

Sounds and Sources in *Sacred*

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ABSTRACT

This paper looks at sound as a representational system in computer games. Being part of a Ph.D. project on the functionality of sound in computer games, this paper does not present a semiotic answer to how we should understand the relationship between computer game sounds, sources, and the real world. Instead, this paper asks several questions concerning computer game sound and its relationship to its source in the game world, and to sounds in our real world environment. Since computer game sound often has important implications to player actions and reactions, it has a special relationship not only to the player, but also to its source and the game environment. This relationship poses several problematic questions about referentiality and how sound may be part of a representational system. Therefore, game sound as representation is evaluated in relation to the functionality of sound in computer games, not at least according to how sound may influence game play. As an empirical case study, I do an analysis of the soundscape of the recent computer role-playing game *Sacred* (Ascaron 2004). The game sound is studied according to whether it relates to onscreen or offscreen sources. In addition, Clive Fencott's concept of perceptual opportunities in virtual environments will be used as analytical tool in order to describe the functionality of the sound in this game.

Keywords

Computer games, perceptual opportunities, representation, *Sacred*, simulation, sound.

1. INTRODUCTION

All those who have tried playing a computer game with the sound turned off know that sound is an extremely important aspect of the game environment, not at least in relation to successful game play. Game designers consciously utilize sound to influence the game experience and the player's behaviour in different ways, by giving the player information crucial to game play performance. In this sense, sound in computer games is highly communicative. Also, sounds in computer games are pre-produced and synthetically added to the visuals in the game. Thus, no sounds are present "by accident" in the way possible in films, where sound may be directly recorded on location. This makes it easy to see sound in computer games as representational. However, seeing sounds as representational also poses problems in several

respects. This raises questions on what exactly sounds may be said to represent: do they represent sounds in the real world, or game-internal sources?

This paper will discuss whether – and how – computer game sound may be seen as a representational system. It will be asked what other kinds of relationships game sound may have to its environment, and in this way the paper tries to illumine the experience of sound both in games and in other contexts. In order to draw on a specific, empirical example, I will study the recent computer action-roleplaying game *Sacred* [1] with reference to what relationship there might be between the soundscape and its functionality in the game environment. Before going on to the analysis of the soundscape of *Sacred*, I would like to discuss how game sounds relate to its in-game sources and to sounds in the real world. The following section will then outline how sound is understood in this paper, and it will also be a fruitful theoretical starting point for a further examination of computer game sound as it will be understood in my Ph.D. project.

2. SOUND & SOURCES

Understanding sound as a representational system may seem intuitive. When we hear a sound in daily life, we connect it to its source, regardless of whether we can see the source or not. When we experience sound, we perceive it as causally connected to either a specific object (the duck says quack), or as the result of a process (sound from a motor) or an event (sound from an explosion). When we listen to sound with an analytical ear, we tend to separate sound from the source according to the senses through which they are perceived, namely hearing and sight. And since the source in general is a physical feature, and also more persistent than sound, we are easily led to see the sound as a property of this source; hence it becomes secondary to it. This may give us the impression that sound somehow points to its source: when we hear a sound, we think of its origin. This impression is not at least due to the fact that sound often comes into being as an effect of some kind of manipulation or physical strain towards a source. Hence, we interpret the sound as a representation of the source, since the sound becomes the auditory effect of a process or event arising from the source. In this sense, the sound points towards its source, thereby creating an indexical relationship between sound and source similar to the relationship between smoke and fire. Based on this thought, both in games and in the real world sound may be interpreted as a representation of its source. But we should keep in mind that this is a purely analytical understanding of sound. In everyday experience we do not perceive sounds as distinct or separable from their sources; instead the sound and its origin are experienced in coexistence, where the one cannot exist without the other. Although sound does not have the same

physical properties as their sources normally have, sound is experienced as another aspect of the source, just as important as all other aspects, but perceived in a different manner. With this symbiosis in mind, it becomes problematic to say that sounds are representations of their sources.

