Project Corvus: A Virtual Reality Horror Tool for Improving Self-Efficacy

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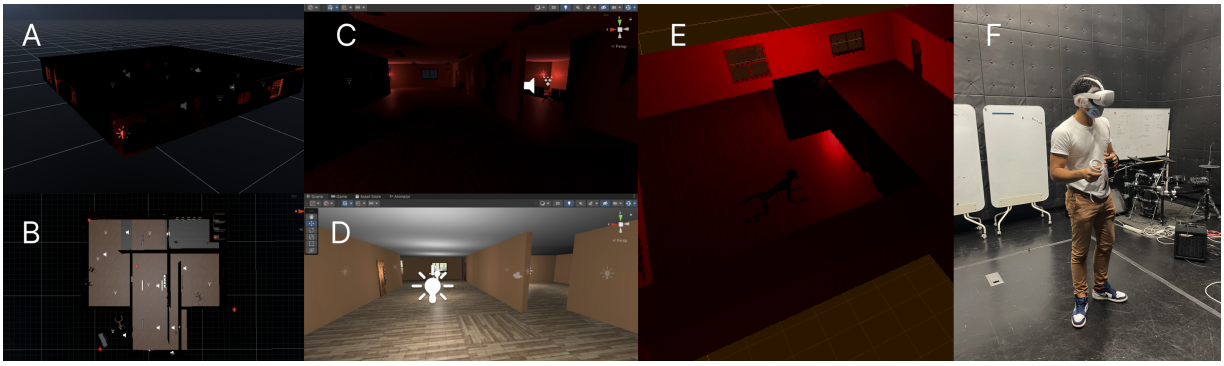

Figure 1: A,B: The 3D model and blueprint of the Corvus; C,D:Sample screenshots of the experience; E:Scary figure in the experience; F:Participant in session

Abstract

Horror is often associated with a negative connotation. Yet, in today's popular culture, the benefits of thrills have become an engaging topic. Why are people drawn to the supposedly repulsive contents of horror? It is an inherent psychological trait we all possess called morbid curiosity. Can we better investigate this behavior towards horror to confront our fears and help us build confidence? In Project Corvus, we explore the ways in which virtual reality (VR) and psychological programs such as exposure therapy can be combined to inform the psycho-educational opportunities in this horror-themed direction. More specifically, to leverage people's morbid curiosity towards horror for the development of self-efficacy. Through short repetition of horror virtual experiences, the goal is to design an assistive program that can help the participants develop their skills in controlling their emotions even when facing real crises in the future.

Index Terms: Human-centered computing—Visualization—Visualization techniques—Treemaps; Human-centered computing—Visualization—Visualization design and evaluation methods

1 Introduction

Throughout our history, horror is often associated with a negative connotation. But in today's popular culture, the beneficial qualities of fright and thrills have become such an engaging topic. Interestingly, people's engagement with darker materials is not merely a result of scare-seeking curiosity but as a way to regulate stress and anxiety. Self-efficacy is another important term in this study. The role of self-efficacy has been studied by various researchers in the aspects of academic performance, physical activities, and more general – daily tasks. There are various ways of aiding individuals to develop self-efficacy, including exposure therapy.

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However, exposure therapy practices are still at the clinical and organizational level, and most immersive horror experiences are still aimed at user engagement than psychological treatments. There is yet a commercial-level program that focuses on how horror can be leveraged to promote self-efficacy.

This work presents Project Corvus, an assistive virtual reality tool to help people build self-efficacy. With this prototype, we explore the possibilities of leveraging designed horror experiences to help people develop self-efficacy. Through a designed program of short horror experiences in VR, the use will achieve small goals in the horror environment that will potentially help the user to build confidence. The concept is evaluated by comparing the participants in the non-horror-induced environment and the Corvus environment with the same tasks. Then the results are presented and compared for differences and effects. The contributions of this work are threefold: 1) We propose Project Corvus, a horror-themed assistive program to help users develop self-efficacy and better control of their emotions, 2) we ran an initial study to evaluate our system in terms of the self-reported self-efficacy and physiological response, and 3) we found that there was an indication that self-efficacy can be improved.

