

How does the light level of a player's environment affect the immersion and scariness of video games in the horror genre?

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Abstract

Immersion is a key factor in delivering engaging video game experiences, particularly within the horror genre where suspense, tension, and involvement are central to player enjoyment. Previous research surrounding the topic has demonstrated how game design elements such as sound and lighting design can influence immersion, however less attention has been given to the role the player's physical environment can have in affecting this experience as well. In this paper, we describe a study that investigates whether environmental lighting conditions influence immersion and perceived scariness while playing a horror game. A mixed-methods approach was utilised for a more nuanced analysis of player experience, combining quantitative measures of immersion and perceived scariness with qualitative data obtained through post-game interviews. A between-participants design was used on a sample of 15 individuals recruited via posters around campuses and via the researchers directly, with participants being assigned to different lighting conditions while playing a horror game for a fixed period of time. Quantitative data was analysed using ANOVA tests, and qualitative responses were transcribed and examined through content analysis to identify recurring themes across conditions.

Statistical analysis revealed no statistically significant differences between any conditions. However, several non-conclusive directional patterns emerged that aligned with the study's hypothesis, with similar trends also observed in the qualitative data. Participants in darker lighting conditions more frequently described heightened immersion, tension, and focus on smaller details, whereas participants in brighter conditions tended to focus more on prominent scripted moments within the game. These findings suggest that the observed effects may have been present but insufficiently strong to be detected through inferential statistics alone, potentially reflecting a Type II error arising from the small sample size.

Overall, while the results of this experiment do not provide conclusive statistical evidence, they are consistent with claims among players that playing horror games in a darker environment may enhance immersion and suspense. This study contributes to existing research by highlighting the potential influence external environmental factors may have on player experience, and by demonstrating the value of combining quantitative and qualitative methods when investigating immersion in video games.

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Introduction

Immersion in video games is a concept many video game players are familiar with. It can be easy to lose track of time and feel completely engrossed within a digital world. Jennett et al. (2008) defines immersion as the psychological experience of being deeply engaged in a task; involving a lack of awareness of time, the real world, involvement and a sense of being in the task's environment. This is most apparent in games of the horror genre, where immersion is needed to deliver an effective horror experience. While developers can try to make their games as immersive and horrifying as possible through various game design choices, the illumination of a player's environment is a variable significantly affecting immersion (Nordin et al., 2014) which is out of the developer's control. There is a general consensus among players that playing in a dark room heightens a horror game's suspense and fear. The purpose of this study is to validate these claims and add onto existing research by exploring the relationship between an environment's light level and the player's sense of immersion and perceived level of scariness while playing a horror game.

Video game immersion is a topic that has previously been discussed to some lengths in academic literature. Early studies (Jennett et al., 2008) sought to define the concept of immersion and explore the effects of being immersed. Experiments found that being immersed in a game decreased one's ability to re-engage with the real world, as well as decreased eye movements when immersed. This research additionally resulted in the Immersive Experience Questionnaire (IEQ), which provides a quantifiable measure of immersion with five additional dimensions: cognitive involvement, real-world dissociation, challenge, emotional involvement and control. The IEQ provided a basis for future studies to investigate the phenomenon of immersion, specifically in relation to the player's environment. Nordin et al. (2014) conducted two experiments. The first of which investigated how mixed-reality games affect the level of immersion, concluding that mixed-reality games have decreased immersion compared to traditional digital games. The second experiment looked into how the lighting level of a room impacts the immersive experience. The lighting level of the room was manipulated from 'dim', 'neutral' and 'bright', and participants were tasked with playing Super Mario Galaxy 2, a motion-controlled platformer. For the overall immersion score, a significant statistical difference was found between light levels. With both of these experiments, it was found that when a player is aware of their surroundings, their immersion decreases. Regarding horror games specifically, there has only been a focus on exploring the effect of virtual reality (VR). Lemmens, Simon and Sumter (2022) found that VR induced greater immersion compared to traditional methods of play, and Pallavicini et al. (2018) found that there was no significant difference between the emotional response of VR and non-VR. VR is a much more transformative way of playing compared to regular input methods, but does share some similarity in how visually limited a player may be in darker light levels. While not as prominent as in VR, there may be parallels that can be drawn between these studies and when light levels are manipulated.