However, there is one situation in which it may be possible to argue that sounds represent their sources, and this is when we do not have direct access to the source. Here we do not have any choice but experientially separating sound from its source in an analytical way. When we do not see the source of the sound, we have to make hypotheses about what its source may be, based on mental models and previous knowledge about similar sounds in the real world. Especially when the sound is not immediately recognized, we assign the sound to hypothetical sources, making assumptions about what effect the sources may have on us. The sound then becomes the representation of its source. While sounds with onscreen sources have a more direct connection to their sources since sound and visual objects are experienced simultaneously, computer game sounds with offscreen sources may in this sense be experienced as representing their sources. In connection with computer games, it is also important to point out that whether one can see the source of a sound or not creates different reactions in the player. Seeing the source, we get a greater sense of control of the situation, since sound and source merge into one experiential entity, and there becomes no doubt about where the sound originates from. But when we do not see it our reactions will be of a more suspicious and interpretative kind where we try to identify the source, not at least because we are in a game environment filled with monsters and potential dangers. The sound from offscreen sources triggers a sense of alertness in the player, and the sounds may therefore be said to point to both monsters and dangerous situations.

When we look at mediated sound, the feeling that sound is a representational system may become even more convincing, since how the sound is intended to work is the result of a conscious choice from the creators' viewpoint. In addition to imitating real world sounds, all mediated sounds are added for a purpose. Especially game sound creates a strong feeling of being representational. Since the visual environment itself is constructed as graphics on a computer, game sound cannot be directly recorded together with the visuals in the same way as film sound¹. Instead it must be artificially assigned to the visuals, which obviously is quite different from recording sound simultaneously with images of its real world source. Thus, when a microphone is present sound may be recorded automatically. Where films may use on-location and direct sound that originate directly from the actual source, computer games must take sound from somewhere else, either by recording sound from the real world, or by synthetically creating an appropriate sound. When sounds and visuals are constructed in this way, what is presented becomes more stylized than what direct recording makes possible, and it is therefore also possible to modify and configure what one wants to present to a much greater degree. This makes computer game sound more communicative and purposeful than direct sound, and this adds to the feeling that computer game sound is a representational system.

¹ There are interesting exceptions, such as computer games where the visuals consist of photographic or filmic images.

However, it should not be forgotten that the sound one hears in a computer game, as well as in a film, *is* a real sound, and it is also experienced as such by the player or viewer. Not only is the sound an auditory stimulus for our ears just as any sound in the real world, also, during game play the player will react to the sound as s/he would react to real life sounds, at least as far as the early stages of game play is concerned. After repetitive game play the player will reach a certain phase of mastery or automation of the computer game. Not only until this stage may the player experience the sound as communicative instead of similar to real life perception experienced in present time, since the player now knows the game so well that s/he recognizes all situations and what sounds appear together with them and for what purpose [2]. But at this stage the game will lose its appeal since it has no challenges for the player any more. As far as sound is concerned, this often leads to players turning off the game sound and start playing their own mp3s instead of listening to the game music.

Above we have seen attempts of describing sound as representation of both real world sounds and of their respective sources, and although we partly may explain sound in this way, there is still something missing. Although sound in games may be seen as a representational system in some respects, it is problematic to say that the sounds are representations of real world sounds. What about the sound from a spell of magic? It is also problematic to say that the distinct sound from a cuckoo bird in *Lineage II* [3] is a representation when the sound has all the same qualities as the sound from a real world bird. The idea of representation does not cover everything that is in the experience of playing computer games, nor does it tell us anything about the functionality of sound in games. A representation of something tries to explain or depict the phenomenon in question, but only on surface level. A representation tells us about some characteristics, but it is never exhaustive. What is lost is the actual functionality, or the cybernetics of the phenomenon: how does it work in practice? It seems thus that a representation only presents properties of a phenomenon for us, and gives us general knowledge of it, but a representation does not teach us how to use anything. While representation focuses on interpretation, it is important to understand how sound may be an important contributor to mastering the game.

Perhaps it is better to understand game sound as *simulation* of real world sounds instead of representation? This is in accordance with how for instance Gonzalo Frasca [4] understands computer games in general. He emphasizes that simulations model the behaviour of objects and systems in addition to representing them, hence simulations give important understandings of the functionality of complex systems. This is especially interesting when studying game sound not only because sound is of prime importance for cueing player action, but also because the functionality of sound is more important than what sound may be said to represent. When discussing how simulation focuses on functionality, Frasca exemplifies by a reference to learning how to drive a car. The functionality of a car will be comprehended much better through a simulation than a representation, since the simulation will show in real time and by first-hand experience how the car works, while a representation such as an instructional map or a book only gives the learner a basic idea [5]. Translated to game sound, we may then say that the sound of an explosion in a game is a simulation when it has the same functionality as the sound of

