Effects of Switching Audio Cues in Survival Horror Games on Level of Fear

Gizem Kockesen
Graduation Thesis, November 2015
Media Technology MSc program, Leiden University
Niels Bohrweg, Leiden, The Netherlands
Thesis Advisors: Maarten H. Lamers, Joey van der Bie (Hogeschool van Amsterdam)
gizemkockesen3@gmail.com

***Abstract*— Sound is an important element that can make video games more realistic and immersive. It is essential to the genre of survival horror, as it has the known ability to cause certain emotions in players. Aside from scaring players, sound can be used to give information about the game state in the form of *audio cues*. While previous research into audio cues was mostly non-empirical, they have provided interesting observations, such as the possibility of unreliable audio cues increasing fear in players. This work studies the effects of audio cues on players' levels of fear in an experiment using a modified version of an existing survival horror game, *Amnesia: The Dark Descent.* Thirty participants were exposed to two game conditions: (a) normal audio cues, and (b) mixed audio cues that give incorrect information about the game state. Participants were asked to rate their fear levels verbally during gameplay, and in a survey after gameplay. Results showed no statistically significant difference in fear ratings between the two conditions. However, it was observed that players' fear levels increase if the game starts with reliable audio cues that eventually become unreliable. Additionally, participants got more scared of an encounter with a monster without reliable audio cues. Results also showed a dependent relationship between game difficulty, participants' fear rating, and enjoyment rating. Our study provides implications for game developers to make scarier and more effective horror games.**

***Index Terms*— Audio cues, video games, survival horror, fear level.**

I. Introduction

Video games have become a popular and increasingly growing industry with the help of new technologies as well as fresh insights in the different aspects of gameplay[1]. In order to improve user experience, research is conducted frequently, and the resulting new understandings help the development of games. Game studies is the main discipline that provides contributions to all types of properties of games; from how people play them to experimenting with new and exciting interactions.

One aspect that is important to study is game sound. To have a fully immersive experience for the player, sound is as essential as having good 3D graphics in a game, since it adds to the realism [1]. It needs to be carefully studied in order to be convincing. The correct sound effects and background music have to be assigned to the correct locations in the game. Sound designers need to provide the right atmosphere to make the player become a part of the game [2].

One video game genre that makes a lot of use of game sound is "survival horror"; a type of a game which places the player in horrific environments with terrifying creatures hunting them (e.g. *Resident Evil*, Capcom, 1996; *Slender: The Eight Pages*, Parsec Productions, 2012; *Fatal Frame*, Tecmo, 2001). Typically in these games, the player can only win by surviving various encounters with the creatures, solving puzzles and finding a way out to escape from nightmarish places. Depending on the game, players can be given no way to defend themselves (e.g. *Amnesia: The Dark Descent*, Frictional Games, 2010; *Outlast*, Red Barrels, 2013); they will have no choice but to run and/or hide when they are spotted by the creatures. Alternatively, they can possess a gun or even a crowbar (e.g. *Silent Hill 1-4*, Konami, 1999-2004; *Alien Isolation*, Sega, 2014), but are recommended to not face the creatures unless they really have to because of the limited number of ammo in their guns and their character being physically weak.

Due to the fact that sound can cause people to have specific emotions, it is effective to make use of sound in this genre to scare the player even more [3]. It can either be used to add eerie sound effects of doors creaking, distressing background music or to provide "audio cues" to the player, which are interactive sounds that carry information about the change in the gameplay status. For example, they can be sounds of a monster growling, which consequently signals the presence of an enemy in the area where the player is currently exploring. Hence, they are different than background sound effects, as the player can use these audio cues to know when he/she has to run and hide, and when it is safe to get out of the hiding spot [4]. Recently, the genre of survival horror has received a lot of attention, as more and more people started to play them and even streaming themselves playing on YouTube.

Since these games only need to psychologically scare people and do not require having amazing graphics, they have become inexpensive to buy and their popularity has increased dramatically. With this rise in popularity, more and more

[1] https://opengamingalliance.org/press/details/core-gamers-are-expected-to-drive-record-growth-for-pc-games

research has started to be conducted in order to gain more understanding of how sound is and can be used to scare players even more; from studying how sound psychologically affects players [3] to changing various parameters of sound effects to see how it increases fear [5]. However, the effects of audio cues have not been studied as extensively, and most of available studies consist of theoretical analysis. In this paper, the effects of modifying audio cues in survival horror games are studied and the findings of accompanying practical experiments are presented. The research question that will be answered by this study is as follows:

Would switching audio cues in a horror game affect players' level of fear?

This research builds on the idea that having a certain degree of unreliability can increase the level of fear [6]. As mentioned before, players depend on the audio cues to know when it is safe and when it is not. If they realize that there are some moments in the game when the cues are not working as expected, it can raise the tension; they cannot completely trust the cues. This level of unreliability can increase the fear value of the game.

In this research, it is aimed to study and test the above-mentioned observations by conducting certain experiments. An existing game is modified to switch its audio cues and provide the right atmosphere for the experiments in order to answer the research question. The results of this study can help game developers make better games, as the research can provide more insight into how people use audio cues and what their effects are on people.

The paper is organized as follows; Section 2 presents an overview of the related studies that had been conducted in the area of this research. Section 3 explains the methodology and the experiment procedure for this research. Section 4 displays the results gathered from the experiment. Finally, section 5 includes a discussion and concludes the paper.

II. Related Work

A. Game Sound and Emotions

As mentioned in the previous section, a lot of research has been made in the topic of game sound over the course of many years. With the increased availability and popularity of the video game genre of survival horror, researchers have questioned the genre-specific aspects of these games. Game sound has been a widely studied topic, as it provides many contributions for creating proper game atmosphere. This section presents a number of selected research projects conducted to see the effects of sound on emotions.

Grimshaw, Lindley and Nacke conducted a research in order to study the influence of sound, in this case, how it can affect immersion [1]. A requirement of immersion, as the researchers mention, is making the player *feel* like they are a part of the game. This is especially important in First-Person Shooter games (e.g. *Doom* series, id Software, 1993-2012; *Half-Life* series, Valve Software, 1998-2007), since the player sees the world in the game from a first-person perspective. The researchers of the study claim that even though a lot of theoretical analysis has been performed in the past, no experiment work has been done to prove that game sound facilitates immersion in games.

To accomplish this task, the researchers conduct an experiment through which they measure each participant's physiological responses while playing a modified, 10-minute long level of *Half-Life 2*. Using various equipment, they measure the test subjects' facial expressions and skin conductance, followed by a survey after the experiment. The game level was played four times, each with a different sound mode; normal sounds (with regular game music and background sounds), only background sound, only game music, and no sounds or music. Despite a statistical difference between the physiological measurements and survey answers, results showed that game flow and immersion get positively affected by background sounds. Furthermore, it was observed that while music decreases tension, it also positively affects immersion.

