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Player Relationships as Mediated Through Sound in Immersive Multi-player Computer Games

Relaciones mediadas por el sonido entre jugadores en el entorno de juegos multijugador

ABSTRACT

This essay examines the relationship between player and diegetic sound FX in immersive computer game environments and how this relationship leads, in large part, to the contextualization of the player within the virtual world of the game. This contextualization presupposes a primarily sonically-based perception of objects and events in the world and, in a multi-player game, this ultimately leads to communication between players through the medium of diegetic sound. The players' engagement with, and immersion in, the game's acoustic environment is the result of a relationship with sound that is technologically mediated. The game engine, for example, produces a range of environmental or ambient sounds and almost every player action has a corresponding sound. A variety of relevant theories and disciplines are assessed for the methodological basis of the points raised, such as film sound theory and sonification, and, throughout, the First-Person Shooter sub-genre is used as an exemplar. Such games include the «Doom» and «Quake» series, the «Half-Life» series and derivatives and later games such as «Left 4 Dead». The combination of the acoustic environment, the interactive placement of the player – as embodied by his virtual, prosthetic arms – in the environment and the sonic relationships between players produces the acoustic ecology. An exposition of this multi-player communication and the resultant acoustic ecology and player immersion, is the main objective of the essay.

RESUMEN

Este ensayo examina la relación entre el jugador y los efectos de sonido diegéticos en entornos de juego inmersivos para ordenadores, y a su vez, la manera en la que esta relación, en gran parte, pone en contexto al jugador dentro del mundo virtual del juego. Esta contextualización presupone una percepción basada principalmente en los sonidos de los objetos y los acontecimientos del mundo, lo que en el entorno del juego multijugador conduce finalmente a la comunicación entre los jugadores por medio del sonido diegético. El compromiso de los jugadores con –y la inmersión en– el ambiente acústico del juego es el resultado de una relación con el sonido mediada tecnológicamente. El motor del juego, por ejemplo, produce una gama de sonidos del entorno o del medio ambiente y casi todas las acciones del jugador tienen un sonido correspondiente. Una variedad de relevantes teorías y disciplinas, como la teoría del cine sonoro y la sonificación, se usan para construir nuestra base metodológica, y nos servimos de ejemplos como el del subgénero del «First-Person Shooter». Este tipo de juegos incluye las series «Doom» y «Quake», la serie «Half-Life» y sus derivados y juegos posteriores como «Left 4 Dead». La combinación del ambiente acústico, la posición interactiva del jugador –con la encarnación virtual de sus brazos protésicos– en el medio ambiente y las relaciones sonoras entre los jugadores produce la ecología acústica. Una exposición de esta comunicación multijugador, la ecología acústica resultante y la inmersión del jugador, es el objetivo principal del ensayo.

KEY WORDS / PALABRAS CLAVE

Computer games, sound, engagement, diegesis, immersion, sonification, acoustic ecology.
Juegos de ordenador, sonido, compromiso, diégesis, inmersión, sonificación, ecología acústica.

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1. Introduction

This essay analyses player engagement with digital games through the medium of sound by suggesting that the player is immersed in, and part of, an acoustic ecology and thus, through this immersion, is engaged and incorporated into the game world and the game-play. In particular, it focuses upon the genre of the first-person perspective game which is best exemplified by the sub-genre of the run 'n' gun game or the First-Person Shooter (FPS). In this type of computer game, the player is encouraged to believe they are in the world of the game through devices such as perspective and real-time interaction with the game world elements. Examples of such games include the «Doom» and «Quake» series, the «Half-Life» series and derivatives and later games such as «Left 4 Dead». A 3-dimensional perspective is presented to the player in which visual objects have an illusory depth and volume. Typically, a pair of prosthetic arms, clutching a weapon, recedes into the game space from the bottom centre of the screen representing, in part, the game-world identity of the player. Objects and characters in the game respond in real-time to the player's actions – a gun reloads, a shadow is cast by the player's character and blood and gore are spattered and enemies die as the player shoots. Sonically, almost every player action has a corresponding sound event; there is a range of environmental or ambient sounds and most sounds have locational properties – depth and volume as do the visual objects. The combination of this acoustic environment and the interactive placement of the player in the environment (with the opportunity of affecting, indeed, effecting that environment) produces the acoustic ecology. This real-time relationship between player and sound provides the basis for communication between the player and the game engine and between players in a networked, multi-player game, and, ultimately, produces the desired engagement with and immersion in the game-play and the game world.

