Summary

In the film industry productions aiming to scare and intimidate the audience is considered a low risk high reward genre namely the genre horror. This is due to the value generated from it usually is higher than the resources invested into it, as well as the process of creation being described as a fun experience. This gives reason to think that it is a genre in which we would see attempts to be innovative and challenge the more generic approach e.g. by introducing robots to take on the intimidating or scary role. Robots has been absent from the horror genre both in movies as well as in games. During my thesis i explored whether it is safe to deem the robot out of the competition for the spotlight in horror productions, more specifically my research studied which of the two character; human or robot. Would inflict more intimidation when faced in an unsettling environment.

The first part of the thesis was focused on designing a research platform that allowed for an immersive and intimidating experience. Thus the platform was aimed to be run on the Microsoft HoloLens 2 which allows for immersive experiences interacting with high quality holograms. The Platform was developed using the Unity engine and reused assets from the horror game *Root of Guilt* as well as assets available from the unity store. Furthermore to support an immersive experience the experience was chosen to be site specific. This turned out to be quite challenging as the holograms would have to be aligned with the real world. Initially the research platform would use Microsoft Azure Spatial Anchors in order to ensure alignment consistency of holograms between sessions. This approach however was omitted as the position in which the anchors was saved seemed to be relative to the position from which the application was started. This lead to a custom solution that allowed to manually but accurately move the experience both using HoloLens 2 gestures for hologram manipulations as well as a panel for fine adjustments. Furthermore the research platform supported multiple unexplored configuration.

In the second part of the thesis experiments were conducted in which a total of 6 participants took part. During the experiments participants would wear the Empatica E4 wristband, this allowed to capture relevant psychological measure of which the Electrodermal activity (EDA) levels for participants would be compared. However the results gathered from the EDA did not provide reliable results, this was later found out to be related to the EDA data provided by the E4 needing additional processing. While this measure was inconclusive according to the participants, 5/6 agreed that the more intimidating character was the human. furthermore the participants evaluated the experience positively and in general wanted more content.

Augmented reality “Root of Guilt”: Responses to Human vs. Robotic NPCs.

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ABSTRACT

While the horror genre has been around for a long time it has mainly been focusing on characters with some sort of human resemblance. Specifically robots have had a very limited appearances in this genre. This paper investigates which of two models; a human and a robot, will inflict the most intimidation according to participants' own evaluations as well as biomarkers. The study presents a research platform which enables a site specific horror-like escape room experience in augmented reality developed for the HoloLens 2. The experience takes baseline in the horror game Root of Guilt of which some assets are reused. The experience is designed to be immersive and interactive in an unsettling environment in which the participants are exposed to the two characters. The results presented show that further data processing is necessary in order to gather viable results from the psychological measures. However according to participants' the human was deemed as the more intimidating of the two. Furthermore the escape room is evaluate as an intimidating yet enjoyable experience and the participants shows interest in more content.

Keywords: Augmented Reality, AR, AI, Escape Room, Horror, Games, Human Computer Interaction.

1 INTRODUCTION

The horror genre is one of the most famous genres both in the movie as well as the game-industry. Looking at the genre itself it dates all the way back to the ancient Greece and Rome[1]. More specifically in the film industry the movie titled *The House of the Devil* is commonly referred to as being the first horror film with its appearance in the late 1800's according to IMDB[1] 1896[2]. With respect to horror video games, we have to skip roughly 100 years ahead in time in 1982 to be exact, the first Survival Horror game *Haunted House* was released on the Atari 2600[2][3].

Not only is the horror genre drawing the consumer's attention but film makers also refer to the genre as favorable in terms of enjoyment in the process of creation but also in terms of budget and revenue where the genre is considered a low risk high reward respectively[4, 5]. In the game industry the currently most played horror game on steam[3] as of to day, 2022, on is *Dead By Daylight*[4] with a total of approximately 40.000 active players[6]. In *Dead By Daylight* you are trying to escape from one of 28 killers. Each of the killers take the shape of a human-like figure in some form.[7, 8].

The horror genre in general seems to be widely dominated by human-lookalikes, creatures, demons, ghosts, etc. *One could suggest that the common denominator for the scary characters, besides from their unpleasant looks, is their resemblance of human life in some way or another e.g. a respiratory system.* Very few movies/games have been working with the robot or machine taking the role as the scare factor. A quick google search will mainly direct towards *Terminator*, *the Sentinels* (from The Matrix) and *Robo-Cop*[9]. These movies, however, are not categorised as horror films, the closest I could come to find a good example of a recent horror production in which the robots/machines take on the scare-role is an episode of the sci-fi-series *Black Mirror* namely *Metalhead*. While the episode itself is not categorised as a horror production according to *IMDB*, many reviews suggest that it belongs in the horror genre.[10]

[1]Internet Move Database

[2]A home video game console developed and produced by Atari, Inc. Released in September 1977

[3]A digital software distribution platform, developed and published by Valve Corporation. Steam is widely known for its video game distribution

[4]Dead by Daylight is a multiplayer (4vs1) horror game where one player takes on the role of the savage Killer, and the other four players play as Survivors, trying to escape the Killer and avoid being caught and killed.

Jacob Stolworthy[5] even argues that the episode takes the spot as the scariest episode in the series[11].

This paper will try to uncover the truth as to whether or not it is safe to deem the robots out among candidates when choosing the character to take on the intimidating/scary role. Specifically I have created the following problem formulation:

- *Which character model will inflict the most intimidation when encountered in horror setting. The human or The robot?*

In order to answer the above mentioned problem formulation i have created a cite specific AR escape room experience for the *Microsoft HoloLens2* in which the participants will be given a task to complete while having encounters with an AI character. The model of the character will be switched between human and robot each run. Furthermore participants will be equipped with the Empatica 4 wrist band to capture relevant psychological measure and be asked to complete questionnaires, both before and after the experiment. The Experience takes baseline in the horror game *Root Of Guilt*. And was developed using the Unity engine and MRTK Toolkit.

