflection), Madeline finds the courage to confront Badeline. Badeline's anger in response is represented visually by her emerging from the dialogue portrait (Fig 12.), which is linked to parameter value 2 'freakout' (Fig 13.) in FMOD. Badeline's voice changes to playing in stereo (ibid), conveying a greater realism to her rageful emotions. These stereo samples are placed on a separate track to which effects - delay and feedback - are applied (ibid). This latter technique serves to enlarge Badeline's presence aurally, just as visually she grows in size and looms over Madeline on the screen. The way the dialogue is implemented within Celeste is seen across the game. It gives Madeline and other game characters a wide and versatile emotional vocabulary through which to tell Celeste's central story in an engaging way.

Having analysed audio implementation in terms of dialogue, music and the use of parameters, we can say that audio does *indeed* communicate the emotions associated with Madeline's metaphorical journey helping to create a dramatic and engaging story for the player to enjoy.

## **2. Does audio help to immerse the player in the gameworld?**

In reviewing this second question, we will consider some of the audio techniques used to help the player interact and feel connected to the game environment. Specifically, we will discuss the use of sound emitters, foley and mix. As Zdanowicz & Bambrick state, "the more interactive the environment is, the more immersive a game is [such that] if something in the environment makes a sound, it tricks our brains into thinking that there is more depth than there actually is in a game scene" (2020, p.38).

## Sound emitters

Sound emitters function as “positional sounds” used “to bring a space to life” within the scene of a game (ibid, p.270). One such example within *Celeste* is the loop of a campfire burning, contained within an FMOD event ***campfire\_loop***. In order to maintain the organicity of this sound within its environment, the *start offset* of the loop is randomised (Regamey, 2018). This means that when a player re-enters the scene containing the campfire, “repeating samples” and “duplication [that] sounds artificial and breaks immersion” are avoided (Sinclair, 2020, p.74).



Fig 14. Chapter 2 (Old Site), Campfire (Games Without Music, 2020)

The game’s various waterfalls, of different sizes, are other sound emitters (Fig 15.). For all waterfall FMOD events, there is randomized pitch and *start offset*. This serves to avoid phasing problems, in those situations where multiple waterfalls are present on screen (Regamey, 2018), which can “make the sound appear hollow and unnatural” (Sinclair, 2020, p.181) and detract from the player feeling immersed in the game.



Fig 15. Chapter 6 (Reflection), Waterfalls (Games Without Music, 2020)

### PICO-8

A more complex example of a positional sound implementation is a loop attached to a little computer on which the player can play a minigame called PICO-8. (Fig 16.)



Fig 16. Chapter 3 (Celestial Resort), Secret room with PICO-8 minigame (Power Up Audio, 2018)

**Pico8\_machine** (Fig 17.) is an event which plays buzzing sounds originating from the computer. On the **pico8\_room** parameter tab (Fig 18.) we find a **snapshot** with automation tied to the built-in distance parameter. The parameter tracks the distance between the audio listener (attached to the camera) and the PICO-8 sound emitter. The automation is set up so that, when the player moves to the right (revealing the secret room containing the little computer), the snapshot intensity switches from 0% to 100% (Regamey, 2018). The music and ambience within the mix are turned off, leaving only the buzzing sound of the little computer (ibid). The aim of this particular sound emitter is to direct the player to play PICO-8 (ibid), which is optional for them to do. As Zdanowicz & Bambrick say, “if we want our players to choose to explore a new area...we can plant a sound effect in that location...[with] enough information to inform their choices, but not to choose for them” (2020, p.26).

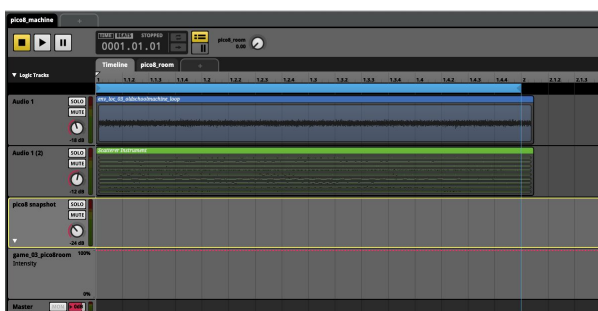


Fig 17. *Pico8\_machine* event timeline (Power Up Audio, 2018)

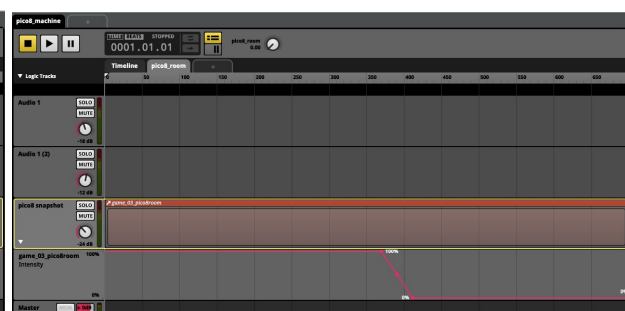


Fig 18. *Pico8\_room* parameter tab, snapshot (Power Up Audio, 2018)

## Foley

Foley can help the player feel more in contact with the game environment as it changes between Chapters. In *Celeste*, we find that Madeline’s foley (footsteps, grabs, handholds and landings) differ depending on the type of surface she is interacting with (Regamey, 2018). This is achieved through the use of a parameter **surface\_index** (Fig 19.), placed on respective events, where samples of dozens of different surfaces are placed on the parameter tab. Though not the most complex example of audio implementation within *Celeste*, the creation of such a broad base of high quality foley serves its purpose of “immers[ing] the player in the game

environment”, through the creation of “unique sounds that complement or enhance...gameplay and visuals” (Zdanowicz & Bambrick, 2020, pp.27-29).