2. Diegetic sound

Sounds in the FPS game can be broadly categorized into diegetic and nondiegetic sounds – categories adopted from French film theory. The former are sounds that derive from or are part of the internal logic of the game world and game-play whereas the latter are all other sounds heard while loading or playing the game (Grimshaw, 2008a: 117-118). Such sounds include those heard while operating the game menu (audio and video set-up and character initialization, for example) in addition to the musical soundtrack heard during game-play. Indeed, game designers typically conceptually separate the soundtrack from the (diegetic) game sounds both in the way the software handles them and in the separate volume controls available to the player in the set-up menu. Many FPS players turn the musical soundtrack off completely; turning down the soundtrack enables the player to attend more closely to subtle diegetic sounds presaging, for example, an enemy's approach – very important in the 'hunter and the hunted' scenario that characterizes FPS games. However, categorically defining the soundtrack as nondiegetic risks the supposition that music has no effect upon the player's actions and engagement with the game. As with film music, game music is often used to create or heighten particular emotions in the player and this can have an effect upon the player's actions, making him more cautious or reckless, for example, or moving the player's character in time to the beat (Grimshaw, 2008a: 117). Some FPS games deliberately use music to cue certain game events and, in deriving from the internal logic of the game-play, such musical soundtracks therefore have a diegetic element to them. This is the case in «Left 4 Dead», for example, where musical cues or sectional changes prefigure an attack of the zombie swarm or the imminent arrival of the fatally powerful non-player character (NPC) Tank. Whilst acknowledging this conceptual fuzziness, the essay will concentrate on clearly diegetic sounds as a means to understanding their role in forming, in conjunction with the player, the FPS game acoustic ecology.

Diegetic sounds, then, can themselves be separated into two categories as a means of comprehending their disposition in this ecology. There are environmental (or ambient) sounds and there are sound events; each of these, particularly the latter, can be sub-categorized further[1]. Environmental sounds are those diegetic sounds which form the base of the acoustic environment of the game, Schafer's keynote sounds (1994: 9-10). They may be animate or inanimate sounds: rain sounds; general machinery sounds; the sound of wind blowing through the leaves of a forest; or birds twittering, for example. These sounds are placed in the game world by the game designer to help create that world by giving it a sonic depth and volume. Unlike the illusory visual depth and volume suggested by the objects depicted on the 2-dimensional screen, the game sound depth and volume is just as real and 3-dimensional as any sound heard in a real-world acoustic ecology; to understand this difference is to understand the importance sound plays in player immersion and, indeed, although the player is not phy-

sically immersed in the visual world of the game, he is so immersed in the game sound. An urban landscape has a different set of sounds to a bucolic landscape and they help create the illusion of presence in the game world through their localization (that is, their locational position) and by giving sonic form and body to the aggregated pixels displayed on the screen. Because the player operates kinaesthetically in the FPS game world (Stockburger, 2003: 9), the player has some control over the sounding of many environmental sounds. Choosing which path to navigate through a game level, the player controls which sounds start to play and which sounds stop playing because these sounds, typically, are local to various parts of the game world. Environmental sounds play, therefore, a vital role in embodying the player in the 3-dimensional world of the game.

In contrast to the game's environmental sounds, sound events are sounded either by the game engine, other players in a multi-player game or by the player himself and are typically short, discrete sounds tied to specific game events or game states. For example, NPCs might emit various sounds such as vocalizations, footsteps or weapons fire and, although often played in response to the player's actions, are usually initiated by the game engine as part of that response. In a multi-player game, where other players can be part of the player's team or can take the part of an enemy, any one player can hear the character sounds of other players in the vicinity. Some games allow players to trigger speech radio messages; taunts from the enemy or team communications, for example. At the end of one level while waiting for the next level to load, the game engine in «Left 4 Dead» will pass the time by triggering short, scripted commentaries on the past action or the characters' prowess, for example. The player himself can directly trigger his character's and action's sounds through keyboard, mouse or controller input. Such sounds include footsteps (the frequency, timbre and intensity of which might signal speed, ground surface and weight of the player's character), weapons fire, proprioceptive sounds like fluctuating breathing (in some games) and an imaginative variety of grunts, groans and gasps (male, female or otherwise as per the player's choice of character) in response to damage sustained in the hazardous conditions of the game.

