

Game Audio Strategies to Inform Players:
A Deep Dive into Sound Design Methodologies for
Designers and Developers

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Abstract

Modern games take advantage of a myriad of design techniques and disciplines to create a creative and unique experience depending on the beholder. Degrees of software engineering, writing, careful design surrounding spaces and user experience, and sound design bring these games together through an often complicated and long-term pipeline. In particular, the work required of sound designers is arguably one of the most important elements of this design process yet is often overlooked, and the work of sound designers often goes unsung. Despite this, there are a wide variety of sound design strategies which have been tried and tested by professional sound designers and can be applied to future game projects to continue to improve the quality of gameplay made available to players going forward should the time be spent to address this crucial element of design and development. Many (but not all) of these sound design strategies will be explored further in the following deep dive, and designers of all backgrounds are encouraged to take the time to muse over these ideas at least on a surface level to ensure the conversation around this area of development occurs, rather than allow it to continue to be an afterthought as has been in the case in some studio environments.

Introduction

The work of a designer is paramount to the consumption of everyday products, entertainment, tools, and more—an idea must first be conceived and judged against other ideas on its merits of quality and usability for everyday people before it can be declared of value and worth creating and selling it. In the games industry, the standardization of design standards historically has varied wildly depending on the area of work (art, programming, audio, etc.) and the experience of the designer in question. Unlike other forms of media like film, art, etc. which have had time to develop these standards, the games industry is still establishing these standards for future generations of designers and developers. In some cases even, some studios may not even possess a designer relevant or experienced in a given area of design.

Sound design is one example of an area of design often neglected, which has often been an afterthought in the discussion surrounding game design for a variety of reasons. Perhaps a given team lacks anyone with confidence to explore and take on the role of sound designer for a given project. Teams could lack anyone interested in exploring fields of design outside of their given interest, or the entire matter could even be of little significance to such a team. The possible reasons for this are immeasurable. However, audio takes a significant role in the immersion process for designers and players alike, allowing designers to convince players to buy into the fiction of a game environment, connect with teaching mechanics built into gameplay loops of a game, and ultimately inform players about the current game state at a moment's notice to create a sense of understanding and fairness through auditory connection. The question then becomes how a designer can hope to accomplish these tasks whether they hold some degree of mastery or not over the topic.

This deep dive will aim to provide options and solutions to a range of gameplay problems using sound design strategies which can be investigated and approached by amateur or expert

sound designers to varying degrees. Given the broad range of such a topic and the rapidly evolving nature of the games industry in the 21st century, it is important to consider these strategies as changing with the field too; a strategy may become more complex or take a different form with the same intent at heart in later years from the publicization of this document. It is thus the purpose of this deep dive to prove that giving the discussion of sound design the time it deserves in the game design conversation at large can lead to meaningful improvements in the design and development of games at large.

Context

First and foremost, it is important to establish what is at stake for designers. Why does the work of a sound designer matter? Is there a point of exploring and implementing sound strategies, or is it simply a new way of making additional work on an already complicated project? To a novice designer, this may indeed appear to be the case, but is far from the truth. Scott Looney and Steve Horowitz discuss this exact topic in *The Essential Guide to Game Audio: Theory and Practice of Sound for Games*, where they note the role of audio in games rivaling that of film, television, and other mediums. They state, “Innovation has been taking artistic forms as well. Games are now competing on a level footing with film and TV and other forms of visual media. Various organizations have been trying to influence the film and TV and music industries to recognize achievements in video games, and specifically audio and music for these games.” (Looney & Horowitz, 3) Currently, the film industry hosts events such as the Oscars, the music industry has the Grammys, yet the games industry seems to have a plethora of their own award shows with varying authority (i.e. the game awards, MIGS, GDC, etc.). Yet interdisciplinary events such as the BAFTAs have historically focused on film and television. In recent years, games have been given space to be celebrated in the same realms of these sorts of award shows and ceremonies, adding to the credibility and reputation of the designers lucky enough to earn such prestigious accolades. It follows then, that improving the identity, usability, and connection of games to players would then improve the odds of earning such accolades (as was the case for games like *No Man’s Sky*, *Inscription*, *Returns*, and many more in the 2022 year’s list of winners). By earning these accolades or even being nominated, the reputation (and sales figures of the nominated games) drastically improve in turn. Furthermore, these competitions often cause competitors involved to grow or improve upon their craft in some way, and the decision of a winner comes from a standardized board or authority (the Grammy’s for instance are nominated and voted on by the National Academy of Recording Arts & Sciences rather than the general public) which could serve to put the games industry into a similar conversation about design ideologies and help to establish a set of best practices going forward. Game design by nature is a highly collaborative craft that benefits the community when even an individual project succeeds, as it proves a new strategy or signals a change in trends for other aspiring designers to improve from, and therefore should be a perpetual goal in which all designers chase towards.