In addition to enabling immersion, game sound can also influence emotions, as was observed in a study done by Toprac and Abdel-Meguid [7]. The authors aim to understand the exact aspects of sound that cause fear in players by manipulating the volume, timing (synchronization of sound effect with event) and source of sound; the three properties that the authors believe to be the most used ones in the design of sound of a game. After a careful analysis of these properties in existing horror games, the authors suggest that having loud, synchronized and visibly sourced sound effects evoke fear in players. In order to test these observations, a series of experiments were performed, in which 34 participants played a modified level of an existing game (*Gears of War*, Microsoft, 2007). Each participant was exposed to the three mentioned sound properties during their gameplay. It should be noted that the chosen sound effects do not consist of audio cues only but mostly of background sounds, since the focus of the study is not on audio cues. Results showed that high volume and timed sound effects are the best properties to cause fear in players. Furthermore, the authors found out that the visibly sourced sound effects do not necessarily cause too much fear.

Garner, Grimshaw and Nabi also experimented with different sound parameters in order to control the level of fear in survival horror games [5]. They observed that out of several tested properties, 3D positioning, loudness, and pitch of the sound turned out to be the most effective in intensifying test subjects' fear. Using these properties, 5 game sounds taken from *Half-Life 2* were manipulated for the main experiment. Using the game engine Cry Engine 2 (Crytek, 2007), a custom level was created by the researchers. The level included all five modified sounds and a creature that hunted the test subjects. The researchers did not obtain statistically significant results. However, the results still showed that the three sound properties have the potential to influence the intensity of the player's fear. This insight can be further experimented with by focusing on only one sound property.

In terms of experimenting with sound properties, Ekman and Kajastila [3] took a similar approach in their research but

with a different angle. They argued that the ambiguity in the location of the source of a sound heard in a horror game affects the fear level of the player; the less the player knows where the sound comes from, the more he/she gets scared. To test this assumption, the researchers experimented with people who were exposed to four different sound samples that were manipulated accordingly. The experiments did not take place in a video game environment, but in a physical room with loudspeakers. To enable fair comparison, each sound sample was modified with two types of sound effects; one that makes it difficult to make out its source and another from a well-defined source, named "spread" and "point" respectively. In addition, the sound samples were played both from the front and back of the participants' position. Participants were asked which sound they thought was scarier, and the results showed that more people perceived spread-out sounds coming from the back to be scarier than the ones in the point configuration coming from the front. An interesting observation was that the level of scariness was almost the same between the spread-out sounds coming from the front and sounds in the point configuration coming from the back. The researchers explain these results by stating that when the sound is spread-out, it becomes difficult to make out whether it is coming from the front or the back. Thus, this uncertainty of the location of the source of the intimidating sound created more tension in people.

B. Games and Audio Cues

Previous research that explored the topic of audio cues in horror games has been mostly non-empirical, which is needed to be studied to better understand its nature before experimentation can take place. For this purpose, Roux-Girard [8] contributed to this topic by studying the role of sound and audio cues in horror games. He claims that audio cues in horror games are more than just background sounds; their nature allows the player to survive. Due to the common practice of limiting the player's vision in order to add to the scariness of the game, he adds, audio cues become the only thing that the player can depend on if they want to finish the game. Based on this notion, he points out two questions that the player asks about sound in a horror game: "1) From where does that sound originate? and 2) what is the cause of that sound?" [8, p. 7]. As it was also mentioned in the previous paragraphs, not knowing the answers to these questions increases fear, for the player knows that they are essential to the survival of the game's character. It must be noted that audio cues do not only consist of sounds; music can also be used to give information to the player. Roux-Girard gives the example of the room in Resident Evil that allows players to save their game progress, stating how the music that always plays in that room refers to the fact that "…the player character is in safety, while fast-paced music normally implies the presence of a threat…" [8, p. 12].

An interesting statement mentioned in his research points out how, while these audio cues help the player progress in the game, they can also almost "discourage" the player; if the player hears a scary sound, he/she will hesitate to advance. Lastly, he makes an important observation that audio cues "…must be unreliable and/or the quantity of information about the localisation of the generator must be limited" [8, p. 16].

The way that game designers make use of audio cues as means of "warning systems" to scare the player in existing survival horror games was carefully analyzed by Perron in his research; through studying previous literature and his own observations from playing a number of these games [4]. In his analysis of *Silent Hill*, he mentions a pocket radio that the character picks up early in the game. This is a great example of an audio cue, for the radio starts transmitting static noise when monsters are close. It becomes a very useful tool in the game, since the streets of *Silent Hill* are all covered in thick fog; the player cannot see far. With the radio, he/she can expect a monster to appear, but the problem is when and from where? As Perron adds, the noise can continue for a little while longer even after the player takes a different route to avoid the monster. This augments the player's fear level; why is the noise still playing? Perron gives a related example of his own gameplay of *Silent Hill 2*, which shows the effects of audio cues on the player. As he was about to get out from the room that he was exploring, he started to hear static from his radio. To make the matters worse, he also heard footsteps and loud growling coming from outside the room. All that audial information made him think that a big monster was waiting for him outside. As *Silent Hill* is a game that does not give you big weapons to protect yourself, he got very scared and consequently froze. He was too scared to get out and progress in the game or even move. What he saw when he finally decided to get out, very tensely, was just a regular monster that is easy to kill with the wooden plank that he had in his possession.

Game designers made great use of audio cues to make the situation seem more frightening than it actually was in this example, which shows an important aspect of horror; suspense. Game designers use audio cues (or forewarning, as Perron calls them [4, p. 1]) to intensify suspense. Rather than showing the threat itself, Perron explains, forewarning gives a sense of *uncertainty* as you expect something bad and sudden to happen but you do not know when and from where (i.e. the pocket radio from *Silent Hill*). You are constantly kept on your toes, which makes the situation scarier. This shows that while the player needs these audio cues to keep their character alive, they are also one of the main aspects of the game that scare the player the most.

The effects of having uncertainty in survival horror games are further studied in a research conducted by Kromand [6]. He assumes that, while game designers use audio cues to transfer information to the player, they also use them to create a sense of uncertainty. He argues that this results in an amplified level of fear in the player. As an example of a type of uncertainty used in these games, he mentions that making it unclear whether a sound is coming from an enemy or just a background effect "…stresses the player into carefully considering his actions and puts him on alert even though no visual threats are apparent." [6, p. 1].

In order to show this trend in practice, Kromand analyzes three horror games that demonstrate different ways to have

uncertainty and their effects on the player. The first game he studies is *BioShock* (2K Games, 2007), which includes various audio cues, such as hearing loud footsteps of one of the important characters, signaling his presence. Reflecting on the sound design of the game, Kromand mentions that while players are able to learn how to interpret the audio cues in the game, hearing the difference between the audio cues and background sounds can be difficult at times. He argues that audio cues are "…mimicked in the ambience" [6, p. 2], and consequently force the player to question its nature; is it a warning or just a sound effect?

The second game that is studied, *F.E.A.R.* (Monolith Productions, 2005), uses a slightly different technique to have uncertainty in the game; creating audio cues that are not 100% reliable. He states that "In FEAR, the player knows that a threat is present, but the cues are slow to reveal exactly when and where it will happen." [6, p. 3]. He gives the example of a part of the game where the player is forced to crawl through a small, confined space. In this part, the player gets exposed to the horrific sounds of the supernatural enemy, the ghost of a girl, "shuffling around and giggling", signaling her presence in the same confined space. Kromand explains that the possible close proximity of the ghost to the player causes him/her to feel "distress". This keeps increasing rapidly until the ghost attacks much later, if she attacks at all. As previously mentioned, *F.E.A.R* includes unreliable audio cues which are not *always* followed by an attack. Kromand explains that this unreliability "… is designed to put the player on edge and make him carefully considering his moves even though no threat is imminent." [6, p 3]. Referring to hearing static when something supernatural *might* happen, he claims that "The misuse of the static reduces the player's faith in it as a reliable tool, but accentuates that something might happen." [6, p. 3].