2 Related Works

2.1 Morbid Curiosity

Morbid curiosity is defined as the general interest in unpleasant and negative things, typically related to death, violence or harm [20, 27]. One social phenomenon that can be associated with morbid curiosity [16] is the booming popularity of horror entertainment. People enjoy the experience of simulation. According to Recreational Fear Lab[1], when exposed to threat in a safe situation [1], people can often find excitement and a rush of adrenaline. Another reason people seek horror entertainment is to gain novel experiences. People want to experience a portrayed or imagined situation to simulate responses and live in an alternate reality. This can be seen recently as the pandemic broke out; researchers reported that people who watch apocalyptic movies feel mentally more prepared than those who do not [24, 28]. On the other hand, if not managed well, potential negative effects could be an overactive threat prospection which may

[1] https://cc.au.dk/en/recreational-fear-lab

lead to higher anxiety [17]. Nevertheless, horror content offers the chance for people to safely explore their curiosity about the dark side of the human psyche. As one of humans' common psychological traits, morbid curiosity can reflect and shape one's behaviour in everyday life. It arises from an inherent necessity to identify and address threats and is propelled by curiosity and imagination [29].

2.2 Self-Efficacy

Self-Efficacy (SE) [21] refers to one's belief in their ability to cope with life situations. It poses a significant role in our lives as it can affect our ability to unlock our potential to build confidence and develop mental resilience. Based on Bandura's social-cognitive theory [3], he points out that there are four major sources of self-efficacy (i.e., anxiety coping, modelling, mental practice, and effort feedback). Huang and Mayer [13] further investigated the effectiveness of various strategies to help individuals develop their SE level. The most significant source of SSE is mastery of an experience. According to Panc et al. [22] SE is an important coping capacity to psychological stress. The construct discusses the role of SE in the various aspects of our life, such as professional, social, educational etc.

2.3 Exposure Therapy

Exposure Therapy is a developed method in psychology to help people confront their fears [25, 26]. Studies show that a fight-or-flight response is triggered when people encounter danger or fear. Exposure therapy often reintroduces the individual to the specific fear factor in a safe environment [5]. Therefore the individual feels in control and therefore can slowly build resilience to the stimulus [19]. There are many methods used in exposure therapy, such as in vivo exposure which directly faces the fear object in reality. Imaginal exposure instructs the individual to recall a certain event or situation that they are afraid of. Interoceptive exposure will artificially mimic the physical sensation that the individual might experience during the feared experience in order for them to build familiarity safely.

2.4 Immersive Experience in VR

Virtual reality exposure is often adopted for its effectiveness in recreating an environment that can be hard to simulate, as it was predominantly used in entertainment. It has been adopted in many other areas [18] for its capacity to customize and prototype. According to studies on the effect of immersive VR experience [10], tailored virtual content can be complementary to conventional treatment for mental disorders. Psychophysiological research methods [10] have gained much traction in the gaming industry to study and measure players' engagement, emotions, and other facets of the user experience. Easily deployable tools such as electrodermal activity and heart rate sensing devices are used to collect players' physiological data during VR. Leveraging the theories and psychophysiological research methods [33] can potentially inform the development of psychological treatments such as building self-efficacy [15].

3 Project Corvus

Project Corvus is designed around the idea of shifting between two opposite "worlds" so that the user can use the experience to confront fear and hence enhance their self-efficacy. We aim to design an effective program that can help people enjoy horror while building stronger mental health in this fast-paced society.

3.1 Pilot Survey

We first ran a semi-structured pilot survey to understand people's fear factors and their responses towards VR horror. A preliminary survey was used to discover the potential user demographic, their opinion and preference towards fear. The survey was about 3 minutes in length and consisted of 15 questions. It was conducted online with 21 collected responses from university students to working professionals. The survey also does not involve any form of stimuli and is primarily used to gain initial insights based on their preference for horror material. The provided questions were regarding their preferred media (movies, books, VR, games, or others), scare factors (supernatural, religious, urban legends, cultural myth, blood and gore, or others), reason for consuming horror (pure stimulation, gain novel experience, self-help, avoid boredom, or others), and willingness to consume horror to build mental resilience (open-ended). Participants responded strongly to audio stimuli compared to visual stimuli. Even though some participants reacted to specific sounds that resonated with them more, all of them responded that audio stimulus is the most effective way to trigger arousal in their emotions towards fear. As for visual stimulus, it was particularly relevant to the participants' cultural background. For example, East-Asian participants reacted strongly to the images representing Asian horror tales while feeling indifferent about images of gothic church buildings. Western catholic participants felt strongly towards pictures of Maria and religious representations as there are implied associations to demons and possessions while being less responsive to Asian legends. Few participants reacted to blood and gore images as well as grotesque characters such as zombies or werewolves. Most participants found abstract and human-like images more horrifying. The general mysterious environment and realistic photos were also scary to most participants. As for horror preferences, about 50% of the participants consume horror from movies, while the rest are scattered amongst VR, gaming consoles, and books. As to what they are most scared of, it was an even split between supernatural activities, cultural myths and folklores, and specific phobias. As for the reason for consuming horror, 40% indicated that they want to gain novel experiences from the viewing, while the rest answered from stimulating curiosity to peer pressure. Surprisingly, more than half of the participants indicated that they are willing to try out an immersive horror experience, but less than half expressed that they think it might help them build higher self-efficacy/confidence.