The motivation of this study is to add onto the work done by prior researchers and to fill in some of the gaps from previous studies. The second experiment conducted by Nordin et al. (2014), involving light level manipulation, used Super Mario Galaxy 2 as the stimuli, which uses motion-controls to control the player character. This input method is not representative of most video game titles, and it is unclear whether this may impact the immersion compared to sedentary input methods. It is also worth noting that this is a third-person experience;

players feel more immersed when playing from a first-person perspective (Denisova and Cairns, 2015). It is also necessary to follow up the research by Lemmens et al. (2022) and Pallavicini et al. (2018) and explore how the experience of playing a horror game is affected with the manipulation of light levels, rather than with VR. In addition, both of these studies were conducted with Resident Evil 7, a mainstream survival-horror game. It is necessary therefore to conduct further research with a different, more relatively unknown, title in order to generalise the previous findings in a wider context and to ensure participants do not have any prior experience with the title before the research activity. Previous studies also lacked an open-ended interview to allow participants to vocalise their experience and support the data collected. It is evident that there is a clear gap between previous studies in which it is therefore necessary to explore how the light level of the surrounding environment affects the immersion and perceived level of scariness of video games in the horror genre.

Pilot Study

A pilot study was conducted with two participants before the final study. This study was conducted with a different game, titled 'From The Darkness' (N4bA, 2021), a psychological horror game where the player must find certain items to progress forward. This game was found not to be suitable for the research, as both participants found it difficult to progress through the game due to an unclear pathway forward, especially worsened by the difficulty to see darker areas in brighter environmental lighting conditions. This study also allowed us to refine the processes going forward by positioning equipment correctly and understanding any potential disruptions in the chosen environment in advance.

Method

Design

The study used a between participants design. The single independent variable had three levels, consisting of 'Bright', 'Low' and 'Dark' light levels. These light levels were operationalised with varying lighting equipment. Immersion was measured using the Immersive Experience Questionnaire (Jennett et al., 2008). The perceived scariness was measured with an interview and survey.

Participants

A total of 15 participants took part in the study. Thirteen participants were undergraduate University of York students, recruited by posters placed across campus, while two participants were not. The poster used to recruit participants was aimed towards individuals who were already accustomed to videogames, and informed potential participants that they would be playing a horror experience in a pre-determined light level. No endorsements were offered as a result of completing the research activity. Four of the participants were already known to the researchers. The participants included nine males, five females and one non-binary person. Fourteen of the participants were aged 18-24, and one participant was aged 25-39. Regarding ethnic groups, ten participants were white, four participants were Asian or Asian British, and one participant was mixed or multiple ethnic groups. All participants reported that they had not played or seen gameplay of the game before the study.

Participants were asked on a Likert scale from 1 to 7 how familiar they were with video games in the horror genre. The median of the results was 5, with an answer of 6 recorded by the most participants. Five participants were assigned to each group, with a total of three groups per light level. Participants were assigned randomly to each group, and did not know beforehand which light level they would encounter while completing the research activity.

Materials

The game chosen was 'Into the Mountains' (DecestiaDev, 2021). It is a low-resolution, atmospheric horror game which involves avoiding monsters and finding key-cards to progress forward. Into the Mountains was chosen because of its relative ease of progression and effectiveness at delivering an appropriate atmospheric horror experience that was not hindered by unclear progression or excessive jumpscare.



Figure 1. In-game screenshot of 'Into the Mountains'

The machine used to deliver the game was an ASUS Vivobook 15 Laptop, which has a 15.6" screen at 1920x1200 resolution and 16:10 aspect ratio, with the game running at 60 frames per second. A Logitech G203 mouse and the laptop's keyboard were the input methods used to play the game. A pair of HyperX Cloud II headphones were used for the game's audio output, being set at a moderate volume. A phone was used as a countdown timer to indicate when the activity concludes, as well as being used as a microphone to record the interview. For the 'Low' light level, a desk lamp was used to create this condition, positioned roughly 80cm away from the laptop (see Figure 2).



