An interactive exploration into virtual liminality and the impact it has on users.

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Abstract:

This study delves into the realm of digital liminal experiences, investigating how environmental design influences users' comfort in digital liminal spaces. Three distinct digital environments were created and tested for this study consisting of a desolate train station, a vacuous supermarket, and a forest full of mysterious structures shrouded in fog. Participant feedback from this testing showed pronounced variations in comfort levels. Notably, level ambience, theming, and the absence of others emerged as pivotal factors shaping users' emotional responses. The empty train station and shop, designed to replicate bustling social settings, evoked discomfort, while the forest environment came across as relaxation. Sound and visuals, particularly in the forest, played a crucial role in shaping comfort. Despite limitations in participant numbers, the insights contribute to a nuanced understanding of impactful design elements in digital liminality and provide the groundworks for future studies into liminality to build upon.

Declaration: I declare that this thesis is a presentation of original work and I am the sole author. This work has not previously been presented for an award at this, or any other, University. All sources are acknowledged as Reference

Acknowledgments: I would like to acknowledge that, to the best of my knowledge, no publications have arisen from the work presented in this thesis.

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Chapter 1: Introduction:

In contemporary society, the rapid evolution of digital technologies has transformed the way individuals engage with virtual spaces, giving rise to a new field of study exploring the intersections between human experience and digital environments. Within this context, the concept of liminality, borrowed from theories of transitional spaces and states, has gained increasing attention in recent times (Smith 2000; Jones 2010; Sandhar 2020). Liminal spaces, characterised by a sense of ambiguity, transition, and transformation, have been identified in various physical and social contexts.

However, the exploration of liminality in digital environments remains an understudied but critical area. This research seeks to delve into the impact of liminal spaces within digital contexts on users' comfort. Understanding the dynamics of comfort within digital liminality is essential for enhancing user experience as it allows developers to affect players on an emotional level leading to a more immersive gameplay experience. This study aims to contribute to the growing body of knowledge surrounding the emotional and experiential dimensions of digital liminality, shedding light on the factors that shape users' comfort in these transitional digital spaces.

Despite the increasing prevalence of digital interactions and the recognition of liminality as a significant concept in human experience, there still exists a large gap in our understanding of how liminal spaces within digital environments influence users' comfort. While the digital realm offers a multitude of experiences ranging from social networking to virtual reality environments, there is a lack of comprehensive research addressing the specific aspects of users' comfort during these liminal encounters. This study seeks to address this critical gap by investigating the relationship between liminal spaces in digital environments and users' comfort, thereby contributing valuable insights to both academic discourse and practical design in the field of interactive media, allowing for more engaging and emotionally impactful environments to be explored by users throughout all forms of media.

Research Objectives

This study aims to achieve a comprehensive understanding of the relationship between liminal spaces in digital environments and users' comfort. The specific research objectives are as follows:

1. **Explore the nature of digital liminal spaces:** investigate and define the characteristics of liminal spaces within digital environments, considering various forms of media and academic resources.

2. **Examine user comfort dynamics:** analyse the factors influencing users' comfort within digital liminality, considering psychological, emotional, and perceptual dimensions.

3. **Identify design elements impacting user comfort:**
   evaluate the role of design elements, liminal features, and environmental components in shaping users' comfort within liminal digital spaces.

4. **Assess user responses and experiences:**
   collect and analyse user feedback after experiencing three created liminal environments through qualitative and quantitative methods to understand their experiences in digital liminality.

5. **Compare comfort levels across different digital contexts:**
   investigate variations in users' comfort levels across the three different liminal environments, specifically analysing the same elements throughout the environments to see how changes can change user’s experiences.

6. **Develop advice for creating immersive liminal environments:**

using evidence from research and user testing, create a set of advice for what does and doesn't work when creating an immersive liminal environment.

7. **Contribute to theoretical frameworks:**
   contribute to the theoretical understanding of liminality in digital contexts by synthesising findings into existing frameworks and proposing new perspectives on the interplay between digital environments and user comfort.

By achieving these research objectives, this study aims to provide valuable insights for researchers, designers, and practitioners in the field of interactive media, facilitating the creation of digital environments that prioritise user comfort and well-being.

Research Questions and Hypotheses

Research questions:

1. To what extent do participants' comfort levels vary across different digital liminal environments?
2. How do users perceive and navigate the designed digital liminal spaces in terms of comfortability?
3. What role do individual elements play in influencing users' comfort within digital liminality?
4. Is there any difference in participants' experiences of digital liminality based on the order in which they engage with the environments?
5. What set of variables within liminal environments affect participants the most?

Hypotheses:

1. Hypothesis 1 (H1): There will be significant variations in participants' comfort levels across different digital liminal environments based on changes within different environmental elements.
2. Hypothesis 2 (H2): Specific locations based on certain themes will be affected more by specific elements, such as lack of other occupants or lighting.
3. Hypothesis 3 (H3): Each location will have an overall effect of making the participants feel uncomfortable and uneasy.
4. Hypothesis 4 (H4): Specific design elements within the digital liminal environments will be identified as significant contributors to users' comfort levels.
5. Hypothesis 5 (H5): The order in which participants engage with the digital liminal environments won't have a measurable impact on their overall experiences, with earlier or later exposure not influencing reported comfort within that location.

These research questions and hypotheses form the foundation for systematically exploring the link between digital liminality and user comfort, guiding the study's data collection, analysis, and overall findings.

Significance of the Study

This study holds substantial significance within the area of user experience research and digital environmental design, contributing valuable insights and implications to both academic discourse and practical applications when constructing digital experiences.

Advancing User-Centred Design:

By researching into the relationship between digital liminality and user comfort, this study contributes to the advancement of user-centred design principles. Understanding how users navigate and experience liminal spaces in digital environments provides useful insights for designers aiming to create more intuitive and engaging experiences, especially for those planning to evoke emotion through environmental story telling alone.

Contributing to Academic Knowledge:

This study expands the academic discourse on liminality, digital media, and human experience. Through research methodologies and a mixed-methods approach, the findings contribute to the studies currently surrounding interactive media, adding depth to our understanding of how individuals interact within transitional digital spaces.

Supporting Evidence-Based Decision-Making:

The evidence and insights found from this study provide information for evidence-based decision-making in digital design and user experience. Designers, industry professionals, and independent game developers can use the study's outcomes to inform decisions related to the development of digital environments, allowing them to create more engaging and impactful digital experiences.

In summary, the significance of this study extends beyond its immediate research focus, influencing the fields of design, education, and academia. By shedding light on the intricate dynamics of user comfort within digital liminality, the study contributes to the broader conversation on creating more emotionally impactful, user-centric, and ethically designed digital spaces.

Scope and Limitations

Scope:

This study focuses on investigating the impact of digital liminal environments on user’s comfort by making and testing three carefully designed liminal digital environments. These locations will each designed and made to induce specific experiences of liminality. The research seeks to explore variations in user comfort levels across these environments to see which specific elements and conditions influence users comfort levels the most. The insights found throughout this study aim to contribute to the fields of user experience research, liminality, and interactive media design.

Limitations:

Generalisability: The findings of this study may have limited generalisability due to the specific nature of the digital environments created and the selected participant pool. The outcomes found within this study may be more applicable to certain demographic groups or digital contexts.

Artificial Nature of Environments: While efforts have been made to create realistic and engaging digital liminal environments, the digital artificial nature of these environments may influence participants' responses. The study acknowledges the challenge of fully replicating the complexity of natural liminal experiences within a digital experience.

Subjectivity in Comfort Assessment: User comfort is subjective, and participants' self-reported comfort levels may be influenced by individual perceptions and interpretations. The study recognises the subjectivity in assessing comfort and aims to compare findings with multiple data sources to mitigate this limitation as much as possible.

Time Spent in Each Environment: To ensure full user immersion, the participants weren't given a time limit in the amount of time they could spend within each environment, allowing them to explore at their own pace. This decision has meant that participant's comfort levels may vary depending on how long they spent in each area and got used to their surroundings.

Technology Constraints: The study relies on the use of powerful hardware to run the Unity testing program. Because of this some participants may not have been able to test the project due to limitations with their software or operating system compatibility. To combat this I have lent my own computer to as many participants as possible that had this limitation so that they were still able to test this.

External Influences: External factors such as participants' mood, external distractions, or real-world events may influence their experiences within the digital environments, introducing potential variables that were not controlled within this study. While participants were instructed to play through the experiences by themselves, their lighting, surroundings, and the time of day they played through the experience were not controlled.

By acknowledging these limitations, the study aims to be as transparent as possible when presenting its findings and encourages future research to build upon and address these constraints for a more comprehensive understanding of user experiences in digital liminality.