The paper is structured in the following order. An introduction has been given to the research area. Upcoming sections will go through some of the existing research that can be relevant for this study. Next up a description of the creation of the research platform will be given followed by the approach taken in order to gather data and an analysis of it. The paper will be finalised with results, a general discussion addressing limitations and future work and at last a conclusion.

1.1 Contribution

The contribution of this paper is three fold.

- A research platform that supports various unexplored configuration options.
- Insight in what seems as an unexplored research area.
- Empirical data on responses to different character models as well as feedback on an interactive augmented reality escape room experience.

2 RELATED WORK

In the study *Playing With Fear: A Field Study in Recreational Horror* they try to find a relation between levels of enjoyment and fear. The research was gathering data from visitors attending the danish haunted house attraction *Dystopia Haunted House*. Participants would be in groups of 3-6 people. The study used heart rate monitoring equipment and two questionnaires one prior to the experience (demographics and expectations) and one immediately after using the 10-point Likert scale to gather information about participants level of enjoyment and fear.

One of the conclusions was that the self-reported fear was positively linear related to the the average heart-rate as well as large-scale heart fluctuations[12].

Other research has looked into different responses to characters in computer games being human or computer controlled and found increased engagement when the character would be presumed human[13, 14].

With respect to the human perception of autonomous systems such as AI, a study in UK found that in general people tend to associate AI with negativity rather than excitement when connecting AI to future scenarios and 25% understood the meaning of AI as robots.[15]

Existing research regarding responses to characters and robot-like models have had a focus on the uncanny valley and identification of its presence. In general the approach that has been used is exposure to slightly different or gradually changing models/pictures e.g on levels of realism. Participant evaluations would be a scale representations of e.g. eeriness and familiarity levels[16, 17, 18, 19].

Tinwell et al.(2010)[19] investigates the responses to virtual characters using video clips including characters from horror games. The study looked into facial attributes of characters as well as auditory aspects. Participants would describe their perception of the characters in terms of strangeness and human-likeness levels.

[5] A Culture Reporter for The Independent. He regularly writes features, reviews and profile interviews across film, TV and music.

3 RESEARCH PROBLEM

While several studies have looked into responses to character models it seems the main focus has been related to identification of uncanny valley related patterns.

It does not seem that within research regarding responses to characters that there has been a direct comparison between the human & robot character models, nor has there been research looking at responses to character behaviors measuring levels of intimidation in an unsettling interactive virtual environment.

The research from the previous section measuring *Playing With Fear*[12] has inspired the research approach of this study as this study will use similar methods to gather data from participants.

4 METHOD

In order to study the participant responses to human and robot enemies in augmented reality, I developed an AR escape room experience and measured the participant physiological measures and gathered additional information from questionnaires from players.

4.1 Creating The Virtual Environment

Microsoft HoloLens 2 is equipped with cameras and sensors allowing it to be spatial aware and enables the headset to create a mesh dynamically which simulates the real world surroundings. This allows for immersive experiences with holograms as their physics behaviours can interact with the ”real world”. This spatial mesh can be accessed and downloaded through the Windows Device Portal as illustrated in the figure 1 below.

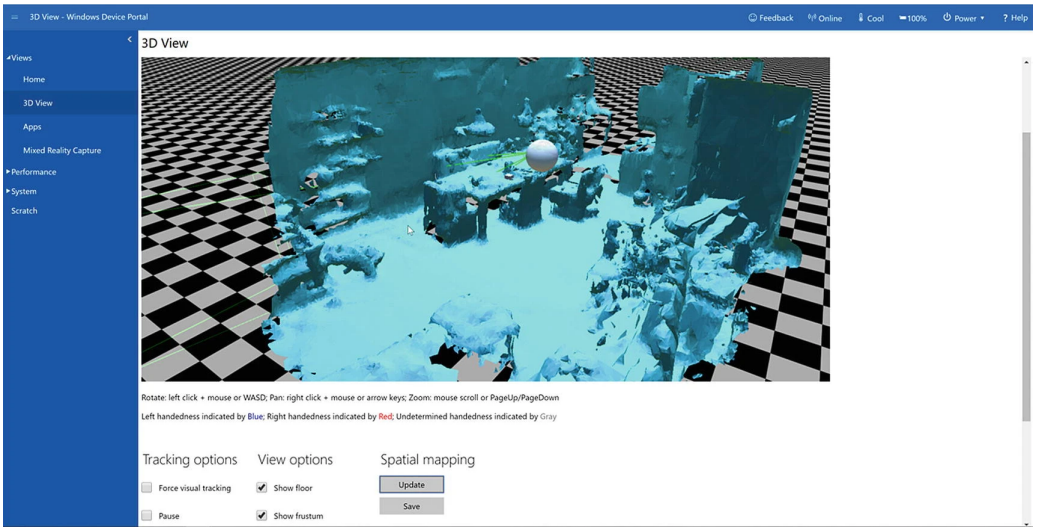
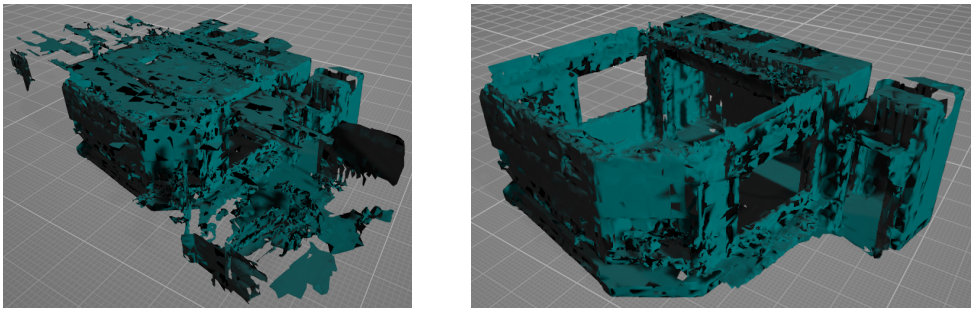


Figure 1. Screenshot of the windows device portal - *3D viewer* with spatial mesh[20].

