

# Meaningful Noise: Understanding Sound Effects in Computer Games

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## ABSTRACT

The various roles of sound in computer games are yet not very well understood and sound is an underused artistic potential in many games. This study presents a framework for understanding game sounds to remedy the situation. The framework is based on examining sound effects and distinguishing between diegetic and non-diegetic sound as signals and referents. In games, diegetic is something that belongs to the game world, whereas non-diegetic is something from outside the game's fictive environment. The framework provides a tool for classifying game sounds, but may also be used as a design tool.

## Keywords

Sound effects; sound design; computer games.

## 1. INTRODUCTION

Computer games are often thought of as a principally visual medium. Sound, on the other hand is regularly given only minimal attention compared to other forms of content. Moreover, the role of sound is often that of being a mere decoration, and sound is seldom used as an element relevant for playing. In fact, many games are even fully playable with the sounds turned off. Compared to the extensive use of visual information, sound remains an underused potential.

There has also been remarkably little discussion on game audio design and game sound research. Consequently, the function of sound in computer games is still not well understood. This can be seen as a distinct gap in the game development literature: to date there are only a few books dealing specifically with game audio [11, 14] and even these focus not so much on design as on sound and music production, tools and career strategies.

The purpose of this paper is to investigate the role of sound effects in computer games and provide a framework that highlights the different signifying functions handled by sounds. The investigation will revolve strongly around the notion of diegetic sound. In film studies, the term diegetic refers to something that belongs to the story world. Diegetic sound, thus, is a sound that belongs to the diegesis, the fictive world. [2] In computer games, a sound can similarly be thought of as diegetic if it is interpreted as being real in the game world. However, computer game sound is only seldom purely diegetic. In this paper, I will demonstrate how analyzing sounds in relation to the game's diegesis can help create an understanding of the different roles that sound effects can have in a game.

The structure of this paper is as follows: First is a section on related work in the area of game sound, sound design and game

sound typologies. Based on the notion of diegetic sound, I will then construct a framework that displays the various relationships possible between a sound signals and referents. Finally, I conclude with a discussion on using the framework in design and discuss its impact with regard to game sound theory.

## 2. RELATED RESEARCH

To date, there has been remarkably little research on game audio. Studying sound in games has mostly been motivated by game development for visually impaired players; see for example [4, 5, 16]. These studies investigate the usability of sound for playing, but primarily focus on sound-only games. Even if some studies [8, 16] also consider the use of sound as an alternative form of interaction for sighted players, they do not consider game sound in combination to the visual components of gaming. Neither do these studies discuss why nor by what means is sound understood in games and what meaning sound is given in different contexts. Consequently, sound design is mostly viewed as an accessibility issue - a view also reflected in the IGDA accessibility white paper [9] - rather than an aesthetic realm of its own.

In addition to academic papers, there also exists a handful of essays about interactive sound, written by composers and game sound designers. However, these papers are for the most part concerned with interactive music composition [7, 12, 17], and only briefly touch on the issue sound effect design. Prince [13] also discusses sound effects, but mainly in relation to sound manipulation techniques. Bernstein's [1] classification of sounds according to their function in games is a rare exception, and I will return to it in the next subsection.

### 2.1 The Meaning of Sound in Games

There have been few attempts at systematically describing the roles sound can take in a game, and part of these has taken place outside academic publication forums. In his blog on audio gaming, Folmann [6] presents a game sound typology. Due to the writers focus on sound production, the typology does, however, not serve to categorize sounds according to how they are interpreted in a game.

Stockburger [15] provides a more detailed categorization of game sounds. Nevertheless, apart from the interesting analysis of the spatial information functions of sound, this typology also remains focused on technical issues related to audio production rather than on how players understand sounds.

A more suitable distinction is the one by game sound designer and composer Bernstein [1], which defines three sorts of game sound types: Sounds can either directly signify the event that is causing them, as when a ball hits the ground with a thwack.