a real world explosion, and when it makes the player act in accordance with it and use it for mastering the motor experience. If a sound is present as illustration, on the other hand, it may be explained as a representation. For instance, if I say “blam!” in order to tell someone what the sound from an explosion sounded like, this may be seen as a representation. But when we hear a the sound of an explosion in a game, it is a simulation because it expects the player to react to it in the same manner as someone would react in a similar real world situation. Thus, situation is important when deciding whether we talk of sound as a representation of a simulation: in isolation it may be easier to see sound as a representational feature than a simulation, since this takes away the importance of functionality. But when studying how the sound may function in a game, it will be more fruitful to see sound as a simulation system.

In short, it seems better to say that sound must be seen in relation to the whole simulation process in a computer game. Even in the case of offscreen sources, what is important is not what the actual source of the sound is, but rather how the sound functions in relation to game play: is it a warning, informational, atmospheric, or something else? This focus on functionality is also in accordance with real world perception. However, when we speak of the functionality of sound, it may be fruitful to draw upon James Gibson’s notion of *affordances* [6]. According to Gibson’s ecological perspective on psychology, any object that we meet in our environment will present for us ways in which we may interact with it. For instance, a door will present us the possibilities for opening and closing. It is hence *openable* and *closeable* in Gibson’s terminology. A chair is *sitable*, while a tree may be *climbable*. But although sound has the ability to influence action and behaviour, it is not straightforward to apply the concept of affordances to the issue of sound. For instance, in one respect the sound accompanying the green light at zebra crossings may be interpreted as *walkable* for the blind. Or in another respect, does the sound tell the blind that it is the street that is *walkable*? It seems here that what is the actual affordance of the sound is to give us information about another feature’s affordances. We may then say that a sound affords information about the functionality or state of things, hence it is *informationable*. Also, hearing sounds from a monster offscreen, the player assumes there is a *run-away-from-able* monster nearby. As long as the sound is offscreen the sound will have an affordance. But when the player hears sound from an onscreen object, sound and source merge into one experiential entity where we cannot speak of the affordances of sound. Instead we must talk of the affordances of the whole complex experience.

This emphasizes the fact that the sound has a special purpose other than merely representing other elements in the world. This may also be illustrated by another kind of auditory perception that has more direct affordances. These are startling sounds and other sounds that make us react intuitively on the basis of bottom-up processes triggered by a reactive part of the nervous system. Such sounds appear suddenly and have the effect of making an individual jump or otherwise being surprised; thus they afford startling. Sounds with certain loud, high-frequency and alarms that have such a piercing sound that one is not able to be in its vicinity without feeling physical pain also may be seen as having their own affordance, namely being *move-away-from-able*. The functionality of such sounds is to create a spontaneous and intuitive reaction, and

in this respect it is dubious to talk about sound as representing anything, since there is no kind of interpretation activated in the comprehension of such sounds.

One may ask whether the discussion on affordances only applies to real world sounds, but as stated above, computer game sound is experienced in the same manner as real world sounds, and therefore these thoughts are also valid for games. However, we need to keep in mind what is mentioned above, namely that computer game sound simulates real world sounds by being functional. At the same time, since game environments consist of computer generated constructs instead of registration of physical events by microphone and camera lens, computer games have a certain representational dimension not present in more traditional audiovisual media. Therefore, it is hard to say that computer game sound cannot be seen as representational, at the same time as it poses several problems to claim that it is so. There are at least two answers to the question of sound as representational, dependent on situation. Game sound is in one respect a simulation of real world sounds, and no representation. This has to do with functionality. In another respect, it may be seen as representing the perceived source in the game when the source is offscreen. But since we also deal with functionality here, it is more fruitful and correct to say that sound cues hypotheses about its sources.

3. SACRED: AN ANALYSIS

Sacred is an action-roleplaying game, placed closer to *Diablo* on the continuum between the *Diablo* games [7] and the *Baldur’s Gate* games [8]. The game offers quests and monster fighting, and the avatar’s skills and statistics develop during the course of game play, but the personality of the avatar and mental development are not issues in the way we know from *Baldur’s Gate*. The game has an isometric perspective, where everything is seen from above so the graphics engine does not have to deal with perspective differences related to distance. The avatar is thus seen from the third person perspective, and from above. The sound dimension of this game does not seem to differ much from for instance *Diablo*; thus, it seems a good case study of games of this kind of genre. What is interesting, at least from the perspective of those interested in how sound is implemented into the game both on a practical and a functional level, is that most of the sound files are installed together with the game as mp3 files in a separate folder. This makes it possible to go into the different files and listen to them in isolation. They also have titles based on situation that make it easy to identify them. However, not all sounds in the game are available in this way. What lacks from the file folder are sounds related to specific objects – that is, sounds connected to game objects. This is probably due to the fact that these sounds are programmed into the objects themselves and not as separate sound tracks. This is interesting in the perspective of this paper, since it deals with the relationship between sounds and their sources. When sounds are programmed into their sources as if they were originating from them, the relationship between sound and source becomes very similar to the relationship between real world sounds and sources. Although the sounds originally have been pre-produced and assigned to a specific source instead of originating naturally from this source, the fact that they are implemented as a product of their sources makes the

relationship feel more natural, since this is what we intuitively expect from sounds. This similarity between real world sounds and sounds in *Sacred* emphasizes the difficulty of dubbing game sound a representational system while real world sound is not. Also, when sound is programmed into objects, it more clearly becomes part of a simulation, where sound and source are merged in order to become as similar to the real world as possible.

However, there are 154 mp3 files available for listening, divided roughly into atmospheric sounds, jingles, sounds related to important non-playing characters (NPCs), and music. Atmospheric sounds are what game designers often call ambient sounds, namely sounds specific for a special area in the game. For instance, the forest will have a different soundscape than the desert, where the forest is dominated by the sound of wind in trees and animals, and the desert will have the sound of wind through an open landscape of sand. In *Sacred*, atmospheric sounds also differ somewhat from whether it is night or day. In *Sacred*, jingles are short² musical themes that appear together with a special event. For instance, there are jingles signalling danger, fights, and quests. There are also five short musical themes (about 10 seconds) associated with important NPCs in the game. Last but not least, there are several music tracks for different situations, ranging from one to four minutes. These may be associated with fighting, death, or whether the avatar is in a village or not. The different files are merged, mixed and repeated during game play, so that the player does not hear the same sound in all similar situations. As mentioned, in addition to these sounds ascribed to separate sound files, there are object-oriented sounds. For instance, there is speech from the avatar and NPCs, and there are sounds of weapons, spells of magic, doors, picking up objects from the ground, using objects, etc., in addition to sounds related to the interface, such as opening menus, and when the avatar gains new levels.

On the basis of this sound environment, I will study the soundscape of *Sacred*. The analysis will be concerned about sound as representational system, related to the actual functionality of sound in this game. I will investigate sounds with a source onscreen versus sounds with a source offscreen. I will study sounds that seem natural in the environment of *Sacred*, opposed to sounds that do not seem very natural in this respect. Here I will take advantage of Clive Fencott's concepts of *surprises* and *sureties*, which are two dimensions of what he calls *perceptual opportunities* [9, 10]. Perceptual opportunities are psychological qualities of a virtual environment that work to seek and keep users attention through the human perceptual system [11]. In this way, their function is to somehow influence user engagement and action within the virtual environment. Since computer game sound works along this axis, it will be fruitful to use the concept of perceptual opportunities as analytical tool when studying the soundscape of *Sacred*. Also, Fencott's perceptual opportunities relate to the idea of representation because they are highly communicative, being developed and placed into the virtual environment for a specific purpose related to the users' attention. As far as sureties and surprises are concerned, designers want these to be natural pieces of the virtual environment, thereby simulating features from the real world.

Fencott separates perceptual opportunities into three groups. *Sureties* are elements in the virtual environment that seem natural in this setting, and which are highly predictable. According to Fencott, sound is an important surety in real world, because it "gives important information about the nature and scale of the space we are currently experiencing" [12]. However, sounds may also have other perceptual opportunities. The second group is *surprises*, which do not have the same predictability as sureties, and which arise suddenly but still seem natural to the virtual environment. They seek to draw attention to themselves, thus stimulating users to take action. The last group is *shocks*, which are not part of the natural environment, but arise from errors in the design process. These draw attention to the virtual environment as construct, and are equivalent to software bugs.

3.1 Sound with Offscreen Sources

The film sound theoretician Michel Chion is also concerned about the relationship between sounds that emerge from onscreen and offscreen sources. He calls offscreen sources *acousmatic* sounds [13], borrowing the term from Pierre Schaeffer. An acousmatic sound is heard while its original cause cannot be seen, a definition that of course makes all computer game sounds acousmatic, since all sounds here are pre-produced and artificially added to the visuals. However, in this context we will instead understand it as sound where the source to which a sound is assigned cannot be seen. In *Sacred*, we can separate between three groups of acousmatic sounds, namely sounds from enemy NPCs, ambient sounds, and music. These are all sounds that cue the player to set up hypotheses about the sources of the sounds, thereby being potentially representative. However, music is separated from the other two by the fact that it is nondiegetic; it does not originate from the game universe but is rather an external, commenting background feature that underlines the fictiveness of the game world. Thus, the player does not look for a source within the game. Ambient sounds and enemy sounds, on the other hand, are features of the game world, and the player therefore expects to find their sources somewhere within the game world. But this is not simple in relation to ambient sounds.

3.1.1 Ambient sounds

To find the sources of the ambient sounds is not easy. Ambient sounds in *Sacred* are not connected to specific objects in the same manner as other sounds in the game. Instead they belong to the general atmosphere of the environment, and consist of a mixture of sounds from different potential sources. In the forest the player hears animals, birds, and the wind blowing in the trees, but if the player goes searching for the sources, s/he will never find them since they do not exist as objects programmed into the game. Still it is possible for the player to identify or have hypotheses about their theoretical sources. In this sense, the ambient sounds may be experienced as a representation of their sources, since the player needs to have a mental model of what may create such sounds. In addition, ambient sounds work as a substitute for the sources not present. However, the source is not really important together with the functionality of ambient sounds. The function of ambient sounds is to create an atmosphere and the feeling of a naturalistic environment, hence these sounds clearly simulate a specific feature of real world sounds. As in the real world, ambient sounds are background sounds that do not draw on our attention but instead makes the environment feel alive,

² No jingles are more than a minute; most are less than half a minute.

and it is this function that is transferred to computer games. In addition, it would be dubious to say that the ambient sounds are a *representation* of an *atmosphere*, since moods are mental states and ideas more than something to be represented. To speak of ambience as representation would therefore have to be in a metaphorical sense. Moreover, neither can we say that ambient sound in *Sacred* simulates mood, but we can say that it is a simulation of sound found in real life locations, which again may represent a certain mood. Here we see again that functionality goes beyond any experience of sound as representation, even though what the sound simulates is not relevant for physical action. We may still say that the sound is *informationable*, since it gives information about what kind of environment the avatar is in. In this case the sound only gives the same information that one receives through the graphics. Related to perceptual opportunities, ambient sound is the prime example of a *surety*, since it is an auditory feature that seems natural to the environment, at the same time as it is highly predictable. There are no dramatic variations in the ambient soundscape, and it works to create immersion and an atmosphere. Thus ambient sound works in the same way as real world ambience; where we normally do not question or try to find the physical source, but expect to have it as omnipresent background sound.

3.1.2 Music

Music stands in special position as acousmatic sound, not only because it is the only nondiegetic acousmatic sound, but also because it experientially tends to blend with the ambient sounds. This is a general tendency in modern computer games, and this trend is transferred also to *Sacred*. Music also has some aesthetic qualities that are hard to describe, not at least when it comes to its relationship to a virtual environment. While the game environment tries to simulate a real environment as far as certain actions are concerned, and not at least as far as the diegetic soundscape is concerned, music does not fit into the simulation in this respect. In my view, music is the kind of sound that we most easily may dub representational, since it has aesthetic qualities, and works to comment game play in a very communicative manner. It also works to create an atmosphere and mood; not by simulating real world sounds, but by presenting music that by the use of certain instruments, tonalities and gamut represents a special mood. In many modern computer games, there is music that signals the entrance of situations or special NPCs; the computer game equivalent of what is known in opera and film as *leitmotifs* [14]. However, *Sacred* does not have *leitmotifs*; instead it has adaptive music [15] that changes according to the situation. This means that situational music does not start until after the event has started. So when the avatar is in combat, the music may start as forest music, and then continue into ambient sounds before going into combat music. However, as I mentioned above, there are jingles signalling for instance danger. But they cannot be called *leitmotifs* because they only inform the player that this is a place where there are monsters, not that they are attacking. It only affords information. When studying music as a perceptual opportunity, we find that it is a complex task to describe it according to this concept. Being nondiegetic, music is strictly speaking not part of the environment, although it works most certainly as a psychological quality which is present to keep the player's attention focussed upon the virtual world. Meanwhile, music is directly connected to the environment and what happens within it. Also, music is not a natural part of