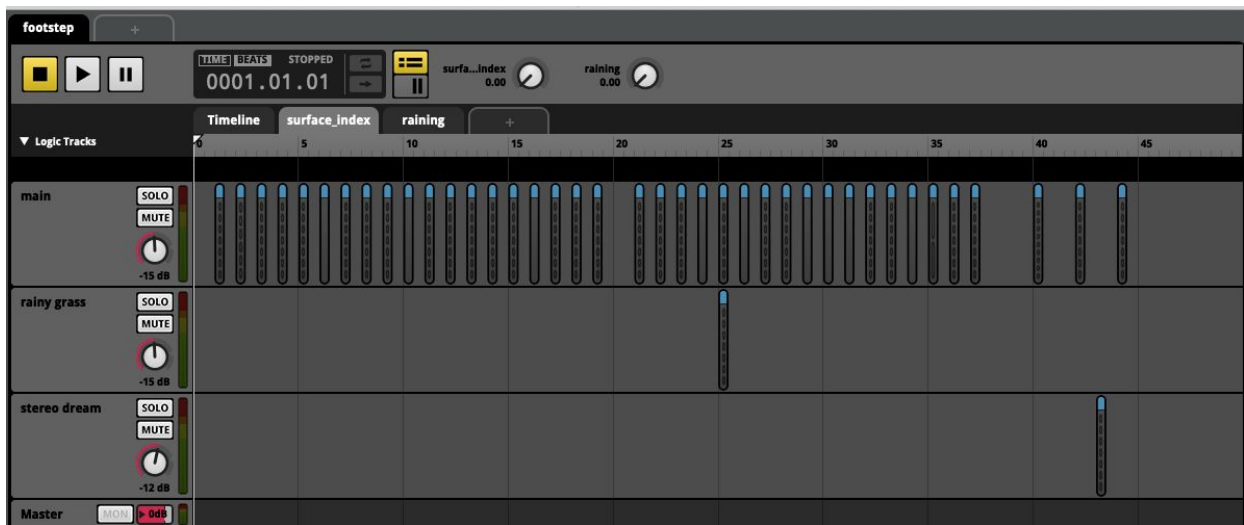


Fig 19. *Surface\_index* parameter tab (Power Up Audio, 2018)

## Mix

As Stevens & Raybould state, “[m]ixing a game needs to be integrated with the game design and should be dynamic and responsive to gameplay. Our game may vary significantly in terms of the intensity of the action taking place, and this should influence our choices” (2016, p.303). To explore Celeste’s mix in more detail, we will focus on Chapter 5 (Mirror Temple), in which we find Madeline passing through a dark and mysterious temple (Fig 20.). A way that the mix contributes to immersing the player within their environment is found in a snapshot used in the ***torch\_activate*** event (Fig 21.). The function of this event is to gel the SFX and music in response to the player's movements. It is triggered when Madeline brushes against little diamonds which then light up and reveal the environment and Madeline’s path through the Chapter (Regamey, 2018).

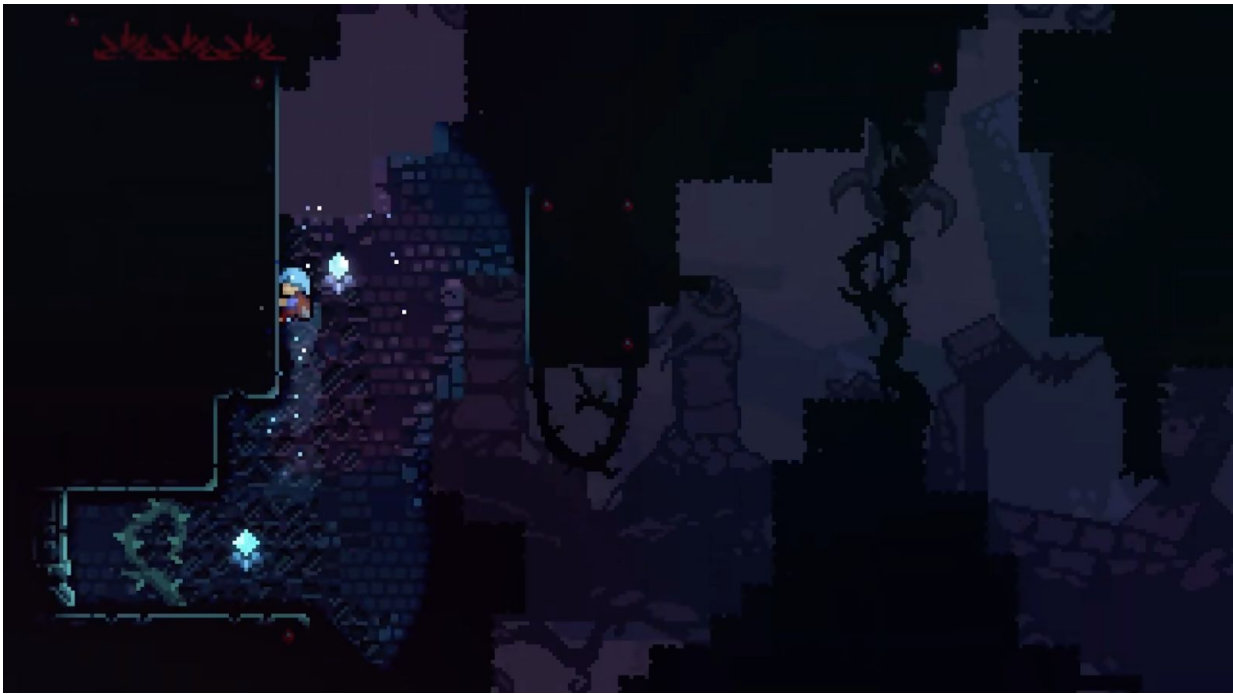


Fig 20. Chapter 5 (Mirror Temple), Madeline activating a torch (Games Without Music, 2020)

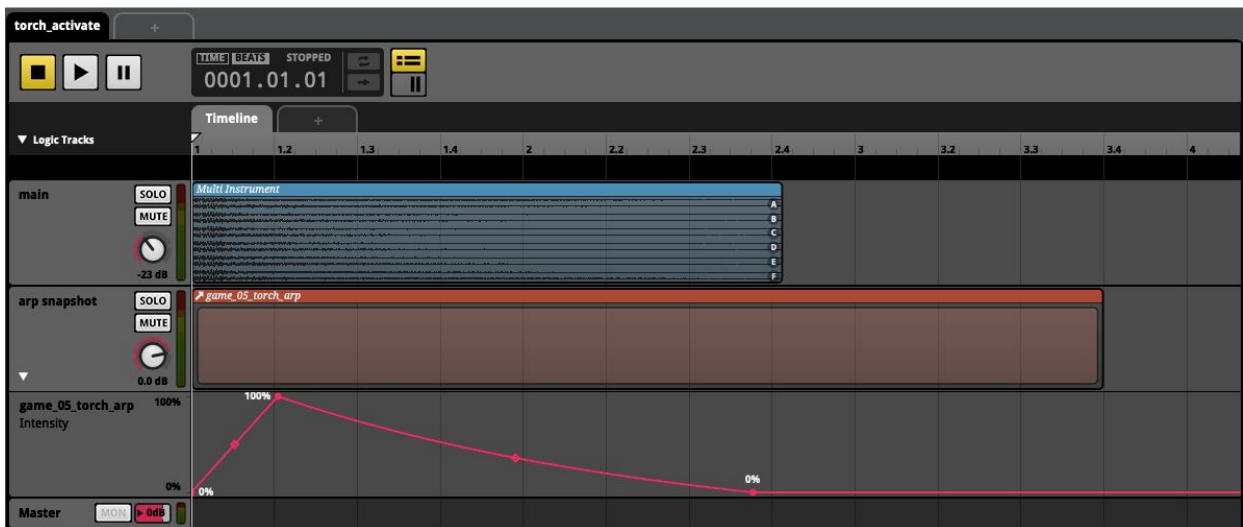


Fig 21. *Torch\_activate* FMOD event (Power Up Audio, 2018)

### Track 'main' - SFX layer

On the event's timeline, we find a multi instrument with a high-pitched 'shimmery' sound as the main sound effect for activating a torch.

