Game or watch: The effect of interactivity on arousal and immersion in horror game media

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Bachelor’s Thesis in Game Design, 15 hp
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07, 2019
Abstract

The aim of the study was to determine if interactivity would affect how immersed and aroused the participants would become when exposed to horror media with different levels of interactivity. Two groups of participants were asked to either play or watch a virtual scenario. The participants had their heart rate measured using an activity bracelet and eyes tracked using a Tobii 4C eye tracker. The study found that as interactivity increased, so did arousal, whilst immersion did not. The results indicated that cutscenes may result in significantly lower levels of arousal, compared to interactive gameplay.

Keywords: Interactivity, Arousal, Games, Immersion, Horror, Psychophysiology

Abstrakt


Nyckelord: Interaktivitet, Upphetsning, Spel, Inlevelse, Skräck, Psykofysiologi
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1. Introduction
This study examined games within the horror genre by creating and examining a game experiment in a controlled environment. This study aimed to examine the differences in immersion and arousal within the horror genre pertaining to non-interactive and interactive mediums. We created one interactive playable scenario, which was referred to as scenario P. A group of participants played the interactive scenario P. The gameplay from the interactive scenario was recorded and shown to another group of participants, who did not play, but only watch the recordings of scenario P. The recordings of scenario P was referred to as scenario W. We collected eye tracking, pupil dilation, heart rate and subjective fear data during an experiment. This data was analysed comparatively, to see what effect interactivity had on arousal and immersion.

2. Theory/Background
Bernard Perron suggested that there are differences in immersion between interactive mediums, such as games, and non-interactive mediums, such as movies (Perron, 2009). He also claimed that horror games, by using cutscenes, pull the player out of their magic circle; in other words, decrease their immersion in the game. He argued that a cutscene, or any form of non-interactive media, implicitly tells the audience that there is only one outcome, and that it most often is not one where the player loses. Although Perron did not provide a clear definition of how he defined immersion, the statement that there are differences in immersion of games and movies suggested that we might get different results when comparing interactive and non-interactive scenarios.

Jennett et al. (2008) found in one of their studies of immersion that measuring immersion can be done through the method of eye tracking, where eye movement during game-play would increase as the subject was less immersed. The study also defined immersion as something that needs concentration, a sense of challenge, control over the game, emotional involvement and real world
dissociation.

In her Hands-On Horror, Tanya Krzywinska (2002) discussed Espen Aarseth’s term the “ergodic” which defines how non-trivial effort is required to allow the reader to traverse text. She then likened Espen’s definition of the ergodic to that of movies and films. Within the context of film and games, games could be seen as ergodic whereas films could be seen as non-ergodic (Krzywinska, 2002). In relation to the differences in interactivity between films and games, and playing or observing, this theory seemed applicable. What Krzywinska suggested about the term ergodic within games and movies could be applicable to what Perron claimed regarding to the difference in immersion within games and cinematics respectively (Perron, 2009). Krzywinska’s take on the term ergodic, suggesting that games are ergodic, requiring more effort to consume, whereas movies are not, also seemed to relate to how Jennett et. al defined immersion as something that increases with challenge. This relation suggested that interactive mediums, would be more immersive than non-interactive mediums.

Hofer et. al (2009) found in a study of the effect of avatar expressions on player fear interactions that players’ fear reactions will be reduced if they play with an avatar that uses expressions. They further found that avatar expressions lowered players’ character embodiment which positively predicted fear reactions. This result was only found in players playing rather than watching people playing, however, which suggested that there may be a difference in interactivity with regards to fear reactions.

Another study showed that when immersion increases, so does state anxiety, and negative- and positive affect. This suggests that measuring fear might indirectly also be measuring immersion (Jennett et al., 2008).

In a study on the relation between non-clinical anxiety and attentional bias for threat information, the following statement was made; “Our results indicated that, within this non-clinical sample, higher levels of state anxiety were associated with a greater attentional bias for threat stimuli.”
(Mogg et. al, 1997). This lead us to believe that our test subject’s individual anxiety levels might moderate the levels of arousal. We therefore decided to take the test subject’s levels of anxiety into consideration and treat it as a variable.

With the phenomenon of streamers’ popularity playing horror games, this study seeks to analyse the relation of playing and watching by looking at state arousal and immersion. Another motivation for why this research could be of use is to help developers with creating horror games by giving them some answers into how arousal could be affected when using in-game cutscenes or through gameplay. The study could also be of use to further the insight in differences between interactive and non-interactive mediums.

3. Research Question

Research Question: Does immersion and arousal differ between interactive and non-interactive mediums within the horror genre, and if so, how?

4. Hypothesis

The interactive scenario (scenario P) shows a larger increase in immersion and arousal compared to the non-interactive scenario (scenario W).

4.1 Null Hypothesis

The interactive scenario (scenario P) shows no larger increase in neither immersion nor arousal compared to the non-interactive scenario (scenario W).

5. Method
We collected eye tracking, pupil dilation, heart rate and subjective fear data during an experiment. This data was analysed comparatively, to see what effect interactivity had on arousal and immersion.

5.1 Participants
23 participants (males = 10, female = 11, nonbinary = 2; mean age = 23.88) were recruited from the Uppsala area. Participants were given a 100kr gift voucher for participating.

5.2 Materials and measures
5.2.1 Game scenario
The experiment was conducted through two different scenarios; one interactive scenario (P), ie. a game, and one non-interactive scenario (W), ie. a recording of the game. The scenario W film clips were constructed to be as identical to scenario P as possible, only removing player choice from the equation. Half of the participants played the playable scenario P, and half of the participants watched the recorded scenario W. The motivation for letting the watching participants watch recorded sessions of the playing participants was to give the observers the same outcomes as the players. Rather than just having one recording of gameplay for all the observers, this allows all of the outcomes of the player’s to be accounted within the observer group in an attempt to lower variability. The data from the sessions were logged in a text document with a timestamp of what occurred. Two events were made to be examined within the scenarios. One encounter with fish and a shark that would come rushing towards the player that will be named the shark encounter. The participant would be forewarned of the incoming shark by auditory cue in the form of strings playing, and by visual cue in the form of a school of fish running away from the shark. The other event involved the player picking up a transmitter which would prompt the antagonist to spawn and grab the player avatar from behind, taking control away from the player, and then launching the player avatar away. For more information on the game scenario, see the appendix.
5.2.2 Game scenario quality control

Before the experiment was conducted, a small scale quality control of the playable scenario was made. The aim of the quality control was to maintain that the game scenario was functional and fear-inducing enough. Peer game design students played the scenario and provided us with feedback. A version of the game was also uploaded to itch.io on the internet, where a handful of people gave us feedback in the form of text and gameplay videos.

5.2.3 Eye tracking

5.2.3.1 Mean fixation distance

For generating data on immersion, we measured eye movement using an eye tracker. We used a Tobii 4C Eye tracker with Tobii Pro Lab software for data collection. Jennett et. al. in a study on immersion using eye tracking found that a player of a game gets immersed, their eyes will move less. Therefore we tracked the mean fixations from the center of the screen for each group (Jennett et al. 2008).

5.2.3.2 Pupil dilation

Pupil dilation of the participants was analysed to measure their emotional arousal. According to Bradley et. al, test subjects showed further increased pupil dilation when exposed to emotionally positive and negative arousing images, compared to when exposed to emotionally neutral images (Bradley et. al, 2008)
We used a very similar method to that of Bradley et. al (Bradley et. al, 2008). To look at pupil dilation we created a forced encounter with negative emotion, which always occurred after the player picked up one of a few selected transmitters, to create a baseline. We then analysed the median change of pupil dilation following the initial light response. Whenever the player picked up one of these selected transmitters, which then would cause the antagonist to appear behind the player and grab them forcing them to face the antagonist, lift them up and then throw them in a straight line.

We then used the logged timestamps of specific events, such as encounters between the player and the antagonists and measured pupil dilation during those events.

### 5.2.4 Heart rate

A study on the relationship between arousal intensity and heart rate response to arousal found that “There was a strong correlation between arousal scale and ΔHR within each subject” (Azarbarzin, et. al, 2014). This lead us to believe that by calculating the Δ heart rate between this
study’s test subjects’ resting heart rates and their heart rates during the scenario, we could measure arousal. The participants of the study wore a heart monitor wrist watch that monitors their heart rate. Each participant would initially measure their resting heart rate for 3 minutes. The participants would then have their heart rate measured during the scenario. Heart rate was measured using an activity bracelet with a built in heart monitor. The activity bracelet was sold under the swedish name “Aktivitetsarmband med pulsklocka - vattentät - touchdisplay” by INF company AB. We failed to find the model name and manufacturer of the bracelet. Whilst a study using our heart rate monitor was not found, a validation study was found that compared the Fitbit Charge 2™ with Polysomnography (PSG) for detecting sleep/wake state and sleep stage composition in healthy adults. The study in question found that the fitbit overestimated light sleep and underestimated deep sleep but showed no bias in estimating REM and wake up after sleep onset (WASO) relative to PSG. The study did however find the tracking of sleep-cycles during their nighttime to be adequate (de Zambotti et. al, 2018).

Figure 2 (above) shows a photography of the heart rate monitor bracelet that was used in this study.
We synchronised the heart monitor with an android smartphone via bluetooth and used the application FlagFit 2.0 to remotely monitor the heart rate.

5.2.5 General anxiety
We wanted to measure the participants’ levels of general anxiety to see any eventual effect on the participants’ responses. We used the GAD-7 (Spitzer, Kroenke, Williams, & Löwe, 2006) screening tool to measure the test subjects’ general anxiety. The Gad-7 has a Cronbach’s alpha of $\alpha = 0.92$ (Spitzer, Kroenke, Williams, & Löwe, 2006). The questions ranged from values 1-5.

The participants were asked to rank how often they found themselves:

- Feeling nervous, anxious or on edge
- Not being able to stop or control worrying
- Worrying too much about different things
- Having trouble relaxing
- Being so restless that it is hard to sit still
- Becoming easily annoyed or irritable
- Feeling afraid, as if something awful might happen

The numbers answered to these seven questions were then added together to form a score. The Gad-7 questions were included in a questionnaire that the test subjects answered before playing or observing the scenario. The questionnaire was often answered in under one minute.

5.2.6 Gaming experience
In the scenario quality control we noticed that the amount of previous gaming experience affected how people behaved, playing the playable scenario. We suspected that this could potentially affect the experience of the participants. Hence, we wanted to measure the participant’s subjective gaming experience. We added a question to the pre-scenario questionnaire that lead: “On a scale from 1-5, how experienced with computer games do you consider yourself?” The test subjects would rate their subjective gaming experience from 1-5, with 1 being “not experienced at all” and 5 being “very experienced”.
5.2.7 Horror familiarity
Furthermore, in the scenario quality control we also noticed that the amount of horror familiarity affected how people behaved, playing or watching the scenario. We suspected that this could potentially affect the experience of the participants. Hence, we decided to measure the participant’s subjective familiarity with horror media. We added a question to the pre-scenario questionnaire that lead: “On a scale from 1-5, how familiar with horror media do you consider yourself?”. The test subjects would rate their subjective horror familiarity from 1-5, with 1 being “not familiar at all” and 5 being “very familiar”.

5.2.8 Subjective fear
To give us further data, we decided to measure the participants’ subjective fear, which is an emotion associated with arousal. We added a question to the post-scenario questionnaire that lead: “On a scale from 1-5, how scared would you say that you were during the scenario?”. The test subjects would rate their subjective fear during the scenario from 1-5, with 1 being “not scared at all” and 5 being “very scared”.

5.2.9 Room setup
Participants sat roughly 60 cm in front of a 52’ tv. The room was unlit with blackout curtains. The participants were wearing a pair of headphones with directional sound. The researchers sat by a table in the room, but did not interfere during the scenario.
5.3 Procedure

Participants entered the room. They then signed a consent form. To measure their general anxiety levels, they were then asked to answer the GAD-7 questionnaire. Once done with the GAD-7, they were asked to sit down, so that we could calibrate the heart monitor bracelet and have their resting heart rate measured. We would then have the participant calibrate the Tobii eye tracking equipment. We would then explain the nature of the scenario. If the participant was going to play scenario P, we would then inform them of the game controls. We would then start measuring arousal and immersion by recording eye tracking data, measuring heart rate and let them either play scenario P or watch scenario W. Participants playing scenario P would play it until they won, or until they had died repeatedly. Participants watching scenario W would watch the entire recording. Once the participant was finished with the scenario, we would stop measuring their arousal and immersion. We would then let them answer the post-scenario questionnaire, to measure subjective fear, subjective gaming experience and subjective horror familiarity. They
would then sign a confirmation, and receive a gift voucher, worth 100 SEK at Akademibokhandeln.

6. Results

Figure 4 (above) shows the variability amongst the participants’ levels of anxiety.
Figure 5 (above) shows the variability amongst the participants’ subjective gaming experiences.

Figure 6 (above) shows the variability amongst the participants’ subjective fear during the scenario.
Figure 7 (above) shows the variability amongst the participants’ subjective horror familiarity.

Figure 8 (above) shows the mean pupil dilation of the scenario P participants and the mean pupil dilation of the scenario W participants during the shark encounter and the forced antagonist encounter.
Figure 9 (above) shows the mean average heart rate of the scenario P participants and the mean average heart rate of the scenario W participants during the scenario.

Figure 10 (above) shows the mean Δ heart rate of the scenario P participants and the mean Δ heart rate of the scenario W participants.
Figure 11 (above) shows the mean fixations of the scenario P participants and the mean fixations of the scenario W participants during the scenario.
<table>
<thead>
<tr>
<th>Group Statistics</th>
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<tbody>
<tr>
<td>condition</td>
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<tr>
<td>Pupil_Shark</td>
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<tr>
<td>W</td>
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<tr>
<td>Pupil_Antagonist</td>
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<tr>
<td>W</td>
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<tr>
<td>Scenario_Heart_Rate</td>
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<td>Fixation_distance</td>
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Table 1 (above) shows the sample size, means and standard deviations of:

- The change in pupil dilation during:
  - the shark encounter.
  - the forced antagonist encounter.
- the participants average heart rate during the scenario.
- the Δ between the participant’s average resting heart rate and their average heart rate during the scenario.
- the participants mean fixation distance from centre during the scenario.

One participant’s data were excluded from the final data set due to experimenter error, and 3 participants’ heart rate data were excluded due to technical difficulties.

There was a significant difference between playing and watching during the shark encounter \((p<0.001)\), with more pupil dilation for participants in the playing condition. There was no significant difference between playing and watching during the forced antagonist encounter \((p>0.5)\).

There was no significant difference between playing and watching with regards to change in heart rate \((p=0.075)\). However the p value was trending towards significant, with a greater change in the group playing.

The increase in fixation distance from centre in the scenario P participants was significantly greater, compared to the scenario W participants \((p=0.009)\).
Across all participants regardless of condition, a negative correlation was found between game experience and how scared they were during the scenario \( (r = -0.55, p = 0.010) \).

For the scenario P participants, no correlation was found within any of the conditions.

For scenario W participants, a significant negative correlation was found between game experience and change in heart rate \( (r = -0.93, p = 0.006) \).

Figure 12 (above) shows the mean in pupil dilation change during the shark encounter. The red graph shows the mean pupil dilation change for participants who played scenario P, whilst the yellow graph shows the mean pupil dilation change for participants who watched scenario W. A positive y-axis corresponds to pupil dilation, a negative value corresponds to pupil constriction.
Figure 13 (above) shows the mean in pupil dilation change during the antagonist forced encounter. The red graph shows the mean pupil dilation change of the participants who played scenario P. The yellow graph shows the mean pupil dilation change of the participants who watched scenario W. A positive y-axis corresponds to pupil dilation, a negative value corresponds to pupil constriction.

7. Analysis

7.1 Data analysis.

7.1.1 Pupil Dilation

Tobii pro lab was used in order to place event markers to be used for analyzing the pupil dilation of the participants during certain events within the scenarios. These events were as follows:

- Shark encounter
- Antagonist forced encounter

The files were then exported into Time Studio version 3.03 within Matlab version 7.12 and analyzed (Nyström et al., 2016). Joshua Juvrud assisted with analyzing the eye tracking data.
The pupil dilation mean of the scenario P participants was then compared to the pupil dilation mean of the scenario W participants. A Pearson r analysis was used to correlate all the variables.

7.1.2 Mean fixation distance
The mean fixation distance was analyzed by comparing the average screen distance from center of screen of all participants watching the scenario and all participants playing the scenario from start to finish of the game scenario.

7.1.3 Heart rate
The participant’s average resting heart rate was subtracted from their average scenario heart rate, resulting in a Δ heart rate. The mean Δ heart rate of the scenario P participants was then compared to the mean Δ heart rate of the scenario W participants.

7.2 Statistical significance
All the data was analyzed using an Independent sample T-test to determine if the means of two sets were different from one another by determining the statistical significance.

7.3 Errors
When gathering psychophysiological data during the experiment, there were some errors. Noticeable errors were:

- Participant B1 had no sound on while watching scenario W, resulting in a different experience.
- The heart monitor turned off while measuring participant B2, resulting in incomplete heart rate data.
- Participant B3’s heart rate decreased from ~130 bpm to ~62 bpm in a very short time, indicating possible heart monitor malfunction.
- The heart monitor turned off while measuring participant B6, resulting in incomplete heart rate data.

The contaminated data was removed from the samples.
8. Conclusions

The results indicate that as interactivity increases so does arousal. The mean in pupil dilation change of the shark encounter strongly suggests that playing in an interactive environment causes higher arousal. The antagonist encounter revealed no significant change between players and watchers.

There was a high variability of the participants’ levels of general anxiety, subjective gaming experience, and subjective horror familiarity. There was a lesser variability of the participants’ subjective fear, with a large number of participant rating their subjective fear 2 out of 5.

Across all participants regardless of condition, there was a negative correlation between subjective gaming experience and subjective fear during the scenario. This suggested that the more experienced they were with games, the less scared they reported being during the scenario. The Scenario W participants had a negative correlation between gaming experience and change in heart rate. This suggested that the more experienced with games they were, the less change of heart rate they had, between resting heart rate and scenario heart rate. All other correlations were non-significant.

9. Discussion

The mean in pupil dilation increase of the shark scenario for P participants compared to the antagonist forced encounter indicate that interactivity increases arousal. As soon as the antagonist forced encounter starts, the scenario P participants interactivity is removed, where as in the shark encounter interactivity remains. The two bumps in the data for the shark encounter also reveals a higher state arousal when the fish approaches, indicating that they get primed before the shark comes.

The fact that the pupil dilation data was not correlating with the change of heart rate could be due to the difference between their time window size. The heart rate was measured during the
entirety of the session but the pupil dilation time window size for each scenario was between 10 and 15 seconds.

A scenario W participant pointed out, once he was done with the experiment, that he as a spectator did not experience the movement restriction that the scenario P participants might have felt as players, when the antagonist grabs the player avatar and prevents them from moving and turning the camera. This could greatly have affected the relation between how scenario P participants experienced the forced encounter, and how the scenario W participants experienced the forced encounter.

By measuring heart rate and eye tracking in order to determine emotional responses, we gathered what is referred to as psychophysiological data. In an article on Gamasutra, Ben Lewis-Evans discussed the benefits of psychophysiological data. He suggested that by gathering psychophysiological data, one has the benefit of detecting emotions or reactions in players that they themselves may not be aware are present (Lewis-Evans, 2011). This related to our motivations for the usage of psychophysiological data, since we measured both arousal and immersion, which could each provide difficult to subjectively define. Lewis-Evans also claimed that psychophysiological measures have an advantage compared to subjective measures, in the sense that psychophysiological data can be gathered continuously, without interrupting, for example, a game session (Lewis-Evans, 2011). This benefit was also one of the reasons behind our decision to gather psychophysiological data, considering that interruptions of our experiment would very likely have affected the participants’ immersion.
As the scenario P participants had a higher mean fixation from centre of the screen than the scenario W participants, meaning they moved their eyes further from the center of the screen more often, our hypothesis on interactivity’s effect on immersion was disproven. Although the hypothesis was disproved, it could be due to our definition of immersion being improperly defined. It is possible that immersion may actually require less movement, perhaps due to increased concentration.

10. Limitations
The heart rate monitor bracelet did not save full logs of the heart rate. Instead it saved the minimum, average and maximum heart value. Hence, we could not look at change in heart rate during certain events.

We were not able to find the manufacturer of the heart rate monitor used, nor the model name of the activity bracelet. We can therefore not determine the accuracy of the heart rate monitor.

With the time being the restricting factor, this study ended up with a rather small sample size. A larger sample size with more participants could have further emphasized the results and potentially provided more statistical power.

11. Future Directions
To get a better foundation and potentially a larger level of significance, a follow-up study could be done with a larger sample size.

A further study could look at how the two scenarios would differ if each watching participant could see the reactions of a player’s face during their playthrough. The phenomenon of streamers’ playing games for others to watch is a fairly common practice on sites such as Twitch or youtube, and a common practice for these streamers is to have a camera filming them as they play to show their reactions. We suspect that the act of being able to empathize with the player as they play would produce a different result.
References


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Creative Assembly, Feral Interactive. 2014. *Alien Isolation*


Monolith Production. 2004. *F.E.A.R.*
Appendix

Scenario: https://drive.google.com/open?id=17FpV0FFDJJm0rbLN5_TvK6i_ursolq1

Scenario Design

The game scenario was played through a first person perspective. Tanya suggests that playing in the first person perspective allows build-up of tension and uneasiness due to the extra proximity to danger (Krywinzka, 2002). We will therefore use this perspective to try to create a more immersive and frightening scenario. In the game Bioshock, most of the narrative is told through semiotics and gameplay. We tried to refrain from using any cut-scenes, which Bioshock uses very scarcely (Bioshock, 2007). With the exception of a player movement restricting enemy attack, the experiment did not make use of any cut-scenes. The reasoning for this is to avoid contaminating the experiment since we want to measure interactivity versus non-interactivity. The interactivity we will measure mainly came through the form of movement. Games like Outlast and Amnesia situates the player in a situation where they are unable to defend themselves (Outlast, 2013, Amnesia, 2010). We believe that this will add fear to the player since it forces them to enter into flight mode rather than fight mode. Another reason for not allowing combat is that we did not think it would contribute to the experiment.

While discussing forewarning, Perron disregards the aspects of HUD elements or audio cues relating to player resources such as health or ammo, which can be interpreted as warning, and instead discusses the effects of being alerted to the presence of monsters that are off-screen (Perron, 2004). We defined forewarning in a similar fashion. Forewarning is our ability to sense the presence of nearby threats within the world we inhabit, such as how the radar in Alien Isolation warns the player of the presence of the Alien (Alien Isolation, 2014). Bernard Perron refers to the works of Alfred Hitchcock and Stanley Kubrick and suggests that by letting the audience, or player, fill in the blanks in a narrative using their imagination, their mental picture will most likely be more terrifying than what any designer or author could have created (Perron, 2009, p. 17).
Perron in one of his papers mentioned that forewarning systems are effective at amplifying emotions of fear, and when uncertain of the outcome, anxiety in the player (Perron, 2004). He further explains how various games use forewarning, both visually and through audio, to act as a forewarning for the player. Our intention was to do this in our scenario in a similar fashion to that of Silent Hill’s radio that emits white noise when the player is near danger which as Perron talks about warns the player about being in close proximity to a threat (Perron, 2004), (Silent Hill 2, 2001). We decided to mainly make use of audiotive forewarning, as visual forewarning, in the form of flickering lights or similar visuals, could potentially contaminate the pupil dilation data as the variation in screen brightness could cause the pupils to dilate.

As for designing the visual style of the game, our aim was to create a somewhat realistic setting. We believed that an environment very similar to our reality would create an increased feeling of unease whenever something would be distorted and unfamiliar, compared to in a very stylised environment. The games Bioshock, and Dead space both isolated the player in a secluded environment which created a sense of loneliness and dread, common to the horror genre (Bioshock, 2007, Dead Space, 2008). Our prototype tried to recreate a similar atmosphere. The player will be situated under water in a sunken ship with little contact to the outside world. Perron talks about how anticipatory fear is heightened when it is hard to see your surroundings, like the mist in the Silent Hill series (Perron, 2004. Silent Hill 2, 2001). Since our surrounding is
under water, the murkiness of the water was used to add to this fear.

Figure 14 (above) shows a picture of a murky corridor within the scenario.

Figure 15 (above) shows a picture of the bow saloon within the scenario.
The objective of the scenarios was to collect all of the lost transmitters, left behind in the shipwreck. The player was supposed to collect all of said transmitters, while simultaneously avoiding an antagonist NPC (non-player character), a cleaver-wielding zombie, which was patrolling around with the aim of killing any unwanted guests of the shipwreck. The core mechanics of the scenarios is similar to that of the game Outlast, where the protagonist has to either run away from, or avoid detection from the antagonist (Outlast, 2013). The win state of the scenario was to collect all of the transmitters. The lose state was to be caught and killed by the antagonist NPC or to drown due to playing for too long.

Figure 16 (above) shows the antagonist within the scenario.

The antagonist NPC made a constant gurgling noise. The sound was three-dimensional, which resulted in that it increased in volume in relation to the distance between the antagonist NPC and the player. gurgling sound was meant to provide the player with a forewarning of the closeness of the antagonist, but also to provide the player with vague information to be processed.
Arguably, the soundscape has a great effect on how a player perceives a horror game. An analysis of three acclaimed successful horror games by Daniel Kromand, published in a 2008 conference paper, provides some insights on effective horror soundscape design. The games in question are Bioshock, F.E.A.R. and Silent Hill 2. Kromand discusses how game sounds can be diegetic, i.e. supposed to exist within the story world, such as engine noises coming from a car in the game, and be non-diegetic, i.e. supposed to exist out of the story world, such as background music. The three games had several similarities, such as unmelodic ambience with little occurrence of music. The ambience of the games is described as highly metallic and an often frequent deep bass with oscillating pitch. Whereas the ambient sounds are often non-diegetic, Kromand argues that the atonity affects the perception of them in the sense that the unmelodic ambience seems less non-diegetic (Kromand, 2008, Bioshock, 2007, F.E.A.R., 2005, Silent Hill 2, 2001). We aimed to reproduce some of these soundscape aesthetics for our experiment. More specifically, we intend to have the metal ship construction creak and crack. We also wanted to convey the pressure of the ocean through the use of ambient low frequencies. Most of the sounds in our scenario were seemingly diegetic. The antagonist was constantly emitting a gurgling noise, hinting its position to the player. The gurgling was coming from the character itself, hence making it diegetic. The scenario however did have non-diegetic sounds, string instruments playing during encounters with the antagonist.

Kromand points out that both F.E.A.R. and Silent Hill 2 makes use of a white noise radio feature. The player has a radio which at several occasions starts to emit white noise. The white noise often serves as a forewarning of eventual close enemies and/or upcoming significant events. The white noise is however not a reliable tool in either of the games, since it toggles on and off at times where it should not. (Kromand, 2008, F.E.A.R., 2005, Silent Hill 2, 2001) We made use of a similar mechanic in our scenarios, in which the test subjects did receive forewarning of the antagonist NPC’s presence by hearing the gurgling sound the antagonist makes.

When designing the scenario level layout we aimed to design multiple turns and doorways, with the intent to have the player constantly worrying about what hides behind the next corner. We
also aimed to have long corridors where the antagonist, whenever noticing the player, would chase them down the hallways. We also created a sort of centre hub in the level, from which the antagonist could go in the players direction through one of the many doorways.

Figure 17 (left) shows the first draft of the ship’s floor plan. Figure 18 (right) shows a wireframe of the final version of the ship.

The number of cabins (the small rooms in the 4 blocks) differed from the initial plan, as we noticed that it was a hard task to search them all. The stern of the ship also deviated from the initial blueprint, with the addition of a pair of stairs leading down to a corridor a floor below. The corridor below was added so that the player would only have one direction to move in. Because there was only one direction in which the player could move in, a forced encounter implementation, where a shark quickly swam towards the player, was possible.
In an attempt to build up anticipation and immersion, the antagonist was not initially existing in the game as it started. Instead, the antagonist would spawn behind the player, whenever the player picked up one of a selected few transmitters. This was also a way to solve an issue noticed in the scenario quality testing, where the antagonist very often sought out the player immediately, killing them. When the antagonist spawned behind the player, the player would be forced to look at the antagonist. The antagonist would pick the player up and then throw them in a straight line. The feature of the antagonist throwing the player away allowed us to spawn the antagonist behind the unsuspecting player, maintaining that every test subject would be exposed to the antagonist, yet without instantly killing the player and thus ending the play session. By being thrown away from the antagonist, the player gained a head start, so that they would have a chance at temporarily escaping the antagonist and continuing their play session.

To control the length of the play sessions, we added an oxygen meter to the scenario. Being underwater, the player would drown and die whenever the limited supply of oxygen ran out. We also believed that this could have provided a stressor to the player, knowing that they had a limited amount of time to succeed at their mission. The game Dead Space made use of a similar mechanic. Whenever the player entered areas without oxygen, a meter would start to decrease, and the player would die as the meter reached zero (Dead Space, 2008). We decided to provide the player with an air supply that would last 15 minutes, as we believed that would be enough time to gather the desired data. During the quality testing of the scenario, we noticed that players with less gaming experience played the game at a slower pace than people with more gaming experience. To let test subjects with less experience of gaming get a hold of the controls, we made the oxygen meter start decreasing whenever the player reached a certain part of the game, more specifically, whenever the player climbed the stairs leading up to the upper floor.

Artificial intelligence

The antagonist AI runs by using a Behavior Tree within the Unreal Engine. The Antagonists’ behavior can generally be divided into two basic behaviors, he is either seeking the player or
chasing the player. The seeking involves 3 cones of vision. The cones’s forward are located at the base of the antagonist head, and moves outwards in the direction of where the head is looking. The first cone has a 180 degree angle that expands from the tip of the head outwards in the heads’ looking direction and has the largest length of outwards expansion. The second cone has a 240 degree angle with a smaller distance. The third “cone” is a circle with a very small radius. The player coming into proximity to these cones will cause the antagonist to chase the player. This chase sequence will continue until the antagonist can no longer see him within his cones, or there is an obstacle in the way of the cone that prevents the antagonist from seeing the player. This will cause the antagonist to first walk towards the last known location of the player, and upon reaching that destination walking towards the player’s new location once more. If the player is in close proximity to the antagonist, the antagonist will attack the player.
Figure 19 (above) shows a representation of the characters field of view.

Whenever the antagonist is not chasing the player, he searches for him by walking around set paths that are created within the ship. Upon arriving at each node of the path, there is a chance that the antagonist will pick the nearest node to the player of the current path it is following. There is also a chance for the antagonist to switch between paths. The ai will always prefer to chase the player over seeking the player, meaning that he will abort any seeking behavior if the
player enters the antagonist’s cones. There is also a chance that the antagonist will stop when in its’ search mode in order to look around its’ environment.