3. Engagement and immersion through diegetic sound

FPS games, like all digital games, are an interactive form of entertainment as opposed to more physically passive spectacles such as cinema and theatre. Indeed, games require active and physical player involvement to be games at all; one of the three conditions cited by McMahon for immersion in a game world is that «the user's actions must have a non-trivial impact upon the environment» (2003: 68-69). For the acoustic environment or soundscape of the FPS game almost every action of the player has an impact upon that environment either by altering sounds already playing or by stopping and starting sounds. As previously mentioned, the game soundscape typically changes as the player moves through the game level. Not only are local environmental sounds stopped and started but their volumes change with changing distance from the sound source and their locations within the sound field change as the player turns or moves sideways (assuming the player's sound reproduction system is capable of at least stereo playback). Very often, environmental sounds will have reverberation either statically encoded as part of the sound or processed in real-time (in later games) to shadow the acoustic properties of the spaces and surfaces of the game locale. This changing soundscape as the player moves is not only evidence of the player's impact upon the acoustic environment but also helps to contextualize the player within the game spaces. Such contextualization is strengthened where reverberation and timbre match the apparent depth, volume and surfaces of the spaces and objects

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portrayed on screen. More directly, the player has a non-trivial impact upon the game soundscape through the triggering of sound events such as the firing of weapons or the sounding of footsteps while walking or running; such sound events may be termed kinediegetic in order to differentiate them from sound events produced by other game elements such as NPCs (Grimshaw & Schott, 2007: 476).

Not only can the player affect the game's acoustic environment but this environment can affect the player's movements and behaviour in turn. Players can be attracted to or repelled by certain sounds through attending to such sounds in the navigational listening mode (Grimshaw & Schott, 2007: 477)1. In «Left 4 Dead», cries for help from trapped teammates act as audio beacons; the wailing and crying of the deadly NPC Witch may similarly beckon the curious and uninitiated but seasoned campaigners navigate well away being aware of the adage 'once bitten, twice shy'.

In a multi-player game, each player operates on and within their own private soundscape. As in a real-world acoustic environment, there is a range of hearing (dictated by the game engine) beyond which the sounds forming other players' soundscapes are not heard. As soon as a player moves into the vicinity of another, their soundscapes begin to mingle and, in addition to their own kinediegetic sounds, each player starts to hear the other player's kinediegetic sounds.

Reference has been made previously to diegetic sounds that match various objects and images displayed on the screen. This is a form of cross-modal comparison and, in most cases, cross-modal confirmation. Footsteps on a metallic surface would be supposed to have a different timbre to footsteps on grass and, in a large enclosed space (represented 2-dimensionally on screen), a different reverberant characteristic to footsteps in an open area. This expectation arises from experience; in this case, probably direct, real-world experience on the part of the player and, if this expectation is not cross-modally confirmed, the game designer risks undermining the perception of immersion in the game world. Experience, however, can be indirect and the resulting expectations only loosely based on reality. A good example of this is the gap between what a firing weapon sounds like in reality and what it is expected to sound like in a different context. Here, cliché and conditioning by the media play a strong role. The sound of Arnie's shotgun in «Terminator 2» is not a faithful reproduction of a shotgun firing but a synthesis of two cannon shots (Palmer, 2002: 9); however, it has become the acme of weapons realism in cinema and digital games despite its lack of authenticity. Further experience is gained, and expectations raised, as the novice player goes through a game learning process where audio cues become recognizable as such and their significance is acquired.

Chion has used the concept of synchresis to explain how film audiences perceptually synchronize images and sounds that, in the cinema, are reflected or projected from different and often widely separate physical sources (1994: 63-64). As Lastra states: «Decades of tin-sheet thunder and coconut shell hooves prove […] that fidelity to source is not a property of film sound, but an effect of synchronization» (2000: 147). The same process works in FPS games with the added support for synchresis of player input, in most cases, producing an immediate and attributable sound (the click of a mouse button simultaneously produces a flame burst from the muzzle of the gun and a satisfyingly deafening blast of sound). It is the player making the sound and this participatory synchresis is a further aid to engagement and immersion in the game world.