Consequently, knowing about the possibility of something scary happening becomes more terrifying than seeing it happen without warning, or even with a 100% reliable warning. This can be easy to imagine; if you become absolutely sure that a sound will always mean an attack after playing the game for a while, the scary effect of the audio cue will disappear, as you will get used to it. *Silent Hill* also prevents this from happening to keep the game scary at all times in a similar way. Like Perron, Kromand also mentions the pocket radio as he examines the game. He observes that the radio can be very unreliable at times. For example, he says that static can be heard when no enemy is causing the audio cue. Moreover, certain enemies in the game do not trigger the audio cue, thus surprising the player without a warning. In conclusion, Kromand argues that this uncertainty and unreliability in the audio cues observed in the three games might cause some players to enjoy them even more, for they "build a more intense experience."

C. Non-game Audio Cues

Audio cues have also been studied outside the field of video games. In particular, Bach, Neuhoff, Perrig and Seifriz showed the effects of two types of audio cues on emotions [9]. One of the studied audio cues possessed various sound properties, giving it a complete feel of motion (named full motion cues). The second cue had only intensity as its property, which increased and decreased. The aim of the study was to observe which type of sound seemed more like a warning to people when the cues sounded like they were approaching and receding. For this purpose, a series of experiments was conducted with participants who got exposed to the cues through headphones. Results showed that full motion cues that were approaching and receding increased the level of skin conductance on people, thus making it sound more like a warning. However, when the motion effect was compared between the two types of audio cues, results suggested that both cues seemed alarming when the approaching effect was used. Participants commented that those cues were "more unpleasant, potent, arousing, and intense".

The possibility of using audio cues to navigate through virtual space was shown by Lokki and Grohn [10]. In a game-like virtual environment, the researchers conducted two experiments in which participants were asked to find their way to the goal that was pointed at by auditory cues. After performing a training session to allow the participants to get used to the sounds and the virtual environment, the first experiment was conducted using visual-only cues, aural-only cues and both, "audiovisual" cues at the same time. The aim of the experiments was to see which type of cues enables people to reach the goal in a fast and efficient manner. The visual cue consisted of a white ball that indicated the goal, while the aural cues were noise bursts. Results showed that while audiovisual navigation allowed the participants to find the goal faster, they were also able to reach the goal using only audio cues. After analyzing the results, the researchers performed a second experiment with better developed auditory navigation. From the first experiment, researchers observed that people had difficulties perceiving the height of the sound. They added this information to the audio cues in the second experiment, which included testing with only audio cues. Results showed an improvement in search times and the distance covered decreased. Thus, researchers have concluded that by improving the properties of audio cues, it is possible to use them to navigate through virtual space.

D. How to Measure Fear

Over the years, different methods to measure fear were used by researchers. These mostly consisted of physiological measurements using sensors (e.g. [11, 12, 13]) and self-reporting using rating scales and questionnaires (e.g. [3, 5, 11, 14]). It had been argued and tested before [15, 16, 17] that physiological measurements can be unreliable and difficult to differentiate between similar emotional states by themselves. Therefore, the latter methodology will be more focused on and is further explained in this section.

Initially, Watson and Clark had developed a scale for measuring positive and negative affect, including fear, named Positive Affect Negative Affect schedule (PANAS - X) [14]. This scale uses words for participants to rate how much a particular word describes their emotional state on a scale of 1 to 5.

In their research [3], Ekman and Kajastila used questionnaires in order to rate the scariness of each sound that they tested. In each question, participants were required to evaluate and choose which one of the two sounds that they heard was scarier. Participants were able to replay the two sounds as many times as they wanted to reassure the validity of their answer.

Vachiratamporn, Legaspi, Moriyama, Fukui and Numao used a combination of physiological measurements with a type of a rating system that they developed; an affect annotation tool (AAT) [11]. The participants of this experiment were recorded on camera while they played a horror game. This was used to allow the participants to annotate their own emotional states by watching a replay of their gameplay and a video of their facial expressions while they played the game. Emotional states were divided into two categories; pre-fear (neutral, anxiety, suspense) and post-fear affects (low-fear, mid-fear, high-fear). Participants were required to annotate their emotions by choosing between the labels from these categories while watching their gameplay. Their physiological measurements were measured during gameplay, while AAT was used after gameplay, followed by a 5-point scale questions rating how much fear and fun they had in the game.

Garner, Grimshaw and Nabi used the combination of ratings scales and questionnaires in their research [5]. They required the participants to rate the scariness of the sounds during and after gameplay. They mentioned that previous research showed that people can forget exactly how they felt while they were performing an action if they were asked to state their feelings afterwards. The researchers argued that by asking participants to rate the scariness of sounds during *and* after gameplay, they make sure that the ratings are valid. The participants were asked to rate the emotional impact of each scary sound on a scale of 1-5 right after they were exposed to them. In order to not break the flow and immersion of the game, the ratings were asked in the game which showed up as a visual prompt after a sound was played. The participants were required to vocally express the rating of that particular sound on a scale of 1 to 5. By coupling this method with a debriefing questionnaire asking about the scariness of the levels, researchers were able to further confirm the exact ratings of the participants.

E. Key Findings

There are a number of important findings gathered from the previous work presented above. These are summarized as follows:

- Sound has the effect of causing people to have specific emotions [3, 5, 7, 9].
- Audio cues can intensify suspense [4].
- The possibility of something bad happening can be scarier than it actually happening [6].
- Ambiguity in the location of the sound source creates more fear [3].
- Unreliability can increase the level of fear [6, 8].
- Using physiological measurements by themselves to measure fear can be unreliable and biased [15, 16, 17].
- Rating scales and questionnaires are accepted methods of measuring fear [3, 5, 11, 14].
- People can forget their exact emotions at a certain point. Using rating scales before and after gameplay can overcome this problem [5].

III. METHODS

In order to answer the research question, an experiment was set up, which required participants to play a survival-horror game created for this research. In this section, the methodology that is used for this experiment is presented. Details of the game, data collection for levels of fear, and the experiment procedure are also presented in this section.

A. The Game

An existing survival-horror game (*Amnesia: The Dark Descent)* was modified in order to test the hypothesis in the research. The decision to modify an existing game was made because developing one from scratch would be inefficient for this particular research; it can take a longer time and thus take the focus out of this research which studies the effects of *audio cues*. Therefore, it was decided to look for an existing game that can provide the necessary elements to test the effects of audio cues.