Chapter 2: Literature Review:

Horror, as a cinematic genre, has consistently maintained popularity and evolved since the creation of *'Le Manoir du Diable'* (Méliès, 1898). In just over eighty years *Haunted House* (Atari, 1982) was released, the first official horror game that was playable at home. Works such as Mary Shelley's '*Frankenstein*' (Shelly, 1818) laid the groundwork for literary horror, while television series like *'Alfred Hitchcock Presents*' (Hitchcock, 1955-1965) brought the genre into

living rooms across the world. It showed that games, just like movies, could scare users and helped create the horror game genre we all know today, despite its simple design compared to today's standards. As described within the book *A match made in hell* the inevitable success of the horror genre in video games (Perron & Rouse III, 2009) *"the goals of video games and the goals of horror fiction directly overlap"* with the inclusion of the ability to lose a game and having to restart provoking the emotions of tension and fear better than any other form of media (Perron & Rouse III, 2009). The objective of this media review will be to examine current literature around uncanniness and liminality within media as well as looking at pre-existing games and media within the horror genre to see how the creators have used these ideas over the years to scare their viewers. This literature review will help strengthen my understanding of the ways liminality, uncanniness and uncertainty are used within media, all of which I will be using for the creation of a digital liminal experience designed around making participants feel uncomfortable and uneasy while navigating through the environments within it. I've decided on this literature review to look into horror media specifically as I believe it will give the greatest insight into what elements work best in creating uncomfortable environments for users. This insight, combined with the knowledge provided about liminal environments, should allow me to create an impactful liminal experience.

Liminality

Theories surrounding liminality have been a subject of scholarly discussion, with evolving interpretations and applications in mainstream society. Examining various academic journals reveals a consensus that liminality represents a transitional phase or gateway. However, the changes in its connotations across different contexts present an intriguing area of investigation.

In "Non-Places: Introduction to an Anthropology of Supermodernity" (Augé, 1992) describes "non-places" as spaces that lack a strong identity, social significance, or a sense of history, with these spaces often being associated with transitional spaces like airports, supermarkets, highways, and hotels. People often pass through these locations without forming any deep social bonds or connections with one another. This description of "non-places" matches the concept of liminality well as it often refers to the idea of transitional phases or spaces which are in a state of constant social ambiguity. Both liminal spaces and "non-places" are environments where individuals never fully engage in nor fully disconnected from. Augé's ideas provide a great framework for liminality and how individuals interact with transitional spaces within their daily lives.

Generally, most reports describe liminal spaces as spaces without a defined set of rules or norms, leading inhabitants to perceive them as chaotic and causing anxiety. Yihan Liu and Ziyun Fan (2022) use liminality to describe gossip and the places that trigger it. The biggest example they provide is a corridor in a hospital where staff gossip about patients and have conversations that would not be appropriate within the ward. They also describe liminal places as transitional experiences "free from clear sets of rules and norms and therefore have ambiguous potential".

In “Liminality, space, and the importance of 'transitory dwelling places' at work” (Shortt, 2014), liminal spaces are described as the opposite of dominant spaces. There are dominant spaces that have "defined mainstream uses" and are "interwoven with social expectations"(Shortt, 2014, p.2). An example of this could be a store in which people are expected to enter, pick up their wanted goods, pay and leave. As a result, there are no mainstream expectations for how liminal spaces should be used. Among these are corridors, airport terminals, and hotel lobby areas. While all of these locations have the general expectation that they will be used to transition from one location to another. Shortt describes that few major events within our lives will occur within these locations. This prevents humans from being able to visualise their experiences in the place properly in their minds, so they struggle to build up proper memories of a place.

A liminal space, as described by Barbara Czarniawska and Carmelo Mazza (2016), is a space outside of the rules and norms that govern the dominant location within our daily lives. They describe liminal spaces as spaces where the inhabitants themselves are free to act and express themselves as they wish as they move from one social group to another, so this freedom and ambiguity is said to cause discomfort for many as they are unable to predict what others around them will do, while also lacking direction in how they themselves should act. In school classrooms, teachers usually have clear rules about what students are allowed and are not allowed to do, but outside within the corridors, things are different. While the school might have general rules on what is expected of students out of class, the lack of constant supervision mixed with the freedom to see students who the teachers might not let you sit with within the classroom often causes a lot more chaos and unwanted behaviour.

Uncanniness

Many research papers also described liminality as going hand in hand with uncanniness. Uncanniness is often described as something being both familiar and mysterious at the same time which can lead to uneasiness among inhabitants. In the paper “*Into the Uncanny Valley: Simulation vs Simulacrum*” (Johnston et al., 2020), the authors describe how humans use past experiences to build up confidence about what is where and what expectations are. When we visit a familiar place but it's different from what we remember, it can undermine our self-confidence since our memories don't match. Sigmund Freud, author of “*Uncanny*” (Freud, 1919) says "the conscious ego views itself as the master of its own home". Taking this control away can lead to an uncanny feeling where we don’t fully understand our surroundings. The research suggests that when we lack confidence, we might feel like external forces have more control over us than we do over them. This could lead us to believe that something or someone else is influencing things from behind the scenes. One example that the paper picks up on is the idea of haunted homes and how they violate the comfort and safety that a home is meant to provide by containing horrors that are often unexplainable. This explanation of uncanniness works alongside what we have already discussed with liminality and shows how the two could be used together to create poor imitations of pre-existing environments to unsettle those within them.

The journal "*Structural deviations drive an uncanny valley of physical places*" (Diel and Lewis, 2022) takes a scientific approach into uncanniness and conducts multiple experiments on participants to see how they feel looking at different images of locations to see what specific elements made the locations uncanny. This paper specifically looks at environmental aesthetics that radiate negative attributes, mainly creepiness or eeriness. Findings showed that the majority of participants found that locations that had a lack of features or were empty were the biggest cause of eeriness. Lack of lighting, distorted sizes and the feeling of a threat were also high in creating an uncanny location that is both creepy and eerie for those viewing it. Interestingly the element that came up the least for causing uncanniness in the participants was having a lack of people at these locations. This was further expanded on in a later experiment in the paper which found that people make a location uncanny if their presence or absence goes against what is expected for the location, such as having an empty public place or a populated private one.

In games, uncanniness is a feeling that many would not recommend reproducing unless you are trying to unnerve the player. It is discussed in the study *"Uncanny Behaviour in Horror Games*" (Tinwell, Grimshaw-Aagaard & Williams, 2010) how uncanny behaviour in media ruin immersion by showing the player something that both looks familiar and wrong at the same time. The report describes it as a mental state in which a person cannot distinguish between what appears to be alive and what appears to be dead. Over the years, video game graphics have improved and have moved closer and closer to realism, which means the line between uncanny and not has become thinner and thinner. This can be seen in the video "*Heavy Rain / The Casting - 2006 Tech Demo*". An animation controller tech demo is shown in this video for *Heavy Rain* (2010), a narrative adventure game. A woman character talks to a camera, monologues, and demonstrates different emotions and movements. When shown, this demo was well received, but many viewers commented that the character was unnerving. With hindsight, it is evident that the main issue with the character lies with the poor lip synchronisation and stiff and jittery movements. As the findings show from "*Uncanny Behaviour in horror games*" (Tinwell & Grimshaw-Aagaard& Williams, 2010) "the uncanniness increases strongly with increasing exaggeration of articulation of the mouth during speech" as well as "uncanniness increases with increasing perceptions of lack of synchronisation between the character's lips and the character's voice." (Tinwell & Grimshaw-Aagaard& Williams, 2010, p.30) Whether done purposely or not when these two features are combined, they create a character who becomes unnerving to view.

The report from "*Uncanny Behaviour in horror games*" (Tinwell, Grimshaw-Aagaard & Williams, 2010) also discusses how we must have both sight and hearing to understand noise, for example. Your brain likes to feel in control of whatever situation you're in, as discussed in previous papers. As soon as you hear a noise, your brain begins to search for the source to help you keep control of your situation, without knowing the source, you begin to worry that there may be factors within your surroundings that you are unaware of.

A useful book for my project is *Uncertainty in Video Games* (Costikyan, 2013) which describes how video games require uncertainty to keep the player's interest as without uncertainty then everything that happens within the game can be predicted from the start. The book goes over a range of different ways that a game can contain

uncertainty, from player skill, to randomness, having ways in which a game can surprise the player allows the player to be more engaged and alert while playing. Examples of this can be seen with the previously discussed games as both *P.T* and *The Stanley Parable* has random unique events that can occur during each individual playthrough that increases the replayability that these games have while always ensuring that the player is never fully comfortable within their surroundings.

Examples of media using uncanniness and liminality

While liminality is a concept that has evolved over time, it is not a recent one. Some existing media, intentionally or unintentionally, effectively incorporate this idea to create memorable experiences. In this section, I examine how creators have already used liminality in media, seeking insights for replicating key elements in the development of my digital liminal environments.

"*Corridor*" (Standish Lawder, 1970) is a 22-minute black and white, short film that shows the point of view of a person going down a corridor towards a set of stairs, but once the person reaches the end of the corridor, they appear to be taken back to the start to repeat their journey. Increasing the number of iterations of the journey, a girl appears at the end of the corridor, and the visuals and audio become more sporadic and chaotic. In the short film, no words are spoken nor is there a direct message. In this short film, the location is the constant transversal of a corridor, a location not often shown in media for an extended period, especially not for 22 minutes . Over the course of the short film, the viewer becomes very familiar with the corridor and see every inch of every wall. As a result, the film forces us to look at and process a location repeatedly that transverse through in a matter of seconds.
This is combined with non-diegetic music to create something unique that is hard to fit into any single genre.