FPS games, as the name implies, provide the player with a first-person perspective in which, visually, the player's character is at the centre of the game world. The graphics engine in the game software logically places the player's character at the centre of the game Cartesian space too and thus all game elements rotate about him. As pointed out before, the first-person perspective is reinforced by prosthetic arms on the screen representing the real arms of the player. The player sees what the character 'sees' and the character 'sees' as the player would were the player physically present in the game world. This view is in contrast to a third-person perspective where the player views the entirety of his character from some point in space usually located behind and above that character. By analogy, the player in the FPS game can be termed a

first-person auditor (Grimshaw, 2007: 122) hearing as the character 'hears' who 'hears' as the player would hear were the player physically present in the game world. However, whereas the visual field of view has an arc of about 140º (somewhat adjustable in many games), the sound field is all-enveloping. Not only does sound have a function that is to cross-modally confirm what the eyes see, it also provides information about the unseen world to the sides and behind the player (and information about sound sources ahead but hidden from view). These acousmatic sounds (Chion, 1994: 32) can be cross-modally confirmed by sight if the player chooses to turn towards the location of the sound source. In other words, as in real life, the player can become an explorer in the acoustic environment, engaged in the process of investigation and discovery of the world around him driven onward by recognizable sound cues and other more mysterious and causally ambivalent sounds.

A strong motivator of immersion in the FPS game world is emotional engagement (Grimshaw & al., 2008) and, in the 'hunter and the hunted' premise of such games, particularly in horror FPS games like «Left 4 Dead», fear is just such a motivating factor. There is a number of elements that might inculcate a sense of fear in the player. The player's knowledge of the game's context and premise, and the expectation deriving from that, is one. A sound, or the conjunction between sound and image, in one context might be frightening but, in another context, might be humorous. A recent study of the uncanny (a perception relating to eeriness and fear) and the virtual characters found in digital games and other media, concluded that uncanniness increases with increasing lack of synchronization between lips and voice (Tinwell & Grimshaw, 2009). This study took place in an abstracted, experimental context and, in the framing context of a FPS horror game where the player is already cued for apprehension and fear, this phenomenon may indeed be apparent. However, badly synchronized dubbing of Hong Kong Chock-Socky movies are a recurrent comedic device. The player's prior knowledge of the game context (horror or comedy, for example) sets up the appropriate expectation and anticipation – a prefabricated emotional framing.

Another element identified as leading to a sense of fear is uncertainty and it may arise in several ways. Difficulty in localizing a sound, that is, locating its source, can cause feelings of apprehension particularly in the predatory environment of the FPS game; the evolutionary link between fear and survival has been suggested as the cause (Ekman & Kajastila, 2009: 2). In the medium of film, Chion posits this unsettling mysteriousness as one of the properties of acousmatic sound: «[Acousmatic sound] creates a mystery of the nature of its sound source, its properties and its powers» (1994: 72). Some ostensibly nondiegetic soundtracks in FPS horror games include a variety of non-musical sounds (sibilant whispering and howls, for example) that leave the player unsure as to whether they derive from the game diegesis or not. This creates «a framework of uncertainty [and the] collapse of the barrier between the diegetic and non-diegetic soundscape is a strategy to build a horror atmosphere» (Kromand, 2008: 16).

Threats, according to Plutchik, are the stimulus events leading to feelings of terror, fear and apprehension (1980). Threats are often presaged by alarms which themselves are typically, due to the usefully pervasive nature of sound, aural. «Left 4 Dead», for example, has a range of alarms: musical cues (as already mentioned); and also the mutterings, growls, howls and screams emanating from dark recesses, growing in density and intensity as the threat approaches. Many fearful sounds that raise alarms and hackles have an animate origin or possess similar properties to animal sounds. For example, the spine-tingling sensation induced by fingernails scraping down a blackboard has, it has been suggested, a root in the sound's similarity to the warning screeches of macaque monkeys – the reaction to such a sound is a deeply buried vestige of a time when humans and their ancestors might have been regularly hunted by predators (Halpern & al., 1986: 80). Allied to this conjecture is the suggestion that some of the vocalizations of primates (laughter and crying) are used at a fundamental cognitive level to arouse particular emotions through the sounds' acoustic properties rather than to convey representational or linguistic information (Owren & Bachorowski, 2003: 187).

Thus far, this essay has considered the game's acoustic environment from one player's point of audition presuming the game is a single-player game having one player with or against a number of NPCs. Most modern FPS games not only provide this single mode of game-play but also, via a network, provide multi-player versions of the game. There are several types of multi-player game: all players may compete against each other in a deathmatch; teams may compete in a team deathmatch; all players may form a team against NPCs; and there is a variety of other team-based modes of play such as the popular capture the flag in which teams score points by safely transporting an enemy's team flag back to their own base. Diegetic

sound provides an important conduit for communication between players, both teammates and enemies.