After a careful analysis of the survival-horror games (most of them mentioned in Section 1), *Amnesia: The Dark Descent* was chosen for the research. *Amnesia* is a game that was highly praised as "one of the scariest games"[2] and has received high ratings[3] from both critics and players. It contains all the elements needed for our research; clearly defined audio cues, dark environments, no ways for the player to defend themselves, and monsters. In addition, the developers of the game have released the engine online with all the necessary editors needed to modify *Amnesia* to create custom game maps. It can be downloaded for free and many tutorials exist online to teach people how to use the tools to make their own levels. With all these aspects, *Amnesia* offers great tools to create custom levels to answer the research question through experiments.

B. Audio Cues of Amnesia

Several different types of audio cues are used in *Amnesia* to inform the player of the state changes in the game. These cues consist of both music and sound effects. Four of them were chosen as the audio cues of the modified levels in this research. They are the most commonly used audio cues in the original game. The descriptions and meanings of the audio cues used in the original game are as follows:

[2] http://www.ign.com/articles/2010/09/03/amnesia-the-dark-descent-review
[3] http://www.metacritic.com/game/pc/amnesia-the-dark-descent

- Calm Music: Plays when there are no monsters around and it is safe.
- Monster Growl: Means that the monster has spawned in the level and is patrolling the area.
- Tension-Building Music: Plays right after the "Monster Growl" audio cue, informing the player that it is no longer safe and they should be careful.
- High-pitched Noise: Plays when the monster has spotted the player, signaling that the player needs to run and/or hide.

C. Experiment Level Design

In order to test the effects of switching audio cues on players, two game levels were created which had two different conditions; one with normal audio cues and the other with mixed audio cues. This way, participants can be exposed to both conditions, and the difference that the conditions make (if they do make a difference) can be observed easily. Furthermore, the design of both levels was made to be exactly the same in order to have the change in audio cues as the only independent variable in the experiment.

The game takes place inside a mansion created with the elements and objects from the original game. The environment is kept quite dark, and the player is the only character present other than the monster. The game is a first-person shooter and just like the original game, the player has no way to defend themselves. The game starts in a safe room where the player can pick up a lantern, which allows them to see the environment a bit better. However, this lantern also allows the monster to see the player better, and so the player has to turn it off immediately when they hear or see the monster. The player walks through two hallways and goes inside numerous rooms to explore the mansion and find an exit. The last door located at the end of the second hallway leads either to the next level or the exit depending on the level the player is in. Figure 1 shows screenshots from the game.

Figure 1. Screenshots from the game created for the experiment: (top) player exploring a room, (bottom) an encounter with the monster.

To further explain the design of the audio cues in the game, the condition with normal audio cues used the correct meanings of the audio cues described in the previous section. The other condition used audio cues whose meanings were mixed up with each other. "Calm Music" and "Tension-Building Music" were switched with each other, meaning that instead of playing "Calm Music" when it is safe, "Tension-Building Music" was set to play; even though there are no monsters around. Players would hear "Monster Growl" or "High-pitched Noise" when the monster has not spawned nor seen the player. Additionally, whenever the monster spawned in the level, "Monster Growl" was set to not play. Instead, "Calm Music" was set to continue playing. These meanings are summarized in Table I.

TABLE I. MEANINGS OF THE MIXED AUDIO CUES

Audio Cue	**Meaning**
Calm Music	Played when there is a monster around
Tension-Building Music	Played when it is safe
Monster Growl	Played randomly when there is no monster around
High-pitched Noise	Played randomly even when the monster has not spotted the player

The only cue that could not be fully modified was the "High-pitched Noise". While it was possible to place the sound anywhere in the level map even when the monster has not spotted the player, it was not possible to remove the sound from playing when the monster has actually spotted the player. The only way to remove the sound was to completely remove it from the whole game, meaning that it could not be used in any of the levels. This option was not preferred at all, since this particular audio cue is one of the defining sounds of the game. It adds up to the horror with its loud, screeching noise that makes players feel very uneasy and nervous. However, it was realized that having this audio cue to play normally in both of the levels could add up to the uncertainty of the game. If the audio cues were to be completely switched, players can learn how to read the switched audio cues in that level. This would result in having *reliable* audio cues; they would simply have different meanings instead of creating uncertainty in the meanings. Like Kromand examined in his research [6], the uncertainty and unreliability of the audio cues in *F.E.A.R* and *Silent Hill* were caused from not completely changing their meanings; it was from having them not to work 100% of the time. Therefore, having one of the audio cues to work normally in both of the levels could make them more unreliable in this research. In this way, players would not be able to assume to distrust the audio cues at all times, as the "High-pitched Noise" cue would play when they are seen by the monster. A player who figures out that this level has switched audio cues would not trust the sound and consequently could get surprised by the monster. Thus, it was decided to keep this audio cue to work normally in both of the levels.

Two versions of the game were created for the experiment. Version A started with the level with normal audio cues, and was followed by the second level with mixed audio cues. Version B had the opposite order. Participants were divided into two groups, Group A and B, and played Version A or Version B of the game respectively.

D. Data Collection

The research required the collection of the participants' levels of fear that is caused by the game. The aim of the experiment was to see how much afraid each participant was and which level they got afraid of the most. For this purpose, a survey was created which asked about participants' experience in the game after gameplay. The reason for not using a readymade survey like Game Experience Questionnaire (GEQ) was due to GEQ not being focused enough on fear. GEQ is also weak in experiments with short gameplays[4], such as the one of this research.

The first part of the created survey requested them to rate the scariness of the levels that they had played, and to share the reason. This was followed by asking them which level they enjoyed the most. They were then asked if they played video games in general, as well as survival-horror games. If they do, they were further asked how often they played them and how much they enjoyed playing them. Their familiarity with *Amnesia* was also asked. Finally, they were asked if they had any comments to share.

As mentioned before, Garner, Grimshaw and Nabi asked the participants to rate the scariness of the sounds that they tested both during and after gameplay [5]. This strategy was chosen to be adapted in this research to strengthen the validity of the collected data. During gameplay, participants were asked to rate how scared they were feeling and verbally express their fear level rating whenever they were shown a red card by the experiment supervisor. Fear level ratings were asked more times in the mixed condition than in the normal condition. The reason for this was that the mixed condition had specific moments where random audio cues were triggered for the unreliability of this condition. Since the normal condition had normal audio cues, triggering more cues depended on the way the participant played; if they were able to avoid being seen by the monster and avoid triggering the "Tension-Building music", it was not possible to ask them how scared they were since they did not trigger the cue. Therefore, it was decided that the ratings were asked at the moment of the encounters, which are named and explained as follows:

- Monster 1 (normal): The first time the monster appears in the normal condition.
- Monster 1 (mixed): The first time the monster appears in the mixed condition.
- Monster 2 (normal): The second time the monster appears in the normal condition.
- Monster 2 (mixed): The second time the monster appears in the mixed condition.
- High-pitched 1 (mixed): The first time the High-pitched noise was played in the mixed condition without a real threat.
- High-pitched 2 (mixed): The second time the High-pitched noise was played in the mixed condition without a real threat.
- Monster Growl (mixed): The encounter that triggers the Monster Growl audio cue in the mixed condition without a real threat.

As the participants played the game with headphones, it was decided to not ask for the fear level ratings verbally. Also, pausing the game to ask for the rating is not ideal either, as it can break the experience and immersion. Using a signal, such as a red card, would let the participants know that they are being asked to rate their fear level without interrupting the game. Fear level ratings were asked typically at the moment when participants were exposed to a scary sound and/or encounter. The ratings were noted down by the experiment supervisor. These encounters included monsters' appearances with and without audio cues, as well as triggering random audio cues without a real threat.