Another piece of media that incorporates a similar idea to corridor is the 2014 game *P.T* (playable teaser) (2014). This short horror experience appeared with little to no explanation on the PlayStation store for free in 2014 and involved the player repeatedly making their way through a hallway in a house. Upon reaching the end of the hallway the player will go down a short set of stairs before remerging at the start of the corridor, often with small changes to objects, lighting, and sound. As the player continues on their journey, they begin to encounter more supernatural elements within the hallway such as a talking creature in the sink, paintings of eyes that move violently and sounds that have no visible source. On top of this the player appears to be getting stalked by a ghoul-like lady with her occasionally being seen above or behind the player. Throughout the player's journey the time on the clock mostly stays the same and the radio constantly plays a news story about a murder that took place. Soon after release by doing specific tasks throughout a playthrough players were able to achieve the "ending" to the game which shows a small pre-rendered video teasing the next (now cancelled) *Silent Hill* game. *P.T.* quickly become a cult classic within the horror genre with game and the popularity of the game led to a Change.org petition (Yauheni Zinkevich 2015) being started in 2015 to un-cancel the game, reaching nearly 200k signatures before closing. While the game itself does contain visible horror elements, many of the scares found within the game come from the anticipation of what

might be coming for you in the next run-through of the hallway. This paired with the liminal spacing of the environment creates a constant aura of uncertainty throughout the gameplay experience.

Repeating environments isn't only used in horror games however, the 2013 hit *The Stanley Parable* (2013) involves the player finding themselves within an office environment with a narrator telling them which paths to go down to progress the story, with the player being able to decide whether they follow the narrators' instructions or not. The game involves loads of branching paths for the player to go down but upon reaching the end of each, the player is (nearly) always taken back to the start to start all over again. However, each time the player starts again there is a small random chance that certain parts of the office layout change, such as objects being in different spots, the layout being flipped, or the colour of the walls being changed. These small details, alongside the many secrets and endings within the game, keep the player interested in going back through the game countless times to try figure out the greater story. While *The Stanley Parable* isn't a horror game itself many players reported that they felt unnerved by the repeating and uncanny environment and felt that they were constantly being watched. This feeling is purposely played with by the creators with them playing non-diegetic sounds within the environment while also containing a secret in which if the player is quick enough, they're able to spot someone else for a split-second walking through the office. This quickly turns a non-horror game into one full of tension where you're constantly peeking behind you to see if you're being followed.

One of the biggest most well-known forms of liminal media is the video series "The Backrooms" (Kane Pixels, 2022) made by Kane Pixels on YouTube. This video series shows multiple sets of found footage of people exploring the "Backrooms", an area which is said that people accidentally "fall into" when living their lives. "The Backrooms" takes space in an office-like maze which has a similar artistic style to *The Stanley Parable*. Throughout the series the characters within the footage explore the different maze-like areas as they desperately try to find a way out while avoiding a roaming monster. This series became an instant hit on YouTube with the first video almost 44 million views and helped to make the idea of liminality mainstream. The utilisation of corridors of an office, a liminal space often not shown with media for extended periods, mixed with the blandness of its design and impossible layout creates allows the location to fall in the uncanny valley. "The Backrooms" video series shows how unsettling the general public finds liminal spaces with the Backrooms becoming a mainstream location online often being referenced within online discussions.

Gaps in preexisting literature

While there is a lot of literature around the concept of liminality, digital liminality and how liminality can be found throughout our everyday life, there is little literature out there that goes into detail about design features and interactive elements within digital liminal spaces and how these design choices can affect a user's emotion. Knowing what exact types of liminal elements affect users most can be incredibly useful knowledge when trying to create a memorable liminal experience.

Additionally, there is a lack of standardised measurement tools to assess the quality and depth of liminal states, which hinders the ability to compare findings across studies and establish a better framework when studying and comparing liminality in digital contexts.

Conclusion

In conclusion, liminality and uncanniness are tools that are already employed in successful media to unnerve the audience. As a player, you may feel uncomfortable in your surroundings and worried that you aren't alone in an endless liminal space, which works well in horror settings. Sounds are also a vital tool when creating a disconcerting experience especially the inclusion of non-diegetic sounds that makes the player question what their possible origin can be. From my research I've been able to find many sources that backup the idea that uncanniness and liminality allow for environments to become unnerving to be in without the need to include any direct horror element or creatures. This shows great potential in my project's idea and gives me great hope in its success. This literature review has also allowed me to find many inspirations for my project to use, especially the impossible layouts found within *The Stanley Parable* (Galactic Café 2013), *"The Backrooms*" (Kane Pixel 2022) and *P.T* (Konami 2014). The ideas of liminality discussed through the literature review as well as how uncertainty can affect people also allows me more tools to use when creating my experience.

The aims, objectives, research questions and hypotheses outlined in this study, stated on page 4 of this thesis, were developed based on this review of existing literature on liminal spaces, digital environments, user experience, and human-computer interaction. These pre-existing forms of media and scholarly sources provide me with plenty of knowledge about liminality and uncanniness within pre-existing media and our current understanding of it. From this I've been able to create a set of hypothesises, stated on page 5, for this study based on information found within these academic journals, as well as gather inspiration for how the environments within my experiences may look, and what aims and objectives I plan to hit in making and testing these environments

Chapter 3: Design and Development of the Unity Testing Application

General Design Elements

To explore the concept of liminality within digital environments I decided to create a first-person exploration experience within Unity. After looking at studies, including "First Person vs. Third Person Perspective in Digital Games: Do Player Preferences Affect Immersion?"(Denisova & Cairns, 2015) I decided for my project that a firstperson perspective would work best for achieving my intended results as a first-person point of view immerses the player directly into the shoes of the protagonist, enabling them to perceive and interact with the virtual world as if they were truly inhabiting it. This design decision not only allows players to gain a better understanding of the spaces they traverse but also gain a better appreciation of the overall scale and atmosphere of each distinct location. Drawing

inspiration from the world of liminal media, where personal perspectives often play a pivotal role, I aimed to replicate this characteristic in my project, recognising its significance in inducing an uncanny sensation within the player and creating a unique and effective liminal experience.

In designing the three levels of my experience, I opted for a linear approach, incorporating a mix of enclosed and open spaces for the player to explore within each level. My main goal was to create an immersive gameplay experience that remained free from elements that might disrupt the player's engagement, such as map markers or explanatory text directing their path. Making these locations linear was important as it guaranteed a seamless and unconfusing journey for the player, eliminating any ambiguity about their intended direction or goal without the need of explaining it. This linear design not only ensured immersion but also allowed for precise tailoring of each level that allowed me to plan specific visual elements and details with a deep understanding of where each player would approach each area and where their camera would likely be pointing.

In designing the user interface for my test, I opted for minimalism, featuring only a small central circle on the screen during gameplay. This small circle helped participants in moving their cameras while navigating the environments. Drawing insights from Norrman's (2020) study on "User Interface's Impact on Player's Immersion," which explored the relationship between UI elements and player immersion, I found that a streamlined interface contributed to heightened immersion. Although the study didn't establish a direct correlation between immersion and the quantity of UI elements, participant comments revealed a preference for minimalism, stating the importance of displaying only essential elements for gameplay. Given that my digital experience revolves only around navigating environments to reach an exit, I decided that there were no additional UI elements necessary for an optimal gameplay experience.

When creating my liminal digital experience, it was important to include multiple different levels each distinguished by its unique theme and design. This was important as it allowed me to explore an array of elements within digital environments and their effectiveness in evoking a liminal and uncanny feeling in the player. These multiple levels span a range of lighting, theming, and layouts, overall creating a distinctive liminal experience for the player to navigate through. By creating these multiple levels, I was able to have a large contrast in what the player experiences allowing them to journey through a sequence of environments, each with its own unique ambiance. This not only broadened the scope of experimentation but also allowed for a more unique and immersive experience.

When creating my digital experience, I found it important to incorporate elements generated by artificial intelligence. While traditional or custom art could have been considered, the decision to incorporate AI-generated media was motivated by its unique ability, through machine learning, to produce art that almost mirrors human creations. The AI-generated art not only contributes to the uncanny familiarity pervasive in liminal spaces but also raises intriguing questions about narrative intricacies and ethical considerations. It invites players to question the boundary between human and machine creativity, provoking thought about the role of AI in crafting digital experiences. The juxtaposition of realism and the subtly disturbing elements within the posters, especially evident in the train level,

serves not only as an aesthetic choice but as a narrative device. It sparks curiosity, encouraging players to inspect further, revealing unnatural and unsettling details that contribute to the overall discomfort and unease.

For the creation of these artificial pieces of art I used the website gencraft.com which allows for images to be created using basic prompts This tool not only enabled me to generate a diverse array of visuals but also ensured a cohesive style across all the artworks. By having all the art created by the same artificial intelligence it created a sense of continuity and shared identity, allowing them to be believably all from the same world. The textures used throughout the entire gameplay experience were generated using Polycam's AI texture generator available on their website. This tool allows for the creation of four distinct textures simultaneously with just a single prompt input. Its significance in the development of my digital environments cannot be overstated, as it allowed the rapid generation of textures, already formatted for use within Unity. The swift output of this tool played a crucial role in the experimentation process, allowing for a lot of testing of various environment designs to determine the optimal look and feel for each location.

The Design Process

For the development of my digital experiences, I stuck to a systematic process to ensure uniform quality and to effectively evoke the intended liminal and uncanny ambiance. I began by researching and selecting a thematic concept for each level, a pivotal decision that needed to allow for distinct gameplay and design elements, differentiating each level while serving as a source for unique experimental exploration.

After identifying a theme, my next step was comprehensive research into existing media that featured similar themes. This exploration was particularly critical when considering elements such as lighting and layout. By looking into preexisting works during the literature review, I aimed to find the common denominators that could inspire my design choices and help me to create immersive liminal environments.