In a multi-player game, each player operates on and within their own private soundscape. As in a real-world acoustic environment, there is a range of hearing (dictated by the game engine) beyond which the sounds forming other players' soundscapes are not heard. As soon as a player moves into the vicinity of another, their soundscapes begin to mingle and, in addition to their own kinediegetic sounds, each player starts to hear the other player's kinediegetic sounds. Primarily, this phenomenon is an indication of player activity in the game world which takes on other meaning, threatening or otherwise, depending upon the mode of play. Furthermore, there is a range of sounds that can be experienced simultaneously across all player soundscapes. Depending upon the particular game level, there may be global environmental sounds (the sound of falling rain, for example). If the game engine allows, there are short radio messages heard by all team members or there may be sounds triggered by the game engine indicating particular states of play (for instance, an auditory icon representing the capture of a flag). Very often, as in the latter case, such sounds provide the only indication that an unseen game event of significance has occurred.

4. The FPS acoustic ecology

Sonification is the technique of transforming non-audio data into sound, the intention being to focus the particular qualities of the auditory system on that data in order to facilitate comprehension or to provide new understanding (Kramer & al.: 3). As an example, our hearing is more sensitive than sight to temporal changes and, unlike sight which may be switched off simply by shutting the eyes, is constantly active and sensing. There are various levels of sonification. 0th order sonification (or audification) is a non-arbitrary mapping from non-audio parameters to sound parameters. For instance, the encoding on an audio compact disc originally derived from a sound wave and so the process of sonifying that data upon playback is very close to the reverse of the original encoding process. In other words, the process of mapping the digital bits to frequency and amplitude parameters is not an arbitrary one. Sonifying population movements over the last century requires some potentially arbitrary decisions to be made. Should population density be represented by sound amplitude? or different cultures be represented by different pitches?

Sonification is at the heart of the player's role in the acoustic ecology of the FPS game. The very presence of the player in front of the game's screen sets in motion the game's sonification processes – to exist at all, the game's acoustic ecology requires a «discerning Subject [sic]» to be present (Böhme, 2000: 15). As all modern FPS games make use of audio samples (pre-recorded snippets of digital audio) for their diegetic sounds, 0th order sonification (of these digital codes into audible sound) underpins this acoustic ecology. Yet there is a more complicated, higher order of sonification occurring too. There is, for example, the sonification process undertaken by the game engine in interpreting player actions and game events and sonifying them. Some interpretations are less arbitrary than others. Movement is sonified as footsteps (and, in some games, breathing, the frequency and strength of which mirrors the exertions of the player's character) and weapons fire is sonified according to the weapon being used (although, as demonstrated earlier, a liberal interpretation can be applied to the concept of authenticity). More arbitrary interpretations are usually reserved for global diegetic sounds signalling various global game events such as the electric guitar chord indicating the capture of a flag in «Quake III Arena». The arbitrary nature of this sound and its lack of indexicality to the event – just what should the sound be of the capturing of a flag in a virtual world? – requires the interpretation of this auditory icon to be learned by the player (as opposed to the directness of more indexical sounds such as footsteps). Where the musical soundtrack has diegetic characteristics – various musical cues and alarms – their arbitrariness too requires learning on the part of the player. Conversely, the more indexical and less arbitrary the sounds, the quicker the immersion process because experience and prior learning is brought to bear. In all cases, sonification is predicated upon the presence of the player and the player's actions; sonification, then, forms the basis of the relational framework between player and soundscape that is the acoustic ecology.

The fundamental components of the FPS game's acoustic ecology are the player and his soundscape. Together, they form a relational and communicational web that is the gateway to engagement and immersion in the game world. The «soundscape acts as the semantic and contextual nexus between players and between players and the game engine» (Grimshaw & Schott, 2007: 480). This relationship between player and soundscape is a two-way relationship where not only do the presence and actions of the player have a non-trivial impact upon the soundscape but the soundscape too has an effect upon the emotions and actions of the player. In this sense, the game's acoustic ecology

is similar to Truax's definition of an acoustic community as a locus «in which acoustic information plays a pervasive role in the lives of inhabitants» (2001: 66).

In a networked, multi-player game there are multiple acoustic ecologies comprising each player and his acoustic environment. The operation of, and relationship between, these multiple ecologies mirrors acoustic ecologies of the real world. There are sounds in common (in a city, the sounds of traffic, for example, pervading different locations of that city), each human inhabits and perceives his own ecology and, at times, these ecologies inter-mingle (a car with thumping boom-box fleetingly passes an ambulance with wailing siren and the occupants of each vehicle experience, and react to, the acoustic ecology of the other). The collection of FPS game acoustic ecologies has been termed elsewhere a virtual acoustic ecology and its organic and dynamic properties, so indicative of the players' immersion in their game worlds, have together been proposed as comprising an autopoietic system (Grimshaw, 2008b). Individual acoustic ecologies, though autopoietic themselves, are the allopoietic components of the larger virtual acoustic ecology, itself an autopoietic system. As an autopoietic system, the FPS game's virtual acoustic ecology is a homeostatic organization dedicated to self-preservation and the immersion of a new player and his soundscape is the autopoietic system's compensatory approach to the perturbations posed by that new allopoietic component.

In a real-world ecology, every naturally-occurring sound is likely to be unique at each sounding of it. Such sounds are combinations of a number of factors including the direct sound from the source object (animate or inanimate, each production of the sound is likely to have slight variations) and reflected sound from the environment.

These reflections (and the amount of direct sound absorbed) inform much about the environment even to an untrained listener as Gaver (1993) describes. Reflected sound informs about the material properties of the environment through the ways in which frequency components of the direct sound are boosted or attenuated (metal surfaces, for example, tend to produce brighter reflections), the difference in intensity between direct sound and reflected sound will also betray information about the sound absorbent properties of the materials in the room while the time difference in perception of both sounds provides some indication of the volume of the space in which the sound is sounded. Something further to note about natural acoustic ecologies is that the number of potentially simultaneous sounds is (to all practical extents and purposes) infinite, the only limit being the number of sound sources within hearing range.

On the basis of the points raised above, an analogy of the FPS acoustic ecology with a natural acoustic ecology can only go so far. Firstly, the game's acoustic ecology, along with other spaces in the game, is an imagined recreation of natural (or fantastic) ecologies. More importantly, the technological limitations of the game's hardware and software mean that sounds are not likely to be unique and that there are only a certain number of simultaneous sounds possible. As already mentioned, FPS games use audio samples for their sounds; the storage requirements for these digital files (several hundred or more) imposes a limit on the number of sounds available on the game's point-of-sale media. Additionally, the computer or game console on which the game is played imposes a limit on the number of simultaneous sounds through its finite memory and processing power. Many FPS games attempt to obfuscate these restrictions by, in the case of footsteps, for example, providing a small number of varied audio samples of the sound then randomizing the order and intensity of their delivery. Some modern FPS games, such as games based on the «Source» game engine, incorporate an audio processing system where the reverberation of some sounds is calculated in real-time according to the apparent materials and volumes of the spaces displayed on screen and the position of the player in those spaces.

In a digital acoustic ecology that is crippled in comparison to real-world acoustic ecologies, it might be supposed that the player's immersion in the game world (through being a component of that ecology) would be seriously impeded, especially in those FPS game worlds that attempt an emulation of reality. However, players do report perceptions of immersion in FPS game worlds.

In a digital acoustic ecology that is crippled in comparison to real-world acoustic ecologies, it might be supposed that the player's immersion in the game world (through being a component of that ecology) would be seriously impeded, especially in those FPS game worlds that attempt an emulation of reality. However, players do report perceptions of immersion in FPS game worlds (Grimshaw & al., 2008) and several writers go further in suggesting that verisimilitude, or a perceptual realism, might suffice to replace sonic realism for the purposes of engagement and immersion. In other words, a realism based upon «plausibility of characterization, circumstance and action» (Corner, 1992: 100) as opposed to a realism of authenticity. Writers such as Laurel (1993), Back and Des (1996) and Fencott (1999) have discussed the use of caricature sounds, rather than authentic recordings, in virtual environments and this essay has already discussed the expectations arising from game conventions and genres. It is in a perceptually-real acoustic ecology, then, that the player is a fundamental component and through which the player is perceptually immersed in the world of the game.

Notes

[1] As part of a virtual, make-believe world, all visual game objects are inanimate, being merely aggregations of pixels. However, by analogy, it is useful to refer to such objects as (animate) organisms or (inanimate) things as if the game world – and the acoustic ecology forming part of that game world – were not virtual but real which, from a phenomenological point of view, it is.

[2] A fourth listening mode to be added to the three defined in electroacoustic music theory: causal, reduced and semantic (Chion, 1994: 25-34).

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