the game environment, although it most of the time is predictable since music follows certain rules of rhythm and tonality. As already mentioned, it is also a background feature that does not directly call on our attention. In this sense, it is no *surprise*, but it is definitely no *surety* either. It is most fruitfully labelled *shock*, since shocks are not natural to the environment, but influences it and draws attention towards the environment as construct. The difference between Fencott's shocks and music, however, is that music is purposefully added as an aesthetic feature influencing the environment, while Fencott's shocks are errors in the design.

3.1.3 Offscreen NPCs

Acousmatic sounds from hostile NPCs in *Sacred* are of another kind, where sounds are directly linked to their in-game sources. While both ambient sounds and music always remain acousmatic in the game, sounds from NPCs has the ability to get *de-acousmatized* [16], or to become visible. When hearing the voice or footsteps of an offscreen enemy, the player knows that the enemy at the moment is out of range of sight, but that it may be visible any moment. While it still remains offscreen, the player will make assumptions about the sound, for instance that it belongs to an enemy since only hostile NPCs make sounds when they are offscreen, and what kind of enemy it is based on what kind of utterances it makes. These assumptions may then cue the player to take action of some kind. The player may change combat tactics by readying a certain spell of magic or a weapon, or if s/he suspects that the enemy has not yet spotted the avatar s/he may stand still or move away from the sounds. It is important that the direction of the sound gives the player information about the enemies' direction, thus moving towards the enemies may be an option, for instance if s/he wants to kill enemies for experience points or if s/he suspects that these enemies are related to a quest s/he is assigned to. Sounds connected to offscreen NPCs are therefore informationable, since they have the function of informing the player about presence, direction, and type of enemy. In *Sacred*, this works in a similar fashion to how we experience real world sounds from sources we cannot see, and in this way it seems to simulate how real world sounds behave in relation to sources in the real world. However, since the player needs to make hypotheses about the source as long as the source is not seen, and these hypotheses will be part of the player's understanding and interpretation of what might be the source of the sound, we may say that there is a representational relationship between the voice and footsteps and the actual NPC while the NPC is offscreen. But once the sound becomes de-acousmatized, the sound and the source merges into one and the player does not experience them as separate. There seems to be no difference between the experience of real world sounds and game sounds in this respect, because the functionality of the sound is more important than whether it may be seen as representing an object. If sound was regarded a representation in this case, we would have problems deciding on what it actually represents: the source, the direction, or the situation? When we speak of acousmatic NPC sounds, these are best seen as *surprises* in the terminology of perceptual opportunities. Since these sounds are potentially de-acousmatized, they must be defined under the subcategory *attractors*, which are features that draw attention towards spaces in the virtual environment distant from the player. They are often spatialized, hence heard from afar, and may also be partially obscured. Player action is affected by attractors, since they inform the player about presence and direction. In this

sense, acousmatic NPC sounds may also be seen as *connectors* that decide the route of the game, affecting where the player moves the avatar [17].

3.2 Sound with Onscreen Sources

3.2.1 Close Encounter: Onscreen NPCs & Events

While voice and footsteps of NPCs may be heard onscreen as well as offscreen, there are also other sounds available when NPCs are in the visual range of the avatar. Even though *Sacred* in theory could have offscreen sounds from events and objects, NPCs will not initiate events or manipulate objects until they are onscreen. Thus, sounds from events such as spellcasting or explosions, do not appear until the enemies are within range of sight of the avatar. Obviously, also sounds from attacks and weapons are not heard until the avatar and NPC are in close range (arrows are of some reason not heard at all). It is then possible to hear very many different sounds, both connected to objects, NPCs and the avatar. When a hit is dodged by the enemy's weapon, there is a sound of metal on metal; when a stroke hits, there is the sound of something hard on something soft; and when there is no hit at all, one hears a "woosh" from steel moving fast through the air. The avatar and NPCs also make grunts when they are hit, and they scream out loudly when they die. We should note that I say that these sounds are onscreen. This is not entirely correct. Although it seems to originate from onscreen agents, it is hard for us to see if a sword hits another sword, the enemy, or does not hit at all. During combat, the player is not always able to for instance monitor the avatar's hitpoint status, and in such a case it is crucial also to hear when the avatar is hit for the purpose of always having a relative idea of whether it is time for healing or running away. Sounds connected to all these events afford informative functions that give additional information to what the player gains through the visuals alone. But the sound does of course also work to create a realistic auditory element in the game. While it would be possible to say that such sounds refer to the physical hit, also here it is more relevant to speak of simulation, since what is important is the fact that the sound influences the player to take some form of action. Since the only senses through which the player may perceive in a game are ears and eyes, it is important to simulate pain and other perceptions through the available senses.

