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JAKUB KOPANIECKI
https://orcid.org/0000–0003–0762–7538
Institute of Musicology, University of Wrocław

Walking the streets of a virtual metropolis. The audiosphere of the game Grand Theft Auto IV

ABSTRACT: On the basis of works devoted to the topic of sound studies and video games, the author presents ways of processing and using sounds in order to create virtual phonic spaces. He examines the means by which contemporary game developers influence immersivity, i.e., the process of immersing the gamer in virtual environments, as well as indicating the mutual influences of audial and visual spheres. Analysig the video game *Grand Theft Auto IV* from the perspective of the sound which accompanies the action, he compares in this respect three areas of the game's Liberty City with their equivalents in New York on which the virtual city is modelled. The similarities and differences between the digital and virtual spaces are identified, and the reasons for them explained. This makes it possible to show how the use of the tools (explained earlier) employed by the developers of the game enable them to create a credible sounding virtual metropolis.

KEYWORDS: Video games, soundscape, city

For some time now video games[1] have been the focus of interest of researchers from many disciplines, including musicology. There is research on their extremely profitable market, their consumers, the technologies they use, the stories they tell, and finally their music and the other sounds they use. In their current form most of these productions resemble high-budget Hollywood films, with their fascinating worlds and intriguing plots. Sometimes they take place in fantastic lands, such as in *The Elder Scrolls V: Skyrim* or internationally acclaimed *The Witcher 3: Wild Hunt*; elsewhere we encounter a world of the future, such as that of *Mass Effect*, in yet other worlds its creators take us into realities closer to our experience – modern cities. *Grand Theft Auto IV* is one of the greatest achievements in the genre of action games of the last decade. It has been the subject of innumerable articles published in a variety of periodicals, as well as of academic texts. Liberty City, the virtual equivalent of New York, where the action takes place, is not just a schematic background for events envisaged by the story writers, but is a living, dynamic centre that simulates a real metropolis

[1] In this article I will use interchangeably the terms 'video games' and 'computer games', since this is how they function in the literature of the subject (Pitrus, 2012, p. VII).

as far as this is possible. How does one create a virtual city sound space in order to achieve maximal immersion of the gamer? This is the question I will try to answer in my article.

The function of sound in games

As in the case of film, in contemporary video games one can distinguish two categories of sound:

1. diegetic, i.e., belonging to the represented world and
2. non-diegetic, i.e., not belonging to it.

Moreover, since the game is interactive, one can also distinguish two sub-categories of sound:

3. dynamic, i.e., sounds that can be influenced by the gamer, and
4. non-dynamic, independent of the gamer's actions (Collins, 2008, pp. 95–96).

In this article I will concentrate only on diegetic sounds, since the subject of research is the audiosphere of the city in which the events of *Grand Theft Auto IV* take place.

I would make the claim that the main direction of current changes in sound production in games is not improvement of the quality of sound, but increasingly sophisticated possibilities of its manipulation. There are now various technologies which enable this manipulation, referred to under the umbrella term *digital signal processing* – DSP (Collins, 2008, p. 46). This process can take place before sound is incorporated in the game, or in real time, during play, matching the current situation in which the gamer finds him/herself, and so improving the experience of immersion, of total involvement in the represented world (Collins, 2008, pp. 95–96). The second variant significantly minimises the risk of the same sound being repeated, and at the same time is also significantly labour-saving, as well as saving space on the carrier. Instead of recording several hundred various files, it is simply enough to have a few, a dozen, that are modified by the game itself.

Sounds to be used in the games come from a variety of sources. Many of them, particularly background noises, come from field recordings. It is also common practice to use sound databases and Foley effects – recording sound effects that are added only in the post-production phase, usually created and captured in a special location full of various objects which can be used to create sounds such as steps, rustle of clothing, sounds of shots etc (Stinson, n.d.). These sounds are recorded and then may be used in a game to create a realistic soundscape. It has been observed that authentic sounds recorded 'from nature' often do not affect the gamer as much as a 'false' effect. The task of the sound director is thus to make the best possible selection of sounds and their digital processing in order to

make them match the visual sphere (Peerdeman, 2010). Sound not only helps in distinguishing objects in space, but also enables association with the real sound and fast comprehension of the simulated situation. This means that objects remain comprehensible, and the surrounding space becomes easier to interpret. The audiosphere created in this way in a sense endows the objects with a 'physical' presence in relation to the gamer and facilitates orientation in the game space (Nitzsche, 2008, pp. 129–131). The player traverses not only three-dimensional spaces, but also explores a differentiated, dynamic soundspace (Nitzsche, 2008, pp. 141–144).