This is not to say implementing meaningful sound design strategies in games is a simple enough goal that all designers should be expected to come immediately. Design of nearly all kinds comes with an iterative process, fixated on seeking out problems and rectifying them

regularly. This is a challenge inherently exclusive to the realm of game design—according to Aaron Mark’s *The Complete Guide to Game Audio*, mediums like television and film do not suffer from this. He argues, “In a film or television program, where the picture is established and consistent, the image of the car pass-by is a linear time established scene that can be scored, synchronized, recorded, and mixed by a sound designer or musician. By contrast, in a 3D game environment there can be hundreds of variables that determine how and where the car exists within a 3D space.” (Marks, xx) It is obvious to Marks how film and television have the advantage of being scripted mediums; time runs in a constant, linear fashion with events always occurring at the same point in each example of either. Games, however, have the challenge of accommodating for the non-chronological nature of events. For instance, a player may trigger their attack in a first-person shooter (FPS) game more than the accounted for number of times a film script writer might guess, or they may spend longer fighting an enemy than another player. Perhaps they interrupt a boss fight by using the pause menu a few times or wander into a safehouse while out exploring. Each of these events usually changes the audio identity required of a digital medium, and video games give players control over when each event happens, frequency, among other factors. Instead of manually scripting the order of these events to always occur the same way, sound designers working on game projects must construct a reasonable set of parameters for players to take total control within.

It is thus up to novice and professional sound designers to handle the tenuous role of creating an audio environment both pleasing and meaningful to users. There are countless elements of audio design such as music, sound effects, queues, rumble patterns, voice overs, dialogue, etc. which apply to this profession necessary to keep the identity of a game believable and providing fair yet meaningful feedback. Bjorn Redecker discusses this abstractly in his work *Game Music as a Boundary Object*. He discusses how sound design methods such as game music have had limitations and requirements come to be expected from it due to the theme of interactivity prevalent in games, and a wide range of ways in which music could be produced and used in such a context. Redecker states, “Due to the ergodic nature of games, game music had to adapt to this condition and has developed strategies and technologies to become dynamic enough to prevail in this interactive environment. As a result. Compositional techniques and aesthetics that were previously less considered (e.g., aleatoric composition, vertical orchestration, etc.) often find their way into a game composer’s compositional toolkit, while “established” conventions from earlier media forms (i.e., leitmotif technique, underscoring, several mood and ambient techniques, etc.) are often remediated to further weave a web of aesthetic and cultural knowledge of society.” (Redecker, 36-49) Despite the broad nature of some of the claims herein, Redecker brings up a good point—many of the strategies have been explored in other mediums like film or television, meaning designers do not need to invent the idea to use it, only test to see if it has a place in the realm of game design. Many of these techniques will be explored below such as leitmotifs (a musical idea often repeated, rephrased, or reprised to some effect in a song or soundtrack), but are shortcuts designers can use to avoid reinventing the wheel in sound design. Even better, novice sound designers can use these existing techniques to create something of professional quality through a few short (but broad) steps to help rapidly prototype and improve upon the audio experience of their work.