Figure 2. Photograph of the setup in the low light level

A short interview was conducted consisting of six questions. These questions directly related to the lighting level and the participant's perceived scariness of their experience. These questions included:

1. Can you describe how you felt playing the game overall?
2. Did the lighting level influence how scared or calm you felt while playing the game?
3. Did it at any point distract you? If yes, how so?
4. Did the lighting affect how well you could navigate or understand what was happening in the game?
5. Were you scared while playing the game? Explain why or why not.
6. What were some specific elements that scared you the most?

The Immersive Experience Questionnaire (IEQ) (Jennett et al., 2008), was used to measure immersion. It consists of 31 questions that provide a total immersion score and five immersion factors to measure the level of immersion the participant experienced. In addition to this, two more questions were asked on a Likert scale from 1 to 7 to gather a quantifiable measure of the participant's perceived level of scariness. These questions included:

1. To what extent did you find this game scary?
2. To what extent did the scariness affect your ability to play the game?

Questions relating to the IEQ and the scariness level were administered on a Google Form along with other participant related questions following the gameplay.

Environment

For most participants, the study was conducted in a seminar room in the Law and Management building at the University of York. For when the activity could not be conducted at this location, the set up (as pictured in Figure 2) was replicated as best as possible. A table was positioned next to the wall with the participant facing the laptop and the wall to ensure there were no visual distractions. The lamp was placed at an appropriate distance from the laptop so that the light was not offputting. The study was conducted after 16:00 during the winter to ensure a dark enough environment when required by the low light condition. There was a risk of background noise from outside corridors that could affect the participants' immersion, but this was mitigated by the headphones. The room's air conditioning also needed to be switched off to lessen any distracting noise.

Procedure

Before beginning the study, a room should be selected that has no natural light, or the study should take place at a time where it is sufficiently dark outside so that there should be no residual light affecting the light level of the room. Before the participants arrive, the room should be set up (as seen in Figure 2) so that the table is positioned beside the wall. The laptop should have the game 'Into the Mountains' loaded, the audio should be set up so that the headphone's volume is not too quiet or loud for the participants, and the mouse sensitivity should be checked so that it is at an appropriate level. There should be no visual distractions or external noise that may affect the participant's immersion. If the participant is measured with a low light level, the desk lamp should be powered and positioned at the appropriate distance from the laptop. When the participant arrives, they should be seated next to the laptop and read a script, describing the details of the study and the tasks that they should be completing. Due to the sensitive nature of the research, such as the viewing of potentially distressing content, participants should be reminded that this is the content that they are viewing and can withdraw from the research at any time. Participants should not interact with the researchers for any other reason, and should otherwise progress through the game. Once the script has been read, the participant should be handed a copy of the information sheet to read through and a consent form to sign.

Depending on the predetermined lighting condition, the room should be illuminated accordingly when the participant is ready. When the participant begins the game, a countdown timer should be set for 15 minutes. The participant should progress through the game, following a fairly linear path that includes some small jumpscare and other conventional horror depictions. The participant needs to be observed to ensure that they are progressing through the game. At the end of the allotted time, the room lights are turned back on, if not on already, and the participant should stop playing the game. A short interview should then be conducted assessing the participant's experience while playing the game, after which the participant should be provided a survey on the laptop with questions from the IEQ (Jennett et al., 2008) and questions relating to the level of scariness. Once complete, the activity should be concluded. Interviews are then subsequently transcribed and data is recorded for analysis.

Prediction

Based on the results from previous studies, we hypothesized that as the light level of the environment decreases, the level of immersion would increase. In addition, a decreased light level would increase the perceived scariness of the experience playing a horror game. Playing a horror game in a dark room would be an immersive and frightening experience, whereas playing a horror game in a bright room would be less immersive and therefore be less scary.