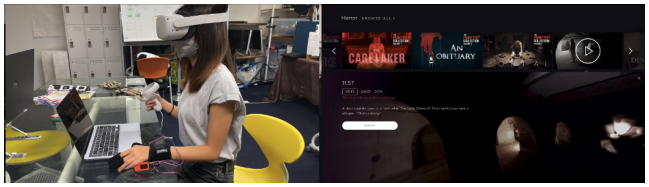

Figure 2: Preliminary workshop where participants watch horror videos in VR and provide feedback

3.2 Preliminary Workshop

The goal of the preliminary workshop was to design the experience of Project Corvus. It was conducted to 1) collect user reactions to fear and to 2) further define the experience. Three participants (1 Male and 2 Females) were recruited to participate in the workshop. Their age ranged from 24-28. P1 is very familiar with VR experience, whereas P2 and P3 have previously used VR a few times. All participants are university students who are interested in the topics of horror as leisure entertainment. The workshop was conducted as a one-on-one session, where the participants were asked to view a short 4 minutes 7 seconds 360° VR film streamed from the Within[2] platform, as shown in Figure 2. The narrative is about the protagonist waking up in a dungeon not knowing what is happening, and eventually being attacked by an unknown monster figure. They were then briefly interviewed about the experience and expressed their opinions regarding the effects of VR horror on self-efficacy.

[2] https://www.with.in/

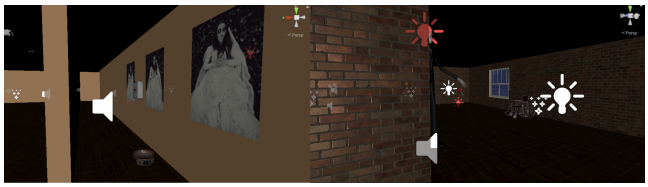

Figure 3: Screenshots of the two worlds in the Corvus

The participants felt more passive than engaged because no interaction and conscious decisions were required during the experience. All of the participants reported that they were somewhat unsettled by the content. They all reacted strongly to the main jump scare halfway into the video. P1 even vocally expressed the emotion. The most significant response was that P1 and P2 specifically mentioned that the low visibility of the environment and the anticipation towards the horror were the most unsettling and scary throughout the viewing experience. P3 mentioned that, due to the immersive nature of the experience, it was stressful at times as he/she could not evade the horror by covering their eyes or muffling their hearing. As a tool, a method to toggle the horror is necessary. All of them reflected that the length of the viewing was enjoyable as VR can cause motion sickness when inexperienced.

3.3 System Design

We designed the final system based on the pilot survey and preliminary workshop results. The Corvus can be defined as an experience of two "worlds". The basic system included three main scenes for design: 1) Tutorial scene for users to familiarize themselves with the interaction mechanic of the program, 2) safe environment (Safe World) for baseline study and fallback from the scary environment, and 3) horror environment (Horror World) - for horror stimulus to observe the users behaviour and reaction. The core interaction mechanic is to retain the power of decision-making in the users' hands so that they feel in control.