With the above in mind, it is furthermore important that designers (especially sound designers) exercise discretion whenever they can. This will be further elaborated on in the “Investigation & Case Study” section of this deep dive, but the use of an audio strategy is not enough to satisfy the need for optimal audio design. Each tool in a sound designer’s toolkit (professional or not) must be used with care to ensure players gain something of value from each audio element. Taken from YouTube, “Crowbat” documents a video comparison between *Back 4 Blood* and *Left 4 Dead* which proves this point precisely. In it, there are many strategies used in the latter which are often neglected or simply not used in *Back 4 Blood* such as signaling audio (the use of music, sound effects, or other audio effect to signify an event or change in the game state). One example of signaling audio they showcase in their video is the horde sounds present in *Left 4 Dead* (Crowbat, 2022). Hordes will regularly attack players in this zombie FPS game and are signaled just before they arrive by a change in music, voice lines spoken by the player character(s), and the obvious cries of zombies on their way to attack players. This combination of game audio is meaningful for players—it informs them about the change of the game state (transitioning from exploration to defense or combat), it warns them about this change because of paying careful attention to the game world through the use of sound, and helps players buy into the fiction of a post-apocalyptic zombie game through a cohesive set of sounds (grunts, intense percussion, screaming, etc.). *Back 4 Blood* however fails to use these same strategies already proven to be successful in *Left 4 Dead*; special events such as hordes, special infected attacking, etc. are not signal in any of the aforementioned ways with the exception of resolving an event; i.e. a dialogue line acknowledging a save of some kind from a team mate when rescued. Crowbat’s video is also credibly backed up from other professional game design mediums like the Game Developer’s Conference (GDC), award shows like the game Awards, professional reviewers like IGN, Gamespot, etc., and via audio devlogs found in *Left 4 Dead*. However, if the developers behind *Back 4 Blood* had iterated on the strategies used in *Left 4 Dead* (the game they compared *Back 4 Blood* to in the sales pitch behind the game), public reception may have been more favourable, and the designers may have even improved on their craft as well. Thus, designers should consider utilizing the tools available to them carefully when considering how best to implement game audio of any kind.

Designers often have a difficult job of deciding what works and what doesn’t in their work, as they only have their own knowledge base and history to work from; designers do not have the vast wealth of game documentation, dev logs, and minds of others to always pour over. Some online resources help bridge this gap, but even this is only a sliver in the storied history of the games industry. To combat this, one good example of a game audio strategy for which designers can measure their rationale can be found in William Ayer’s *What is it Like to be a Dolphin?: Echolocation and Subjectivity in Video Games*. In it, Ayer describes a relatively simple game (by current standards, anyways) which has the player take the role of a dolphin navigating the ocean and avoiding walls of seahorses. Ayer states, “Just before each seahorse wall appears, an audio cue plays that indicates the location of an opening. A high frequency sound indicates a higher opening in the wall while a low-frequency sound indicates a lower opening, as demonstrated in the gameplay of Video 1.5.”(Ayer, 1-33) First, there are strengths to this strategy. This is a strategy designers can find in other games, suggesting it has popped up in various games for a reason (it works to some effect perhaps). Using echolocation connects with

the source material as dolphins are known to have this real-world ability, and thus becomes a form of mechanic designers and players can use to communicate ideas. Thus, it fits into the fiction of the game as it communicates using the game's own language, ruleset, and environment. Nothing about this mechanic breaks the immersion a player may have, and arguably by using this mechanic and audio queue, they buy into the world a bit more with each use and interaction. Furthermore, the use of echolocation is meaningful—it tells the player something about the world they might not have known in a useful way which has some sort of value to them. In this case, players are warned about the position and threat of incoming seahorses, which they can use this information to avoid said seahorses and continue their play session. Of course, this example can and has been iterated upon by novice and professional sound designers, but at least four (4) useful criteria can be taken here to measure games on a case study basis to affirm or deny the usefulness of a game audio strategy found within it. They are:

- **Immersion:** Does the strategy violate the player's ability to connect to or buy into the world the game is set in? Or does this strategy make it easier to accept the fiction of the game world? Do the sound strategies clash with existing ideas or other strategies at play?
- **Meaningfulness:** Do players get anything meaningful out of the strategy in question being used in the game? Is there a point, and how major is it? Does the technique simply repeat information the player might already know or not care about? Does it tell players about the game state?
- **Innovative:** Does the technique in question enrich the player's experience in any way? Does it iterate on an existing strategy found elsewhere, or simply copy an example found elsewhere? Is it based upon a need or merit for such a strategy, and does it aim to solve a problem faced in development?
- **Complexity:** Is the strategy in question complicated or requiring a great deal of time/expertise? Does the solution feature a level of variety for a range of conditional situations, and to what extent? How manageable is the strategy to implement to a game on a surface level?

Using the above four criteria, designers can discern between audio strategies which may be of help to their game or current situation to address existing problems in their game or current work.

Investigation & Case Studies

Some strategies mentioned throughout this deep dive can be observed in some of the recent successful titles of the 21st century. However, there are other audio strategies not discussed here which are worth note as well below should designers be open to a broad array of game audio examples to pull from for inspiration, and thus designers of all backgrounds should remain open to. By considering the following methods sound designers and non-sound designers have incorporated into some of the following titles, designers can glean strategies to use or evade in their own current projects to improve upon immersion, teaching moments, and game cohesion.

The following strategies which will be explored below are as followed (and are not a full list of all audio strategies available for aspiring designers):

- **Proximity Audio:** The use of a sound effect or audio cue (such as music) when the player is in spatial range of another entity to warn or alert the player of an event or threat which may be of value to the player.
- **Negative Space Audio:** The intentional use of no audio or minimal audio to provide emphasis to another audio or visual element. Often this is used to establish tension, importance, or act as a sort of cognitive 'pause' for players.
- **Discovery:** The use of audio as a player witnesses or performs an action to establish an audio-narrative connection to a singular or collection of game events.
- **Metaphoric Audio:** The use of sound effect(s) or other audio element(s) which displays the characteristics of the event or element it is intended to provide information about in a metaphoric manner.
- **Game State Audio:** The use of sound effect(s) or music to indicate something about an update to the current game state in shorthand fashion.
- **Divergent Audio:** The use of audio element(s) which players can directly influence in a manual method while in the game world to provide an aesthetic-based feature, such as radio selection.

Left 4 Dead

As one of the more recognizable zombie FPS games to date, the *Left 4 Dead* series has been periodically noted as a strong game to compare aesthetically and gameplay wise to co-op, horror, and campaign games in many cases due the level of polish it incorporates overall. In particular, *Left 4 Dead* features a complex set of audio strategies it uses to enrich player experience in a variety of methods, which ultimately help to inform and immerse players.

First, *Left 4 Dead* makes use of **proximity audio**. One example of this occurs when a player comes in range of an enemy such as the witch, which will trigger a short looping audio clip to signify the proximity of the witch and the threat she poses. Furthermore, *Left 4 Dead* uses a female siren-like voice to indicate to the player what the witch might look like if they haven't yet spotted her (frail, female, etc.). The strategy is relatively easy to implement, requiring only a sample of looped audio and a single specified item or location to trigger it around. For designers from other disciplines like programmers, level designers, etc., creating such an example would be relatively straightforward. Proximity audio also provides meaningful information to users about the locations of threats nearby and the degree of threats they pose to players based upon volume and complexity in the audio pattern. Tanks for instance have a bass forward track which plays when fighting them to signify a boss has appeared and requires the players to group up to tackle the challenge.

Left 4 Dead also uses proximity audio in interesting and innovative ways. This audio technique is used to signal enemy threats, but also allies who attempt to update the player on the game state as well. If an ally walks over a steep edge, they will automatically grab the edge and enter a downed state. In this state, they must be picked up by a teammate or they will fall and die. As they struggle, the struggling team member will call out for help which players can listen

for and use to decipher their location from. There is value to this strategy in situations where players may otherwise be distracted (i.e. while fighting hordes), but players also have team vision which allows them to see each other through walls via a white or yellow outline, depending on the status of that team member. For the purposes of this analysis, the team vision feature combined with proximity audio help to reinforce a singular feature and accomplish a goal—to make players aware of their surroundings. However, audio in this case takes a supporting role to meet this need from players.

There are however downsides to some of the methods of recording and processing audio in *Left 4 Dead*, specifically to do with the sheer range of audio content available. According to the developer commentary from “Crowbat”’s video which compared *Back 4 Blood* to *Left 4 Dead*, the latter featured over 1000 unique lines of dialogue for each character alone. (Crowbat, 2022) This means developers spent the time recording, processing, filtering, and implementing these audio effects into *Left 4 Dead* for approximately 4000+ protagonist voice lines before enemy sound effects, music, or ambient cues were even touched. The sheer amount of time that would need to go into such a task would be unreasonable at most game studios, even with the help of audio middleware tools like FMOD or Wwise for developers to shorten the implementation time. The extent to which the team at VALVe took to implement a variety of audio lines to achieve strategies such as signaling audio were attempts in the correct direction, but as can be said from the perspective of developers themselves was likely overkill.

Crypt of the Necrodancer

Running off the trail end of the analysis for *Left 4 Dead*, *Crypt of the Necrodancer* uses a similar method to signify where the shopkeeper is when the player is within a certain tile range of the player, but through more feasible means. There are currently only two sounds possible for the shopkeeper to make: a cappella vocals with a Freddie Mercury-inspired twist designed to be intentionally distinct among the music soundfont used for floor themes, and a twisted, distorted version used for an enemy version of the shopkeeper. No player response is given when the player sees the shopkeeper, yet the vocals which lured them to that part of the map are powerful enough to solve this wayfinding problem on their own—they stand out amongst other sounds, trigger in specific circumstances, are repeatable, provide useful information to the player (where the shop is), and build on the immersive rhythm-based reality the world traverses through. In these regards, *Crypt of the Necrodancer* solves a simple problem (how do players find shops) in a manageable way through signaling audio without blowing the sound budget available to game studios.

However, *Crypt of the Necrodancer* features a different problem to *Left 4 Dead*. Where the latter features too much diversity in the player dialogue lines, the former features too much diversity in floor music. The game features unique soundfonts and musical versions of each stage of environment for each of the 4 main characters with story paths in-game. Each character run features 22 unique songs: 15 for each zone’s stages, 4 for regular bosses, 1 hub track and 1 for a final boss. Assuming each track averages ~3 minutes in duration (as they typically do), this amounts to 4 hours 24 minutes of audio needed to be produced as final audio, assuming the same main bosses are encountered in each run. Additionally, regular bosses typically feature a higher

degree of technicality and are randomly selected, meaning the entire set of boss music tracks must be available in that character's sound fonts (cadence acts as a standard font, melody sounds more EDM-based, Aria is based in rock/metal, and Nocturna is based on Dance). Furthermore, completely unique music is written for the final boss of each character's path: Cadence fights version 1 of the Necrodancer, Melody fights in a rematch setting, Aria fights the Golden Lute, and Nocturna fights the Conductor. All these tracks require proper mixing and approval of the studio (in this case, Brace Yourself Games) regardless of if they outsource some of the music or not. Additionally, the newly written final boss tracks require sound designers at Brace Yourself Games to be involved further to ensure the proposed music fits the sound identity of the game while still providing creative authority and freedom to independent contractors. All said, *Crypt of the Necrodancer* has a very diverse and interesting set of tracks available for players based on which character is chosen, but the sheer level of work it created for Brace Yourself Games (or other studios in this situation) would have likely been very difficult to manage even with an optimal workflow internally and most of the music outsourced.

These strategies overall do provide a unique sound identity for players which is difficult to forget, but like *Left 4 Dead* struggle with making these sources of sound production unmanageable for developers. As a player, there is much to be of value and enjoyed—it builds on the key criteria outlined previously (Immersion, Meaningfulness, and Innovation), but ultimately it falls flat when judged according to the complexity criteria established. Implementing these strategies on a more limited scale could still provide value to players however and serve to enrich the quality of product produced and skillsets developed as a result for developers should they be carried out with scrutiny.