### Track 'arp snapshot' - Music layer

On the second track there is a snapshot linked to the music in the Chapter. Through complex routing, the snapshot corresponds with an arpeggiator layer



**torch** (Fig 22.), which is inside another event containing music. **Torch** is a melodic layer which is inaudible until it's triggered through the snapshot within the **torch\_activate** event (Fig 21.). As a result, **torch** layer becomes a part of the overall sound effect and is always in key with the music (ibid).

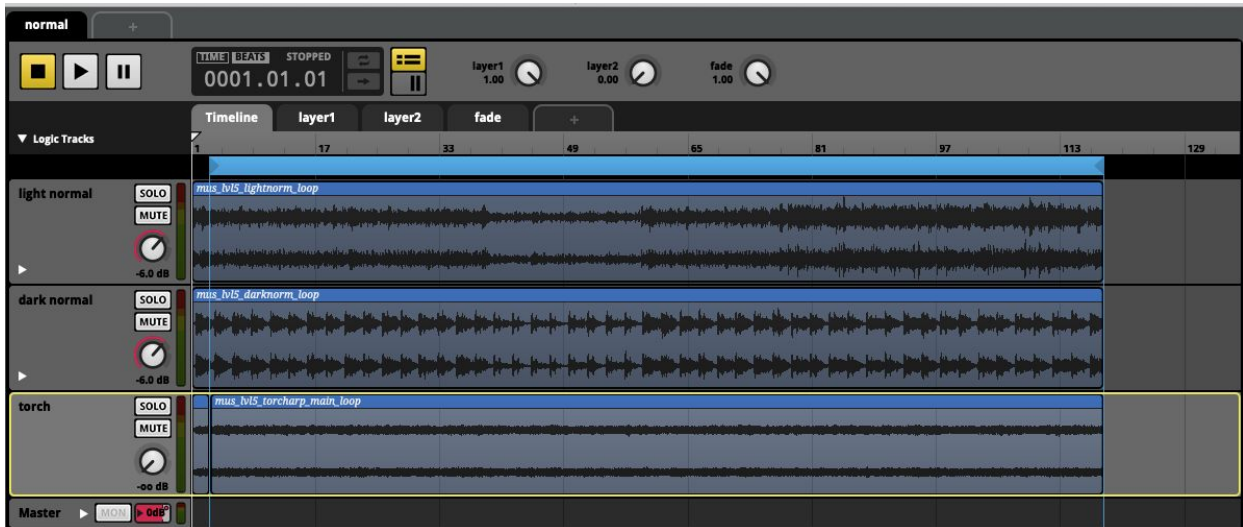


Fig 22. *torch* track inside an event containing music for the Chapter (Power Up Audio, 2018)

The effect of this implementation is subtle and likely not consciously noticed by the player (ibid). What it accomplishes, however, by blending the torch SFX with the music is to enhance the ethereal and beguiling sound of the level - without at the same time overpowering other SFX more important to gameplay (such as jump). As Zdanowicz & Bambrick state, “[v]ariety in even the smallest sonic details can go a long way to making the experience more believable]” (2020, p.250).

In this section, we have reviewed the role of sound emitters, foley and mix; having in mind the question of whether game audio helps to immerse the player in the gameworld. Indeed, we find that it does. We have seen how positional sounds enrich the soundscape and make the environment more realistic and immersive. We further saw how they can be used to draw attention to objects and areas within the game, encouraging the player to behave in certain ways. We have also noted how foley helps to connect the player to the environment. Finally, we have seen that music and SFX are gelled together through an effective dynamic mix.

### **3. Does audio support the player to master the skills required to progress through the game?**

Our final question relates to the way that Celeste's audio informs and educates the player. Celeste is in many ways a conventional platformer, "focus[ing] on players moving quickly through an environment - often jumping and dodging to avoid obstacles" (Novak, 2012, p.70). The sounds of the surfaces and interactive objects are key to learning because "[t]he association of sounds with events helps teach us or orientate us in the game, reducing the learning curve" (Collins, 2020, p.176). Celeste as a game is "brutally hard" (Gleich, 2018) with frequent player death an intrinsic and unavoidable part of the player learning the game (Thorson, 2017). This makes it especially important that all components within Celeste work towards the player gaining skill, so as to succeed and avoid becoming disconsolate and giving up.

We will cover three ways in which audio enhances the player's understanding of the environment and physics of the gameworld, its rules and objectives. Namely, these are: pairs of contrasting actions/directions, using familiar and abstract sounds and earcons.

#### **Pairs of contrasting actions/directions**

Within Celeste we find symmetries in the pairings of opposing forces which are mirrored in the pairings of sounds (Regamey, 2018). Death & Revive SFX and Wind are two such examples.

#### ***Death & revive SFX***

As we have said, playing Celeste involves repeated trial and error - where error means death. This creates the challenge of communicating dying as a useful prompt for learning, so that the player changes their strategy or approach. A solution to this is found in sound design and in implementation, through the paired

*death & revive* SFX. The Death SFX is separated into three separate events which play in an ordered sequence:

***predeath*** (optional)

***death***

***revive***

Though *death* is a negative sound with a downward pitch, the *revive* sound is the opposite - an uplifting sound with increasing pitch (ibid). The *death* and *revive* sounds therefore work together as a pair to help the experience of failing to become a teachable moment, rather simply one that is adverse to the player (ibid).

***Predeath*** also warrants mentioning, as an event that is triggered when Madeline hits surfaces (for example, spikes) that cause death. The sound that plays is the same, regardless of the type of surface (spikes, hot lava, plants) that kills the player. What this does is to create a consistent, clear audio cue for the player which says: 'don't touch this, it kills you', such that they are given a reinforcing reminder of when to take a different action next time, so as to avoid dying. As Sinclair states, sometimes sound design needs to prioritise simplicity and consistency, otherwise "we take the risk of having the user discard audio cues altogether" (2020, p.16).