Results

Statistical Analysis

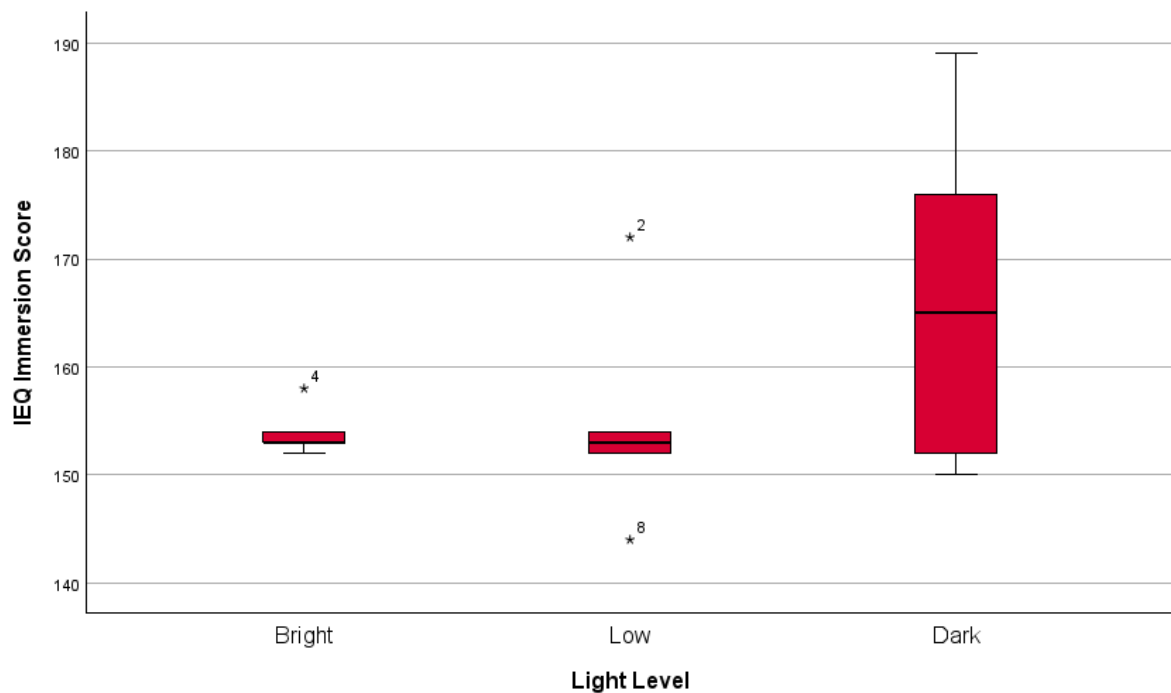


Figure 3. Box plot for Immersion Score for each condition.

	Bright	Low	Dark
IEQ Immersion Score	153.2 (0.837)	153 (1)	166.4 (16.441)
Cognitive Involvement	48.8 (1.643)	51.6 (4.506)	53.2 (1.304)
Emotional Involvement	25.80 (2.28)	28 (8)	31 (4.243)
Real World Dissociation (RWD)	35.8 (5.357)	33 (1.414)	38.8 (6.797)
Control	26 (2.121)	24.4 (3.05)	28.2 (2.28)
Challenge	16.2 (2.95)	16.4 (2.074)	14.6 (2.51)

Table 1. Table showing Mean (Standard Deviation) for Immersion & each component of the IEQ.

As hypothesised, descriptive analysis suggests the mean in Immersion Score tends to increase as the light level decreases, as demonstrated in Figure 3, with the greatest difference between the bright and dark conditions. The means for all dimensions (see Table 1) of the IEQ follow the same trend, with the exception of the Challenge; however, it is worth noting the experiment's challenge would not have varied based on light level.

To confirm that the experimental manipulation was having a significant effect on immersion, the immersion score, along with each component of immersion in the IEQ, was compared in each condition. ANOVA tests indicated no statistically significant differences between groups on any factors. However, trends towards significance ($p < .10$) were observed for IEQ Immersion Score ($F(2, 12) = 3.252, p = 0.074$), Cognitive Involvement ($F(2, 12) = 3.012, p = 0.087$) and Control ($F(2, 12) = 2.874, p = 0.096$); consequently, the null hypothesis was not rejected. These findings should be interpreted cautiously, as the small sample size may have limited statistical power.

Likert Response	Bright	Low	Dark
1 - Not at all			
2		1	1
3	2		
4	1	1	
5	2	3	1
6			2
7 - A lot			1
Median (IQR)	4 (2)	5 (2)	6 (3)
N	5	5	5

Table 2. Frequency table showing responses and Median (Interquartile Range) for the Perceived Scariness on a Likert scale (1-7).

Likert Response	Bright	Low	Dark
1 - Not at all		1	
2	3	1	1
3	1		1
4		2	
5	1	1	1

6			
7 - A lot			1
Median (IQR)	2 (2)	4 (3)	5 (5)
N	5	5	5

Table 3. Frequency table showing responses and Median (Interquartile Range) for Affected by Horror on a Likert scale (1-7).

In relation to the perceived level of scariness, Table 2 and Table 3 shows that the median tends to increase for both measures of scariness. Kruskal Wallis tests were conducted to confirm if this was significant. No statistical difference was found for Perceived Scariness ($H = 2.811$, $df = 2$, $p = 0.245$), and Affected by Horror ($H = 2.569$, $df = 2$, $p = 0.277$).

Content Analysis

Themes	Description	Frequency		
		Bright	Low	Dark
<i>Sound design</i>	Mention of sound effects, music, ambience, etc. within the game.			
<i>Lighting</i>	Mention of lighting both within the game and in the environment.		 	
<i>Immersion</i>	Positive mention of feeling immersed, not paying attention to/getting distracted by surroundings, etc.			
<i>Tense/uneasy</i>	Mention of any feelings of tension, uneasiness, hesitance, anxiety, on edge etc.			
<i>Scared</i>	Positive mention of feeling/getting scared, more explicit/intense than the previous theme.			
<i>Jumpscare</i>	Mention of jumpscare (scripted moments within the game).			
<i>Flashlight</i>	Any mention of the flashlight within the game, mechanics, visuals, etc.			
<i>Graphics</i>	Any mention of visuals, includes mentions of the environment within the game, i.e. room layouts, visual stylisation, etc.			

Table 4. Table showing results of content analysis conducted on transcribed interviews from each participant.

Subsequently, content analysis was conducted on transcribed recordings of interviews with the participants. Table 4 summarises the themes used, including descriptions of nuances taken into account during analysis, and the frequency at which the themes were mentioned between all groups.

Discussion and Conclusions

Although no statistically significant effects were observed at any stage of analysis, several non-conclusive directional patterns emerged that aligned with the study's hypothesis. Across all stages of analysis, these patterns reflected the expected outcomes, suggesting that the failure to reject the null hypothesis may have been influenced by the small sample size, rather than the absence of underlying effects. Participants were not in control of their environment at any point and therefore had no opportunity to prepare themselves prior to gameplay. Under low light conditions, participants appeared to become more involved with the game, potentially due to a reduced awareness of their physical environment and an increase in cognitive involvement. The use of a between participants design also reduces the likelihood that participants were deliberately comparing lighting conditions when responding to the questionnaire and interview. However, during interviews several participants, notably those in the bright condition, did hypothetically compare their experience to how it might have differed in another environment, although this was unlikely to have substantially influenced their final responses.