I also looked further into preexisting media during this phase of development, especially games, to see what sort of liminal environments I felt I could replicate well for testing. Games such as the original Silent Hill (1999) served as a significant inspiration, showcasing the use of fog to maintain a consistently tense atmosphere, where the player is perpetually unsure of what might be lurking just out of sight. PT (2014) was another major influence, as it unfolds within a single location yet denies the player a sense of true safety. My goal was to create environments that evoke a sense of familiarity while keeping the player on edge throughout exploration.

Once a theme had been decided, I began the process of mapping out various gameplay elements I planned for each environment to include and test. For example, in the forest level, the inclusion of an abandoned satellite and the distant train platform in the train level were carefully considered choices that were added to give objects for the player to view in the distance, creating the feeling that the environments are much bigger than they really are. Early planning of these elements was essential as it allowed me to structure the linear environment around them.

Upon the incorporation of these key elements and the creation of a layout, I proceeded to playtest the level, assessing timings and sightlines. Each environment was tested to see what areas, rooms and objects did and didn't afflict the feeling of liminality with adjustments being made where needed. Once this phase was completed, I then added created appropriate textures using artificial intelligence as well as the created and integrated 3D assets. With these added I would then pick out and add sounds that fit each location as well as went through and fine-tuned the lighting. These final touches were crucial in enhancing the immersive quality of the experience.

In the closing stages of development, I personally engaged in rigorous playtesting adhering to predefined guidelines and a set of well-defined objectives, to ensure that the experience succeeded in invoking a liminal and uncanny feeling. This included comparing my environments with pre-existing media involving liminal spaces to see if they invoked the same feeling and adjusting where needed until the desired emotions were created. Final adjustments and refinements were implemented, guaranteeing that the end product was a journey that effectively immersed players in a liminal and uncanny world.

Individual level design choices

Train

Figure 1 - Screenshot from train platform within train station level

The train level was the first level I worked on and was the environment I had the clearest vision for early on. I envisioned an outdoor setting at night, where the player's exploration would take place on a train platform and exit tunnel. This choice held dual significance; it offered the openness of an outdoor environment while including a subtle constraint, preventing players from venturing beyond the platform's boundaries. The rationale behind this design was rooted in the overall idea of liminal spaces, being that they are transitional thresholds that bridge two different areas. A train station is perfect for this as it is designed to transport people from one place to another, perfectly replicating the essence of liminality.

Figure 2 - Screenshot of seating area within Train level

Moreover, the train station allowed for a variety of environments within a single location, encompassing an expansive open platform, compact bathrooms, empty waiting rooms, and an unsettlingly long corridor towards the end. This amalgamation of spaces prevented the player's sense of comfort, allowing for an array of lighting and textural elements to create a range of liminal experiences that could be tested. To add to this, I set the level at night with a thick fog that constantly played with the player's curiosity about what might lurk in the distance.

Figure 3 - Screenshot from end tunnel section of Train level

Further adding to the sense of liminality, train stations serve as very public spaces. A large theme of liminality revolves around the unsettling feeling of being in a public space entirely alone. To evoke this feeling, I aimed to replicate as much of the station's features as possible, thereby crafting an environment that convincingly recreated the feeling of being alone yet watched.

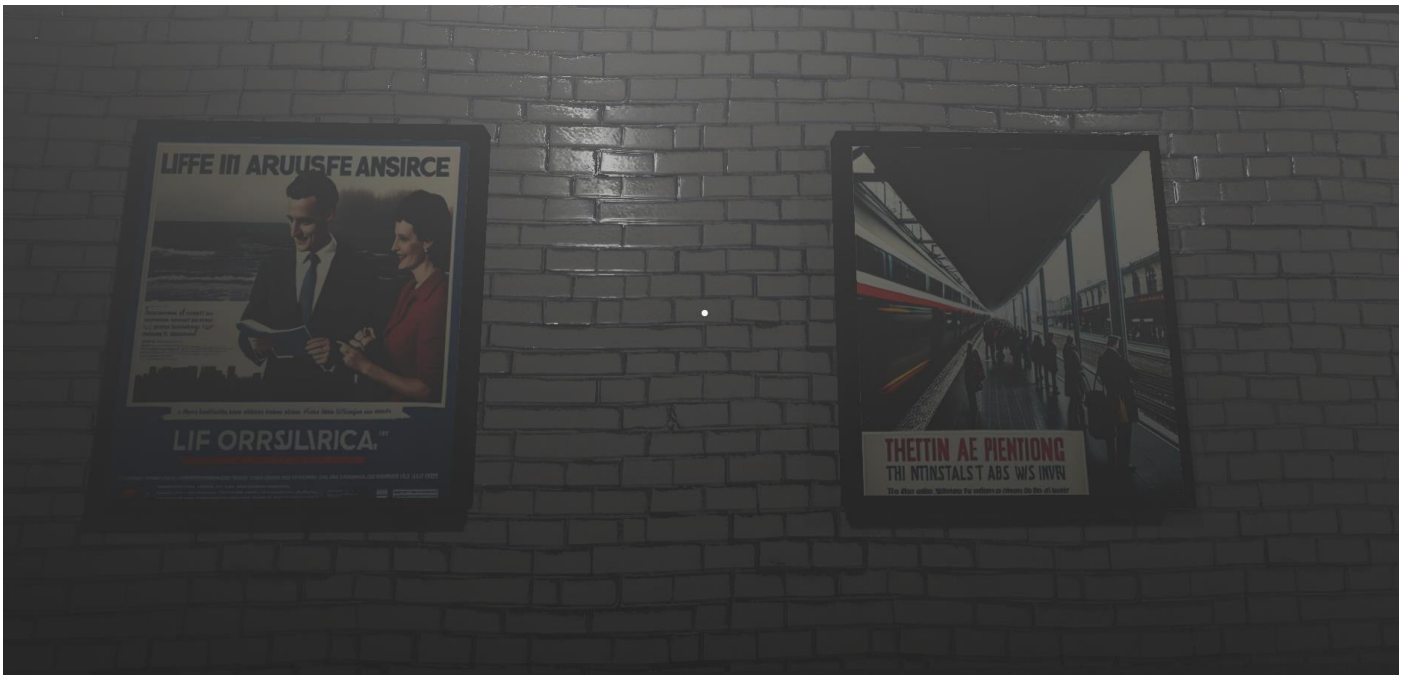


Figure 4 - Screenshot example of AI generated posters throughout the Train level

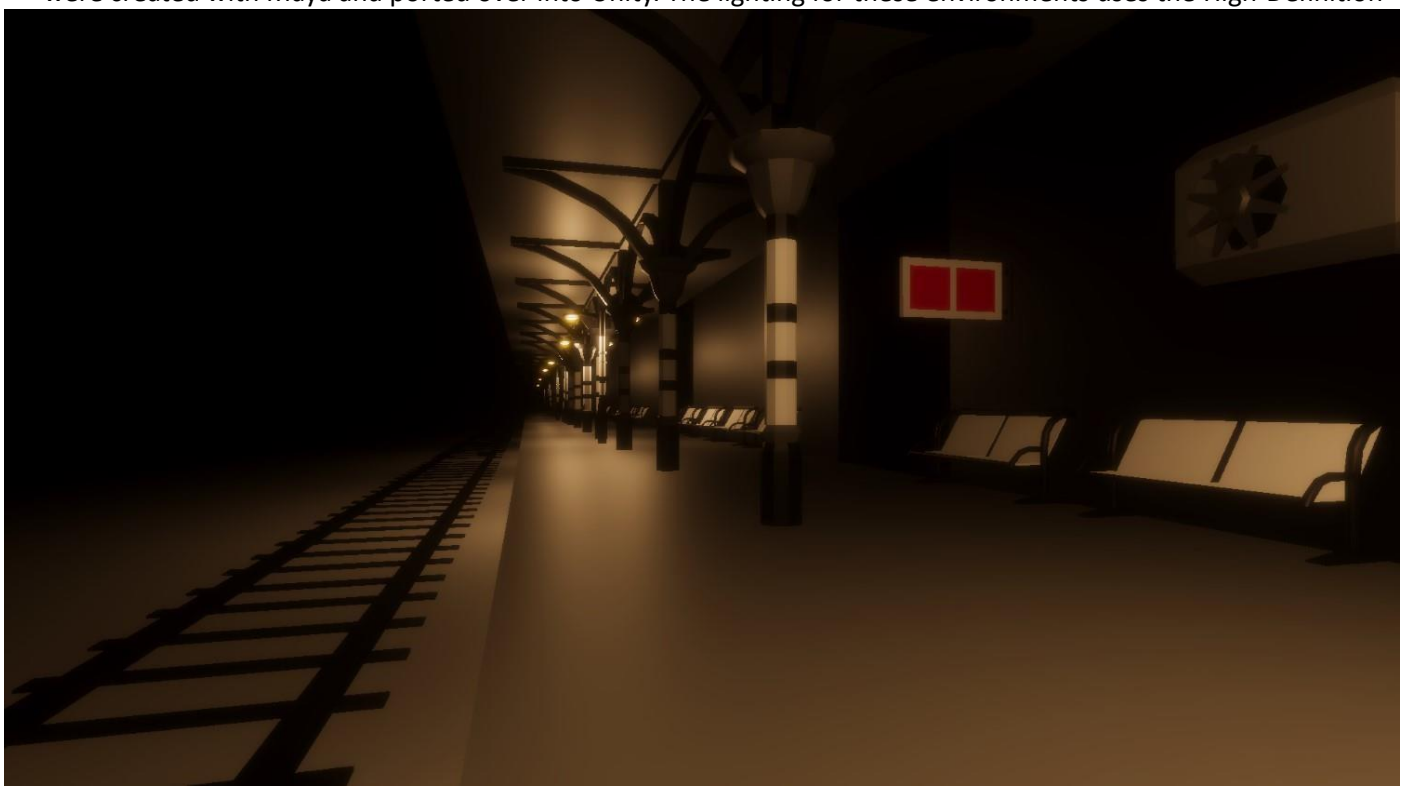
The train station level served as a testing ground for several key elements integral to liminality, with the first being the impact of navigating through a vast, dimly lit, and open space, which constantly challenged the player's comfort and familiarity. This large open area towards the beginning contrasted massively with the enclosed corridors and rooms found throughout the rest of the station, creating a strong feeling of liminality. In addition, a constant unintelligible voice served as a disconcerting constant throughout the level. This auditory element was designed to create a sense of uncanniness and disorientation, making the player constantly question their surroundings and whether someone else may be around. The incoherent nature of the voice mirrored the unsettling nature of liminal spaces, where familiarity and the unknown collide.

Figure 5 - Screenshot of toilet within Train level

Another element that was being tested throughout the level were posters featuring art created by artificial intelligence. These posters introduced an intriguing layer of artistic divergence into the liminal landscape. AIgenerated art works well in creating something that is familiar to us while also including subtle elements that go against what we would expect the art to include, such as confusing perspectives, disfigured body parts or unidentifiable objects, adding to the sense of uncanniness. Furthermore, the train station level allows me to explore a diverse range of different room sizes, from the large open platform to the cramped bathrooms and empty waiting rooms. This variation in dimensions generated a constant tension as it does not allow the player to settle and feel comfortable in the space around them.

Figure 6- Early screenshot of the first version of the Train level platform area

The image above shows the original concept for the train environment. These early versions were created within Unity itself and were made as a proof of concept as well as to test general ideas about the different environments to see if they would work well at replicating the feeling of being within a liminal space. The objects within this version were created with Maya and ported over into Unity. The lighting for these environments uses the High-Definition



Render Pipeline (HDRP) which was completely new to me at the start of the creation process, with a lot of time needed to be spent learning this new lighting pipeline.

Figure 7 - Second screenshot of an early version of the Train level containing basic models and single coloured textures

The general layout was decided early on as I knew, from a design perspective, it would provide an interesting environment to traverse and allow for an open space without the need to create complex surroundings, as the darkness would conceal them. This location stayed very similar to its initial render ideas with the final version using some the same items and props, just with better lighting and texture work.

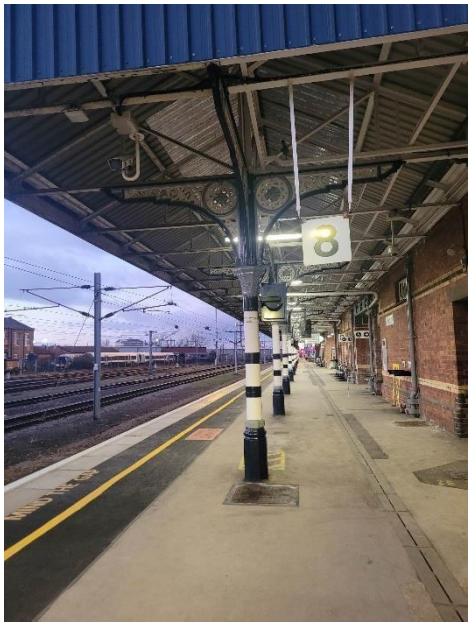


Figure 8 - Photo of a bench at Doncaster station

Figure 9- Photo taken of a train platform at Doncaster

The platform section of the location was heavily inspired by Doncaster train station with these reference pictures being the ones I took when heading through it when traveling home. This train station perfectly replicated the feeling I was going for and worked well as a linear environment with open surroundings. The tunnel section of the level was added at a later point to be able to test different elements as well as extend the overall duration of the level to match the rest.

Forest

Figure 10 - Screenshot of the opening section of the Forest level

The forest level was the second level I created for my project and consists of a forest filled with structures that seemed out of place in their surroundings. The primary emphasis for this level focused on creating specific sightlines that would guide the player's journey and maintain a sense of direction and purpose while also constantly unsettling the player with having a structure loom in the distance that they had to walk towards. These sightlines can be seen from the start with the abandoned satellite dish that looms into view as the player emerges from the tunnel. This landmark as well as future sightlines, such as the abandoned park further along the path, were important in creating the level's layout and the player's experience and helped to navigate the player through the level by giving them something to aim for.

Figure 11 - Screenshot of the park within the Forest level, showing off the fog and surrounding foliage

This level takes place within a dense, fog-shrouded forest during daylight. The goal of this is to create the eerie ambience of an outdoor natural setting. The choice to explore this environment was chosen early on and was aimed at testing the ability to create discomfort and unease in an open, forest area. For this level I decided to add the continuous loop of crows cawing to add another layer of discomfort to the experience. This sound is purposefully designed to prevent the player from ever settling comfortably in their surroundings. I decided crows would work well as they are frequently associated with elements of horror and dread. Horror is often associated with darkness, so I wanted to test creating a liminal environment that was able to discomfort the player during the day.

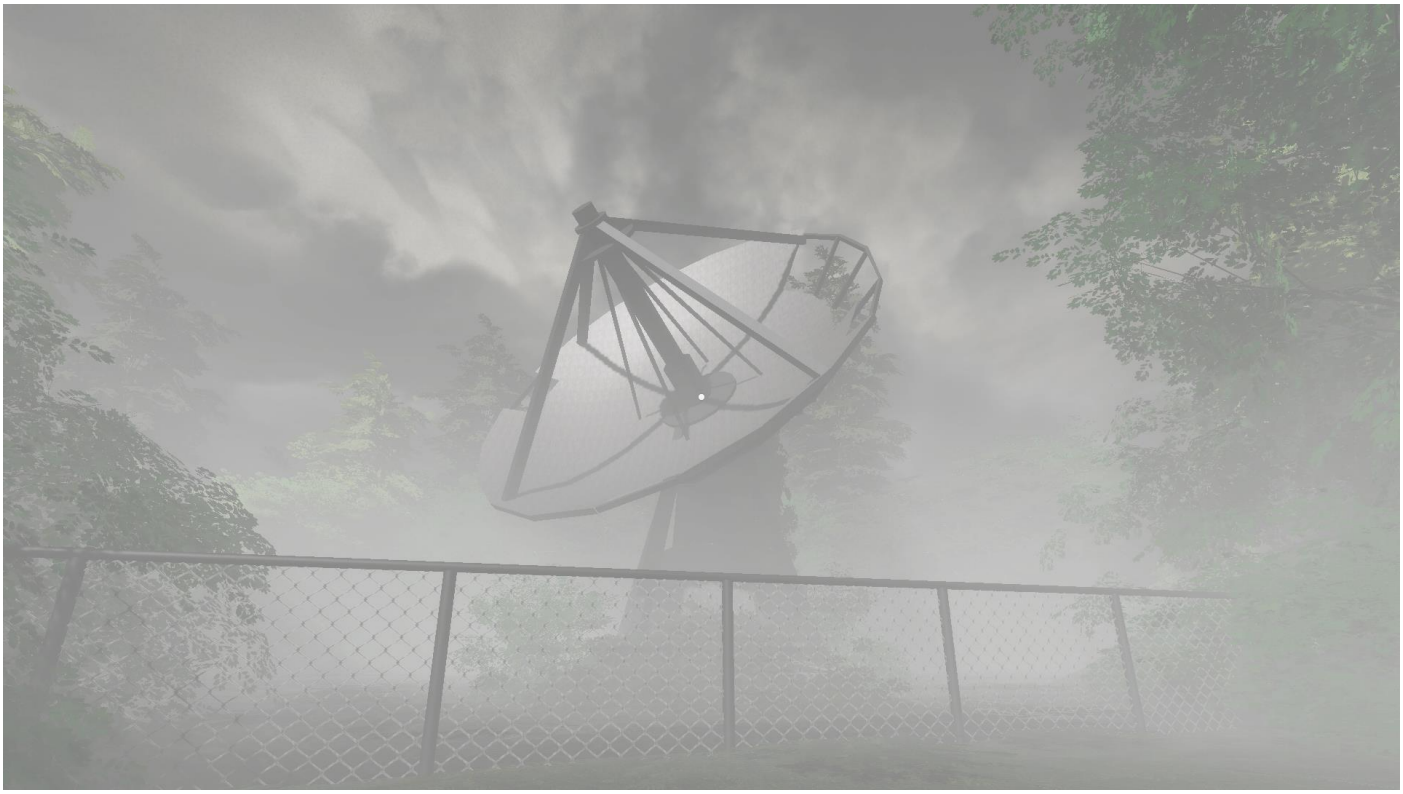


Figure 12 - Screenshot of the satelitte setpiece within the Forest Level

This level also includes many sections where the player can see into the distance at areas that they are unable to reach, such as the beginning of the tunnel, the area around the satellite, and the hills surrounding the nature path. This is designed to constantly keep the player on edge as they never truly know the whole space around them. The goal was to create an open and expansive feel throughout the level, emphasising distant scenery to enhance the perception of a larger space and evoke a sense of being watched.

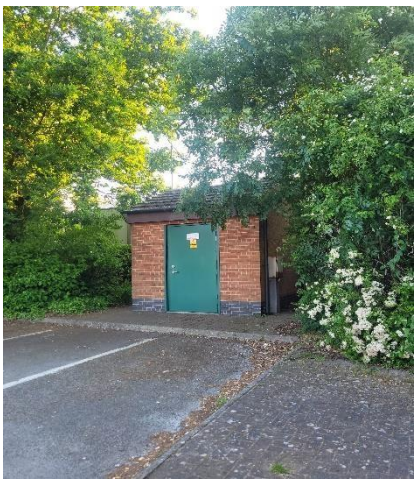


Figure 13 - Screenshot of the building within the Forest level inspired by the maintenance shed photo

Figure 14 - Photo of maintenance shed near the University of York

One inspiration for this environment was of this picture I took of a maintenance shed surrounded by foliage near the University of York. Upon seeing this I knew it was the exact sort of theme I was hoping to replicate within my digital environment, and I ended up using the overall design of it heavily when creating the end location for the forest level.

Figure 15 - Screenshot of the original version of this level, using basic models and textures

The screenshot above shows the original renders for this level. This level was the hardest to design lighting wise as I didn't want the environment to feel like a peaceful walk through a forest. As you can see from the original design the level used to be much brighter and depicted the forest on a bright sunny. This lighting was used in earlier versions of testing, but I found it didn't create the same feeling in viewing it and wandering around as I was hoping for. I ended up replacing the lighting for a sunset before eventually changing it into the foggy day that can be seen within the final version.

Figure 16 - Second early screenshot of the forest level, depicting a set of abandoned buildings that the player would originally have to navigate through

As shown above, the layout of the original prototype of the level was also very different. Although the overall design goal of having mysterious, abandoned structures in the forest remained, the specific ones encountered by the player changed. Initially, players navigated through abandoned buildings, creating an exciting but unintended explorer-like atmosphere. To better achieve the intended atmosphere, the final version replaced the abandoned village setting with a distant satellite structure visible from the start. This change, coupled with surrounding fencing, effectively created the sense of trespassing into restricted territory and provided a great slight line for participants to see and head towards at the start of the environment.

Shop

Figure 17 - Screenshot of the start of the Shop level showing of the shop floor

The shop level was the last I worked on for my project and proved to be the most challenging to conceptualise in terms of layout and design. From the beginning I was committed to the idea of creating two contrasting sections within this commercial space with the first being the vibrant, well-lit shop floor with cheerful music and the second being the dark, cramped employee backrooms. The purpose behind this contrast was to lure the player into a false sense of comfort as the first section is bright and open while the second half is claustrophobic and dark.

Figure 18 - Screenshot of the Shop level showing one of the aisles

A large element of liminality comes from the juxtaposition of the familiar and the unknown which is a feeling frequently encountered in commercial spaces where corporate franchises often replicate consistent styles across their establishments. This feeling of familiarity within a commercial setting is what I aimed to recreate in this level. I sought to create a shop that felt familiar by incorporating recognisable tropes and elements, including the colour scheme and overall store layout. This aspect of the level was important in testing the boundary between the known and the unknown within a commercial environment.

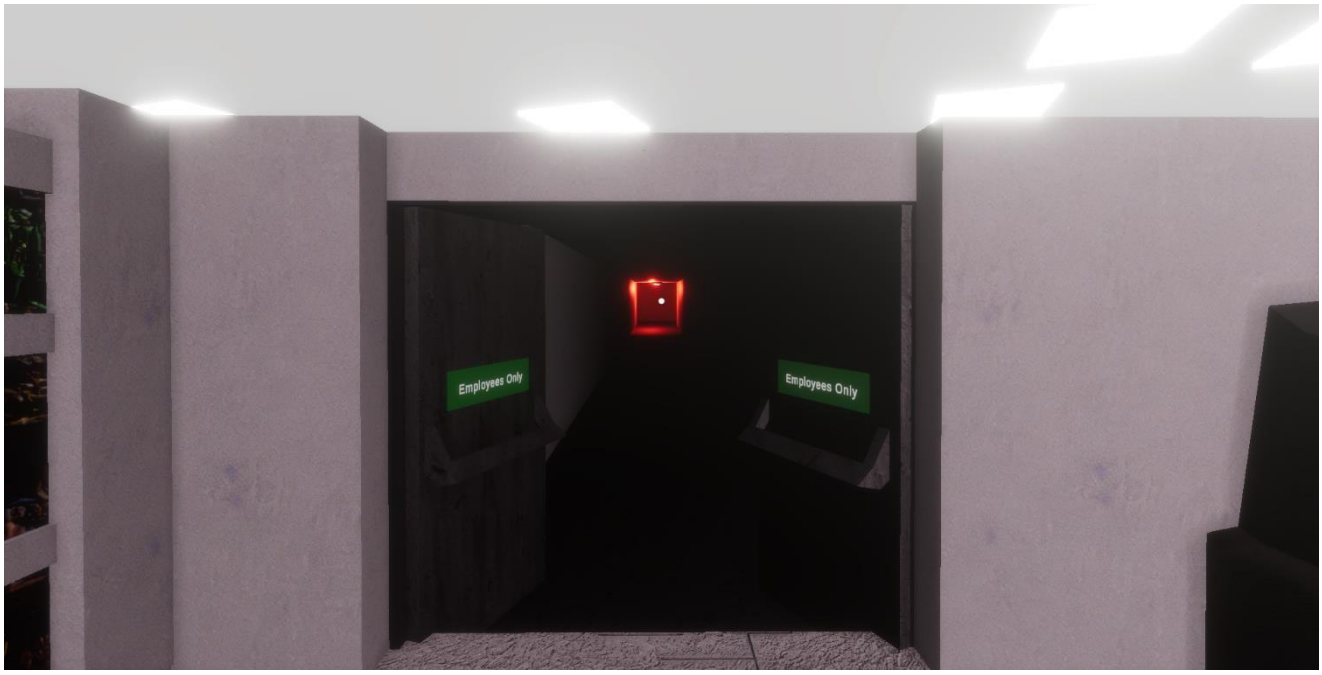


Figure 19 - Screenshot of the staff tunnel towards the end of the Shop level

The level also includes a large emphasis on an expansive ceiling containing an array of lights, stretching far into the distance. This exaggeration of a commonplace feature in commercial spaces aimed to evoke once again the sensation of something being familiar and unfamiliar at the same time. It also allowed for the testing of a distinctive lighting environment, exploring how it might impact the player's experience and emotions.

Figure 20 - Screenshot showing the end of the Shop level within the dark backrooms

In the first section of this location, music plays in the background as the player explores the front of the shop. This AI-generated music was intentionally slowed down to unsettle the player, containing elements one might expect from a typical song but with an offbeat quality. The music stops as the player transitions into the second half of the level, further creating the contrast between the vibrant shop front and the dark backrooms of the store.

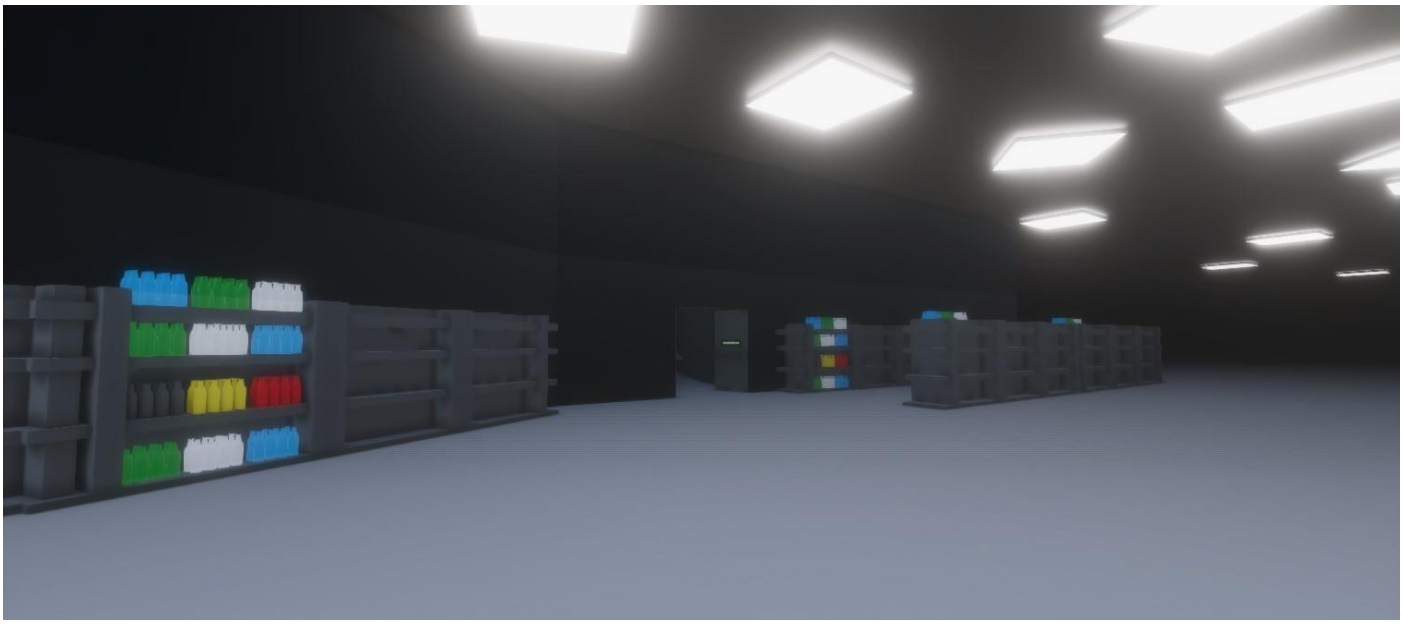


Figure 21 - Early screenshot showing the general design of the shop level

The above image shows the original render for the shop environment. The overall ambience as well as the lighting and large contrast between the front shop floor and employee back rooms was decided early on within the initial brainstorming phase. The original plan for the level included a much larger shop floor for the player to navigate, but this had to be scaled back to maintain the high quality I was aiming for. The original environment also contained 3D models for the products found throughout the shop, but this was changed to artificially generated images to both play off the feeling of uncanniness and liminality better as well as improve performance by cutting down the number of polygons within the level.