However, in *Sacred* there are also objects and events connected to sounds that do not correspond to sounds from similar real world objects. This fact makes it difficult to see sounds in this game as a representation of sounds in our world. One obvious example is the sound from spells of magic, which we have no real world reference to. However, we do have an idea about magic as a concept from fairy tales, legends and fantasy fiction, and when this concept is simulated in a game it also needs to be accompanied by a sound in order to be convincing. This is because similar features in the real world such as explosions and other violent events are accompanied by sound.

The sounds discussed here connected to onscreen objects may be categorized as *surprises*, since they are sudden sounds that appear naturally from the environment. Although not distant or spatialized, as surprises we may see them as attractors, since they call attention to themselves by informing for instance about relative hitpoint status. However, they are still predictable according to their situation, since we do expect sounds to arise from physical encounters such as a sword

hitting a person, and it may be argued that these sounds are not surprises at all, but sureties.

3.2.2 Sound Related to Other Objects

There is also another way in which *Sacred* questions the representative status of sound in games. When the avatar picks up objects from the ground, or equips objects from the inventory menu, the player hears a sound. When the object is a weapon, there is a short metallic sound that reminds of a knife pulled against a grindstone. When the object is armoury, the sound is like dropping a chain mail to the ground. When the avatar picks up or equips magical objects, the sound reminds more of a short strike on a harp. Although the sound here is not equivalent to how we experience sound in real life in these situations, the sounds are added for the purpose of a special function: they are informationable since they notify the player that objects in the inventory are used, so that s/he does not run the risk of using objects involuntarily without noticing. In this sense, they are auditory simulations of physical manipulation. Concerning perceptual opportunities, these sounds are in an awkward position. In a sense they do belong to the environment, since picking up objects and using them are environment oriented; but also, they are sounds of the interface, and thus place themselves somewhere on the threshold between the game space and the player's space. We could label them shocks, on similar reasons as we suggested shock as category for music, but at the same time they are related to the actual diegetic picking up and manipulation of items. We must also admit that implementing these sounds is a way of simulating use and manipulation of items, so it would probably be best to regard them as belonging to the game world. In one sense, we may label them sureties, because often do expect a certain sound when manipulating objects; on the other hand they appear suddenly, and often have the function of attracting attention towards the fact that the avatar uses an item. However, concerning sounds from the interface, there is one interface sound we must label shock, since they are not part of the game world, and this is a subtle click that always appears when the player opens a menu.

The reason why we are convinced by these kinds of simulations, which are not equivalent to the sounds we hear in similar real world situations, is that it is formed a spontaneous relationship between what one sees with what one hears at a specific point in time. This is what Chion calls *synchresis* [18]. Although the sound and its source are not originally connected, they are perceived as such because of their synchronous appearance, and provide thus an explanation of why we accept such connections between sound and a source as described above. Not at least, the idea of *synchresis* supports the idea that sound and source are experienced as one entity when the source is visible, and not as two separate parts where the one represents the other.

3.2.3 Avatar Sounds

Concerning sound related to the avatar in *Sacred*, these can obviously never be offscreen, since the avatar always is the central focus in the image. In *Sacred*, avatar sounds are limited to a few: non-volatile sounds, and those related to voice or vocal chords. Non-volatile sounds are footsteps, heavy breath, and grunts. Footsteps are present at all times when the avatar moves, and they change according to whether it walks on grass or tiles. Heavy breath appears frequently when the avatar is running around, and grunts indicate that the avatar is hit by an