E. Experiment Procedure

The experiment started with a briefing about the procedure of the experiment. Participants were told that they would be playing a short horror game, but they were unaware of the

[4] http://www.allaboutux.org/game-experience-questionnaire-geq

differences of the two levels. They were told that their objective in the game was to explore every room and proceed onto the next level until they finished the game. The basic mechanics of the game were shared with them, such as the monster and the fact that they cannot fight it. They were also informed that the red card meant that they were asked to rate their fear level at that moment by shouting out a number between 1 and 5 whenever they saw the red card.

In order to keep the participants' familiarity with the way audio cues were typically used in *Amnesia* at the same level, as some of them could have played the original game before, the cues that were used in the experiment were played and explained to them beforehand. It should be noted that only the normal version of the audio cues with the original meanings from *Amnesia* were explained to the participants.

Furthermore, a paper showing how to control the character in the game was placed next to them during the whole experiment. As the game started in a safe room, participants were able to test these controls inside the game. After they got familiar with the controls, they were asked to leave the room and start the experiment.

IV. Results

After gathering all the data from the experiment, a series of statistical analysis was conducted. For all the t-Tests, the statistical significance threshold was set to 0.05. The population variances were unequal and the t-Tests were two-tailed. This section presents these results.

A. Participant Characteristics

A total of 30 participants (N=30) completed either Version A or B of the game during the experiment. Both of the versions were completed by exactly 15 participants each. On average, they took 10 minutes to complete the game. Participants were of varied nationalities and genders, with an age range between 18 and 31. A total of 26 participants played video games, and 11 of them played horror games. Five participants had played *Amnesia* before, while one had watched other people play it.

B. Fear Level Ratings

This section presents the results of the various tests and analysis made on the fear level ratings gathered from the experiment.

1) Fear Level Ratings during Gameplay

Fear level ratings that were collected from the participants while they played the game were added up for each participant per condition; one with the game level that has normal audio cues (normal condition), and the other with mixed audio cues (mixed condition). The ratings of each encounter were added together and divided by the number of encounters per condition to calculate a total rating of each condition. Table II shows the means and standard deviations of the fear level ratings per condition.

TABLE II. Means and Standard Deviations of the Fear Level Ratings per Condition during Gameplay

	N	Min.	Max.	Mean	SD
Normal	30	1	5	3.32	1.23
Mixed	30	1	5	3.18	1.17

A Paired t-Test was conducted on the ratings of the two conditions to test the statistical significance of the results. The test revealed no statistically significant difference between the two conditions on participants' levels of fear with the p-value at 0.38. Figure 2 shows the results of the Pearson's Correlation test, which revealed a very strong positive correlation between the fear levels of the two conditions (r = 0.76).

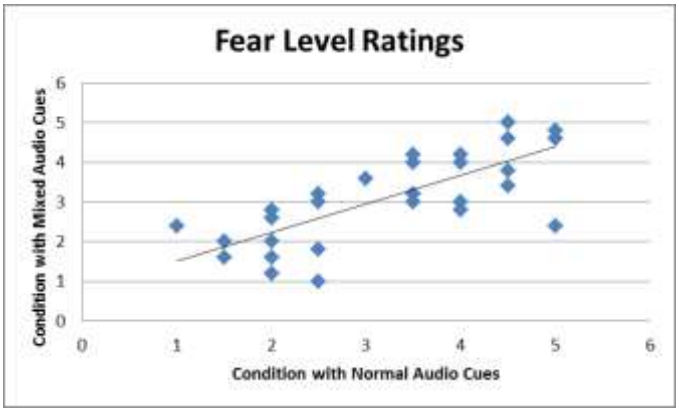

Figure 2. Scatter Plot for the Fear Level Ratings during gameplay of the two conditions, r = 0.76. Each point represents one participant data (n = 30).

2) Fear Level Ratings from Survey after Gameplay

The survey required the participants to rate each condition according to their scariness. The means and standard deviations of these ratings per condition are shown in Table III.

TABLE III. Means and Standard Deviations of Fear Level Ratings After Gameplay

	N	Min.	Max.	Mean	SD
Normal	30	2	5	3.2	1
Mixed	30	1	5	3.5	1.31

A Paired t-Test was conducted on these ratings to see if there was a statistically significant difference between the two conditions in terms of fear. Results showed no statistically significant difference with the p-value at 0.11. The value for Pearson's Correlation was 0.66, which is depicted in Fig. 3.

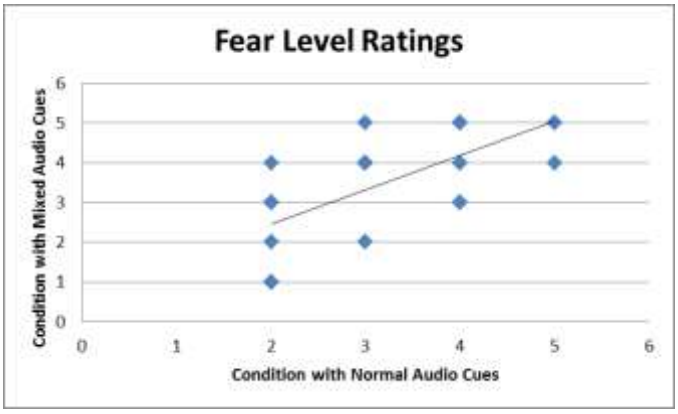

Figure 3. Scatter Plot for the Fear Level Ratings after gameplay of the two conditions, r = 0.66. Each point represents one participant data (n = 30). Some points overlap due to participants giving the same rating.

3) Comparison of Fear Level Ratings during and after Gameplay

The Fear level ratings gathered from both during and after gameplay were compared with each other per condition. Using Pearson's Correlation on the normal condition's ratings revealed a very strong positive correlation between the results (r = 0.88). A positive correlation was also achieved on the mixed condition (r = 0.76).

Statistical significance of the results was tested using Paired t-Test on the ratings of both conditions. The test on the ratings of the normal condition gathered from during and after gameplay revealed no statistically significant difference, with p-value at 0.29. The same was true for the mixed condition, with p-value at 0.05

4) Fear Level Ratings of Individual Encounters in the Game

So far, the analysis consisted of looking at the total fear level ratings per condition. Further analysis can also be made on the scariness of the individual encounters within the game. This analysis can show us if there is a statistically significant difference between the encounters and give us a clear view on which particular encounter (monster attack with or without audio cue, and random audio cues without monster) was the scariest for the participants. Friedman's Test was used for this purpose with the threshold at 0.05, and results showed a significant difference in fear levels between the various encounters ($p < 0.0001$).

The results were further analyzed to see which encounter was the scariest for the participants. Table IV shows the results of the multiple pairwise comparisons between the encounters.