Sounds can also be indirect. In this case, a certain sound signifies an event in the game, but the link is indirect. Third, sounds can also be environmental, in which case they provide to convey a sense of game world presence. This categorization is closer to the player's perspective, since it attempts to define sounds in terms of how they relate to a player's actions and game-world events. The categorization is not attempted as a full typology, but it will serve as a starting point for the framework in this paper.

### 3. CONSTRUCTING A FRAMEWORK FOR UNDERSTANDING SOUND

From a semiotic viewpoint, the meaning of signs can be examined by looking at two aspects: the sign, that is the sound signal and the thing the signal points to, the signified event. In game sound, the signal is the sound itself, as heard by the player, whereas the referent is the thing that is being told by the sound. As Bernstein's [1] classification suggests, one way of analyzing the various types of game sounds is to look at what kinds of events sounds signify, or simply put, what information the sounds give to the players. We will therefore proceed with a closer look at the sound signals, and, on the other hand, the signified game events.

The means for doing this will be the notion of diegesis mentioned earlier. In the introduction, the term diegetic was defined as something that is real within the game world. Non-diegetic, on the other hand, is something that is not part of the fictive world of the game. Examples of non-diegetic parts of gaming are the physical environment where a player is situated while playing as well as (in most cases) the game's interface.

**Table 1 Outline of a framework of sounds in computer games. There are four main types of signal-referent relationships.**

	Diegetic signal	Non-diegetic signal
Diegetic referent	Diegetic sounds	Symbolic sounds
Non-diegetic referent	Masking sounds	Non-diegetic sounds

We can start by sketching a framework based on the signal-referent distinction, as shown in Table 1. The framework shows four main types of relationships that can exist between the signal and the referent of a sound. The function of a sound depends on the nature of this relation; of how the signal and the referent stand in relation to the game world's diegesis. Next, the framework will be explained after which I will conclude with a discussion on how the framework can be used to guide design decisions in the sound design process.

#### 3.1 Diegetic and Non-diegetic Signals

As noted earlier, the basis for the framework is the distinction between diegetic and non-diegetic, and, on the other hand signal and referent. How can we, then, define whether a sound is diegetic or not? To answer: the issue is mostly one of interpretation. The question that has to be answered is whether

the sound that the player hears is to be considered real within the story and whether it is a sound that exists in the game world. One approach to deciding whether a sound is real is to evaluate whether a sound has a source within the game. Another approach is to evaluate, whether the sound behaves in a realistic manner in the game. One way to decide whether or not this is the case is to study the reactions of other characters to determine if they can hear the sound or not. If the sound is real, then it should be coming from somewhere and other characters in the game world should, in theory, be able to hear it (assuming, of course, that they are able to hear at all and close enough to the source). Consequently, if a sound has no in-game source, then the sound signal is non-diegetic. Also, sounds should be considered non-diegetic if they are treated in such a way, that they do not seem real within the game world.

#### 3.2 Diegetic and Non-diegetic Referents

The referent of a certain sound is the meaning it carries. In games the referent will often be a certain event within the game. But it can also be something less clearly identified, such as ongoing processes like the presence of a character or place. The referent can also be information about internal state, as when a certain sound is signifying emotions experienced by some character. The relevant point is whether the event or information signified by a certain sound is real within the diegesis, that is, whether it is concerned with things that exist as real in the game world. Whereas a change in the state of the game engine is not diegetic, the emotions of a character are as real as anything fictive can ever be, and thus should be considered diegetic.

#### 3.3 Different Game Sound Types

Depending on the sound signal and the referent's relations to the game world (diegetic or non-diegetic), four different combinations of signal-referent relationships can arise. I will refer to these sound types as diegetic, symbolic, masking and non-diegetic.