We should not think of the sounds in a video game as an accompaniment to the visual effects. Sounds serve to activate emotionally the users of the medium, who are directly exposed to sound stimuli. While they can close their eyes to shut out the picture, they cannot close their ears. Sound may stimulate, warn, calm, but above all it builds up the mood, the atmosphere, the unique identity and credibility of a given space. Regardless of how photo-realistic modern computer graphics become, they are still distinguishable from reality (unlike a film), but sounds, especially recordings originating from the real world, are almost indistinguishable.

The production of the sound layer of a film is based on one version which represents the constant, immutable sound track of the finished film. However, in the case of a video game we need to consider the interactive factor. The production and planning of a video game thus requires the support of a theoretical background concerning the system that will enable the gamer to make use of the virtual world. The activation and manipulation of sound is bound up with the comands issued by the players using the controller, for example when giving the command responsible for repositioning. Thus the reproduction of the sound of a car driving along the street will depend on the perspective of the camera, the movement of the figure and the spatial conditions of the location. The more complex the virtual world, the greater the number of parametres influencing each other. This means that creating acoustic space in video games is a very demanding task. The function of sound is not only to realistically reproduce the represented world, but also to dramatise the story being narrated, to evoke specific emotions and to provide guidance (Ekman, 2008). Importantly, the visual position of the gamer is usually different from his acoustic position. The listener should be in such a position as to increase his feeling of immersion, and this does not necessarily mean following closely the camera angle. Immersion results from many factors and is not simply dependent on a very realistic picture or sound. This is because the sound environment in which the gamer moves is not created for him, but above all by him (Grimshaw, 2012, p. 355), through the possibility of manipulating the position of the figure being controlled in virtual space. The sounds which reach the gamer via the headphones or speakers are emitted from the perspective of the figure located in the game and depend on its position in relation to the sources of sound. One cannot but draw attention to the schizophony of this situation. In contrast to the way sounds function in nature, the sounds of a virtual world reach the gamer through the equipment which emits them, and not directly from the objects located in space; on the other hand, the gamer

assumes that their source is really inside the game. Moreover, in modern games these sounds are specially processed recordings adapted to the requirements of the medium. We may thus talk here of simulated, or even synthetic soundscapes (Grimshaw, 2012). Visually and audially the gamer finds himself in the centre of the world of the game, since all the auditory stimuli reach his ears and eyes directly and there is no difference between watching and listening to the real world (Grimshaw, 2012, p. 353). Sound may also be used in conjunction with the picture, creating an analogy to the real world, but it can also be used without a picture, to a greater extent calling upon the gamer's experience and imagination (Grimshaw, 2012, p. 359).

In the case of music, Karen Collins postulated creating technological solutions to enable its dynamic and natural adaptation to the events taking place on the screen (Collins, 2008, p. 61); work on analogous solutions in the area of other acoustic phenomena is already taking place. Scientists from the Department of Informatics, Electronics and Telecommunications at Akademia Górniczo-Hutnicza [University of Science and Technology] have created the RAYA engine, which calculates the parametres for sound for a given scene in real time by reconstructing the route of the sound on the basis of physical acoustic effects, including reflections, diffraction and passage of sound. The sound changes dynamically with the movement of the gamer's figure and sources of sound.[2]

Research on city audiosphere – questions of terminology

In order to move on to further discussion of city soundscape in the game *Grand Theft Auto IV*, it is necessary to define the basic terms coined in the area of soundscape studies. The term audisophere is used in relation to people's sound environment (Losiak, 2008, p. 253) including all the acoustic phenomena which surround them (Losiak, Tańczuk, 2016, p. 57). On the other hand, the concept of soundspace proposed by Raymond Murray Schafer refers to the totality or a segment of the sound environment examined in the context of its recipient (e.g., perceptual, social, social-historical) (cf. Kapelański, 1999, p. 13). In Schafer's understanding, sonic environment encompasses not only our immediate environment, but practically every area filled with sound which we are able to perceive and investigate, including virtual space. Since the reception of the sound environment, the *hearing* of it, is involuntary, while the phenomena *listened to* arise from some specific intentions and take place in a specific context,[3] attempts at audiographic investigations will always be subjective, taking place from the perspective of the researcher's senses.

Other terms introduced by Schafer include '*hi-fi soundscape*', with diversity and clarity of sound information, and '*lo-fi soundscape*', with high redundancy (Kapelański, 1999, p. 13). The *lo-fi* category is usually identified with the concept

[2] https://www.agh.edu.pl/nauka/info/article/dzwiek-w-grach-komputerowych/ (access: 12.08.2019)

[3] *Hearing* is understood as involuntary reception of sound stimuli, while listening as intentional focusing on a given sound phenomenon.

of noise, which may be understood as an excess of acoustic stimuli, disturbing the ecological balance of the environment, excessive loudness, which goes beyond human perceptual tolerance, as well as simply the absence of silence. According to Schafer, silence is not necessarily associated with a situation of total absence of acoustic stimuli but, rather, an environment in which there is no overload of sound and there is clarity, i.e., a *hi-fi* environment (Losiak, 2017, pp. 117–118). It is worth noting that noisiness, or hubbub, is almost a qualifying characteristic of city audiosphere. However, we should not always regard the *lo-fi* soundscape purely as a disturbance. Mariusz Gradowski states directly that the hubbub of a modern city is a form of phonic communication, indicating the specific nature of a large city's audiosphere (Gradowski, 2004, pp. 58–61).

In order to capture the differences between the sounds of an audiosphere, Schafer introduced their division into *keynote sounds, sound signals, soundmarks* and *sound events*. *Keynote sounds,* or background sounds, dominate in a given acoustic space and provide points of reference for all the other sounds. It may be the murmur of the waves on the beach, birdsong in a park or music seeping out of the speakers in a restaurant. *Sound signals* are the sounds to which we pay particular attention. These may be, for example, the sounds of sirens of emergency vehicles. *Sound marks* are orientation sounds characteristic of a given location that have a special meaning for a given community, such as the bugle call in Kraków. *Sound events*, on the other hand, are most closely associated with the perspective of the individual, they are the smallest units of the soundscape (Kapelański, 1999, pp. 111–112). They are characterised by randomness, unpredictability, and usually focus all the attention of the percipient, as for example, the sound of cars crashing into each other, an unexpected gunshot, or spontaneous violent reaction (such as a scream) by a passer-by.

The world of Grand Theft Auto IV

Grand Theft Auto IV is an open world action video game produced by Rockstar North studio, and published in 2008 by Rockstar Games.[4] This is the next version of the popular series of games with the same title. The average rating of *GTA IV*[5] version for the Xbox 360 console is as much as 98 out of a hundred, the rating being made up exclusively of reviews described as 'positive'.[6] The game tells the story of Niko Bellic, an immigrant from Eastern Europe, who comes to the United States to make his American dream come true. His older

[4] Open world games offer an area which can be freely explored by the gamer. Moreover, productions of this genre are often characterised by a non-linear plot, which means that the gamer decides, to a greater or lesser extent, the development of the plot. Importantly, the linearity-nonlinearity of the plot and the openness/closure of the world do not result from technological developments, but tend to be stylistic decisions undertaken by the game developers. (Cf. Hanisch, 2009).

[5] The abbreviated title of this game series is generally used in the media as well as by its developers, hence this form will also be used here.

[6] Data taken from the Metacritic webpage. https://www.metacritic.com/game/xbox-360/grand-theft-auto-iv (access: 30.11.2018).

brother, who lives there, is supposed to help him realise that dream, but instead the hero is drawn into the intrigues of a criminal underworld.

The events in *Grand Theft Auto IV* take place in the fictional Liberty City, located on the eastern coast of the United States. The city is largely inspired by New York. The four islands into which the map is divided in the game correspond to the districts of New York: Manhattan, Brooklyn, Queens, Bronx and part of Jersey City, whose residents work mainly in Manhattan. However, the similarities involve more than the map. The designers of the game took care to reproduce the architecture characteristics of New York, its tourist attractions, vehicles, and even the hot-dog carts, but above all the sounds. One could claim that Liberty City is a stereotypical representation of New York, corresponding to its popculture image, and containing a 'concentrate' of all the features generally associated with that metropolis.In view of technological limitations, Liberty City is clearly a much smaller but at the same highly condensed representation of that American city. A satirical, at times exaggerated, vision of New York, a city twenty times larger, is packed into not quite 50 square kilometres.[7]

Although *GTA IV* depicts a fictional story, the designers of the game try at every step of the way to make the gamer feel that the represented world is real. We may have a similar impression when we watch a film, when we realise that it's only fiction, but becoming involved in the story we watch we suspend rational thinking and, at a given moment, and a given degree of concentration, we regard the events we see as credible.[8] The difference between a game and a film lies in the area of interaction with the medium being experienced, particularly at the level of immersion that can be achieved. A film can only be watched, and regardless of how much we become involved in it, we always remain passive in relation to it. A video game, even if it has a short, intense linear plot, similar to film, allows the recipient to be part of it, even if only through pressing the keys responsible for the movements of the figure watched on the screen. How immersive a game is will influence the final degree of satisfaction of having experienced it. However, it is not only the visual images that affect the degree of immersion, or involvement in the events seen on the screen. Liberty City, as a metropolis should, is filled with people who talk, walk, do sports, drive cars. There are sounds of emergency sirens, mobile phone ringtones, muted music can be heard from inside vehicles.

The virtual city may be explored according to the gamer's preferences. One can move around it in mechanical vehicles (cars, lorries, motor boats or helicopters). One can also traverse it on foot, or use public transport. The realistic illusion of a city always on the move requires the introduction of a multitude of objects, not only graphic but sound ones. When walking around the city, gamers are constantly surrounded by sounding objects designed to give the impression of a living environment.

[7] It is worth emphasising that games from the *Grand Theft Auto* series have always had a very challenging attitude to American society, usually showing it in a distorting mirror.

[8] In the theory of film music this phenomenon is described as 'willing suspension of disbelief', intentional acceptance of untruth (Ji, Raney, 2015, p. 2).

Sounds in Grand Theft Auto IV

The world of GTA IV is divided into 86 areas differentiated phonically, where we find sounds which may be classified as non-dynamic and dynamic sounds (MacGregor, 2014). The emitters of non-dynamic sounds are permanently located at selected points on the map, and their range encompasses an area strictly defined by the designers. These are mainly sounds which create the climate of a given area, against the background of which can be heard all the other sounds close to the gamer (https://www.gamesradar.com/grand-theft-auto-iv-audio-qa/?fbclid=IwAR1YsXiqoMwmlM8sOuRUe8PendgKvuVZflYxuyzU8b0kYUphwJAT79LotG4). Such a background may involve the rustle of trees or the burbling of water, street traffic, the hum of such equipment as air conditioning. We may estimate the area they encompass, but we cannot interfere with them, since their source is not physically present in the world of the game. These sounds do undergo changes, but these changes are independent of the gamer and result from the adaptation of sounds to the processes taking place in the world of the game, associated with the day-night cycle (in the game this lasts 48 minutes) and the current weather. They function as background sounds.

As has been said earlier, the dynamic sounds may change depending on the actions of the gamer. In the world of the game these will be primarily individual sounds emitted by objects in the closest proximity (in contrast to background sounds, which build the *illusion*, emitted by an invisible source). These might be moving cars, conversing pedestrians, sirens of emergency vehicles, but also sounds that result from the gamer's actions, such as a splash of water as the hero steered by the gamer jumps into it, the cracking of a broken pane or a machine gun shot. What makes these dynamic is the fact that the source of the sound may move, may be eliminated (the car is destroyed, the TV set switched off), or, on the contrary, it may be established by the gamer. An excellent example characteristic of this game series is the sound of radio stations which we can hear from the cars being driven. After getting into the vehicle, we have the choice of one of a number of radio stations offering different ranges of programmes. The stereophonic sound is then directed right at the gamer, as if he was actually sitting behind the wheel of the car. We also have the possibility of turning off the music altogether, and this means that the environmental sounds can be heard more clearly. There is also nothing to stop us leaving the car without turning off the radio. We then hear muted music, now coming directly from the vehicle located in three-dimensional space. It should be emphasised that the greatest degree of digital processing is applied to the dynamic sounds in order to adapt them to the situation in the world of the game. Thus within the area of dynamic sound one can then distinguish between the universal and characteristic sounds. Universal dynamic sounds are those that can be encountered within the whole area made accessible to the gamer. Regardless of the phonic area in which the gamer is located they will sound exactly the same. On the other hand, characteristic dynamic sounds are variants of the universal sounds or are totally different sounds which can only be heard within a given phonic area. Both kinds

of dynamic sounds, depending on the context, function as background sounds, signal sounds or sound events.

As we learn from an interview with an employee of Rockstar Games, the final shape of the audiosphere of Liberty City results from the interaction between the non-dynamic and dynamic sounds. The designers' intention was to construct the world of the game in such a way that the gamer even with his eyes closed should be able to tell precisely where he is, at what time, and what the weather is like (https://www.gamesradar.com/grand-theft-auto-iv-audio-qa/?fbclid=IwAR1YsXiqoMwmlM8sOuRUe8PendgKvuVZflYxuyzU8b0kYUphwJAT79LotG4).

In order to simulate the real world, the world of the game was given a day-night cycle and changeable weather. A different set of non-dynamic and dynamic sounds was prepared for each occasion. During a downpour one can hear the falling rain (non-dynamic sound) as well as water being splashed by a speeding car (dynamic sound). In the morning and in the afternoon there are sounds of increasing traffic (non-dynamic sounds), while at night the sounds of cars grow silent and footsteps of pedestrians and telephone conversations are sometimes replaced by the singing of inebriated party-goers (dynamic sounds).

As we learn from the information issued by the designers, the library of audio files used in the game contains both field recordings (this concerns primarily background sounds), recordings from commercial databases and those made in the studio specifically for the needs of the game. For example, sounds of gun shots and car engines were recorded during work on *GTA IV* and often are the result of combining a number of separate sounds (https://www.gamesradar.com/grand-theft-auto-iv-audio-qa/?fbclid=IwAR1YsXiqoMwmlM8sOuRUe8PendgKvuVZflYxuyzU8b0kYUphwJAT79LotG4). As I mentioned earlier, each sound undergoes digital processing, something regarded by the designers as the greatest achievement in the area of sound design (https://www.gamesradar.com/grand-theft-auto-iv-audio-qa/?fbclid=IwAR1YsXiqoMwmlM8sOuRUe8PendgKvuVZflYxuyzU8b0kYUphwJAT79LotG4). This means that the sound may be automatically modified depending on the place from which it is emitted or the current weather. For example, a car horn will sound quite different in a concrete tunnel 100 metres from the gamer with pouring rain at night than in the middle of a flyover on a sunny morning. In the earlier parts of this series of games, both for technical and financial reasons, all aberrations of the basic audio file had to be introduced by hand, which meant that the work took longer and the number of potential variants was limited, with negative influence on immersion. Now, thanks to *DSP*, the sound designer only defines the parametres of how the sound should be modified under given circumstances, and the processing takes place within the game itself, in real time. This provides a much wider range of possible variants, as well as saving much time and disc memory.

Field research?

Is it possible to conduct field research in the world of a video game? *Grand Theft Auto IV*, because of its open construction, where the gamer decides the

pace of plot development, makes it possible to freely explore the world accessible to the gamer without time limitations. I decided to compare three analogous areas of New York and Liberty City at the same time of day and in similar weather conditions. Since I could not conduct independent research in the American metropolis, I started by using the soundmaps of that city which are accessible online,[9] and then I reached for sound databases (after a thorough verification and selection of the enormous amount of recordings available on the Internet),[10] and finally I used amateur film recordings available on YouTube.[11] As far as the game is concerned, I repeated many times variations of the experiment, first positioning the figure in a chosen location, listening to the sounds and observing the environment over a few 'game' hours. I would then take sound walks around a selected small area of the map.

The following locations were the subject of research, selected for their recognizability, differentiation and availability of field recordings:

1. one of the crossroads near Brooklyn Museum in the Brooklyn district of New York, and its corresponding equivalent in the Broker district in Liberty City between 6 and 7 a.m.

2. Central Park in New York and Middle Park in Liberty City around mid-day,

3.Times Square and Star Junction after dark.

Figure 1: Map of Liberty City. Source: https://www.gtavision.com/images/content/iv_map/gtaiv_map_hq.jpg (access: 11.12.2018)

[9] On websites http://citiesandmemory.com/new-york-sound-map/ (access: 03.02.2019), and http://www.soundseeker.org (access: 03.02.2019).

[10] See https://www.soundsnap.com/tags/times_square (access: 03.02.2019).

[11] See https://www.youtube.com/watch?v=2DdJNRzw28Q (access: 03.02.2019).

Figure 2: Map of New York with division into districts. Source: https://www.mapsofworld.com/usa/new-york-city-map.html (access: 11.12.2018)

Ad. 1. The composition of the background sound in the case of selected locations in the real and virtual cities is very similar. It is dominated by the hum of car traffic, which increases with the passage of time, and conversations and footsteps of pedestrians walking along the pavement. Occasionally there are also signal sounds (car horns, mobile phone ringtones). There is also an interesting difference in the audiosphere of the two cities: in the recording from New York one can hear the barking of dogs, absent from Liberty City. This is because in the world of the game there are no animals. Moreover, the recording from Brooklyn is filled with a monotonous, vibrating sound of car alarm. Car alarm was not heard at all during a number of 'visits' to the Broker district, although the game allows such a possibility. The soundscape here might thus be described as *hi-fi*, and the appearance of the sound of car alarm, in spite of its intensity, should be regarded as a random event.

Ad. 2. The soundscapes of parks are the most difficult to distinguish in the case of both cities. The background sound here consists of birdsong, rustle of leaves and tinkling of water in a fountain, with muted sound of traffic from a distance; however, it is decidedly clearer in the case of New York. Occasionally one could hear quiet conversations between walkers. The soundscape in both cases may undoubtedly be described as *hi-fi*.

Ad. 3. At dusk the centres of both cities are filled with loud hubbub: the hum of passing traffic, bleeping of traffic lights, conversations, music coming from many bars and restaurants, as well as from buskers, the clinking of bottles, sounds intensified by being reflected from the sides of skyscrapers. Moreover, both in the virtual and real cities there is widespread presence of signals: mobile phone ringtones, sirens of emergency vehicles, tooting of car horns, as well as sound events such as cars crashing. However, the soundscape of Liberty City is much clearer, the density of sounds is lower, enabling one to identify nearly every source and concentrate on it. New York's Times Square is a space with exceptionally high noise pollution, almost deafening. Although one can distinguish individual elements in it, they meld into one sound mass which surrounds the pedestrian with the same intensity from all directions.

Liberty City versus New York

Summing up the results of the analysis carried out here, one may conclude that the main difference between New York and Liberty City consists in the intensity of the sounds which fill the explored spaces. New York is a much louder city, in fact noisy, and even in the case of high quality recordings it is sometimes difficult to distinguish individual sounds. Liberty City, even though field recordings are used as non-dynamic background, is a much quieter space, as a consequence of the number of dynamic sounds which can be reproduced simultaneously being limited by technology. This applies in particular to the sound of running car engines, most characteristic of a large city audiosphere. The world of the game has to be comprehensible and clear for the gamer, both visually and audially. It cannot be a *lo-fi* scape since an excess of stimuli might interfere with the reception of information necessary to complete the game; also, it would simply be tiring. Interestingly, however, Liberty City has many more sound events such as car accidents, breakages, or even fighting among the pedestrians. This comes from the sometimes imperfect simulation of traffic and interaction between the virtual inhabitants of the city.

One cannot but acknowledge that it is possible to create a virtual sound representation of a modern metropolis. Although the designers of *Grand Theft Auto IV* did not create a perfect equivalent of New York, they did create a city with its own character and acoustic climate, a location for events in which the gamer takes an active part. Paraphrasing the words of the designers, one can confirm that the gamer, even with his eyes closed, will feel that he is in a large, modern, vibrant metropolis. It is only when he opens his eyes that he will know he is listening to audio files on a computer disc, skilfully introduced into virtual space.

Translated by Zofia Weaver

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