TABLE IV. MULTIPLE PAIRWISE COMPARISONS BETWEEN ENCOUNTERS IN TERMS OF FEAR LEVEL

Encounter	Sum of Ranks	Mean of Ranks
High-pitched 1 (mixed)	81	2.7
Monster Growl (mixed)	106.5	3.55
Monster 2 (normal)	114.5	3.82
Monster 2 (mixed)	121	4.03
High-pitched 2 (mixed)	123.5	4.12
Monster 1 (normal)	133	4.43
Monster 1 (mixed)	160.5	5.35

As it can be seen from Table IV, "Monster 1 (mixed)" was the scariest encounter for the participants. This was followed by the same encounter with the monster but this time in the normal condition, and the second time the High-pitched noise was played in the mixed condition.

Furthermore, the results were analyzed to look for pairwise differences between the encounters. Significant differences were observed between "Monster 1 (normal)" and "High-pitched 1 (mixed)" ($p = 0.031$), "Monster 1 (mixed)" and "High-pitched 1 (mixed)" ($p < 0.0001$), and "Monster 1 (mixed)" and "Monster Growl (mixed)" ($p = 0.021$).

C. Relationship between Fear and Other Factors

The resulting experiment data enabled an analysis to be made to explore the relationship between fear and other factors which were gathered from the survey. This section presents the analysis of these relationships.

1) Fear and Enjoyment

Participants were asked to choose the scariest and most enjoyable game level after gameplay in the survey, resulting in two binary variables. A Chi-Square Test was performed on the data gathered from both of the questions to find out whether or not fear and enjoyment are dependent on each other. Results of the test provided a p-value of 0.03, which is less than the significance threshold of 0.05. Thus, fear and enjoyment levels in the game are found to be dependent on each other.

2) Fear and Game Difficulty

Questioning the playing difficulty of the two conditions in the survey allows for an analysis to be made on the relationship between fear and difficulty of the game conditions. Using Pearson's Correlation, it was found out that there were positive correlations between the fear level during the game, after the game and the difficulty level per condition. Specifically, the correlation values for the fear level during gameplay and difficulty of the normal condition was 0.47, while the value for the mixed condition was 0.50. Between the fear level after gameplay and difficulty of the normal condition, there was a strong positive correlation value of 0.52, while the value was increased to 0.57 for the mixed condition.

D. Group Comparisons

Additional analysis was made on the two experiment groups who played the game with the two conditions in a different order. The results of various comparisons made between these groups can be found in this section.

1) Comparison of Fear Level Ratings of Group A and B during Gameplay

In order to see if there was a difference in terms of fear levels between the two groups, an analysis was made on the

results that were gathered during gameplay. Table V presents the means and standard deviations of the fear level ratings from both groups.

TABLE V. MEANS AND STANDARD DEVIATIONS OF THE FEAR LEVEL RATINGS PER GROUP DURING GAMEPLAY

	Group A		**Group B**	
	Normal	***Mixed***	***Normal***	***Mixed***
N	15	15	15	15
Min.	1	1	1.5	1.2
Max.	5	5	5	4.8
Mean	3.37	3.29	3.27	3.07
SD	1.2	1.09	1.29	1.27

Results were tested for statistically significant difference between the fear level ratings of each group per condition. Paired t-Test was used to search for significant difference between the two conditions' fear level ratings on Group A. However, no significant difference was found ($p = 0.73$). The same was true for Group B, whose p-value was 0.39.

Another set of Paired t-Tests was conducted on the ratings of the normal condition from Group A and B. The obtained p-value was 0.66, meaning there was no statistically significant difference between the groups' fear levels during the gameplay of the normal condition. The same was also true for the ratings from the mixed condition with a p-value of 0.52.

A series of Pearson's Correlation tests were conducted to further analyze the data for group comparison. Results showed a very strong positive correlation ($r = 0.76$) between the two groups' fear levels in the normal condition. In the mixed condition, a moderate positive correlation was observed ($r = 0.36$).

2) Comparison of Fear Level Ratings of Group A and B after Gameplay

The results of the fear level ratings gathered from the two groups after they played the game were compared with each other. Table VI shows the means and standard deviations gathered from the two groups.

TABLE VI. MEANS AND STANDARD DEVIATIONS OF THE FEAR LEVEL RATINGS PER GROUP AFTER GAMEPLAY

	Group A		**Group B**	
	Normal	***Mixed***	***Normal***	***Mixed***
N	15	15	15	15
Min.	2	1	2	1
Max.	5	5	5	5
Mean	3.13	3.67	3.27	3.33
SD	0.99	1.05	1.03	1.54

Paired t-Test was conducted on the data from Group A, and results showed a significant difference between the two conditions in terms of fear for this group ($p = 0.04$). On the other hand, the results of the Paired t-Test on the data gathered from Group B did not provide a significant difference ($p = 0.80$).

As it was done for the data gathered during gameplay, another set of Paired t-Tests was also conducted on the fear level ratings of the normal condition from Group A and B gathered after gameplay. Results showed no significant difference ($p = 0.55$), which was also the case for the mixed condition ($p = 0.48$).

Pearson's Correlation tests showed a positive correlation between the two groups for the normal condition ($r = 0.66$). However, the correlation significantly dropped for the mixed condition ($r = 0.07$), showing no relationship between the two groups.

3) Comparison of Group A and B in terms of Fear and Enjoyment after Gameplay

Further analysis on the two groups was made in terms of fear and enjoyment levels of the participants after gameplay. The data used for this analysis was gathered from the questions which asked the participants to state which game condition they were afraid of and enjoyed the most. A series of Chi-Square Test were performed on the data, and results showed no significant difference between the two groups in terms of which condition they were afraid of the most ($p = 0.27$). However, a significant difference was found for the condition they enjoyed playing the most ($p = 0.03$). Figure 4 presents the results, which showed that more people from Group A enjoyed the mixed condition, and more people from Group B enjoyed the normal condition.

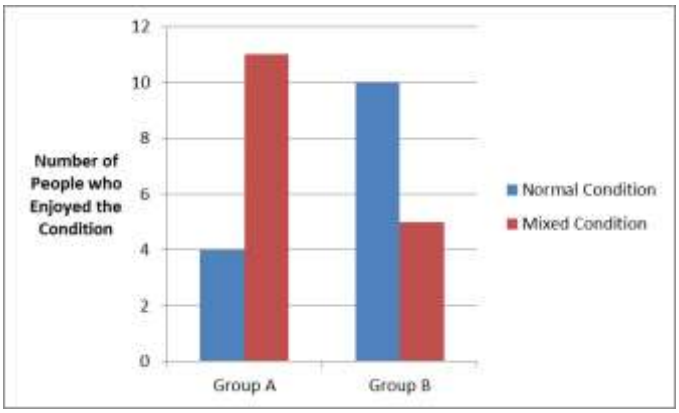

Fig. 4 Comparison of Group A and B in terms of which condition they enjoyed the most (n = 15 per bar).

E. Participant Comments

In the survey, participants were asked to give a reason why they thought one of the two conditions was the scariest. A

participant from Group A thought the mixed condition was the scariest because the monsters seemed to appear suddenly.

Two participants from Group A, who also thought the mixed condition was scarier, both mentioned that it was in the mixed condition that they saw the monster which scared them more than the normal condition.

A participant from Group B chose the mixed condition as the scariest one and stated that it was the confusion in the mixed condition that scared her the most.