Phasmophobia

While proximity audio is used in *Phasmophobia* in various ways, such as to signal to players about changes in their local environment, it does so primarily with the interest of building on the tense sense of immersion inherent to the horror genre. Footsteps in an otherwise vacant space, creaking doors, and other ambient noises help to build the tension present in *Phasmophobia* and only to remind players of their objective in each house or building; to find and assess paranormal activity. Yet these examples of sound can be classified under a different strategy: **negative space audio**. While negative space is more commonly associated with visual art mediums, it can be used by sound designers of varying skills in other mediums like video games to achieve a sense of tension. According to Shaun Farley, “Likely we are instinctively aware of space via its sound, but the amplification and reintroduction of spatial sound characteristics makes readily available this seldom examined facet of our sensual interpretation of a place. As this sense comes forward, and as the flux between object/ground operates both in sound/negative sound and body/space, metaphoric values may apply.” (Farley, 2014) He points out the value human perception places on the absence of sound when this absence becomes the main feature to an audio region. Though his discussion of this is mainly in context to music in the absence of audio wave elements, this concept also applies to games. As seen to players of *Phasmophobia*, the lack thereof audio for the bulk of the gameplay heightens the user's audio perception to be more receptive of the audio they do hear; the intentional use of not even background noise puts players on edge, expecting something distinct to pop up in the audio when

they least expect it. When monsters or ghosts appear, this makes the experience all the more exhilarating when the audio finally pays off on this long-expected wait and is a fantastic technique for designers to consider (especially when creating tense situations). Negative space audio does not provide much in the way of meaningful audio; players do not learn a great deal from it other than to expect additional meaningful audio sometime soon. The tension it provides is, however, useful for causing stress and signaling hostility or importance in the player's actions which ultimately builds on the player's immersive experience. Furthermore, the technique is quite innovative, being a method rarely explored or thought of by audio designers in modern digital media as a whole; many methods presently focus on the inclusion of specific audio elements in calculated ways, such as the proximity audio technique discussed earlier. Negative space audio is quite creative, finding its roots in the visual arts to establish significance due to the absence of something, not the inclusion of it. Finally, negative space audio can be as complex as designers make it; for novice designers, many game engines such as Unity or Unreal will not render sounds by default, but only when told to from audio sources. It would require intentional effort to violate the principles of this strategy. Instead, designers would need to be selective of what type of tension they wish to create, and what supplementary sounds could help provide a cadence to this strategy to meet this. If an audio designer wanted to use negative space audio to draw significance to a new item the player receives, then perhaps they could slowly lower the volume to zero on existing audio sources when approaching this item. For horror, simple ambient sounds like clocks, creaking, or muffled voices can add to a psychological experience. The possibilities are endless, and it is ultimately up to designers to decide the use of this technique for their purposes.

FIFA 23

Discovery is a technique inherent to many sports games such as *Fifa 23*. This technique requires audio which follows the exploits of a player as they occur, unlike proximity audio which warns of a future event should the player stay on the current path of gameplay. In *Fifa 23*, discovery is present in many elements of gameplay; announcer voices will narrate players which take possession of the ball as they happen, referee calls are signaled by a whistle as the call is made, etc.. This audio technique may be frequently mixed up with proximity audio which aims to warn of oncoming events, which *Fifa 23* also utilizes to warn the player they are in range of a shot on a net through crowd excitement ramping up near goals. Discovery is a strategy more fixated on the chronological sequence between event and reaction but is not exclusive of other strategies at play—often a strategy such as proximity audio or negative space audio can be present at the same time as discovery. The latter is only concerned with when a cue is played, and not the purpose behind the cue.

Furthermore, there are some challenges with discovery. While the strategy is not fixated on metrics like innovation and complexity (ultimately up to the limitations and imagination of the designer), there is a high ceiling for immersion and meaningfulness in this strategy. Designers can combine other strategies with discovery to create ambient audio environments as seen in *Fifa 23*, making players feel as though they are personally in the game's stadiums and in

charge of game decisions. This can be done down to even the lowest level of audio (i.e. environmental reaction sounds like footsteps, wind, etc.) should designers wish to do so. As a result, creativity is limited only by the imagination of the designer and the other strategies combined with discovery, but as creativity and immersion rise, so too does complexity.

Apex: Legends

In many FPS games, another strategy which is quite common is the use of metaphoric audio—sound effects or music meant to resemble or mimic how we perceive the audio source in its current environment. In *Apex: Legends*, body shields are frequently shown to be thin vests which players put on over top of their characters for protection and charge with shield cells (energy deposits meant to energize the shields they wear). Furthermore, these body shields are quite frail, and even the highest-ranking red body shields seem to deplete quite quickly when players come under enemy fire. To match the expectations established with this sound effect, designers chose to use a glass shattering effect, with great success. The sound effect is uniform, meaning no variance is needed regardless of how the shield is broken. It portrays how players view the shield they wear (i.e. fragile, brittle, expendable, etc.) with real-world equivalencies by using glass shattering—a sound players may already be aware of and easily described with the same adjectives. This effort is both excellent for immersion as it meets the expectations of the sound effect's adjectives and utility, but also provides information concisely to players who shatter enemy shields—their target has lost a portion of their defenses and the time to finish them off is now. Doing so serves as a meaningful example of sound design, demonstrating the value of metaphoric audio as a sound design strategy which designers of many backgrounds (but likely professional designers to higher degrees of accuracy) can take advantage of to enrich the audio identity of their games.

Though metaphoric audio is quite useful as a tool for designers of varying backgrounds, it is also important not to undersell the complexity of these sounds and the time it takes to perfect them. Processing of these sounds and their various iterations take time, and rarely might a given sound effect submitted as a first draft also be the final draft needed to get the job done. Furthermore, designers may need advanced equipment like recording booths, high quality microphones, or digital audio workstations (DAWs) to make these sounds come to life. There is a careful process involved here which is beyond the scope of this analysis, but this method is quite technical and should be approached carefully, acknowledging there may be a time sink involved with this strategy.

TETRIS: Effect, Rock Band, Guitar Hero, & Super Mario Bros.

Not all games need sound effects to communicate ideas in 3-dimensional space to players. Sometimes, audio must communicate general ideas about the present game state, such as how *Rock Band 4* and the *Guitar Hero* series often has when the player achieves a long enough combo to be considered doing well in the context of the game, often triggering a crowd applause of some kind. In *Tetris: Effect*, this strategy is also used as players match lines and work towards the current stage objective. For the purposes of this analysis, this strategy will be referred to as **game state audio**. This tactic is fixated on communicating abstract, high-level ideas to players in

short but iconic ways, usually via audio which may fit the soundfont of a game's genre but stands out as an iconic or distinct audio element. In *Super Mario Bros.* for instance, the game uses game state audio in several ways. First, level audio will transition to a 50% faster version when the player reaches a minute or less of gameplay time left, usually preceded by a warning sound trigger. Additionally, different types of levels use game state audio to communicate the type of challenge featured therein; water levels in *Mario* usually use a water level music track of some sort to communicate an abstraction in the level design found in that level, and castle levels use a much more menacing music track to communicate to players that they have reached the climactic challenge in a given world of the game (i.e. 1-4, 2-4, 3-4, etc. in *Super Mario Bros.*). This strategy has been so popular for the *Mario* franchise that it has reappeared in later games as well. *Tetris: Effect* unfortunately does not use many examples of this strategy beyond reaching a 50% point in a level and completing the level, but this strategy should not be disregarded for the value it provides to players; it communicates incredibly meaningful information about the current game state and helps divide levels into more manageable pieces for players through a relatively easy audio element which can be implemented by many kinds of designers. It features a low level of complexity yet offers a great deal of meaningful information to players in turn. However, the strategy has become commonplace in many modern games due to its success for designers of any background. As it has become quite commonplace in video games and explored to great extent, the room for innovation by use of this strategy available for designers is likely quite low—designers looking for accolades in their audio implementation might not earn any awards for using game state audio, but instead might have this come into consideration when competing for awards in usability or accessibility.

Fallout: New Vegas & Grand Theft Auto V

The final strategy to be exemplified in this deep dive is the use of **divergent audio**. This tactic uses audio (primarily music, but not limited to this) to allow players to express themselves or connect with the game world while providing agency to players over what audio is played. As with many of the above games, divergent audio is not specific to games like *Fallout: New Vegas* and *Grand Theft Auto V* (GTA V); many video games in other genres like *Crypt of the Necrodancer* or *PC Building Simulator* take advantage of this strategy to help players adapt to the game world in a comfortable manner.

Divergent audio is a broad strategy, but an easy example of this can be seen in the radio features of *Fallout: New Vegas* and *GTA V*. In each title, players can select radio stations while travelling around the open world environment which are based around a genre of music and will cycle through a playlist of genre-specific songs usually set in the era the game world takes place in. These radio stations allow players to feel some level of agency of the game, allow developers to address the issue of long journeys between objectives by distracting players, and immerse players in the game even more (though, to varying degrees depending on the game). In *Fallout: New Vegas* for instance, divergent audio allows players to listen to two major radio music stations through the pip-boy's radio menu: the Mojave Music Radio which plays a non-stop selection of country and western music which further connects the player to the post-apocalyptic

cowboy wasteland aesthetic of the Mojave, and Radio New Vegas which provides a mix of radio host commentary connecting to the player's actions but also playing a selection of Las Vegas influenced '40s, '50s, and '60s music. Players can also connect with events in quests using some of the minor radio stations for quests like "Crazy, Crazy, Crazy" which tasks the player with a quest at a mountaintop radio broadcast tower where they must clear super mutants from the area and stop the broadcast. Though *Fallout: New Vegas* lacked a great deal of polish in other areas, this strategy allowed *New Vegas* to quickly become a cult classic amongst players for its ability to connect players, music, and the game space thanks in part to this strategy. Further tying in the radio feature into side quests and the ultimate final quest of the game (via the "NCR Emergency Broadcast" station) would allow players who wished to connect to the game space do so, recapping events as they occurred, providing a rather innovative use for divergent audio at the time of inception (2012).

Grand Theft Auto V also featured a similar addition of a radio station selection menu, though it was only available while driving a vehicle (usually a task required to get to a quest or complete a quest objective, such as escorting a character to a location). Like *New Vegas*, it helped developers fill the negative space between game moments. Some quests featured their own audio tracks and sound effects, but using music from modern albums (i.e. Lorde's *Tennis Court*, Gorillaz's *Feel Good Inc.*, CCR's *Fortunate Son*, etc.) significantly cut down on the work sound designers would need to do for such an expansive game world. Radio stations were more expansive in this title, featuring 23 stations with no overlapping music between them for players to explore as they travelled from place to place. Though it was not what many might consider an innovative use of divergent audio for the time, the diverse selection of audio found throughout these stations provided a low level of complexity for designers to help distract players from the driving routine between objectives and add a sense of 'flavour' to the game's audio identity. If a player wanted to roleplay as a modern thug or gang member, there were radio stations which might help to fit that persona. Players seeking music they personally enjoyed would likely be able to find something among the 23 stations available as well.

Conclusion

Game designers can use game audio strategies such proximity audio, divergent audio, negative space audio, game state audio, discovery, and/or metaphoric audio to solve specific game design challenges and add value to games for players at the same process. Designers can use these strategies to solve various problems which emerge in the design and development process, communicate ideas concisely without subjecting players to extensive tutorialization or text screens. Using these strategies are not exclusive to professional sound designers—programmers, game designers, and other designers may implement such solutions as well. Doing so improves the holistic understand of game design these professionals can bring to their craft, and improve the likelihood for their project to be nominated or win accolades for such efforts. In doing so, they improve upon the quality of game design and development produced in the games industry.

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