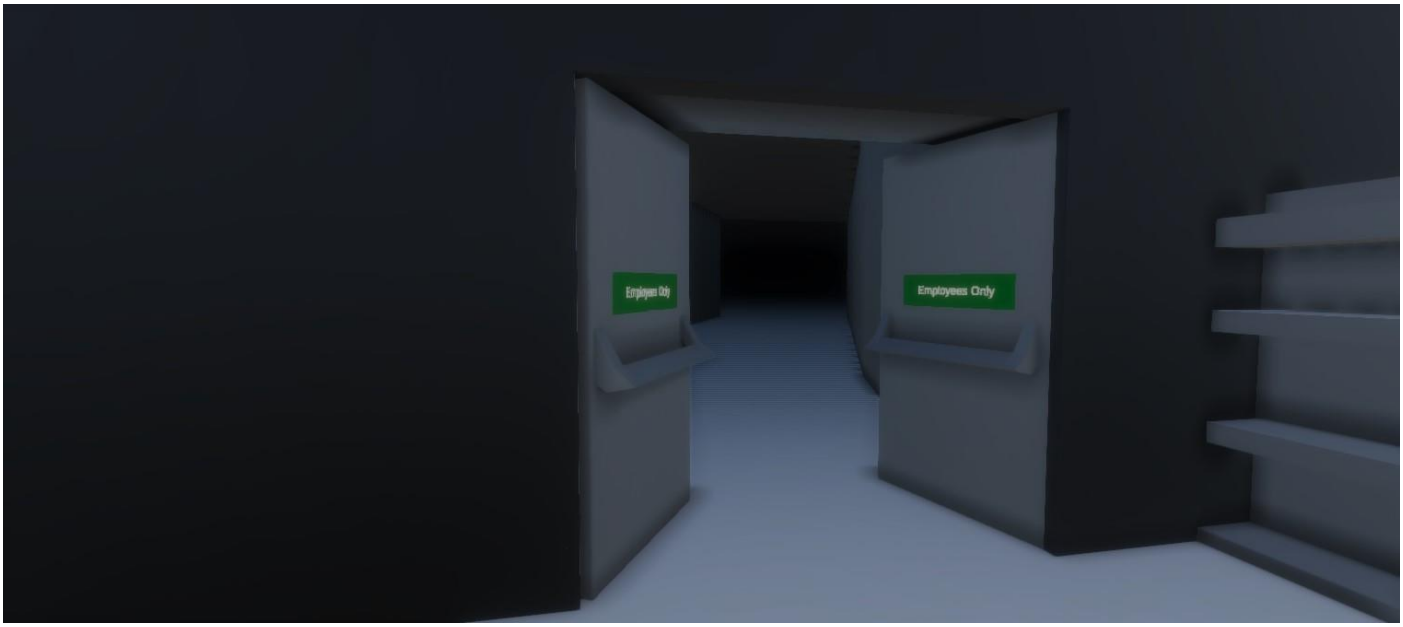


Figure 22 - Early screenshot showing the entrance to the staff backrooms within the early version of the Shop Level

This location was the only location that didn't have a real-life reference image when designing it. Instead I based the location on my experience from working within retail environments, especially with the stylistic contrast between having the bright, well maintained shop-floor and the dark staff backrooms.

Chapter 4: Methodology:

Research Design

This study combines both qualitative and quantitative approaches to investigate the impact of digital liminal environments on user comfort. The research design uses three key components:

Creation of Digital Liminal Environments:

The study involves the design and implementation of three distinct digital environments, each crafted to induce specific experiences of liminality to test users comfort levels within these spaces. These environments are carefully curated to represent varied scenarios, allowing for a range of consistent elements between the environments to be tested and compared. These digital environments have been created using preexisting research done into liminality as discussed in lit review to ensure that they replicate the feeling of being within a liminal location as closely as possible.

Experiences and Participant Questionnaire:

Participants progress through the digital environments in a random order, navigating their way through these linear locations to reach the exit. This intentional variation in the order of experiences aims to capture a range of user

responses, accounting for potential variations in engagement and comfort levels across different contexts., as well as avoiding practice effects with the user getting used to the experience and what sort of events to expect within it. Following each location, participants complete a structured questionnaire that combines Likert-scale questions for quantitative assessment and open-ended queries for qualitative insights into their experiences. The questions for each location remain consistent to allow for comprehensive comparisons, enabling a thorough analysis of the impact of each digital environment on user comforts.

Analysis of Quantitative and Qualitative Data:

Quantitative data, obtained through Likert-scale responses, will undergo statistical analysis to identify patterns, correlations, and statistical significance. Thematic analysis will be applied to qualitative responses, uncovering recurring themes and in-depth narratives. The use of both quantitative and qualitative data allows for a robust analysis of user experiences to get a greater understand of how user's comfort changes throughout the different locations, allowing for more in-depth findings and contributing valuable detailed knowledge about creating immersive liminal environments to the evolving field of both interactive media and user experience research.

Participants

Participants for this research will be recruited through a multi-levelled approach consisting of recruiting participants via word of mouth and advertising the study in a large range of different online spaces and forums. By inviting people from a wide array of different places, this study seeks to ensure diversity in participant backgrounds, experiences, and digital engagement habits. This recruitment strategy aims to capture a varied range of users who navigate liminal spaces in digital environments in different ways, contributing to the richness and depth of data collected from the study. Participants will be briefed on the study's objectives, ethical considerations, and the voluntary nature of their involvement, emphasising the confidentiality of their responses. Ages of participants were not collected during this study as the main focus is on exploring the impact of environmental design on user comfort in digital liminal spaces, I felt age demographics were irrelevant to the study's goal. Additionally, the limited sample size, caused from the Unity executable requiring a powerful windows computer to run, meant that any require found through different ages were unlikely to be reliable or significant.

Instruments and Materials

This research uses a set of digital environments specifically for this study designed to induce liminality, providing participants with distinct yet controlled experiences. These environments, simulate scenarios reflecting various aspects of liminality that we may see throughout our daily lives, such as being on an empty train platform or walking through a forest alone. Participants will navigate through these environments, each designed to emulate the ambiance of a liminal space, allowing us to gauge users' responses and reactions. Upon reaching the end of each

location, participants will be asked to complete a structured questionnaire that combines quantitative and qualitative questions. The quantitative section utilises a Likert scale to measure participants' responses about how each element in the level affected how comfortable they were within them. The Likert scale ranges from very uncomfortable/very uneasy to very comfortable/very relaxed, providing a standardised metric for numerical analysis as each element will be using the same number scale allow for direct comparison between one another. Alongside the quantitative questions, the questionnaire includes an open-ended qualitative question at the end of each environment, encouraging participants to leave any comments they have about the location and experience as a whole. This approach allows for an in-depth understanding of how participants felt navigating through the different environments and gives great insight into what did and didn't work in each location as participants will be able to specifically note which elements affected their comfortability the most.

Procedures

The procedure for this research involves using participants and having them engage digital liminal environments to gather comprehensive insights into their experiences. After obtaining informed consent, participants will be provided access to a folder that contains a Unity file that has an experience made up of three distinct digital liminal environments shown to the user in a random order. Each location has been designed to be linear in nature and each experience starts with an information screen to inform each user on how to navigate their way through the experience. Each environment will test different liminal elements, such as different lighting, locale, and theming to allow for environments to be compared to each other to assess efficacy and identify shortcomings in their design and elements. Following each interaction, participants will be asked to fill out the next section with the provided questionnaire, where they will provide both quantitative and qualitative feedback on their experiences. The questionnaire will be administered through Google Forms with this data, as well as participant's consent forms, being stored within a secure location to ensure participant's data integrity. Strict ethical considerations, including participant anonymity and data privacy, will be maintained throughout the study.

A large consideration for the procedure of my testing is ensuring internal and external validity. The testing themselves were done online to ensure that location wasn't a restriction when it comes to which participants were involved, allowing for a wider range of people of different backgrounds. When it comes to the testing itself participants have been instructed to test the environments in a room by themselves with headphones on to ensure that there are no external factors around them that could disrupt their immersion. The environments themselves were also created to be equal when it comes to length and what elements are being tested in each one. Each location starts and ends in the same way and uses the same controls, art style and use of sound to ensure that there is no location that's at an advantage or disadvantage during the tests.