## **Wind**

A more complex example of paired sounds can be found in Chapter 4 (Golden Ridge) in the sound of wind. Implementation here is particularly interesting, because of how one event (Fig 23.) combines the main ambience of wind with a directional wind which affects the player. This allows the sound of wind to mirror a game mechanic: that of the wind pushing the player in either direction across the screen.

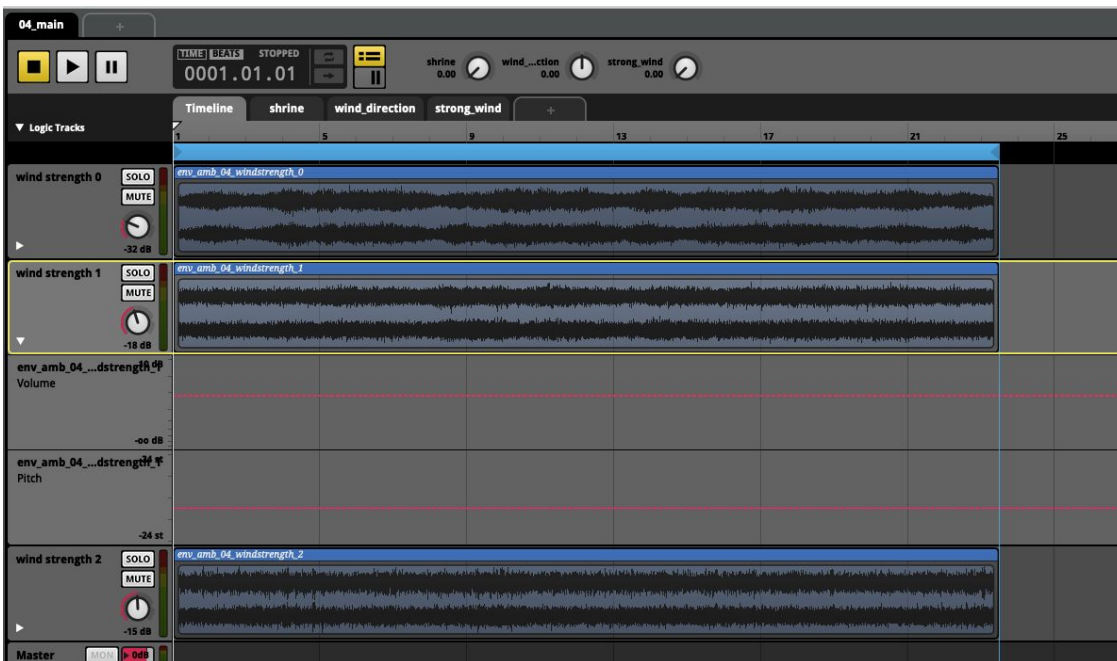


Fig 23. *04\_main* FMOD event containing wind sounds (Power Up Audio, 2018)

The sound of the wind changes in pitch depending on the direction it is blowing, as controlled by the *wind\_direction* parameter (Fig 24.). These subtle changes in pitch help the player to use the wind and the physical force it is exerting on her to her advantage in the game. When the *wind\_direction* parameter is at 0, the event plays the ‘neutral’ (ibid); signifying that the wind doesn’t have the power to push Madeline either way and becomes purely an ambience sound.

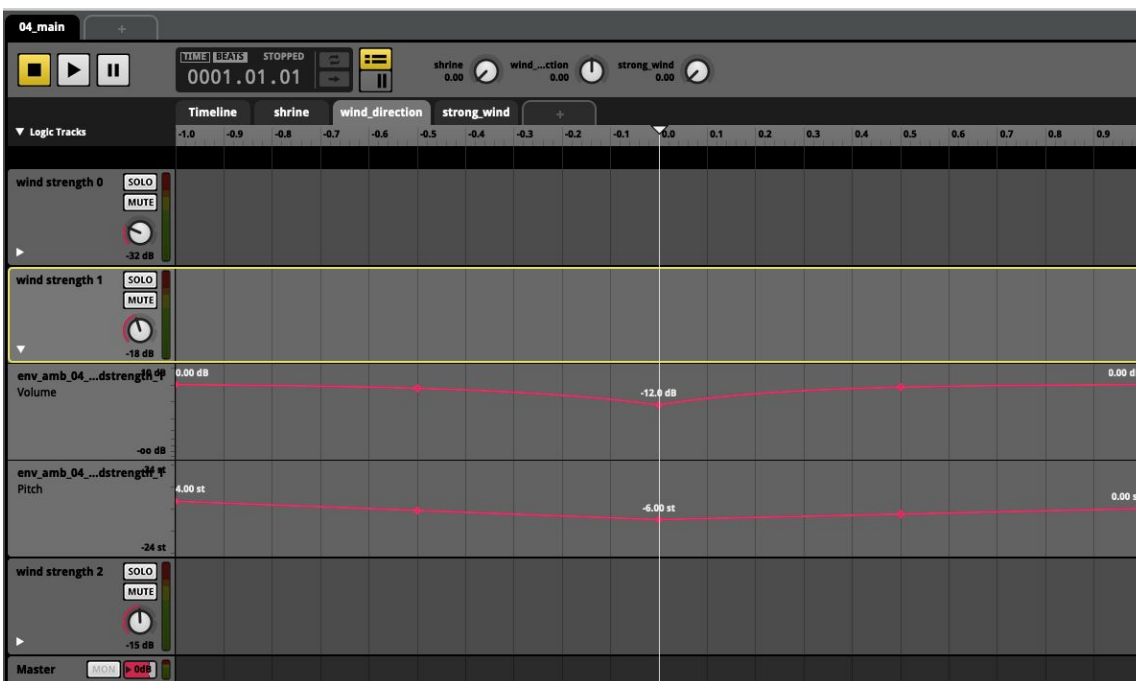


Fig 24. *wind\_direction* parameter (Power Up Audio, 2018)

We find other parameters in the event, such as *shrine* and *strong\_wind*. *Shrine* reduces the volume of the wind when the player is in a quieter area of the Chapter (ibid). *Strong\_wind*, meanwhile, responds to the intensity of the wind and is mainly audible during the ‘active’ directional wind mentioned earlier (ibid).