##### 3.3.1 Diegetic Sounds

With diegetic sounds, both the sound signal and referent are diegetic. These sounds are real within the game world and they signify events or information that is real in the game. This seemingly trivial definition has one crucial implication for design: it requires that the sound has real effects within the game world. This is currently not very common in computer games, and not many games actually use this kind of functional sound. However, herein lays the power of the notion of diegetic sound. When a sound is diegetic in the sense we have defined above, it becomes part of the game structure instead of being merely a decoration.

To name an example, in the Thief series (Eidos Interactive 1998-2004) the sounds of a player character's footsteps are diegetic and form a crucial role in playability. Guards can hear the player move and there is a comparatively stable and understandable relationship between how loud the footsteps sound to the player and how well they can be heard by guards at different distances. This way, the game uses the properties of diegetic sound to create interesting new playing experiences. The design solution has created an interesting game mechanic: the player has to

sneak silently along corridors in order not to get caught. Sneaking as a concept would in fact be impossible without an understanding of whether a sound can be heard by other characters or not. [10]

### 3.3.2 Symbolic Sounds

Symbolic sounds have diegetic referents, but the actual sound signals are non-diegetic. These kinds of sounds are very common in computer games. One example is the use of music to accompany the player's actions in the game. These sounds relate to events within the game, while the signals remain non-diegetic.

Sometimes, the distinction between diegetic and non-diegetic signal is not as easy to draw. Without knowledge about the game designer's view of the world, it may sometimes be impossible to decide whether sounds belong to the world, or whether they are sounds from outside the game world. The decision is somewhat alike determining if the squeaking sound of two cartoon characters shaking hands is the actual sound of their hands rubbing against each other (diegetic), or, if it is rather a (non-diegetic) sound glued upon their otherwise silent handshake. Similarly, many of the sounds in Pac-Man (Namco 1980) may be considered either diegetic or non-diegetic, depending on how we choose to interpret the maze-world in which Pac-Man exists.

This discussion is parallel to a situation in film studies, where the sounds of events on screen have been substituted to make them sound 'bigger than life'. For example, a common practice in film is to use cornstarch to create the sound of walking in snow, since in reality, walking on snow does not make much sound. Film sound theorist Chion calls these 'rendered' sounds, the embellished and boosted variants of the 'real' sounds of the events [3]. Nevertheless, even if some sounds are artificial, they can be perceived as real within the story. More importantly, the way we interpret them lays not only in the sound signals, but much in how the sounds are related to. In a game, part of this decision is how other characters react to sounds. In most current games, non-player characters show no reaction to sounds heard by the player. Thus, at the moment, most games use non-diegetic signals, which can be inferred from the way they are treated.

### 3.3.3 Masking Sounds

Sometimes a sound signal is diegetic, but it signifies a non-diegetic event. In this kind of relationship, the sound is used to mask a non-diegetic message with a diegetic signal, hence the name. A common example of masking sound is when a player triggers a monster in the game and is notified of this by, for example, a growl or shout from the monster in question. The sound is, essentially, played because the player has entered a certain hot spot. In many games, the reason for the sound is not related to whether the monster actually can see the player, or vice versa, so the signified event is non-diegetic. However, the sound is masking this technicality and notifying the player of the event with a diegetic, in-game growl.

Masking sound is often used to make something that is essentially non-diegetic fit in with the rest of the gaming experience. However, this way of thinking about sounds highlights an interesting part of game expression. In a sense, game sounds (or visuals, for that matter) are never signifiers of

'real' events, but are always constructs covering up the technical functionality of the game engine. Thus, essentially, all game-initiated sounds could be thought of as masking sounds, since the sounds are constructions. The exception is the player's actions, since these events are the only ones that 'truly' take place within the diegesis.

Nevertheless, some game-initiated events are more diegetic than others. Consider for example the sound of a door creaking open or the footsteps of a character in the stairwell. Both events are game-initiated and technically they have nothing to do with the fictive world of the game. However, these events can be interpreted as belonging to the diegesis, at least much more so than the event of monster proximity triggering mentioned before. Thus, when comparing sounds within a game, some events are closer to the diegesis than other.

### 3.3.4 Non-diegetic Sounds

The last alternative in the framework is that neither the signal nor the referent is diegetic. Here, the sound effect is shown to signal an event that is not real within the game world. However, instead of masking this with a diegetic signal, as in the previous category, now also the chosen signal is non-diegetic.

The most common example of this kind of sound is the sound of the game interface. With interface sounds, neither the referent (e.g. a menu-choice) nor the sound signifying it (dry pop) claims to exist in the game world. The sounds are communicating information from outside the game. Naturally, they may be designed in a manner as to suit the general mood of the game. Such would be choosing hollow metallic sounds in the menu of a horror game. Regardless of the general design of these sounds, they are nevertheless, unconcerned with the story world, disconnected from the game environment itself.

Despite this disconnection, non-diegetic sounds are also often part of the sounds of playing. For example, in most games, background music is non-diegetic. Like in movies, the player accepts the symphonic sounds as something from outside the story and does not anticipate finding an orchestra perched on a nearby hilltop or balcony. Another common form of non-diegetic sound is the narrator's voice. This is not so often used in games, but it does exist. For example, the game *Broken Sword: The Sleeping Dragon* (THQ 2003) features characters, who will narrate the player's actions. The narration is also in past tense, which takes it further from the now-and-here of playing. For example, in reply to something that cannot be done in the game, the female character will say, "I thought about doing that, but decided against it".

## 4. CONCLUSIONS

The potential of sounds have recently been recognized, and games are starting to use sounds in new and interesting ways. One direction has been to use sounds so that they are relevant for playing the game. This development involves both games in which listening is important for playing and games where players produce or manipulate sound as part of the gaming activity.

There are several ways in which a sound can become relevant for playing. For example, sound could be used as a primary source of in-game information. This would allow creating games in which

part of playing is to actively gather information by listening to the sounds of the game (for comparison's sake, think of the many games in which the player visually scanning the environment for objects of interest). On the other hand, games can also use sound manipulation and the production of sound as a core game mechanic. This way of thinking about sound facilitates interesting new gaming forms, in which a player plays by making sound, or as a contrast, by being quiet.

One reason for the unrealistic reactions to game sound lies in the difficulty in making game characters with perceptive abilities, such as hearing. However, despite technical limitations this question is becoming more important with the recent increase in online gaming. The distinction can be thought of more as a philosophical one – is the sound such that if there were hearing characters, it could be heard? Since online games allow players to play with (or against) other players instead of computers, there is a possibility to create games in which the sounds of a player's actions do matter without having to implement complex procedures for handling perception.

For example, in multiplayer gaming environments, game sounds can become important for playing simply by making them available for other players to hear. Conversely, if sounds are not transmitted, they will remain non-diegetic and meaningless from a playing perspective. Finally, from a functional viewpoint it is enough if there is even one character in the game world that potentially can hear the player's sounds. The fact that there is at least someone to hear the player's actions (and use this information as a basis for their actions, whether for collaboration or opposition) is enough to make the sounds relevant for playing. This function can be seen especially within the genre of first-person shooter games like, for example, Quake (1996-2001), Doom (1993-2002) and Unreal Tournament (1999-2004). In these games sounds are already relevant for playing, calling for game activities such as stealth moving and performing silent hits.

This paper presents a framework for classifying game sounds. The framework illustrates how game sounds function, and shows what elements affect the meaning attributed with a sound. By highlighting how sounds are interpreted, the framework can be used to support the sound design process. Since the framework builds heavily upon the notion of diegesis, it is most suitable for analyzing and designing games involving fictive worlds.

Understanding the ways in which sound functions in games is also important for the emerging field of academic game sound studies. This paper redefines the notion of diegetic sound to fit the active-participation frame of computer gaming by addressing the way players make sense of game sound as they interact with the game. At the same time, examining game sound from the viewpoint of a game's diegesis will hopefully provide common ground for discussion between film studies and game studies.

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