Another reason for the mixed condition being the scariest one was given from a participant from Group A, who thought the monster was out all the time in that condition. Similarly, another participant from Group B stated that the reason for the mixed condition to scare her most was that "the monster kept appearing out of nowhere". Another similar reason was given from a participant from Group A, who thought the mixed condition was scarier because he "felt like the monster could be anywhere".

The mixed condition scared another participant from Group B the most because he said that he was not able to react to the encounters on time. This is another consequence of the audio cues not giving the right information about the state of the game.

On the other hand, a participant from Group A thought that the normal condition was the scariest because he knew the moments when he had to hide. Knowing that something scary was going to happen scared this participant more than the unreliable audio cues in the mixed condition.

A participant who was a frequent player of the original *Amnesia* stated that he was more scared in the mixed condition because the music not working properly surprised him more.

The order in which the game was played seemed to be the cause of the fear in some of the participants. One from Group A thought the normal condition was scarier and the other one from Group B thought the mixed condition was scarier. The reason given for it from both of them was that they were new to the experience. An interesting remark that the participant from Group A added was that in the mixed condition, the monster's behavior was the same. He did not feel the change in audio cues.

Finally, a participant from Group B perceived the change in audio cues as the game having jump-scares[5] in the mixed condition, which scared him the most.

V. Discussion

A. Effects of Audio Cues on Fear Level

1) Differences in the Fear Level

The results shown in the previous section revealed that mixing up the audio cues in the game did not significantly affect the fear levels of the participants. They did not increase nor decrease the levels of fear. However, when the results of the fear level ratings gathered after gameplay were analyzed per group, it was observed that when participants from Group A play the normal condition first, their fear levels significantly increase in the mixed condition. This can be caused by the unreliability of the audio cues; participants play a version of the game in which they learn how to interpret the audio cues, however, when this interpretation changes, they get surprised and scared more now that they cannot trust the audio cues. The reason for the fear levels of Group B not increasing significantly could be because starting the game with unreliable cues causes more confusion than horror. Therefore, it is possible that starting the game with reliable audio cues and slowly making them unreliable as the player advances can increase the player's fear level.

Additionally, Pearson's Correlation tests showed that the more a participant got scared in the first game level that they played, the more they got scared in the second game level. This was observed in the fear level ratings from both during and after gameplay, and regardless of the game version that was played. Therefore, it is possible that how much the second game level scares a participant depends on how much they get scared in the first level of the game, regardless of the game version.

The results also revealed that each participant reported very similar ratings of their fear levels during and after gameplay. Therefore, it was observed that in spite of having slight differences, the participants were able to recall how scared they were in the game after playing it.

2) Differences in the Fear Levels of Encounters

While there was no difference in the overall fear levels of the two conditions, results showed differences in terms of how much an individual encounter scared the participants depending on the condition. It was observed that the two scariest encounters for the participants were at the moment when the monster appears for the first time in both conditions. It seems natural that participants got more scared when they met the monster for the first time.

Even though the difference is statistically insignificant, the first encounter with the monster without warning (no audio cue) seemed scarier than the same encounter in the normal condition. This is understandable; without the audio cue, this encounter acted as a surprise that shocks and catches the player off-guard. If participants had heard the monster beforehand, they could have been more prepared for the encounter. However, not expecting an encounter scared the players more.

The fear levels of the second encounter with the monster in the two conditions were very similar to each other. Even though the encounter from the mixed condition seemed scarier, the difference was very little. Also, participants got less scared in these encounters, possibly because they had already seen the monster in the first encounter.

The difference in fear level was high between the first encounter with the monster in both of the conditions and the first time the "High-pitched noise" played without a real threat; the latter was much less scary than the other audio cues. This audio cue appears to have only confused the participants without scaring them. However, the difference in the fear levels of the first and the second time this audio cue is played points out to the importance of timing. It is possible that this difference was caused by the point of the game at which this

[5] Jump-scares are the types of scares that startles the player by happening very suddenly, causing them to "jump".

audio cue was played. The first time it was played in the game was in the beginning, while the second time was after the first encounter with the monster. It seems that the reason why the second time the audio cue is played scared the participants more is because they had gotten scared before and were already in a suspenseful mood. On the other hand, the first time the audio cue was played, they had just started the game in the second condition and all the audio cue did was confuse them. This could mean that the timing of unreliable audio cues is important; their effects in terms of causing fear can be increased if they are placed in the further areas of the game after encountering the monster first.

The audio cue of "Monster Growl" also caused less fear in the participants when it is not caused by a real threat. Compared to the first encounter with the monster in the mixed condition, it significantly scared the participants less. This suggests that a real threat without an audio cue can increase a participant's fear level more than an audio cue without a real threat can.

3) Participant Comments on the Effects of Audio Cues on Fear Levels

Some of the ways in which unreliable audio cues affected the participants and how they perceived this unreliability can be seen in the participant comments. Analyzing their comments shows that some of them were scared of the mixed condition because of this unreliability; they did not get a warning of the monster appearing hence they ran into it in the mixed condition while they had managed to avoid it in the normal condition. This caused them to see the monster and consequently get scared.

The unreliability of the audio cues scared other participants in a similar yet a slightly different way; it caused them to keep running into the monster. After learning how to read the audio cues' original meanings from *Amnesia*, participants knew that the "Calm music" played when it was safe. However, this meaning was switched in the mixed condition which caused the participant to get out of the hiding when he should not have.

Other participants perceived the unreliable audio cues as the sudden appearances of the monsters, which scared them more than the normal audio cues. This is understandable; the monster appearing without a warning can cause the player to get startled since it happens unexpectedly.

B. Fear, Enjoyment and Game Difficulty

As it was mentioned in Section 4, the results of the Chi-Square Test show a dependent relationship between fear and enjoyment. It was observed that the participants enjoyed the condition which scared them the most. It appears that people enjoy being scared when they play a horror game; this enjoyment increases as the horror increases in the game.

In terms of the comparisons between the enjoyment levels per group, it was observed that regardless of the condition, participants enjoyed the second condition that they played. This could be because the participants get more familiar with the game the more they play it. In order to confirm this possible effect, it can be studied further by having the participants play the same condition in both of the game levels.

A strong relationship was also observed between the fear levels and the difficulty of the game. Participants' ratings on the difficulty increased as their ratings for the fear level increased. This suggests that people struggle more in the game when they are scared.

C. Implications

Game developers and researchers can make use of the observations that were made in this research. First of all, it was shown that if a game starts with reliable audio cues which slowly become *unreliable* players' fear levels increase; this can be used to make survival horror games scarier. The results of the enjoyment test also show the possibility of players enjoying being scared; this can be further studied and if proven right, it can be used to make more successful games which increase players' levels of fear and enjoyment.

The analysis on individual encounters can also be helpful to improve the scares within a horror game. More encounters with a monster without reliable audio cues can be added to games in order to scare the players more.

If encounters without monsters are planned to be added without reliable audio cues to a game, it should be added to a part further into the game. This seems to prevent the audio cues' effect of only confusing the player and failing to scare them. In order to make this type of unreliable audio cue (without a real threat) scary, it should be added later in the game when the player is in a suspenseful mood.