By wearing the HoloLens2 in the cite specific location while updating the mesh I was able to create a custom mesh which was used for the development of the experience as the mesh depicts the room in which the experience will take place in, in a 1:1 scale relation. The custom mesh is shown in figure 2

As seen in figure 2 (a), the initial spatial mesh had a lot of excess and or unnecessary mesh. This was due to the two large observation windows' refection, which is also a known common issue with the spatial mapping struggling with translucent surfaces, hence why some mesh was floating[21]. Unneeded or extra mesh was removed using Blender resulting in the mesh shown in (b).



(a) Image of the spatial mesh downloaded from 3D view.

(b) Image of the spatial mesh after clean-up.

Figure 2. Two images of the mesh before and after clean-up.

4.2 Development

The application was build using the Unity engine and appropriate MRTK packages. Specifically the MRTK build window allowed to effortlessly build the application, which then later could be installed directly to the HoloLens using the device portal and the Holographic Remoting enabled frequent and immediate testing on the Hololens through Unity play mode. Furthermore the Unity engine also supports emulation of the Hololens directly in the editor. This allowed evaluation of the application without requiring the use of the Hololens.

4.3 Technical Design

The Mesh from figure 2 (b) was modified within the Unity editor and populated with appropriate assets from the previous project *Root Of Guilt* and some from the Unity Asset Store. All the assets and relevant GameObjects were then made a child to a single GameObject, the *GameContainer* as shown in figure 3. The *GameContainer* was then made a prefab containing the whole experience which would be reinstantiated each playthrough.

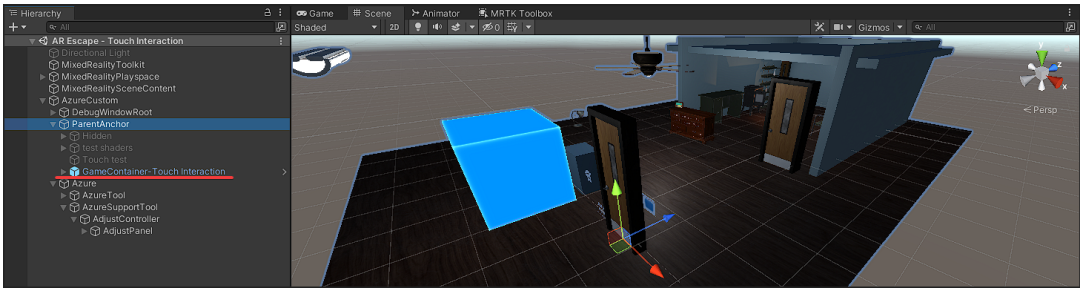
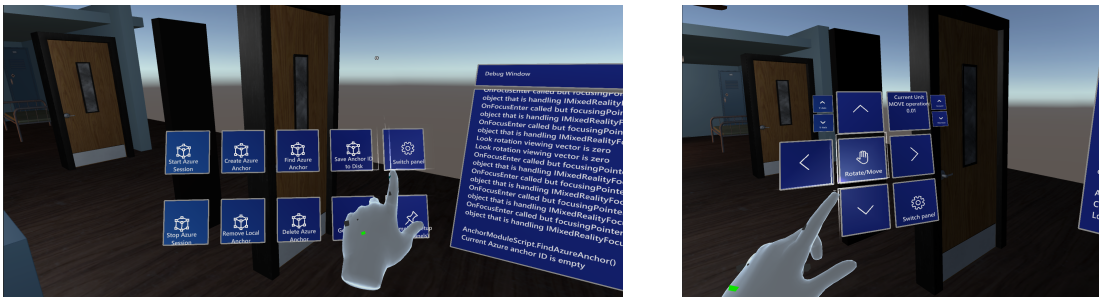


Figure 3. Screenshot of the hierarchy & scene in the unity editor showing the *GameContainer* childed to the ParentAnchor highlighted with the red line and the origin of the *ParentAnchor*.

The experience would then be anchored to the real world within the running application both manually moving it but also using a custom designed tool *AdjustPanel* allowing precise and subtle changes to the position and rotation this will be further described in subsection 4.4.

4.4 Alignment with Real World

A wide variety of attempts has been made with respect to insure consistency of holograms at specific anchor points between application sessions, such as Fiducial Markers like Vuforia or Spatial Anchors Microsoft Azure. Initially I chose to setup my Unity project with the Microsoft Azure. The integration of the Azure was handled by editing the panel, which comes along with the Azure project assets[22] by adding a button giving access to the custom *AdjustPanel* that allowed to reconfigure the position of the *GameContainer* indirectly by moving its parent *ParentAnchor*. This can be viewed of figure 4. In order to ease the alignment process to the real world, the origin of the *ParentAnchor* was made the entrance-door illustrated in figure 3. Once the experience is anchored satisfactory the user will simply complete the setup phase by pressing a button in the *Modified Azure Panel*.



(a) Modified Microsoft Azure Panel view.

(b) Custom Adjust Panel

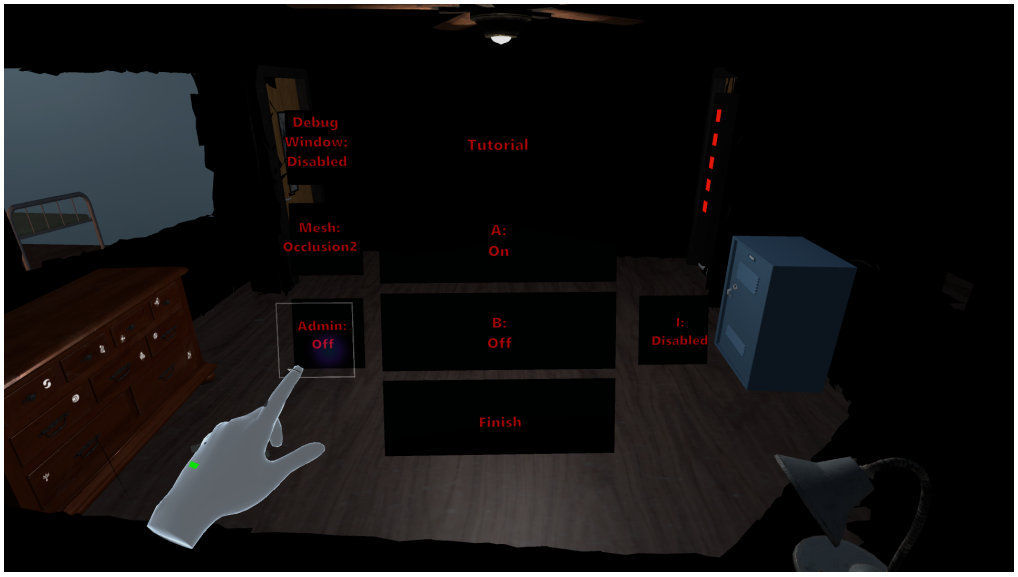
Figure 4. Screenshots from the Unity Game-view emulating the HoloLens.

4.5 Research Platform

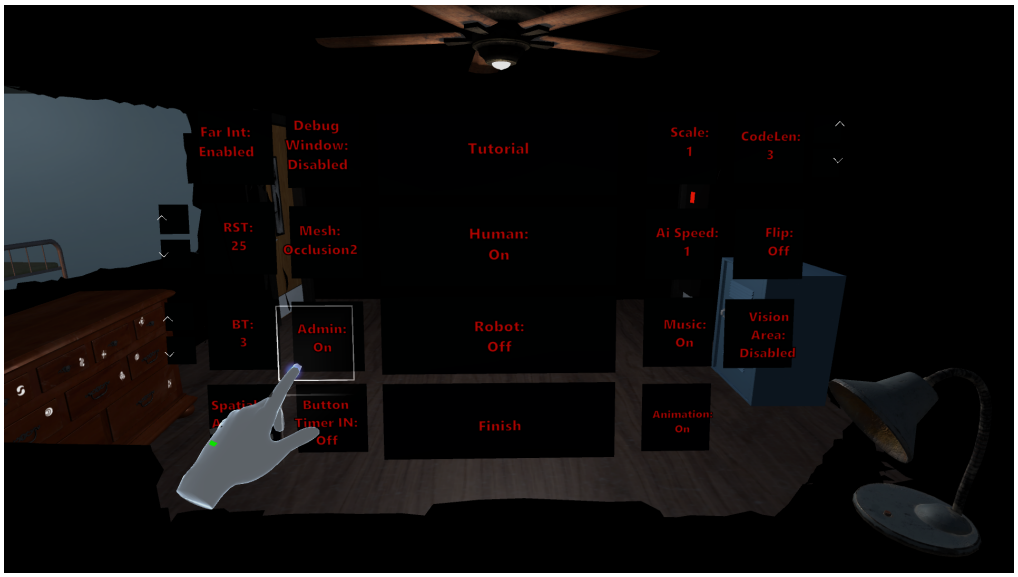
One of the main contributions of this work is that a research platform has been created, which enabled running many configurations varying aspects of the experience including enemy choice, speed of character, etc. These can be viewed on the right side of the *menu panel* in figure 5 (b).

In initial pilot studies, various configuration options were explored for the experience, but these were omitted as it was chosen to only change the model of the AI since the surprising factor seemed to diminish each playthrough.

This platform can be used in the future for other purposes, however now the used configurations of the present study shown in figure 5 (a) will be explained.



(a) Menu: final version (admin off)



(b) Menu: initial version (admin on)

Figure 5. Images of the final and initial version of the menu.

4.6 Escape room task

As explained in the introduction section the experience is very much inspired by the game *Root Of Guilt*.

some sentences here explaining design rationale -

Ensure users explore and traverse the entire physical space - in order to support this, we removed the ray cursor functionality and forced all interactions to take place by touch thereby requiring the players to move around the room and touch/manipulate the virtual objects -3/4 view with the numbered steps in the room

Immersive experience - complex tasks that require focus and problem solving

Emotionally unsettling - designed the environment to be dark, eerie sounds, flickering lights, typical cues to heighten the sense of fear

The goal is essentially the same that you take the role as a kid who is trying to retrieve his teddy without being noticed by the AI roaming around in this case in the room next to the one that you are exploring.

In figure 6 an illustration of the task flow and environment is depicted.

1 Pickup key.

2 Open door and collect light bulb from drawer. The AI emerges in the adjacent room (purple area).

3 Fixing the lamp by attaching the bulb to it.

4 Turn on the lamp to reveal the solution to the drawer puzzle and solve the drawer puzzle to get the locker key.

5 Unlock the locker and grab the teddy.

6 Try to exit the room with the teddy (the door is locked), alarm goes off, AI is alerted and buttons will appear on the wall.

7 Player Tries to activate all buttons on the wall.

8 All buttons are activated, door is unlocked and player exits before the AI comes in.

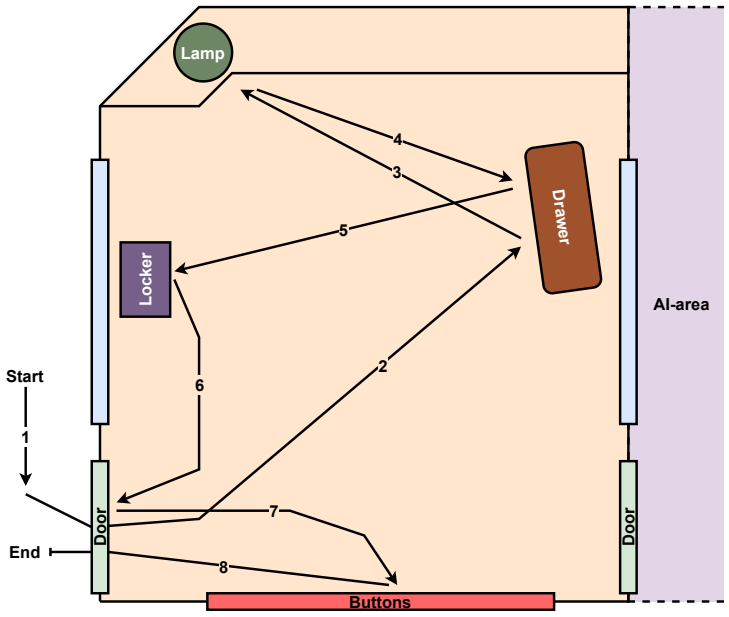


Figure 6. Plan view of the experimental setup with arrows indicating the required movement of the participant to complete each sub task.

4.7 Experimental Setup

The experiments was conducted in a Usability Lab at Aalborg University, Cassiopeia - House of Computer Science. The escape room experience was installed as a standalone application onto the HoloLens2. Particpants also wore the Empatica E4 wristband to gather physiological data. Figure 7 shows an image of a particpant doing the tutorial wearing the HoloLens2.

Figure 7. Picture of particpant taken in the usability lab.

4.8 Questionnaires

The participants completed two questionnaires one prior to the experience and one after plus some additional commentary on the experience.

4.8.1 Pre-questionnaire

The questionnaire prior to the test would gather information about participants demographics: gender, age, and additional relevant information such as participants level of experience with both AR, VR and Escape-Rooms.

4.8.2 Post-questionnaire

The questionnaire post to the test would ask participants which of the two models they found more intimidating and what character model was their first encounter. Additionally participants were asked 3 questions:

q1. *What made the chosen character more intimidating to you?*
q2. *What is your general opinion about the experience?*
q3. *Do you have any ideas for improvement or extras?*

4.9 Experimental Procedure

The participants' was given a short brief about the procedure before signing the consent form, after which they were asked to complete the pre-questionnaire. After running the HoloLens Eye-calibration the particpant would be guided through a tutorial familiarising them with the HoloLens2 and the gesture mechanic which was limited to the touch interaction only for simplicity reasons also.

During the tutorial the players would be guided by a script to ensure consistency between the players experiences. The tutorial would differ as it did not include any of the character models but a dummy as a placeholder to the AI making the player aware of their own visibility to anything in the AI-area. Furthermore unsettling auditory cues would be disabled from the tutorial.

After the participant had completed the tutorial they would be equipped with the Empatica E4 wristband and run a playthrough with either robot or human character model. Once the Empatica finished calibrating a secondary timer would be started and the player would be allowed to begin. The secondary timer would be used to mark relevant events for later data analysis, this will be further described in section *Psychological Measures* 5.4.2.

Once the participant had completed their first run they would have a short break to neutralize their emotional levels to enforce better test results. Then they would repeat the same procedure with another character model.

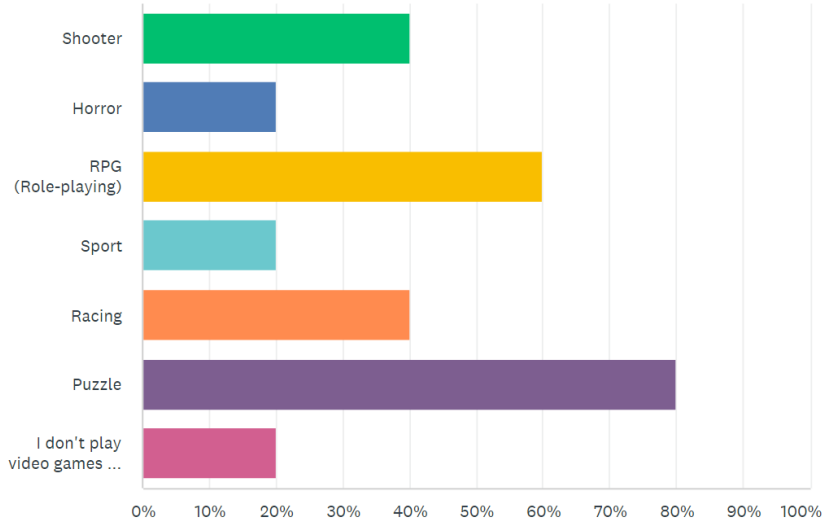
After the second run, participants would be asked to complete the post-questionnaire and the extra commentary on the experience. A single participant test sample would take approximately 45 min.

5 RESULTS

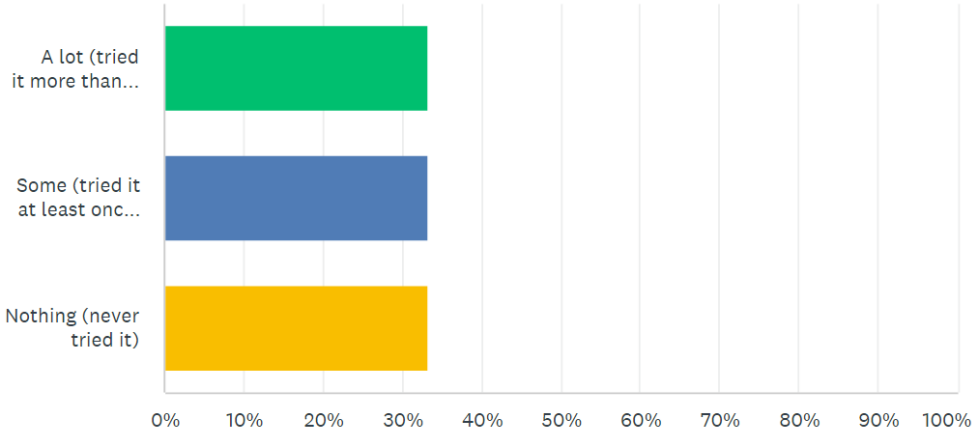
This section provides insight in the participants questionnaire results both with respect to their answers prior to the experience as well as the answers given after. The participants answers will be compared to the data gathered using the E4 wristband. Furthermore participants described their reasoning for their choices which will presented as well. The completion time of the experience will also be presented.

5.1 Participants

In total 6 people (1 female) took part in the experiment between the ages of 24 to 62 years *(M = 31, SD = 13)*. None of the participants owned an AR or VR-supporting headset, and in general the participants had less experience with AR than VR. With respect to preferred video game genres the participants favoured the puzzle genre of the given selections as can be viewed of figure 8 (a).



(a) Diagram showing participants choices when selecting preferred video game genres (max 3 selections each).



(b) Diagram showing participants Escape-Room experience

Figure 8. Diagrams of participants answers to the Pre-questionnaire.

Participants had an even distribution of Escape-Room experience ranging between three levels figure 8 (b).

5.2 Completion Time

The experience was deemed completed if the participants either did a successful-escape (**not** caught by AI) or failed-escape (caught by AI). In total 12 playthroughs were completed, of which 10 of the runs were successful escapes.

Average completion time across all participants was *(M = 202seconds, SD = 78)*. All participants had an improved completion time comparing first and second playthrough. The average of the first playthrough was 245 seconds. Participants improved by an averages of 162 seconds for the second playthrough with average time to complete *M = 81s, SD = 73s*.

5.3 Stress Measures

Electrodermal activity (EDA) is a Biomarker to measure psychological stress. It has been used to capture stress levels in multiple studies[23, 24, 25] and is used in stress measuring devices[26]. As mentioned in the section 2 average heart rate has been used to evaluate peoples responses to scary experiences. Stress affects the heart rate indirectly though the hormone Adrenalin which temporarily increases the heart rate[27]. Hence these measures are considered stress indicators.

5.4 Evaluation of responses

The evaluation of participants' responses to the Human and Robot character will be completed in 2 steps. First by revealing each participant's choices and reasoning behind them from the *Post-questionnaire*. Secondly comparing those results to the data collected using the E4 analysing to decide whether there is a relation between the two. And finally with respect to the general evaluation of the experience show the answers to *q2 and q3* from section 4.8.2.

5.4.1 Post-Questionnaire

The *Post-questionnaire* forced participants to choose which of the two characters they found more intimidating, of which the results showed that only one participant (p4) chose the Robot, the rest picked Human. Additionally participants were asked to elaborate on their choice with the following question:

- *What made the chosen character more intimidating to you*

Of which the below comments from participants was collected:

p1: "The human was personally the most intimidating due to me feeling like an intruder. It was somewhat due to it being the first character together with the unknowingness of what would happen if I was caught. The human seemed very upset that I was in that room. The fact that it was a robot and knowing that it had a lack of common human attributes, made it feel like it was less of a 'crime' of some sort."

p2: "The human was the most intimidating, since i found it more relatable. However at the first try, i got more scared, since it was the first time. Thus the second time, I got more used to the system."

p3: "The human was more intimidating because he was more animated. He moved his arms and legs as he walked around the room, so it feels like he would be more intimidating if he came in to my room. Moreover, his face made it clear when he looked at you. He was more alive. The robot's face was less prominent than the rest of its body."

p4: "The voice from the robot had an effect on how much I stressed. The robot was harder to ignore at the end of the game than the man."

p5: "I found the man more intimidating as he was very human-like which I think made him more creepy than the robot."

p6: "He was fat and bald and looked quite scary."

Participants choosing the human as the more intimidating reasoned their choice based on the human being more relatable and realistic. Those who had the first encounter being the human also argue how the first encountered character might affect their choice. This can be deduced from participant 1 and 2's comments.

The person who chose the robot describes their choice being based of the robotic voice stressing them and was more difficult to ignore in the end of the experience compared to the human. (p4)

As mentioned by participant 3 it would seem that the human was perceived to have more attributes making it stand out and adding more character which leads to the general observation of the participants, that the character's level of intimidation is highly associated with how relatable/human-like it is perceived (p1, p2, p3 and p5).

Below an overview of participants' choices can be viewed of figure 9.

	p1	p2	p3	p4	p5	p6
Choice	Human	Human	Human	Robot	Human	Human

Figure 9. A table of the participants showing which character they chose as the more intimidating.

5.4.2 Psychological Measures

In order to evaluate the experience I will present the results using the E4 and use the bio markers to create possible connections between the psychological measures and participants answers.

To support data analysis I created 4 relevant event time stamps of each playthrough for later data analysis, these are shown in figure 10.

	1	2	3	4
Order	Start (key pick-up)	Ai emerge	Ai chases	Player exit
H	00:00:36.482	00:01:11.849	00:03:20.139	00:04:59.322
R	00:00:12.962	00:00:31.455	00:01:56.170	00:03:09.827

Figure 10. A table showing the events timestamps for p4 human and robot (H and R). Notice that the event numbers do not directly respond to the task numbers mentioned previously in figure 6, the event numbers would then have been (1, 2, 6 and 8)

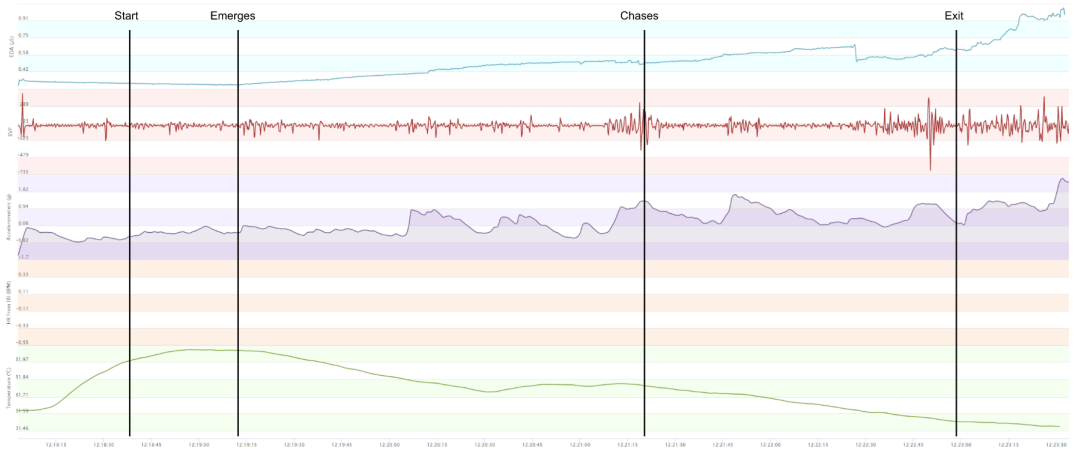


Figure 11. Graph from p4-Robot with events timestamps shown by vertical lines.

In figure 11 the data gathered from participant 4's playthrough of the robot encounter is shown. Furthermore the vertical lines respond to the event shown of figure 10. In the figure the following data is displayed from bottom to top *(Temp, HR, Accelerometers, BVP and EDA)*[6] respectively. The graph shows a slight increase in EDA levels once the AI emerges, this may indicate that p4's stress levels slowly increase as they sees the robot for the first time. However after the event showing that the AI now tries to get p4 the EDA still continues to rise with same rate. Notice that *event 3 (chasing)* showed increased activity levels,

[6]Temperature(°C), HR from IBI (BPM), Accelerometers (g) BVP EDA (µS)

this was not surprising as the task required participants to actively press multiple buttons. The heightened activity is derived from the increased accelerometers levels[28], this can also be considered a factor that indirectly would increase the EDA levels[29].

Now considering participant 4's second playthrough (human) we see the following of figure 12:

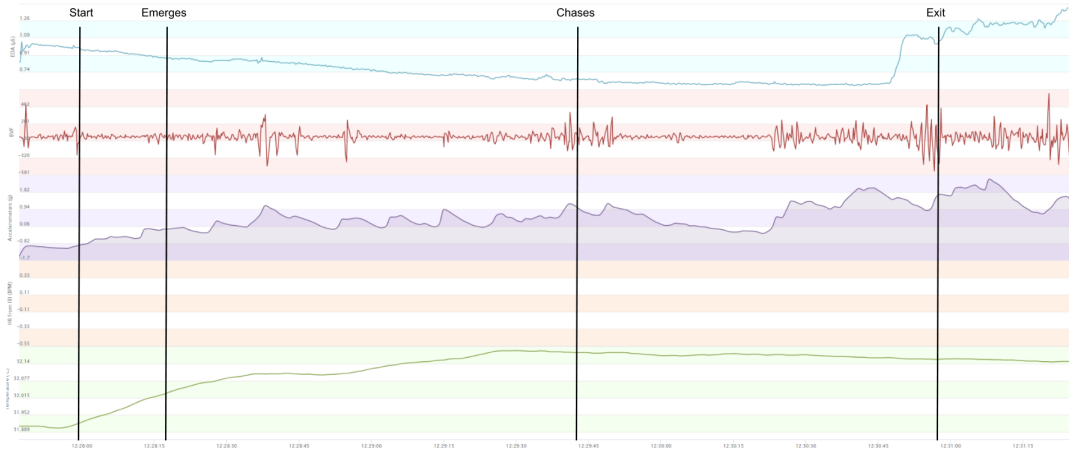


Figure 12. Graph from p4-Human with events timestamps shown by vertical lines.

The EDA levels start by slowly decreasing and continue to do so all the way past chasing. Only just before p4 exits the room the EDA levels seem to rise. Thus the data does not show a response to the human character, this did however match with the participant's results as they deemed the robot the more intimidating character. While this is true, it is difficult to neglect that the human would not have the slightest impact on the player.

Now presenting participant p5 responses to the human character figure 13

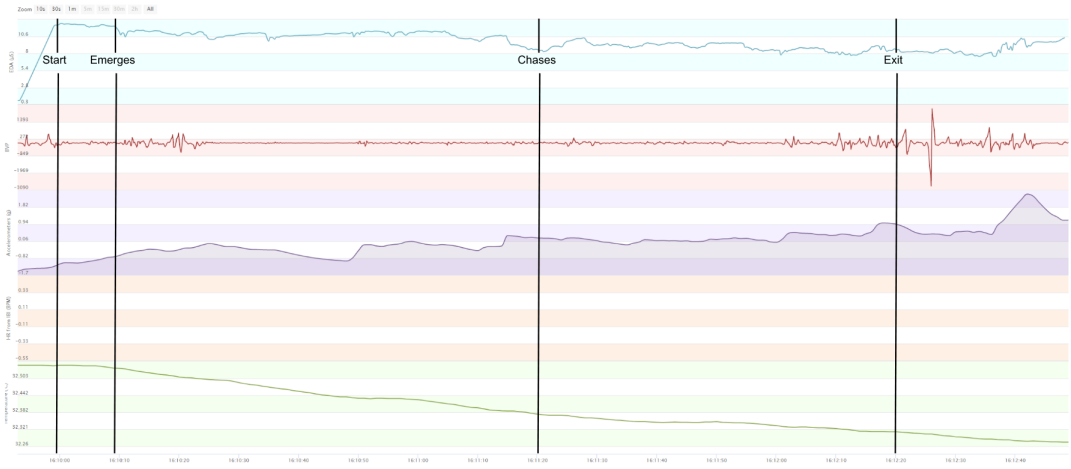


Figure 13. Graph from p4-Human with events timestamps shown by vertical lines.

From the figure above it can be deduced that the responses to the human character was not visible looking at the EDA levels and this was generally the picture which formed looking directly at the EDA levels presented on the graphs for all of the participants. Therefore the evaluation of the more intimidating character based on this measure proved to be inconclusive. This will be elaborated on later in the *Discussion* section 6.

5.4.3 Experience Evaluation

Participants were also asked about their general opinion about the experience, to which there was an agreement between their enjoyment, and overall they evaluated it as a fun and exciting experience. Here are some of the participants' comments:

p1: ***"I love escape rooms so this was a huge hit for me. It felt like an intimidating experience, also pressing the lamp power button was very satisfying."***

p2: ***"Very funny, challenging and engaging"***

p3: ***"It was especially stressful accessing the drawers without being noticed and pressing the red buttons, It worked surprisingly well, when I compare to my previous experiences. I can easily see the idea behind it, and really I just wish that it was longer. I really wanted to try a longer version with more puzzles."***

p4: ***"Funny and exciting, comprehensible yet challenging"***

p5: ***"The music and design supported a creepy atmosphere and it was stressing pressing the buttons to avoid being captured"***

p6: ***"Very fun experience, the music made me feel more stressed"***

The participants mentioned how the interaction felt very satisfying and they would want to do similar experiences in the future with more things to explore and puzzles to solve (p1 and p3). In general participants would mainly mention additional ideas and extra content to enhance the experience.

6 DISCUSSION

This section will address challenges and research proposals based on the findings of this study.

6.1 Possible Limitations

In this study the EDA was found to be very difficult to measure and compare as the findings of the study suggest that psychological effects carry over between sessions and will not simply neutralize over a short break.

EDA neutral levels also seems to vary between participants making comparing the raw values possibly impossible.

Other studies have proven that EDA is in fact a viable tool when it comes to measuring psychological stress levels, however this requires further data processing carried out by implementing the data in specific additional software.[30, 31]

As previously mentioned in section 5.2 participants' average completion time improved as their time spent on solving the sub-task decreased from experience. This gave less data points for the second experience and overall made the comparison less accurate. To compensate for this the experience could have been designed with the goal being to maintain same length each playthrough. Nevertheless this study focused on creating an engaging experience which would ensure a more immersive playthrough.

Furthermore evaluating across participants' single experiences might have been better as this would eliminate the effect of a pre-exposure to one character or the other. This was however accommodated by switching the starting character between each participant.

The human had moving legs, while the robot had a solid body. However they both followed the same path and the robot had same voice lines as the human, the only difference being a robotic voice filter applied to the voice of the robot

6.2 Future work

It would be interesting to see studies that look into possible ways to neutralize psychological measures efficiently e.g by giving participants simple tasks in-between experiments. This could potentially aid studies like this to provide more accurate results.

As mentioned in the section above, the evaluation of this project was comparative and this had some limitations, however the choice of evaluation method was based on the limited amount of participants.

A study could conduct similar research and conclude which character is more intimidating based on scores, e.g a likert scale rather than choosing one over the other and have more participants take part in the experiments.

Similar research could also be conducted in which the participants' experiences would be recorded from their perspective. The evaluation of such a study could then compare the data in relation to the recordings of the participants' playthroughs.

7 CONCLUSION

The study presented has introduced an interactive way of investigating responses to different types of characters. A research platform has been developed for a sight specific AR experience that allows for multiple unexplored configurations.

The results provided show that all participants learned to navigate in an AR experience and that a single experience was enough for them to improve their interaction efficiency with holograms using HoloLens2 gestures, meaning that the adaptation of the interaction control was very intuitive.

This study has evaluated the human against the robot character looking explicitly at what participants found to be the more intimidating of the two. Furthermore the unprocessed EDA data was deemed as unreliable, which supports the findings from other studies suggesting that the EDA data provided by the Empatica E4 wristband need additional processing in order to provide viable results.

Acknowledgement

Once again I would like to thank DADIU and the rest of the development team of *Solar Studios* for making this possible. Also a public thank you to all the people who took their time both participating in the experiments conducted as well as giving constructive feedback. And finally a special thank you to my supervisor Timothy Robert Merritt (Aalborg University) for his supervision during the project as well as insight in testing and setup procedures within the research field of Human-Computer Interaction who has been a tremendous help to me.

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