enemy. The function of these sounds is to simulate auditory features within human beings, and thus make the environment more realistic. Some of them, for instance footsteps, are partly informationable, but with no clear relevance for game play. However, heavy breath, for instance, does not seem to be present for other reasons, although one could believe that it suggested that the avatar was tired and needed to rest. Since the functionality of this kind of sound is very limited, it is possible to argue that this is only a simulation of naturalistic human sound reduced to representation. But I do not support this argument since it is only one part of the whole simulation of a human being that is the avatar. The same goes for the avatar's use of voice, which in most cases is atmospheric and does not have any function related to physical game play. Avatar speech in *Sacred* is in general non-informational, instead related to combat situations, where the utterances take the form of threats towards the enemies, which do not react to verbal threats. In this case, the sound has the function of surety, since the sound seems to be a natural piece of the environment, and is predictable, in addition to the fact that it has no direct relevance for game play. But there is an interesting exception to this. If the player moves the avatar in a direction with no relevance for current quests, the avatar will tell the player so by comments such as: "I have no reason to chase enemies in this part of the country". Here we see that the voice has direct relevance to game play, by discouraging the player to take a certain direction. This may be seen as an subcategory of surprise, namely *connector*, since it decides the route of the game.

As mentioned, sounds from onscreen objects and events are more directly connected to their sources than sounds from offscreen sources are, most of all because the player does not have to speculate about the sound's origin. Instead, sounds from onscreen sources are parts of the simulation of objects and events. When we perceive a real world object or event, we perceive it as a whole, where sound is a natural part of what happens. It is not possible in the general course of experience to perceive sound as separated from its source. There is no way we can say that there is an arbitrary relationship between sound and its source, but this is not the same as to say that the sound is a representation of something else. When we say that sound is a representation of something else, this is to reduce the importance of sound to secondary compared to visual perception, and this would be problematic not at least when we regard sound as having important functions related to action and reaction both in computer games and the real world.

4. CONCLUSIONS

Talking about sound as representational system is a delicate issue, and as this paper demonstrates, the discussion comes to no conclusion. Seen in isolation sound may be experienced as a representational system, but when sound is contextualized and given the function to provoke action and behaviour in a player, and thus be a catalyst to mastery of a system, we see that sound is wended up in a larger system of simulation. However, representation and simulation are not mutually exclusive: a simulation may also include representation of some sort, but a representation can only describe simulation, and not demonstrate how the simulation system works.

It is hard to separate a sound from what produces it; they exist in symbiosis, and any separation between the two is an

analytical and artificial construct. We hear a sound and know that it always has a source of some kind, but we do not think of it as a representation of its origin. Although there is a cause-effect relation between a sound and its source, it becomes dubious to even see sound as an indexical sign of its source. This would be the same as to claim that clean dishes next to the sink are a representation of dishwashing. To claim that cause-effect relations in general are semiotic systems is a reductive way of seeing such relations, since it degrades the effect to a "signifier" of something else; thus implying that its status is evaluated as less important, or less real. Also, since sound has temporal qualities and can only be studied or registered as a temporal feature, i.e. we cannot pause sound and study it at one exact moment of time as we can with images, sound should be understood as a *process* or an *event*. In the same way as the sound from a computer's fan, ambient sound in a game is a process, since it comes into being as the result of an ongoing process that in itself produces a more or less monotonous sound that is present as long as the process is going on. The sound from a sword that hits a monster in a game can on the other hand be compared to the knock on a door, which is a sudden and short sound resulting from two or more physical objects that meet. This is a different way of seeing cause-effect relations that goes beyond a mere semiotic explanation, and which is helpful when studying symbiotic and multi-perceptual phenomena such as sound comprehension. However, when one hears the sound from a source that cannot be seen, we make hypotheses about the origin of the sound. This way of perceiving sound may have representational qualities, since we must have a mental model in our minds about its source and its implications in this respect. This is especially evident when we have problems identifying the sound according to its source.

This paper has also used *perceptual opportunities* as an analytical tool in relation to sounds in *Sacred*. This has been done because the concept seems to fruitfully combine important qualities of the idea of representation with the functionality aspect of simulation. The concept of perceptual opportunities looks at objects in virtual environments as a medium with communicative features produced for a purpose by designers, yet also as a navigable space where a user may manipulate objects and take actions that matters and influences the system in a way that previously only has been possible in the real world, and not in media constructs. Perceptual opportunities therefore let the virtual environment be both representative and simulative at the same time. However, as we have seen in the analysis of *Sacred* the ideas of *sureties*, *surprises* and *shocks* do not seem to cover all ways in which sound in games function. It may therefore be a fruitful next task to further develop perceptual opportunities into also including the functionality of game sound.

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