During content analysis, several patterns again emerged that supported the predicted direction of the results. Participants in darker conditions mentioned sound design, positive immersion, and feelings of tension more frequently than other conditions. This may suggest that participants in darker light conditions may have felt more in tune with the experience and overall felt much more consistently uncomfortable or on edge during gameplay, resulting in an increased sensitivity to subtle details in the environment. In contrast, participants in the brighter conditions more frequently mentioned lighting and jumpscares, which may indicate that lighter environmental conditions may have distracted participants, and that they directed their attention to larger, scripted moments due to a lack of focus and ability to pick up on smaller details during gameplay. Across all conditions, the mention of feeling scared occurred at a similar frequency, suggesting that intense fear responses were largely driven by the same scripted events rather than the environmental lighting. Mentions of the flashlight and graphics also occurred at similar frequencies across conditions, indicating that these elements had minimal influence on immersion compared to other factors. The qualitative findings from the content analysis appear to complement the quantitative results. While the ANOVA tests did not reveal any statistically significant effects, the frequency of the themes that emerged during interviews followed similar directional patterns. These similarities found between qualitative and quantitative data may suggest that the observed effects were present but insufficiently strong to be detected through inferential statistics alone.

It should be mentioned that several external factors may have limited the strength of the findings. A frequently encountered concern was that within the allocated 15 minutes, only approximately half of the participants reached a point at which a clear threat was introduced,

as some became stuck at certain sections of the game for extended periods of time. This may have reduced immersion and perceived scariness, as these participants did not necessarily get to experience the full intended gameplay, and may have experienced increased boredom or irritation. Additionally, background noise from the room's air conditioning may have affected immersion for one participant, as the sound was noted during the interview. Also, a concern with the content analysis was that interviews with some participants were very brief, which may have skewed the frequency at which certain themes were mentioned.

Future research would benefit from a larger sample size to more accurately assess whether any statistically significant differences exist between conditions. The limited sample size likely reduced the statistical power of the analysis, increasing the likelihood of a Type II error. As a result, real effects may not have been detected despite the presence of consistent directional trends across measures. Increasing the number of participants would improve sensitivity to smaller effects within the data and allow for more confident conclusions regarding the impact of environmental lighting on immersion to be drawn. If the experiment was to be replicated, it would also be advisable to allow participants to play until a predefined point in the game rather than limiting their gameplay by time. This would ensure a more consistent gameplay experience and reduce potential frustration associated with time pressure or becoming stuck. It would also be recommended to add an objective measure of fear/emotional state, such as a heart monitor or a more standardised questionnaire, rather than relying on a Likert scale for such data. Additionally, interview procedures should ensure that all participants are encouraged to elaborate on their responses in order to obtain a more consistent depth and quality of qualitative data. Despite these limitations, the mixed-methods approach utilised in this study allowed for a more nuanced understanding of player experience than would have been possible through qualitative measures alone.

Bibliography

DecestiaDev. (2021). *Into the Mountains*. [Game]. Available at: <https://decestiadev.itch.io/in-the-mountains> [Accessed 5 January 2026].

Denisova, A. and Cairns, P. (2015). First Person vs. Third Person Perspective in Digital Games: Do Player Preferences Affect Immersion? *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*. pp. 145-148. Available at: <https://doi.org/10.1145/2702123.2702256>

Jennett, C., et al. (2008). Measuring and defining the experience of immersion in games. *International journal of human-computer studies*, 66(9), pp. 641-661. Available at: DOI: 10.1016/j.ijhcs.2008.04.004.

Lemmens, J., Simon, M. and Sumter, S. (2022). Fear and loathing in VR: the emotional and physiological effects of immersive games. *Virtual Reality*. 26, pp. 223-234. Available at: <https://doi.org/10.1007/s10055-021-00555-w>.

Nordin, A., et al. (2014). The Effect of Surroundings on Gaming Experience. *International Conference on Foundations of Digital Games*. Available at: http://www.fdg2014.org/papers/fdg2014_wip_14.pdf.

N4bA. (2021). *From The Darkness*. [Game]. Available at: https://store.steampowered.com/app/1517340/From_The_Darkness/ [Accessed 5 January 2026].

Pallavicini, F., et al. (2018). Effectiveness of Virtual Reality Survival Horror Games for the Emotional Elicitation: Preliminary Insights Using Resident Evil 7: Biohazard. Antona, M. Stephandis, C. eds. *Universal Access in Human-Computer Interaction. Virtual, Augmented, and Intelligent Environments*. (UAHCI 2018). Available at: https://doi.org/10.1007/978-3-319-92052-8_8.