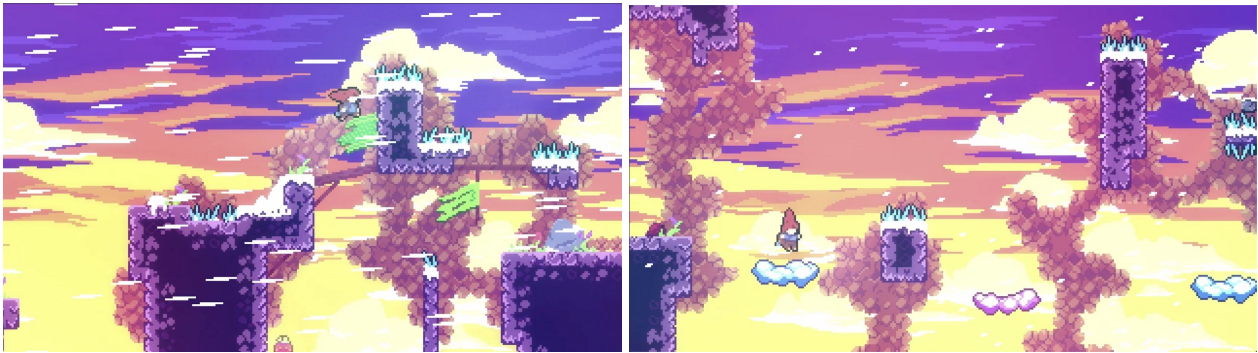


Fig 25. Chapter 4 (Golden Ridge), ‘directional’ wind blowing to the left affecting the player (Games Without Music, 2020)

Fig 26. Chapter 4 (Golden Ridge) ‘neutral’ wind - ambience (Games Without Music, 2020)

Overall, we find that wind within Celeste is a cleverly executed blend of a ‘passive’ ambience sound and an ‘active’ sound which informs and guides the player. Why the sound of wind is particularly amenable to this kind of blending is because it is an auditory icon; that is, a sound that we are familiar with from the natural environment. As Ng & Nesbitt write, “auditory icons allow...developers to create direct links between the player and the game environment in terms of sound events and objects that also occur in the natural world. Due to our everyday knowledge of [of them] the information in the encoding is naturally understood (2013, p.3).

### **Using both strange and familiar sounds**

For players to progress through Celeste, they need not only to understand the environment and how Madeline will interact with it, but also to accept it as it changes to become quirkier and further from the gamer’s lived experience. Celeste accomplishes this by changing game mechanics and visuals in a graduated, rather than sudden, way. Audio does the same, still retaining the use of familiar sounds

even as others become more bizarre, so as “simultaneously [to] reinforce the abstract visuals of the game while grounding the player in some kind of familiar sound to associate it with” (Zdanowicz & Bambrick, 2020, p.37). We find an example of this in ‘moving blocks’ (platforms) which are present and evolve throughout the game.

In Chapter 1, the player is introduced to moving blocks. These first versions of blocks (Fig 27.) visually and sonically resemble mechanisms in the real world; such that the player is primed to accept and quickly set about learning how they work. Later, when the player encounters visually and operationally stranger (Fig 28. *arrowblock*) or more abstract (Fig 29. *greenboster*) blocks, audio still retains familiar elements. For example, in Chapter 6 (Reflection), the player encounters *crushblocks* (Fig 30.) which bark as they move. Nevertheless, other parts of the audio still sound familiar; for example *crushblock* metallic sound, which matches *crushblock*’s rusted look.

In other cases, sound design provides information about the texture and behaviour of objects (Zdanowicz & Bambrick, 2020, p.38) through fun sounds which exaggerate their properties or play upon their associations. When Madeline jumps into the *greenboster* (Fig 29.), for example, the sound is similar to water bubbles, which informs the player about its bouncy properties and jelly-like texture. When it then boosts Madeline through the air, a whoosh sound is heard, communicating her movement through the air.



Fig 27. Chapter 1 (Forsaken City) *zip mover* (Games Without Music, 2020)

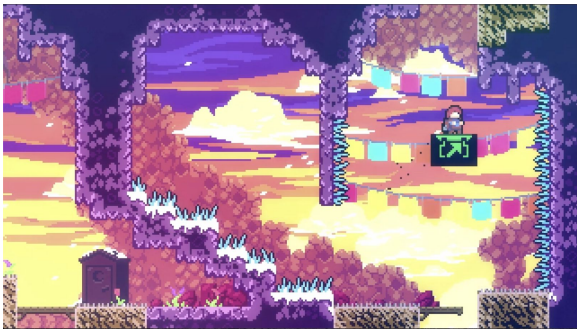


Fig 28. Chapter 4 (Golden Ridge), *arrowblock* (Games Without Music, 2020)



Fig 29. Chapter 4 (Golden Ridge), *greenbooster* (Games Without Music, 2020)



Fig 30. Chapter 6 (Reflection), *crushblock* (Games Without Music, 2020)

## Earcons

Earcons are “synthetic tones that can be used in structured combinations to create auditory messages...[containing] symbolic and arbitrary sounds such as artificial noises and music” (Ng & Nesbitt, 2013, p.3). In Celeste, earcons are used to provide information about collected items, so that the player is given quick information about what collecting them signifies in terms of gameplay. One such example of a collectible is a **diamond**, which gives Madeline an extra dash while she’s in the air (Fig 31.).

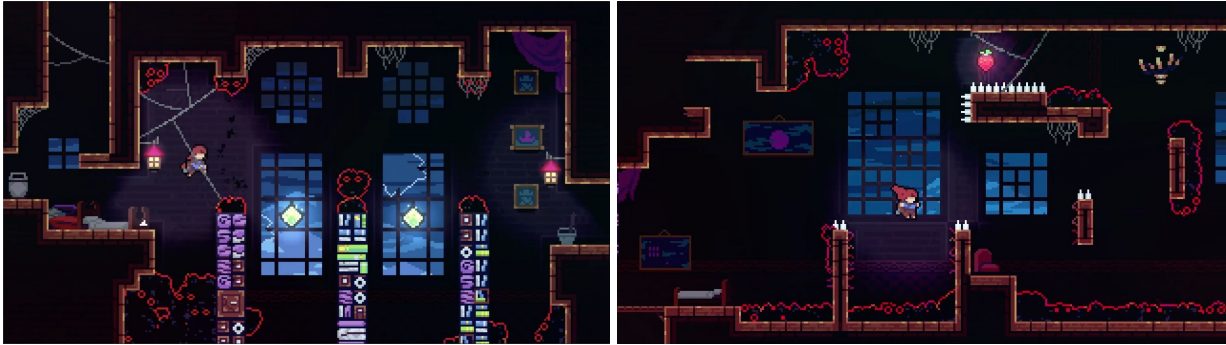


Fig 31. Chapter 3 (Celestial Resort), *diamond* (Games Without Music, 2020)

Fig 32. Chapter 3 (Celestial Resort), *strawberry* (Games Without Music, 2020)

Other collectibles, such as **seeds** and **strawberries** (Fig 32.) are found in difficult to reach places in the game. This means that the process of getting to them increases player skill - which can then be applied in other areas. To encourage the player to make difficult, and optional, diversions to collect them, earcons are used to reward the player for succeeding in the effort. Generally, these sounds are abstract, sometimes musical and fun, and go up in pitch; an example being ***strawberry\_get*** event which plays when the player collects a strawberry.