1) World toggle The world toggle is the switch between the "safe environment" and the "horror environment" in the experience. The safe environment is a basic space with no threat of any scare elements, while the horror environment is tailored and filled with scare elements that will spook the participants, as shown in Figure 3. The interaction mechanic to switch between the worlds is bound to the user's translational movement. When the user changes their position, the horror environment, referred to as the horror world, will be present, and by stopping, the user can switch back to the safe world. Rotational movement, either head or body, is not linked to this feature. Therefore, it is the user's decision to evaluate how long and how frequently they will confront the fear [32]. Based on the concepts of "World toggle". The environment design is essential to the experience. In order to avoid motion sickness [9, 31], snap turning at 45° is also added to the player control so that the user can navigate without physically moving their bodies. As mentioned in the earlier sections, participants feel most scared when they are anticipating an unknown threat. In order to build the suspense [8], the environment employed various point-light techniques that only lit up part of the environment. The rest of the way was dimmed to extremely low visibility with a fog effect for the dynamic and mystery of the experience. Other threat simulations, including longer hallways and sharp corners, are also purposely designed to ensure the participant only has limited visual distance at any given time. The map and environment are designed to induce the feeling that anything could happen anywhere at any time.

2) Non-linear sounds[3] Non-linear sounds are often considered paramount to any horror movie [6]. It refers to audio frequencies that are outside of the typical musical range of a voice, an instrument, or an animal. The cries of children, the distress calls of wild animals, and the abrupt and unpredictable frequency changes of acoustic instruments are all examples of non-linear noises. Human brains have a natural aversion to distressful sounds [11,34]. In a study conducted by Daniel et al. [4], participants were asked to listen to two different groups of original music. One included film soundtracks that are emotionally neutral. The other one had nonlinear sounds. The study's findings demonstrated that the music with nonlinear sounds stimulated emotions to a much greater extent and produced more negative feelings. Combined with the results from the preliminary studies, an array of non-linear sound triggers were placed along the explorational journey of the participants in the Corvus program. The goal is to use the number and intensity of these non-linear audio stimuli to control the fear level of the environment. Sound effects that mimic footsteps and heartbeats were incorporated to offer a more immersive experience. This can reflect a higher sense of agency for the user when controlling the camera/character in the program. The last area is the animation trigger of the scary figures. As reported in the previous study, a higher sense of urgency and life threat can induce more fear. More threatening and intense movements, such as attack and running, are attached to the figures in the program.

3) Element of surprise The last aspect is the element of surprise. It is a technique commonly used in film-making and storytelling [23]. In this design concept, the element of surprise is applied as some animated figures at intentionally designed locations. For example, blind spots right before the participants can retrieve the key. Individuals tend to relax their awareness when they are closer to the goal. By exploiting this pattern, the scary figures can function as an element of surprise to shock the participants in the experience if not noticed.

4 Initial Study

The goal of the initial study is to determine if Project Corvus has a significant effect on self-efficacy. The Corvus is designed and developed in Unity[4]. The study is conducted in a recording studio for minimal noise and distraction. As one of the most updated VR systems for the time being, The Meta Quest 2[5] was the selected VR device. Based on the feedback collected from the previous iteration, the final prototype also included three different map designs to avoid user prediction in the study. In every session, the participant will spawn and navigate a new space for the key.

4.1 Participant

Fourteen participants (6 Males and 8 Females) were selected to participate in the field study. Their age ranged from 24-34 (M=26.28, SD=3.38). Four of them are relatively familiar with VR experience, eight had some experience using VR, and the other two have no experience using VR entertainment. They each signed a consent form stating that they are free to withdraw from the experience at any time should they find the content too disturbing or feel discomfort from motion sickness or the experience itself. This work has also been approved by the university ethics committee.

4.2 Procedure

The participants will be immersed in a VR session to accomplish a key retrieval task. The experience should last approximately one to three minutes for each session. The participant will be informed of a context that a fictional child is in distress, and they require a key to rescue the child. The participant should attempt to locate the key in the designed space. However, the space will go to the horror world setting as soon as it detects motion (the participant

[3] https://nevadafilm.com/production-notes-non-linear-sounds/

[4] https://unity.com/ja

[5] https://www.meta.com/jp/en/quest/products/quest-2/

starts moving). The scare elements in the horror world will vary in each session. To stay in the safe world, the participant needs to stay still. Therefore, it is the participants' choice to decide how and when to overcome the horror and reach for the key. In order to carry out the effect of the assistive program. Three sessions of testing are carried out to simulate the repetition in exposure therapy design. The participant will be instructed to complete a simple tutorial session to understand the program's movement and mechanics without any added horror effects. Then the participants will be asked to complete three sessions of key retrieval without the safe/horror world mechanic as baseline observation and three sessions with the safe/horror mechanic as experimental observation. The order of the designed experiences will be randomized in each experiment session to avoid order bias [14]. Screenshots of the experience are shown in Figure 1. The assumption is that the participants will gain a higher level of confidence after going through the experimental experiences. The Self-Efficacy score was collected three times for comparison with the New General Self-Efficacy Scale (NGSE) developed by Chen et al. [7]. Each participant's initial NGSE score is taken as the baseline score one day before the study. On the day of the study, the scale was handed out six times after each completed session of the experiment yielding three scores under the non-horror baseline environment and three scores under the horror experimental environment for comparison of the changes of SE. The last score is taken approximately two days after the study to observe the lingering effects of the experiment. Finally, we performed an open-ended interview with each participant regarding their general feedback on the experience.

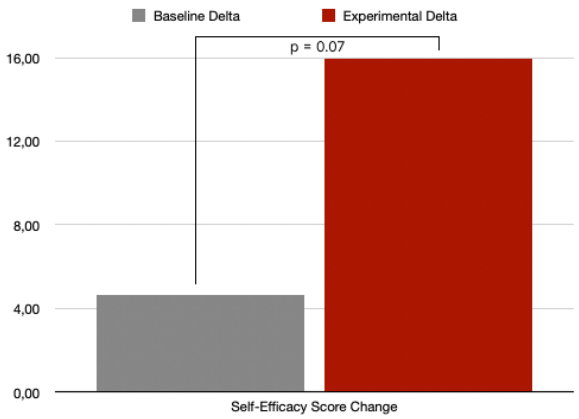

Figure 4: SE Score Delta of all participants

5 Results and Discussion

We compiled all 14 participants' SE scores and calculated the average increase in the relative delta. We found differences in the changes in SE score, and 3 participants showed reversed results. A total of 11 out of the 14 participants' results displayed various levels of increase in SE score. After performing a t-test, the participants demonstrated no significantly better self-efficacy scores, $t(14) = -1.52, p = 0.07$. The result is not significant at $p > 0.05$. This is illustrated in Figure 4.

From the discussions, several participant's self-report of SE increase aligned with Bandura's theory [3] that self-efficacy can come from the mastery of an experience. Most of the participants shared that they felt a confidence boost when they became better at doing a task. However, participants also expressed the difference of perceived self-efficacy being drastically different in various scenarios. Several of them agreed that they have a self-efficacy boost when the scenario is associated with a rewarding purpose. When discussed about their experience of the Corvus, one participant specifically mentioned that the experience was scary, but it was also empowering as the scary element gave the power to go through the experience. Another insight was that Several participants mentioned that the most scary part of the environment was the audio stimulus. Especially a male coughing sound effect triggered a strong fear response in most of the participants. A total of 10 out of the 14 participants also expressed that they are willing to try a higher level of horror than they believe they can endure if the experience would yield an increase in self-efficacy when asked if they are interested in participating in similar programs. The participants all showed interest, with the exception of one participant not believing the experience would help in self-efficacy development. One participant specifically mentioned that "I would be willing to try more scary experiences if I believe it can help me build confidence." In addition, as we can see from the scoring of the NGSE, the answers showed noticeable improvements in 8 self-perceived self-efficacy levels compared to the immediate score after the experiment. However, it could be due to other events that might have contributed to the increase in the score. The final prototype of the Corvus presents an attempt to use horror virtual reality to assist individuals in developing their self-efficacy for daily life. How individuals process and respond to cues of a novel threat in their environment can be related to their level of self-efficacy, the hypothesis is that systematic exposure to such controlled threat in virtual reality can result in an increase in self-efficacy capacity. Through designing a system of horror experiences in VR, the effect of such a hypothesis was tested at a relatively small scale.

From the combined results in the previous section, the system has displayed some level of potential to aid the individual's development in self-efficacy. But there are still factors to be considered to validate the hypothesis. For example, the capacity of self-efficacy is still situation specific. The tool can only assist to a certain extent in general SE development but can still be limiting in specific situations.

6 Conclusion and Future Work

We propose Project Corvus, a horror VR-based tool to improve self-efficacy. Based on our initial results, we plan to explore several aspects further. Firstly, we plan to include additional modalities, such as haptics, for a higher level of immersion. Secondly, we plan to include real-time physiological feedback [2, 12, 30] so that the environment can adapt to the user's fear level. Lastly, we plan to update Project Corvus to be more personalized to the user. To achieve this, we will first build several standalone modules and have the user provide some information via a questionnaire. The results will then be used to procedurally generate an environment based on the modules created.

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