Furthermore, the results suggested that the scariness of the later level of the game depends on how scary the first level was. This can be used to prevent players' levels of fear from decreasing later in a game; if they were scared enough in the first levels of a game, they seem to continue getting more and more scared.

D. Future Work

Future work that can be done in this field of research includes the further study of enjoyment levels of players. As mentioned before, the possible insight of players enjoying the second condition of the game the most can be studied more to prove it. Additionally, since the results suggested that players enjoyed the conditions which scared them the most, more methods to measure their levels of enjoyment can be used to study this possible effect.

Moreover, more encounters without a real threat can be added further in a game to test whether or not they are more effective at scaring the player when they are in a suspenseful state.

Other variables such as flow and immersion can be additionally measured in order to see if they affect the results of the experiment.

In terms of measuring fear, rating scales and questionnaires can be coupled with physiological measurements. Also, the experiments can be conducted using a longer game in a future research.

REFERENCES

[1] M. Grimshaw, C.A. Lindley and L. Nacke, "Sound and immersion in the first-person shooter: mixed measurement of

the player's sonic experience," in Proceedings of Audio Mostly Conference, 3rd Conference on Interaction with Sound. Sweden, 2008, pp. 1-7.

[2] K. Collins, Game sound: an introduction to the history, theory, and practice of video game music and sound design. MIT Press, 2008.

[3] I. Ekman and R. Kajastila, "Localization Cues Affect Emotional Judgments–Results from a User Study on Scary Sound," in Audio Engineering Society Conference: 35th International Conference: Audio for Games. Audio Engineering Society, 2009.

[4] B. Perron, "Sign of a threat: The effects of warning systems in survival horror games," in COSIGN 2004 Proceedings. 2004, pp. 132-141.

[5] T. Garner, M. Grimshaw and D. A. Nabi, "A preliminary experiment to assess the fear value of preselected sound parameters in a survival horror game," in Proceedings of the 5th Audio Mostly Conference: A Conference on Interaction with Sound. ACM, 2010.

[6] D. Kromand, "Sound and the diegesis in survival-horror games," in Proceedings of Audio Mostly 2008, 3rd Conference on Interaction with Sound. Sweden, 2008, pp. 16-19.

[7] P. Toprac and A. Abdel-Meguid, "Causing fear, suspense, and anxiety using sound design in computer games," in Game Sound Technology and Player Interaction: Concepts and Developments. 2010, pp. 176-191.

[8] G. Roux-Girard, "Listening to Fear: A Study of Sound in Horror," in Game Sound Technology and Player Interaction: Concepts and Developments. 2010, pp. 192-212.

[9] D. R. Bach, J. G. Neuhoff, W. Perrig and E. Seifritz, "Looming sounds as warning signals: The function of motion cues," in International Journal of Psychophysiology, 74(1), 2009, pp. 28-33.

[10] T. Lokki and M. Grohn, "Navigation with auditory cues in a virtual environment," in IEEE MultiMedia, 12(2), 2005, pp. 80-86.

[11] V. Vachiratamporn, R. Legaspi, K. Moriyama, K. I. Fukui and M. Numao, "An analysis of player affect transitions in survival horror games," in Journal on Multimodal User Interfaces, 2015, 9(1), pp. 43-54.

[12] T. A. Garner and M. Grimshaw, "Psychophysiological Assessment Of Fear Experience In Response To Sound During Computer Video Gameplay," in International Conference Interfaces and Human Computer Interaction. 2013, pp. 45-53.

[13] J. Windels, G. McAllister, A. Smith, G. White and P. Mirza-Babaei, "Scary game findings: A study of horror games and their players," 2012. Online Feature Article. http://www.gamasutra.com/view/feature/134848/

[14] D. Watson and L. A. Clark, "The PANAS-X: Manual for the positive and negative affect schedule-expanded form," 1999. University of Iowa.
http://www2.psychology.uiowa.edu/faculty/clark/panas-x.pdf

[15] J. T. Cacioppo, L. G. Tassinary and G. G. Bernston, The Handbook on Psychophysiology. Cambridge University Press, 2000.

[16] D. C. Moffat and K. Kiegler, "Investigating the effects of music on emotions in games," In Audio-Mostly, Piteå, Sweden, 2006.

[17] R. Stenstroem, A. Birke, J. Olesen, M. Schmidt, L. Hagen, D. Teglbjaerg, "Affective Measurements in a Horror Game," 2011. Student project report, Medialogy Programme, Aalborg University Copenhagen.

APPENDIX A

Document Structure:

I. Introduction
II. Related Work
    A. Game Sound and Emotions
    B. Games and Audio Cues
    C. Non-Games Audio Cues
    D. How to Measure Fear
    E. Key Findings
III. Methods
    A. The Game
    B. Audio Cues of *Amnesia*
    C. Experiment Level Design
    D. Data Collection
    E. Experiment Procedure
IV. Results
    A. Participant Characteristics
    B. Fear Level Ratings
        1) Fear Level Ratings during Gameplay
        2) Fear Level Ratings from Survey after Gameplay
        3) Comparison of Fear Level Ratings during and after Gameplay
        4) Fear Level Ratings of Individual Encounters in the Game
    C. Relationship between Fear and Other Factors
        1) Fear and Enjoyment
        2) Fear and Game Difficulty
    D. Group Comparisons
        1) Comparison of Fear Level Ratings of Group A and B during Gameplay
        2) Comparison of Fear Level Ratings of Group A and B after Gameplay
        3) Comparison of Group A and B in terms of Fear and Enjoyment after Gameplay
    E. Participant Comments
V. Discussion
    A. Effects of Audio Cues on Fear Level
        1) Differences in the Fear Level
        2) Differences in the Fear Levels of Encounters
        3) Participant Comments on the Effects of Audio Cues on Fear Levels
    B. Fear, Enjoyment and Game Difficulty
    C. Implications
    D. Future Work

APPENDIX B
Survey

Welcome!

Could you please fill in this survey about your gameplay in the experiment? Thanks a lot!

1. Please rank the scariness of the levels:

	Not scary								Very scary
Level 1:	1	-	2	-	3	-	4	-	5
Level 2:	1	-	2	-	3	-	4	-	5

2. Can you state the reason why which one of the levels felt scarier?

   Level ☐ felt scarier because _____

   _____

3. Please rank the difficulty of the levels:

	Easy								Very difficult
Level 1:	1	-	2	-	3	-	4	-	5
Level 2:	1	-	2	-	3	-	4	-	5

4. Which level did you enjoy playing the most?

   Level 1: ☐

   Level 2: ☐

5. Do you play video/computer games? Yes / No
6. If yes, how often do you play them?

Very little								Very often
1	-	2	-	3	-	4	-	5

7. Do you play horror games? Yes / No
8. If yes, do you enjoy playing horror games? Yes / No
9. If you play horror games, how often do you play them?

Very little								Very often
1	-	2	-	3	-	4	-	5

10. Have you ever played “Amnesia, The Dark Descent” before? Yes / No

11. If yes, did you like “Amnesia, The Dark Descent”? Yes / No
12. Do you have any comments?

If you do not want to share the following information about yourself, feel free to leave them blank.

13. Age:
14. Gender:
15. Nationality:

Thank you for your participation!

To be filled in by the supervisor:

Group: