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«Left in the dark: playing computer games with the sound turned off»

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In audio-visual contexts we often get the impression that the use of audio is merely ornamental and present only for the purpose of supporting a specific atmosphere. Although this is an important and interesting feature of audio in such contexts, it is only one of several roles that audio may have. Audio may also work to provide specific information about a setting and situation, and may have direct influence on actions and events in the environment. In the context of computer games, audio has clear usability functions in addition to supporting a specific mood and the sense of presence in the game environment. This chapter will take the role of game audio into account by demonstrating how playing without any sound affects the game experience, both on the level of the game environment and on the level of the game system.

Recently, game audio has become a hot commodity in the game industry. This is demonstrated by an increased awareness during the last couple of years of the need to implement audio in games in innovative ways. One example is the *Grand Theft Auto 3* games in which the player may change in-game radio stations when driving around in the city, and another is how the Xbox 360 game console allows the player to add music from his or her computer hard drive into the game she/he is currently playing. This may be seen as a symptom of the golden rule in game audio design, which is to never let the player become annoyed or bored by the repetitiveness of the sound. By allowing the player to be in charge of the music, the developer may avoid players turning off the music intended for the game. In the context of this chapter, however, the question is whether (and if so, how) removing the implemented game audio influences the game experience. I will argue that taking away the sound has consequences for the player's orientation and awareness in the game world. In addition, certain kinds of information are harder to grasp when sound is removed. The argument is based on qualitative studies of empirical game players' understanding of game audio in context, and how they experience the game without any sound present. Since theories specifically aimed towards game audio at the time of writing are scarce, the empirical data will be further supported by auditory display studies and film theory. Auditory display studies will emphasize game audio as a usability feature, while film theory underlines game audio as a support for the game environment.

In audio-visual contexts it is often believed that sound and image work as two complementary information systems that compete in the meaning making process.

Michel Chion describes the relationship between sound and image in films as an audio-visual contract in which sound always will transform the meaning of the image to a certain extent.[1] However, the informative value that sound brings to the image tends to give the impression of stemming from the image itself. Because of its added value, sound is often given a lesser role in films than it deserves. Such a problematic relationship does not exist in games, however. Since the temporal relationship between sound and image is dynamic in games, and not fixed as in films,[2] talking about the relationship between sound and image as the central one for understanding what is going on in computer games is not the right focus. In computer games it is important to examine how sound and image affect the game experience and the game as activity. In most computer systems the visual and the auditory channels are the only ways in which the system can communicate with the user. This means that both should be utilized in order to provide all necessary system information to the user. In games both sound and graphics therefore have the function of providing usability information and supporting the sense of presence in the game environment. When sound is removed from this context, one of the two only channels for communication on the part of the system is lost, and the user runs the risk of losing important information. Even though this information is often provided by visual output, the user may not be able to pick it up if the visual system has a lot of other information to keep track of,[3] a point which will be demonstrated below.

Although research into game audio is young at the time of writing, scholars have tried to identify the role of sound in gaming contexts. Stockburger outlines a range of sound objects in order to demonstrate the important informative role game audio has in orienting the player and providing a sense of spatiality in the game environment.[4] Stockburger's sound objects are sounds connected to objects and events in the game environment, and should be seen as discrete elements that provide information about a specific object, event or location. His overview is useful for identifying sounds and their relationship to the game environment, but it does not go into detail of how sound is relevant for how the player experiences the game system and the game dynamics. Collins moves further in this direction and describes game audio as dynamic in the

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1   Michel Chion, *Audio-Vision. Sound on Screen* (New York, 1994), p. 9.

2   Axel Stockburger, 'The Game Environment from an Auditory Perspective', in Marinka Copier and Joost Raessens (eds), *Proceedings: Level Up: Digital Games Research Conference* (Utrecht, 2003), http://www.audiogames.net/pics/upload/gameenvironment.htm (accessed 28 April 2007).

3   Carrie Heeter and Pericles Gomes, 'It's Time for Hypermedia to Move to Talking Pictures', *Journal of Educational Multimedia and Hypermedia*, Winter 1992, http://commtechlab.msu.edu/publications/files/talking.html (accessed 31 January 2007). G.B. Kramer, T. Bonebright, P. Cook, J. Flowers, N. Miner, J. Neuhoff, R. Bargar, S. Barrass, J. Berger, G. Evreinov, W. Fitch, M. Gröhn, S. Handel, H. Kaper, H. Levkowitz, S. Lodha, B. Shinn-Cunningham, M. Simoni and S. Tipei, *The Sonification Report: Status of the Field and Research Agenda* (Santa Fe, 1999). http://icad.org/websiteV2.0/References/nsf.html (accessed 31 January 2007).

4   Stockburger, 'The Game Environment from an Auditory Perspective'.

sense that it may either respond to game events or player actions.[5] She also points out that this goes both for game sounds with a perceived source existing within the game universe (diegetic sounds), and game sounds with no realistic in-game source (extra-diegetic sounds). This puts emphasis on game audio as different from other kinds of audio in the sense that it is always closely related to player actions and in-game events, and needs to be understood from that perspective. Whalen goes further in how he understands game audio by claiming that game music may either expand the concept of the game world, or draw the player forward through sequential game-play.[6] This means that game music works to support the sense of space and presence in the game environment, or that it helps the player to progress through the game. This view is not very far from the view I will pursue in this chapter, since my claim is that game audio works as support for the game world and the usability of the game system.[7]

Empirical background

As mentioned above, this chapter is based on findings from qualitative studies of empirical players. In connection with my PhD research, thirteen studies were carried out in which players were observed while playing either the real-time strategy game *Warcraft III* (Blizzard 2002) or the stealth game *Hitman Contracts* (Io Interactive 2004). The participants were experienced computer game players who played the game in question under normal conditions for about 15–20 minutes before the sound was turned off. Then they played for additional 10–15 minutes with no sound. The playing was recorded by video capture software, which allowed us to have a conversation based on the actual playing immediately after the playing session. This conversation focused on the players' description of what they were doing in the game with special attention paid to how sound related to their choice of actions.

It should be kept in mind that game audio plays different roles from game to game and from genre to genre. The two games in question were chosen because they are representatives of genres that present very different challenges to the player. In addition, the two games place the player in very different positions, which has important consequences for the use of sound. Categorized as a stealth game, *Hitman Contracts* demands the player be discreet, stealth-like and tactically focused. Cast in the role of a professional assassin, the player must take violent action to take out his targets, but the player gains bonuses for executing the missions without being exposed

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5   Karen Collins, 'An Introduction to the Participatory and Non-Linear Aspects of Video Game Audio', in Stan Hawkins and John Richardson (eds), *Essays on Sound and Vision* (Helsinki, 2007).

6   Zach Whalen, 'Play Along: An Approach to Video Game Music', in *Game Studies. The International Journal of Computer Game Research* 4/1 (2004): http://www.gamestudies. org/0401/whalen (accessed 28 April 2007).

7   See also Kristine Jørgensen, 'On the Functional Aspects of Computer Game Audio', in *Proceedings of the Audio Mostly Conference 2006* (Piteå, Sweden, 2006); Kristine Jørgensen, *'What are those Grunts and Growls Over There?' Computer Game Audio and Player Action*, Ph.D. dissertation. (Copenhagen, 2007).

by guards or civilians. The game is played through an avatar, which is the player's personification in the game, positioned as an actual character within the game world. *Warcraft III*, on the other hand, is a real-time strategy game in which the player plays against human or computer opponents. The game is real time, which means that each participant develops and manages his/her military base and his army simultaneously and with no interruptions in order to beat his/her competitors. The player does not have an avatar in this game, but controls a number of semi-autonomous units. These are given specific orders such as build, patrol or attack, which then are carried out until the unit dies or is given a new order by the player.

In *Hitman Contracts* sound is important as a system that informs the player about his/her own status in relation to the game environment. Guards will shout at the avatar if he/she acts suspiciously, and the background music will change according to whether the situation is calm or critical. This makes sound an important feature that works to inform the player about how characters in the environment will react to his/her presence, at the same time as it works to create mood. Also, the sombre music often tends to blend with the environmental ambient background sounds, creating a mood that suggests a continuous danger state, while also discretely reflecting the life of a professional assassin as one coloured by moral dilemmas. In *Warcraft III* the sound is important for different reasons. The high pace of the game, and the focus on controlling several processes at the same time, makes it necessary to keep the player updated at all times on events taking place both on- and off-screen. The game is set in a medieval fantasy world, and each unit has verbal responses that reflect their place in a feudal society and underline the units as caricatures. This creates a light-hearted and humorous mood on the audio side. It is also important to point out that the player's representation in the two games has consequences for the realization of audio. In *Hitman Contracts* the game system may communicate to the player through the avatar, by making all sounds address the avatar instead of the player. In *Warcraft III*, on the other hand, there is no avatar, and instead the game system communicates directly with the player situated outside of the game world. This means that communication stays within the boundaries of the diegetic game world in *Hitman Contracts*, while in *Warcraft III* units that are represented as characters within the virtual world communicate with a space located outside the diegetic world of the game.

Consequences for the game as virtual world and as usability system

The participants in the study did not know beforehand that the sound would be removed from the game half way through the session, and their immediate reaction towards this sudden modification was that they thought playing without sound would be problematic. They felt that they lost control, and described this feeling in terms of other perceptions. One of the participants felt that he was being left completely in the dark (Petter, answer 31), while another compared it to losing a leg (Nils, answer 46). It was also underlined by a few that the game felt less engaging without any sound (Geir, answer 25; Stian, answer 34). One participant admitted that he never thought

that sound would affect a game like *Warcraft III* very much, but that this view had changed during the course of the research session:

> I knew I thought it's duller to play without sound. But I didn't know I would think it affected the game so much. But it's like, I have seen people play Counter-Strike without sound and that doesn't work [laughter]. (Nils, answer 38).

In specific genres such as first-person shooters like *Counter-Strike*, where two teams play each other in a hostage scenario, this participant believed sound was an important feature, but he did not think that the same applied for a strategy game before participating in the research. Nevertheless, after playing with a certain focus on the auditory part of the game, he realized that sound also plays an important role in this genre in relation to how successfully he could play the game. Below we will see how the absence of sound decreases the sense of control in the game, and how the sense of presence and a lifelike universe is affected. We will also see that although the absence of sound changes the attentive focus of the player, it does not lead to a decrease in attention. In addition, it will be demonstrated that in certain situations, removing the sound also contributes to removing certain distractions from the game experience.

Information and orientation

One of the reasons why the players experienced a loss of control and a sense of helplessness when the sound was removed was that one of the two access points between the game and the player had disappeared. This has specific consequences for the players' ability to orient themselves in the game environment. Compared to visual perception, auditory perception has the fortunate advantage that it does not require a listener to be oriented in a specific direction. This means that sound is useful in situations where the visual system is not available, for instance to provide information about events located out of line of sight, or when the visual system is busy with other tasks.[8] Removing sound from a computer game will therefore decrease the player's ability to locate enemies and receive information about specific events. This is also demonstrated by Stockburger, who points out that sound objects connected to specific visual objects or events have the ability to situate objects in the game environment.[9]

In *Hitman Contracts* the avatar positions the player as a character existing within the game world, and the game environment therefore reacts to the player's presence. This means that everything that goes on in the surroundings may affect the player's character directly, and the sound of a door opening behind the avatar may therefore contain crucial information about the situation. One of the participants believed that removing the sound in this game severely constrains the player's understanding of what goes on in the game:

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8   G.B. Kramer et al., *The Sonification Report: Status of the Field and Research Agenda*.

9   Stockburger, 'The Game Environment from an Auditory Perspective'.

You don't get any feedback from the surroundings ... [The sound] contributes to placing you in ... when you hear a door open up behind you, or hear a door opening and there're no doors before you, you think it's behind you. But it's like ... you don't want to end up in that situation (Geir, answer 25).

The playing situation becomes a very different one without sound, since there is no possibility that the players can orient themselves in relation to events outside range of sight. The result is that the sense of spatiality disappears, and consequently the players have no way of understanding the specific situation. According to Stockburger, providing information about what is going on in other locations is one of the most critical roles of game audio, and he calls it the acousmatic function with reference to Pierre Schaeffer and Michel Chion's use of the term.[10] The acousmatic function refers to the situation where one can hear a sound but cannot see the source. In games, acousmatic sounds are important since they provide information to the player in situations where the visuals have no power to do so. In *Warcraft III*, for instance, the player monitors a range of processes and events simultaneously, and in this respect acousmatic sound is a vital orienting system. When the player visually attends to one part of the game, there may still be processes going on offscreen in different parts of the game. For instance, when the player is moving his army in the direction of the enemy base, there will still be processes going on in his own base. In order to keep track of what is going on back home, the sound works as an important system of information:

If you're working on one part [of the map], doing many things and then you get 'summoning complete' or 'building complete', then perhaps you start thinking, what was that I was building which should've been finished [by now] (Anders, answer 16).

Here the player is allowed to concentrate on different tasks when a process has been started, since acousmatic sound will provide information about changes in status. Without these sounds the player must double-check visually on all processes, thereby having less control over all situations. Worse, the player would run the risk of forgetting processes he/she had already started:

If I'm out with a couple of men and my hero's hunting xp [experience points] for the next level, and I don't hear anything from the town, I would've ignored the town. Would have had like, three thousand gold and three thousand trees and only five buildings (Lars, answer 18).

In this sense sound also becomes a reminder that helps the player keep track of processes. These examples demonstrate Stockburger's emphasis on the importance of acousmatic sounds, and supports the view of auditory display and sonification theories that sound is a tool that is beneficial in monitoring and alarm situations.[11]

Sound may also be used as an informative system that enables listeners to pick up a higher amount of data compared to the visual system, and sound is therefore

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10 Stockburger, 'The Game Environment from an Auditory Perspective', p. 10.

11 G.B. Kramer et al., *The Sonification Report: Status of the Field and Research Agenda*.

suitable when providing a lot of simultaneous information to a listener.[12] In computer games this means that the player will receive less detailed information about events and processes in the absence of sound. One of the *Warcraft III* participants explains that in chaotic situations, it is not easy to see what is going on. This is especially evident in battle situations. The player cannot see how much health enemy units have left, but sound indicates when units die, what kinds of units are involved and how large the armies are:

> I recognise the attack sounds and death screams of some of the units. So I notice – if I hear a lot of bows, sounds from archers attacking, then I know they're attacking, so if I suddenly hear the death scream of one of the heroes I think, ha ha. There! My archers got him (Richard, answer 27).

The participant here knows from experience that his army has archers, while the enemy does not. Thus, hearing a lot of bow strings compared to the sound of enemy units is a good thing. When he also hears screams from an enemy hero, the participant knows that his army has been able to take out one of the most central enemy units. Although it is possible to see a difference between the units, it is hard to register exactly which units die and which stand without a high level of visual attention due to the large number of units in play. Using sound instead, the game frees the visual system from unnecessary tasks, at the same time as auditory information provides more detailed information than the visual system could do alone. We see a similar example in *Hitman Contracts*, where the participant was able to identify whether he hit or missed the enemy with a piercing weapon based on the sound:

> [The sound of] the knife and the meat hook. They are ok, since then you know you've done something. Also because … yes, there it was again. The sound when I fail to hit something, too (Anders, answer 10).

In this game the player has no visual meter that monitors enemy health. Instead he/she must evaluate the situation based on the sound, which has a different characteristic related to whether the player hits or misses. In this sense, sound contributes to an identification of the situation and supports the process of playing the game.[13] The usability role of sound as a response system that provides immediate feedback to player actions becomes very evident in this situation.[14] When sounds like these are absent, the player has a less detailed information system telling him/her how he/she is doing in specific situations. Although lack of sound in these contexts does not make the game unplayable, it makes the player's status in relation to the opponent uncertain.

These examples also demonstrate how the absence of sound isolates the player from certain information, and that usability messages become harder to apprehend.

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12 Scaletti and Craig cited in G.B. Kramer et al., *The Sonification Report: Status of the Field and Research Agenda*.

13 Collins, 'An Introduction to the Participatory and Non-Linear Aspects of Video Games Audio'.

14 Stockburger, 'The Game Environment from an Auditory Perspective', pp. 6, 9. See also Jørgensen, 'On the Functional Aspects of Computer Game Audio', p. 49.

Without sound, the visual system alone must interpret and notice events and information that normally would not require much attention.[15] In this situation the eye perceives more slowly because it has too many tasks to which it must attend.[16] One of the participants described how he repeatedly clicked a unit because the game did not provide any response to the fact that an object had been selected:

> Sometimes I sit like, I often hear 'click', then you hear 'not enough gold', and perhaps I click once or twice more. But now it was 'click-click-click-click-click-click'. Oh shit. [laughter] Nothing came up. So it took me a little longer to notice things (Richard, answer 34).

When the sound was removed, the participant experienced clicking several times before realizing that the order had already been carried out. Thus, the player's ability to know whether an order has been received or not decreases when the auditory system is removed. The participant also noticed an increased reaction time, since he was dependent on actually seeing what was going on before knowing for certain that the system had accepted his order. This also supports the idea that channel redundancy, that is, presenting the same information on several channels, increases the likelihood that the information will be received.[17]

When reaction time increases, the player's overall performance also decreases. This can be traced back to the acousmatic function of sound discussed above.[18] One of the participants explained that the reason for the decrease in performance was that he did not receive information about events that happened off-screen, that still had equal relevance to what was within range of sight in the game world:

> The first thing I notice is that my time of reaction has increased by ten. For example, in the beginning I sent a farmer through the woods at midnight ... And I noticed at once when he was attacked because of the sound. But now ... My whole base was attacked three centimetres below [the edge of] the screen, and I didn't notice anything. And it changes things very drastically, you're not able to move things where you want them, and you're not able to build defences as fast as you would've wanted to (Lars, answer 33).

The participant reported that his playing generally became less successful, since the environment failed to inform him what was going on in the surroundings. In addition to being connected to the fact that certain pieces of information cannot be attended to or are harder to grasp, performance also decreases because the player needs to refocus his/her attention on the visual channel. This sudden change is unfamiliar, and contributes to making the whole game seem different from ordinary playing circumstances. All in all, the sense of lack of control is connected to the fact that the player cognitively must adjust him/herself to new mental models since new ways of relating to limited game output must be learned.

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15 Heeter and Gomes, 'It's Time for Hypermedia to Move to Talking Pictures'.

16 Chion, *Audio-Vision. Sound on Screen*, p. 11.

17 Heeter and Gomes, 'It's Time for Hypermedia to Move to Talking Pictures'.

18 Stockburger, 'The Game Environment from an Auditory Perspective', p. 10.

Emotional connections to the game world

Another issue that felt very pressing for all participants was that the sense of presence in the game world disappeared together with the sound. Presence is an important concept in the study of virtual environments, and refers to 'the successful feeling of "being there" in a synthetic environment'.[19] The sense of presence demands that we direct our perceptions to a different reality than that of which we are currently part. This means that feeling present in a game is feeling that you are part of the environment in question, and that you understand the world presented as a three-dimensional reality that can be interacted with in a similar way to our own world. According to Alison McMahan, an increase in the sense of presence can result from a range of different factors. Most important for this chapter, one of these factors is the graphical and auditory realism of the environment,[20] or how well the environment sounds and looks like the real world. The degree of immersiveness generated by the interface is a second important contributor to the sense of presence.[21] The sense of presence is enhanced by how the users perceive the space, in terms of how well they can orient themselves in space.[22] Stockburger also points out that specific sound objects have the power to aurally define and identify specific areas in the game environment.[23] He states that music is often connected to specific locations in a similar manner. Since music generally has a huge emotional impact on listeners, it also works to enhance the player's engagement in the game world.[24] The thoughts of both McMahan and Stockburger support Whalen's idea that game audio may expand the game world by creating an awareness of the game space and providing characteristic auditory features of it.[25] The importance of sound in creating a sense of presence, and a feeling that one is in the environment in computer games, suggests that the absence of sound would affect the feeling of the game world to a great degree. One of the participants believed that *Hitman Contracts* did not feel right when played without sound:

> It's like [gun scenes] don't work right, because it's like you're reminded that this actually is a computer game. So when there's no sound, it's just like two animated figures standing there, shooting at each other (Rasmus, answer 13).

The sound normally provides the environment with a sense of life, and when the sound was removed, the participant was reminded that what he saw were just computer

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19 Marie-Laure Ryan, *Narrative as Virtual Reality: Immersion and Interactivity in Literature and Electronic Media* (Baltimore, 2001), pp. 67–8.

20 Alison McMahan, 'Immersion, Engagement, and Presence. A Method for Analyzing 3-D Video Games', in Mark J.P. Wolf, and Bernard Perron (eds), *The Video Game Theory Reader* (New York, 2003), p. 72.

21 McMahan, 'Immersion, Engagement, and Presence. A Method for Analyzing 3-D Video Games', p. 73.

22 McMahan, 'Immersion, Engagement, and Presence. A Method for Analyzing 3-D Video Games', p. 75.

23 Stockburger, 'The Game Environment from an Auditory Perspective', p. 8.

24 Stockburger, 'The Game Environment from an Auditory Perspective', p. 9.

25 Whalen, 'Play Along: An Approach to Video Game Music'.

graphics, and that the figures shooting at each other were animated features. In this sense, the illusion of an actual world disappears and the artificiality of the virtual surroundings becomes clearer. The sense of presence disappears in this situation because the game world does not seem consistent anymore[26]. In the natural world objects produce sound when manipulated, and when they do not do that in the game world, the environment loses part of its similarity to the real world environment. One of the participants playing *Warcraft III* had a similar experience to that above. He described how the military units felt more artificial with no sounds present,[27] and described them as nothing but 'numbers':

> It becomes like, you become more systematic, they become almost like numbers. Like, that unit fell, that unit fell, and now I lost one and stuff. There's almost no emotion behind the fact that they're falling (Stian, answer 36).

From providing an impression of being living human beings, the units are now reduced to nothing but a large number of entities. This observation is supported by Stockburger, who points out that sound effects objects create a cognitive link between a visual object and a sound, and enables the orientation of objects in space.[28] In this sense, removing sound is also removing a sense of physicality from game objects and units.[29] The lack of lifelikeness without sound makes the player become less emotionally engaged, since the virtual world seems to have fallen apart. Consequently, the player becomes more distanced from the game world, or feels even alienated, as the participant above described.

A last interesting effect related to the sense of presence is that in the case of *Hitman Contracts*, one of the participants reported becoming more scared and even a little paranoid when the sound was removed. Since he could not receive any auditory information about what was happening out of the line of sight, he felt that dangers may be hiding in the shadows everywhere around him:

> Yes, first you get like plugs in your ears, and it was just a lack of hearing. But after a while, then ... I get much more paranoid. I become actually a little scared when there's no sound, because you need to hear if things are around you, as it were. Where things are (Jonas, answer 26).

The player's sense of helplessness when playing without sound affected his sense of being within the game world. The participant became especially aware of the informative and orienting roles of sound when not being able to use audio for getting a sense of what was going on around him in the game environment. The sense of distance to objects and events disappeared, leading to a situation that was even more frightening than hearing enemies around. This reaction strongly supports Stockburger's emphasis on the acousmatic role of game audio,[30] and shows that

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26 McMahan, 'Immersion, Engagement, and Presence. A Method for Analyzing 3-D Video Games', p. 69.

27 Chion, *Audio-Vision. Sound on Screen,* p. 14–15.

28 Stockburger, 'The Game Environment from an Auditory Perspective', p. 6.

29 Whalen, 'Play Along: An Approach to Video Game Music'.

30 Stockburger, 'The Game Environment from an Auditory Perspective', p. 10.

game audio that refers to off-screen events may be even more important than audio connected to onscreen events.

Although a lot of information disappears in the absence of game audio, there are also many distractions which disappear with the sound. In the quote above, Stian described how he played in a more systematic way when he became emotionally detached from the game world as a result of the lack of sound. It was easier to concentrate on the tasks in the game without sound, without getting distracted by the mood following the auditory atmosphere of the game. This became very evident for one of the participants, who played *Hitman Contracts* in an aggressive manner that made non-playing characters run around in fear of the uncontrolled gunman:

> It's a very chaotic situation, and when the sound was on, I played in a chaotic way. But now when the sound's turned off and I became more systematic, it was partly because the immersion in that chaos was equal to zero. It's almost the same as in role playing games. If you don't immerse yourself into the character, you can per definition play more effectively. But it becomes much worse role playing (Lars, answer 27).

When playing in an aggressive manner, the participant found that the situation became very chaotic. Guards and civilians were running around shouting and screaming, accompanied by up-beat and fast-paced music. In this situation, the sound became yet another feature of distraction. With the sound turned off, the distractions decreased and the participant found it easier to concentrate on the objectives of the game. He compared it to pen and paper role playing games, where being 'in character', or playing the role of a specific personality, may exclude some behaviours and strategies. In a similar manner, sound affects the player's experience of the game emotionally, with the consequence that the player plays the game in a more or less calculated manner. This example demonstrates that too much sound may lead to an overload of information, and that in such cases, it may ease performance and concentration to remove some of the sources of information, in this case audio.[31] Another participant also explained how his concentration in *Warcraft III* was taken away from what was important because of information overload:

> Well, sometimes the sound can take away some of your concentration. You're working on something and then you hear that a building you've been waiting for is finished, then you want to jump right to it although perhaps you should've done other things. So it may … be a little too much sometimes (Anders, answer 39).

The participant knew that sound was important for performance in this game, and that it provided usability information about processes and events. When he heard sounds that signalled a change in status, such as a finished process, he wanted to check on it immediately, even when he was busy with other tasks that might be more pressing. In this situation the absence of sound appeared for the participant as a sudden opportunity to concentrate on what was important, instead of trying to attend to all sounds at once. In this sense, overload of sound decreases the player's ability to distinguish between more and less important pieces of information.

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31 Heeter and Gomes, 'It's Time for Hypermedia to Move to Talking Pictures'.

Although Collins argues that sound can serve to focus our attention,[32] it also seems that the player's attention changes when the sound is removed. Without sound, the player must utilize visual perception of data that earlier would be provided through auditory information. In this sense, the player must change his/her attentive focus from relying on both auditory and visual perception to visual perception only. This sudden new focus is unfamiliar, and the participants were discontent in having to read certain messages instead of listening to them, since they often failed to notice them in the absence of sound:

> I noticed that I had to start looking much more at the messages displayed down here, and that was annoying sometimes, and I didn't always notice things happening (Richard, answer 26).

Since the utilization of sound frees the visual system from attending to a lot of data, such as written messages rolling over the screen, it becomes easier to process a lot of simultaneous information. This is also supported by the fact that presenting the same information over different perceptual channels increases the likelihood that a message will be understood.[33]

Since sound has the property to enhance a visual or haptic display by providing a second channel of information,[34] we may easily believe that the ability to attend to and comprehend what is going on in the game world decreases in the absence of sound. Nevertheless, even though attention and apprehension do change when the game is modified in this manner, the level of attention apparently remains the same. One of the participants believed that what changed was the balance between auditory and visual perception:

> Well, the level of attention remains the same. Although I actually think it increases when I play with no sound, because it's like you're deaf or something (Rasmus, answer 12).

The participant claimed that he had the same high level of attention as before, but now the auditory part disappeared and what remained was the visual attention. The visual attention became sharpened since it remained the only perceptual threshold between him and the game.

It is also important to note that even though the game experience changes, and the system becomes less responsive, the most experienced players already have a very close relationship to the game as system, and know that the system responds even when they do not receive the information aurally. One of the participants was convinced that unfamiliarity was the reason why difficulties in playing occurred immediately after the sound was turned off:

> Yes, in fact, the first seconds … I became a little, like, woah – what's happening now. But I soon got used to it. My reaction became much slower, I'm certain about that. But I don't

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32 Collins, 'An Introduction to the Participatory and Non-Linear Aspects of Video Games Audio'.

33 Heeter and Gomes, 'It's Time for Hypermedia to Move to Talking Pictures'.

34 G.B. Kramer et al., *The Sonification Report: Status of the Field and Research Agenda*.

know ... The difference isn't really that great, I'm so familiar with what's happening, I'm so used to attacking in a specific manner if a spot turns up, then I have to do this and that (Stian, answer 33).

The participant had a certain routine when it came to playing the game, and he always reacted in the same manner. His style of playing also utilized the visual markers such as text and spots on the mini-map, which meant that he still received the information although the sound was gone. The participant did, however, believe that his reaction time increased, which underlines that redundancy increases the performance of the players.[35]

Conclusion

All in all we see that the games were affected on two levels when the sound was removed. On the one hand, the usability of the system decreased, since the players did not receive any responses from the system regarding their own actions and commands. Likewise, the players received no warnings or alerts from the system about abnormalities. Although both responses and alerts often can be detected visually as movements, text or as highlighted interface elements, these may be difficult to grasp when the eyes are busy with other tasks. On the other hand, the mood, sense of presence and the feeling of a lifelike world disappeared, and the games revealed themselves as nothing but animated graphics on a screen. In this sense, the games suffered both as user-oriented game systems and as virtual worlds when sound was not present, which means that both the progression through the game and the sense of presence in the game environment were affected.[36]

However, we see that these consequences have different relevance in different games. The strategy game *Warcraft III* was most severely affected on the level of the usability of the system, while the stealth game *Hitman Contracts* was most clearly affected on the level of presence in the game world. In *Warcraft III* the players experienced problems receiving important information. Alerts about enemy attacks were harder to grasp, and the system became less responsive. Status notifications about off-screen processes were also lost without sound. The reason for this is first and foremost because of the player's positioning in the game. As an external force situated outside the game world, the player's role is to command units and manage situations from an indirect point of view. This means that the player has no control over every single action that the units take, and must often leave them alone while attending to other tasks. In such situations audio becomes a necessary acousmatic information tool. In *Hitman Contracts*, on the other hand, the sense of presence was affected to a greater degree when sound was removed. This became especially evident when participants reported that distractions became fewer when the sound was removed. *Hitman Contracts* has a gloomy soundtrack supposed to reflect the not-so-glorious life of a professional assassin, and the audio team behind the game underlined a desire to put the players in an unpleasant mood when playing the game.

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35 Heeter and Gomes, 'It's Time for Hypermedia to Move to Talking Pictures'.
36 Whalen, 'Play Along: An Approach to Video Game Music'.

When this was removed from the game, the player was freed from a specific bias, which indirectly may have caused them to act more carefully in the game.

It should be kept in mind that removing sound may have additional effects in other genres. For instance, in a dancing game like *Dance Dance Revolution* it is likely that the players would be physically constrained since there would be no rhythm that they could follow. From an overarching perspective, the dual role of game audio to serve as a central usability feature while also adding to the sense or presence of a lifelike universe is connected to a specific ideal in software design, that the computer system appears invisible or transparent. Sound is a major contributor in that respect, since it may remove parts of the visual interface while maintaining or even increasing the usability of the system. This means that sound helps change the player's attention from the visual interface to other, more pressing tasks.[37] However, when audio partly takes over for the visual interface, it merges with the depicted virtual world. In doing this, audio may support the usability of the system in different ways. Sounds that seem to be motivated by a sense of realism in the game world are given usability functions. This was the case with guards shouting in *Hitman Contracts* – in this sense, diegetic characters produce the sound, but from the point of view of the game rules, the sound works as a warning signal. Alternatively, auditory system messages with a clear usability role are implemented into the game world as diegetic sounds. We find this in *Warcraft III* when units produce utterances as 'what do you need' in response to manipulation. Extra-diegetic game music may also appear as joint mood providers and usability features when a change in melody signals an event in the game environment. When merges like these happen, it may feel intuitive to claim that the usability sounds become 'unheard'.[38] Usability oriented signalling sounds are normally meant to be heard and reacted to consciously, but when they merge with the virtual environment, they become seamlessly part of the game environment. In this sense, their communicative role may become more transparent, but it is important to see that transparent and 'unheard' are not equals. Although masked as mood-enhancing features, the sounds are still important usability signals and it is crucial that the player apprehends them. This means that they are still heard and reacted to consciously, which is emphasized by the fact that players' performance is indeed affected when the sound is removed from the game.

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37 Heeter and Gomes, 'It's Time for Hypermedia to Move to Talking Pictures'.

38 See Claudia Gorbman, *Unheard Melodies? Narrative Film Music* (Bloomington, IN, 1987).