Certain earcons build towards ever more rewarding sounds. For example, in the event ***seed\_touch*** (Fig 33.), sound effects for collecting a seed are placed directly on a parameter called ***count***, ascending in pitch (Regamey, 2018). With each collected seed, the sound played is higher in pitch (ibid). If all seeds are collected, they turn into a strawberry and the fun “audio bling” (***seed\_complete\_main*** event) plays: a “sonic reward for performing a correct action...provid[ing] positive reinforcement” (Collins, 2020, p.206).

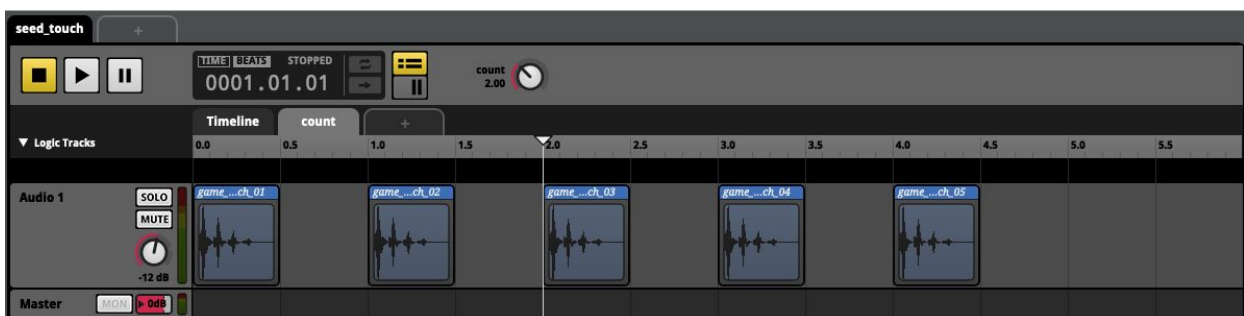


Fig 33. *Count* parameter (Power Up Audio, 2018)



In this section, we have addressed the question of whether audio supports the player to master the skills required to progress through the game. In summary, we can say that it does. Pairs of contrasting actions/directions serve to mirror mechanics within the game (Regamey, 2018) and provide consistency in audio feedback, helping the player to acquire mastery of movement within the game. Meanwhile, auditory icons help to convey information about physical properties of the objects and forces within the environment, also supporting player learning. Familiar and strange sounds are blended so that the player feels comfortable to continue to learn as the environment changes around them. Finally, earcons help to reward the player and provide information about events in the game to which the player has to learn to react to quickly. We can say that audio implementation overall creates a set of sonic principles that correspond with the rules of the gameworld.

## **Conclusion**

This essay sought to address the criticism from Ng & Nesbitt that sound from small game developers tends to be of lower quality than from bigger studios. To interrogate this claim, we addressed whether audio within Celeste helped to entertain, immerse and inform the player and found it did so successfully in all areas. It is unsurprising, therefore, that Celeste's audio is critically acclaimed, gaining the Best Audio award from Game Developers Choice Awards 2019. Tom Marks' IGN review echoes what we have said about sound effects within Celeste and "*the amazing amount of life they add to each location*" (2018).

Importantly, seven years have passed since Ng's and Nesbitt's claim. In 2020, we find that more resources are now allocated towards audio design (Lopez, 2018), as even small developers start to appreciate audio and the value it can add. We saw this with Celeste when a dedicated Music Composer was commissioned for the game (Merserau, 2018). As much as proper resourcing, it was the way that the

audio team was integrated into the wider creative team that was beneficial to Celeste. The audio team was brought in early into game development (Gleich, 2018), giving them time to develop complex implementation ideas, add extra detail and polish the overall sound. In the end the success of Celeste's audio is testament to the benefits of a tight knit, skilled team.

Analysing audio implementation within Celeste offers lessons for the audio designer. These include, firstly, to consider working with a game developer who values the impact that sound can have in a game. Secondly, audio designers should try to become involved in the game development process early on, so as to have more time to develop sound and implementation ideas that best support the game's mechanics, story and feel. Finally, close work with the composer is beneficial, towards the goal of sound design and music supporting one another. There are clearly opportunities in the integration of these two elements, as we see in Celeste.

**Word count: 5195**

## Bibliography

### **Game analysed**

Matt Makes Games, 2018. *Celeste* [PlayStation 4] Matt Makes Games.

### **Celeste FMOD Studio Project**

Power Up Audio, 2018. *26. Appendix: Celeste Getting Started Guide*. [FMOD project] FMOD. Available at:

<<https://www.fmod.com/resources/documentation-studio?version=2.1&page=appendix-a-celeste.html>> [Accessed 14 December 2020].

### **Celeste FMOD Tutorial**

Power Up Audio, 2018. *Celeste FMOD Commentary*. [video] Available at:

<<https://www.twitch.tv/videos/248998904>> [Accessed 14 December 2020].

### **Books**

Collins, K., 2020. *Studying Sound: A Theory And Practice Of Sound Design*. London: The MIT Press.

Novak, J., 2012. *Game Development Essentials: An Introduction*. 3rd ed. Clifton Park, NY: Delmar Cengage Learning.

Sinclair, J., 2020. *Principles Of Game Audio And Sound Design: Sound Design And Audio Implementation For Interactive And Immersive Media*. New York: Routledge.

Stevens, R. and Raybould, D., 2016. *Game Audio Implementation: A Practical Guide Using The Unreal Engine*. London: CRC Press.

Zdanowicz, G. and Bambrick, S., 2020. *The Game Audio Strategy Guide: A Practical Course*. New York: Routledge.

### **Conference Papers**

Ng, P. and Nesbitt, K., 2013. Informative Sound Design in Video Games. *IE '13 Proceedings of The 9th Australasian Conference on Interactive Entertainment, Sept 30*, [online] Available at:

<<https://nova.newcastle.edu.au/vital/access/manager/Repository/uon:13441>> [Accessed 14 December 2020].

Ng, P., Nesbitt, K. and Blackmore, K., 2015. Sound Improves Player Performance in Multiplayer Online Battle Arena Game. *Conference: Australasian Conference on Artificial Life and Computational Intelligence*, [online] Available at: <[https://www.researchgate.net/publication/290542348\\_Sound\\_Improves\\_Player\\_Performance\\_in\\_a\\_Multiplayer\\_Online\\_Battle\\_Arena\\_Game](https://www.researchgate.net/publication/290542348_Sound_Improves_Player_Performance_in_a_Multiplayer_Online_Battle_Arena_Game)> [Accessed 14 December 2020].

## Online articles

Bridgett, R., 2009. *A Holistic Approach To Game Dialogue Production*. [online] Gamasutra. Available at: <<https://www.gamasutra.com/view/feature/132566>> [Accessed 14 December 2020].

Castruita, B., 2018. *Celeste Interview With Matt Thorson Of Matt Makes Games*. [online] Charged Shot. Available at: <<https://chargedshot.com/blog/2018/11/16/celeste-interview>> [Accessed 14 December 2020].

Gleich, A., 2018. *Enhancing Gameplay With Music In Celeste*. [online] Medium. Available at: <<https://medium.com/game-audio-lookout/enhancing-gameplay-with-music-in-celeste-5da210bbc602>> [Accessed 14 December 2020].

Horowitz, S. and Looney, S., 2019. *Game Audio, Level 2: Get In The Game—Implementing Audio In Unity*. [online] Sonicscoop.com. Available at: <<https://sonicscoop.com/2019/04/29/game-audio-level-2-get-in-the-game-implementing-audio-in-unity/?singlepage=1>> [Accessed 14 December 2020].

Jonkers, D., 2011. *11 Tips For Making A Fun Platformer*. [online] Dev.Mag. Available at: <<http://devmag.org.za/2011/01/18/11-tips-for-making-a-fun-platformer/>> [Accessed 14 December 2020].

Koncewicz, R., 2009. *What Made Those Old, 2D Platformers So Great?*. [online] Significant Bits. Available at: <<https://www.significant-bits.com/what-made-those-old-2d-platformers-so-great/>> [Accessed 14 December 2020].

Kouvelis, P., 2019. *What 2D Game Developers Fear About Surround Sound And Why You Should Do It Anyway*. [online] Gamasutra. Available at: <[https://www.gamasutra.com/blogs/PanagiotisKouvelis/20190731/347625/What\\_2D\\_game\\_developers\\_fear\\_about\\_surround\\_sound\\_and\\_why\\_you\\_should\\_do\\_it\\_anyway.php](https://www.gamasutra.com/blogs/PanagiotisKouvelis/20190731/347625/What_2D_game_developers_fear_about_surround_sound_and_why_you_should_do_it_anyway.php)> [Accessed 14 December 2020].

Lopez, A., 2018. *How Do Indie Games Get Their Sound?*. [online] LucidSound. Available at: <<https://lucidsound.com/blogs/news/how-do-indie-games-get-their-sound>> [Accessed 14 December 2020].

Marks, T., 2018. *Celeste Review*. [online] IGN. Available at: <<https://www.ign.com/articles/2018/01/25/celeste-review>> [Accessed 14 December 2020].

McCarthy, C., 2018. *Celeste Review: Mountains May Depart*. [online] USgamer. Available at: <<https://www.usgamer.net/articles/celeste-review>> [Accessed 14 December 2020].

McCarthy, C., 2019. *How Celeste Was Designed With Speedrunning In Mind*. [online] USgamer. Available at: <<https://www.usgamer.net/articles/how-celeste-was-designed-with-speedrunning-in-mind>> [Accessed 14 December 2020].

Merserau, K., 2018. *Celeste Composer Lena Raine Talks Video Game Music, Philosophy, And Upcoming Projects*. [online] Destructoid. Available at: <<https://www.destructoid.com/stories/celeste-composer-lena-raine-talks-video-game-music-philosophy-and-upcoming-projects-502679.phtml>> [Accessed 14 December 2020].

Minkkinen, T., 2016. *Basics Of Platform Games*. [online] Available at: <<https://www.theseus.fi/bitstream/handle/10024/119612/Thesis%20-%20Toni%20Minkkinen.pdf?sequence=1>> [Accessed 14 December 2020].

Playtonic Games team, 2015. *6 Musts For A Perfect Platformer, From The Yooka-Laylee Team*. [online] Gamasutra. Available at: <[https://www.gamasutra.com/view/news/243310/6\\_musts\\_for\\_a\\_perfect\\_platformer](https://www.gamasutra.com/view/news/243310/6_musts_for_a_perfect_platformer)> [Accessed 14 December 2020].

Tailby, S., 2018. *Celeste Review (PS4)*. [online] Push Square. Available at: <<https://www.pushsquare.com/reviews/ps4/celeste>> [Accessed 14 December 2020].

Thorson, M., 2020. *Is Madeline Canonically Trans?*. [online] Medium. Available at: <<https://maddythorson.medium.com/is-madeline-canonically-trans-4277ece02e40>> [Accessed 14 December 2020].

USgamer Team, 2019. *USG's Top 20 Games Of 2018*. [online] USgamer. Available at: <<https://www.usgamer.net/articles/usg-top-20-games-of-the-year>> [Accessed 14 December 2020].

## Videos

Alex // WE Audio, 2018. *Enhancing Gameplay With Music In Celeste | Game Audio Lookout*. [video] Available at: <<https://www.youtube.com/watch?v=NYjlfL7dHCQ&list=PLTPt-coqi8wdPT7z7uD25vbb18Gwrrc8B&index=7>> [Accessed 14 December 2020].

Games Without Music, 2020. *Celeste Without Music - Part 1*. [video] Available at: <<https://www.youtube.com/watch?v=axqUtUGdwkQ&t=1706s>> [Accessed 14 December 2020].

Games Without Music, 2020. *Celeste Without Music - Part 2*. [video] Available at: <<https://www.youtube.com/watch?v=bdLFPIYJ9Vk&t=6s>> [Accessed 14 December 2020].

Games Without Music, 2020. *Celeste Without Music - Part 3*. [video] Available at: <<https://www.youtube.com/watch?v=kjK2-CjyFCc>> [Accessed 14 December 2020].

Games Without Music, 2020. *Celeste Without Music - Part 4 (Ending)*. [video] Available at: <[https://www.youtube.com/watch?v=AVpE-NwP\\_CY](https://www.youtube.com/watch?v=AVpE-NwP_CY)> [Accessed 14 December 2020].

GDC, 2018. *Level Design Workshop: Designing Celeste*. [video] Available at: <[https://www.youtube.com/watch?v=4RIpMhBKNr0&feature=emb\\_title](https://www.youtube.com/watch?v=4RIpMhBKNr0&feature=emb_title)> [Accessed 14 December 2020].

Iplaythedjembe, 2018. *Celeste Secret Room (Chapter 6) (Towerfall Ascension Easter Egg)*. [video] Available at: <<https://www.youtube.com/watch?v=c2sgvhM8NQg&list=PLTPt-coqi8wdPT7z7uD25vbbI8Gwrrc8B&index=4>> [Accessed 14 December 2020].

Jub Dub, 2019. *Celeste The Movie (All Cutscenes + All Dialogue)*. [video] Available at: <<https://www.youtube.com/watch?v=JIXqmjYF4F4&list=PLTPt-coqi8wdPT7z7uD25vbbI8Gwrrc8B&index=6&t=2779s>> [Accessed 14 December 2020].

Noclip, 2019. *The Story Of Celeste's Development*. [video] Available at: <<https://www.youtube.com/watch?v=c3mbELVqAmo&list=PLTPt-coqi8wdPT7z7uD25vbbI8Gwrrc8B&index=5>> [Accessed 14 December 2020].

OK Beast, 2018. *Celeste: Breaking Down Level Design [Nintendo Switch]*. [video] Available at: <[https://www.youtube.com/watch?v=w\\_aWMxchrgw](https://www.youtube.com/watch?v=w_aWMxchrgw)> [Accessed 14 December 2020].

Scott Game Sounds, 2020. *FMOD & Unity | Blending Sounds Between Playing In 2D & 3D (Kinda Like In Borderlands)*. [video] Available at: <<https://www.youtube.com/watch?v=kZ2YdzzZg9g>> [Accessed 14 December 2020].

TeDeMos, 2018. *Celeste All Dialogues/Full Story Chapter 2 Old Site*. [video] Available at: <<https://www.youtube.com/watch?v=wmRRkLbwqs0&list=PLTPt-coqi8wdPT7z7uD25vbbI8Gwrrc8B&index=9>> [Accessed 14 December 2020].

TeDeMos, 2018. *Celeste All Dialogues/Full Story Prologue + Chapter 1 Forsaken City*. [video] Available at: <<https://www.youtube.com/watch?v=TZpQH8kSWNU&list=PLTPt-coqi8wdPT7z7uD25vbbI8Gwrrc8B&index=8&t=2s>> [Accessed 14 December 2020].

Thorson, M., 2018. *Celeste Developer Commentary Livestream*. [video] Available at: <[https://www.youtube.com/watch?v=u-nSjhlgmXc&list=PLTPt-coqi8wcz3dBzzLL07118KlzUr\\_FR&index=3&t=905s](https://www.youtube.com/watch?v=u-nSjhlgmXc&list=PLTPt-coqi8wcz3dBzzLL07118KlzUr_FR&index=3&t=905s)> [Accessed 14 December 2020].

Appendix A		
Implementation features in the order of appearance in the essay		
Name	Type	Celeste FMOD Commentary timestamp
<i>chaser_count</i>	parameter	00.11.35
<i>escape</i>	parameter	03.21.32
<i>badeline</i>	event	00.20.50
<i>dialogue_portrait</i>	parameter	00.20.50
<i>campfire_loop</i>	event	01.16.02
<i>waterfalls</i>	event	01.16.58
<i>pico8_machine</i>	event	01.07.27
<i>pico8_room</i>	parameter	01.07.27
<i>surface_index</i>	parameter	00.39.47
<i>torch_activate</i>	event	02.29.52
<i>torch</i>	track	02.29.52
<i>death</i>	event	00.43.17
<i>revive</i>	event	00.43.17
<i>predeath</i>	event	00.43.17
<i>04_main</i>	event	00.55.59
<i>wind_direction</i>	parameter	00.55.59
<i>shrine</i>	parameter	00.55.59
<i>strong_wind</i>	parameter	00.55.59
<i>strawberry_get</i>	event	01.43.55
<i>seed_touch</i>	event	01.43.03
<i>count</i>	parameter	01.43.03



Appendix B				
Component type	Brief description	Where/when heard	Parameters for change (start/stop/alter)	Other audio sounding simultaneously
Character sounds: Madeline	Movement sounds including core sounds (jump, dash, climb, death); Foley	Gameplay - whenever the player is doing something	See FMOD examples: <i>surface_index</i> parameter, events: <i>predeath</i> , <i>death</i> , <i>revive</i>	Depends on a situation (can be everything apart from UI);
Character sounds: NPCs	NPCs' sounds (all sounds that NPCs make)	Whenever they are present in the Cutscene or Gameplay and are doing something or interacting with the environment	See FMOD examples: <i>Chaser_count</i> parameter	Depends on a situation (can be everything apart from UI);
Character sounds: Dialogue	Synthesized voice different for each character	When Madeline talks to NPCs: Cutscenes, Gameplay	See FMOD examples: <i>badeline</i> dialogue event and <i>dialogue_portrait</i> parameter	Depends on a situation (can be everything apart from UI);
Environment	Environment sounds for each Chapter of the game: ambieces, positional sounds (sound emitters)	Gameplay, Menu	See FMOD examples: <i>campfire_loop</i> event, <i>pico8_machine</i> event, <i>pico8_room</i> parameter, <i>torch_activate</i> event, <i>04_main</i> (wind) event, <i>wind_direction</i> parameter, <i>shrine</i> parameter, <i>strong_wind</i> parameter	Everything else
UI	Sounds that help the player navigate menu - abstract sounds and musical sounds	Menu	N/A (not discussed in the essay)	Music, Ambience
Music	Different music for each chapter	Gameplay, Menu, Titles	See FMOD examples: <i>Escape</i> parameter	Everything else or nothing else. Player can choose to play with/without music
SFX	General game sounds which are not strictly linked to any particular Chapter or character, e.g. collectables (e.g. seeds, strawberries, diamonds), unlocking door, unlocking secret areas of the game	Gameplay	See FMOD examples: <i>seed_touch</i> event, <i>count</i> parameter, <i>strawberry_get</i> event, <i>seed_complete_main</i> event	Depends on a situation (can be everything apart from UI);