Ethics

Ethics approval for this study was granted by the Ethics Committee for the School of ACT at the University of York. Ensuring participants' well-being and confidentiality was a paramount consideration during the project's testing phase. No confidential data was collected, and all information was stored within a secure online database. This database was deleted upon the finalisation and release of this report. Participants had the option to opt out of the study at any point, with any related data promptly deleted.

Data Collection and Analysis

Data for this project was collected through the use of a structured questionnaire provided to each participant that was filled out at the conclusion of their gameplay test. The gameplay tests took place online and involved the participant sitting down and playing through the liminal experience I have created within Unity. This experience consists of 3 separate 3D environments with different themes that the player navigate through in a first-person perspective using a mouse and keyboard. The experience was test piloted to test a few different elements and it was found that overall the experience took about 10 to 15 minutes to complete. Participants were instructed to play the experience alone with a pair of headphones on to be as immersed into the experience as possible.

The questionnaire was hosted on Google Forms and was carefully designed to capture a comprehensive range of insights, including the players' subjective experiences and emotional responses. Open-ended questions were added to encourage participants to provide detailed qualitative feedback, while Likert-scale and multiple-choice questions enabled quantitative analysis of their responses.

Data collection for this study involved the collection of both quantitative and qualitative data to gather comprehensive insights into participants' experiences within the digital liminal environments. Quantitative data was collected through the Likert-scale responses obtained from the questionnaires, measuring how each element within each environment affects the users. Statistical analysis was then done using these quantitative responses to test for any significant differences in how comfortable specific elements made the participants feel.

Qualitative data for this project was gathered from participants' responses to the open-ended questions in the questionnaires, capturing unique details of their experiences. Thematic analysis was then employed to identify recurrent themes, patterns, and unique narratives emerging from the qualitative data. The qualitative findings were paired with the quantitative results to interpret participants' interactions within the digital liminal spaces.

Throughout the data analysis process, an unbiased approach was applied to ensure the validity of the findings. All information provided to the participants, from the project's information sheet, consent form and questionnaire included no leading information or questions to avoid social desirability bias. The integration of both quantitative and qualitative data aims to offer a comprehensive understanding of how participants navigate and perceive liminality

within the digital environments, contributing valuable insights to the broader discourse on user experience within liminal spaces.

Originally, I was planning on also conducting online interviews with random participants after their experience had concluded. But I found that the comments left in the questionnaire comment boxes in-depth and useful enough that it wasn't needed to get the level of insight I was looking for. This also avoided issues in scheduling as well as participants having forgotten what specific elements were like when interviewing them.

Chapter 5: User Testing:

Introduction to User Testing

User testing was a significant component in the investigation of user experiences within digital environment, providing useful insights into the impact of design elements on participants' emotions, and overall comfort. In this study, user testing serves as a key methodology for investigating the influence of digital liminal environments on user comfort. The user testing involves participants immersing themselves in three distinct locations meticulously designed to elicit specific experiences – an empty train station at night, a bright shopfloor with a dark employee backroom, and a forest path on a foggy day. Each location has been chosen to represent diverse contexts, allowing for a wide range of elements and conditions to be tested.

Throughout the user testing process, participants were given a Unity experience to play through where they would navigate through these three digital environments in random order. At the end of each environment, participants would be directed to record their comfort levels within a Google Form questionnaire, offering valuable quantitative and qualitative data. This approach enables the study to capture insights into how different elements within each environment contribute to participants' overall feelings and comfort.

Design of User Testing

The user testing was designed to be able to be completed online to ensure that location was not a limitation in participation recruitment. For the design of the test itself I wanted to ensure that, when it comes to playing digital games on a PC, user skill levels wouldn't be a factor that prevented players from being able to complete the test. To negate this, I made sure to make the controls of the testing were basic with only the WASD keys being used to move throughout each environment, which was instructed to users via an information screen at the start of the test.

Description of Participants

A total of 16 participants took part in my study. Participants for my study were recruited using word of mouth and advertisements within online groups and forums. This range of recruitment allowed for participants from different backgrounds and experience within digital environments which was crucial in collecting a range of different

responses. The only requirement for participants were that they had a windows PC and were able to run the Unity file to test the program. The participants were given the information sheet for the project as the consent form to sign before they were given access to the actual Unity testing files. Participants were also briefed via the testing email about testing conditions and instructed to conduct the test alone with headphones on to enhance immersion.

Results and Analysis

In general, the majority of hypotheses found support in the data collected through user testing, with the exception of H3. Once the data was collected, I first sorted it so that all the data from each level was together and then used SPSS to analyse it to see what elements had a significant impact on player's comfort. To achieve this, a One-Way ANOVA was conducted, using the factor 1, 2, or 3 to represent the respective levels (1 for the train station, 2 for the forest, and 3 for the shop). The objective was to identify elements in each level with a Sig. value below 0.05, indicating statistical significance in the differences between results across levels.

Overall comparisons

One Way ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Lighting	Between Groups	10.042	2	5.021	3.292	.046
	Within Groups	68.625	45	1.525		
	Total	78.667	47			
Sound effects	Between Groups	4.292	2	2.146	1.338	.273
	Within Groups	72.188	45	1.604		
	Total	76.479	47			
Absence of others	Between Groups	6.542	2	3.271	2.122	.132
	Within Groups	69.375	45	1.542		
	Total	75.917	47			
Level theme	Between Groups	10.500	2	5.250	4.890	.012
	Within Groups	48.313	45	1.074		
	Total	58.813	47			
Level layout	Between Groups	4.542	2	2.271	2.356	.106
	Within Groups	43.375	45	.964		
	Total	47.917	47			
Navigating	Between Groups	36.792	2	18.396	14.303	<.001
	Within Groups	57.875	45	1.286		
	Total	94.667	47			
Narrow spaces	Between Groups	15.125	2	7.563	7.212	.002

	Within Groups	47.188	45	1.049		
	Total	62.313	47			
Open spaces	Between Groups	3.500	2	1.750	1.198	.311
	Within Groups	65.750	45	1.461		
	Total	69.250	47			
Overall ambience	Between Groups	10.042	2	5.021	5.387	.008
	Within Groups	41.938	45	.932		
	Total	51.979	47			
Design of objects	Between Groups	7.042	2	3.521	2.937	.063
	Within Groups	53.938	45	1.199		
	Total	60.979	47			
Average	Between Groups	8.476	2	4.238	7.273	.002
	Within Groups	26.222	45	.583		
	Total	34.698	47			

As shown in the table above, it is evident that certain elements significantly impacted participants' comfort. These elements include lighting, level theme, navigating, narrow spaces, and overall ambience, with there being an overall notable significance in the average comfort across all three levels. On the other hand, elements such as sound effects, absence of others, level layout, open spaces, and design of objects did not exhibit statistical significance within my test. It's important to note that even elements lacking significance may still have implications, as the

Means Comparison Test

Level		Lighting	Level theme	Navigating	Narrow spaces	Overall ambience	Average
1 (Train)	Mean	2.31	2.81	1.69	2.69	2.19	2.481
	N	16	16	16	16	16	16
	Std. Deviation	1.078	1.047	1.078	1.014	.911	.5890
2 (Forest)	Mean	3.31	3.56	3.81	3.38	3.13	3.350
	N	16	16	16	16	16	16
	Std. Deviation	1.352	.892	1.167	.957	1.147	.8687
3 (Shop)	Mean	2.38	2.44	2.50	2.00	2.13	2.438
	N	16	16	16	16	16	16
	Std. Deviation	1.258	1.153	1.155	1.095	.806	.8041
Total	Mean	2.67	2.94	2.67	2.69	2.48	2.756
	N	48	48	48	48	48	48
	Std. Deviation	1.294	1.119	1.419	1.151	1.052	.8592

absence of significant differences between locations could indicate equal positive or negative effects on participants.

Conducting a means comparison test on the significant elements reveals the effectiveness of each element across different levels. The data, collected on a Likert scale ranging from 1 to 5 with 1 stating being uncomfortable/very uneasy, 5 being comfortable/very relaxed and 3 being neutral/no effect. A mean below the midpoint of 3 indicates a negative effect, while a mean above 3 suggests a positive effect on participants' comfort. The total row at the bottom provides an overview of how these elements collectively influence participants' comfort across all three locations.

Analysis of each element

Lighting

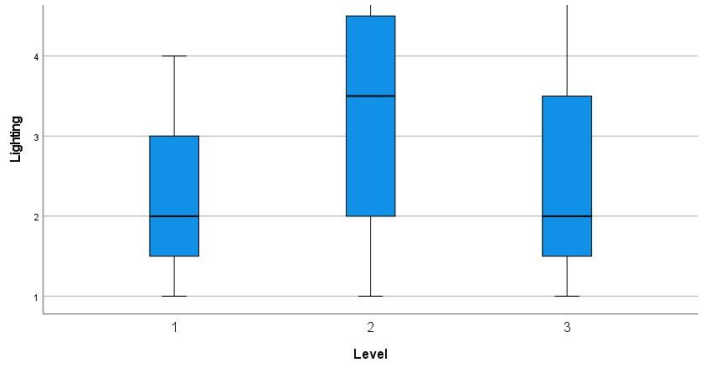
Lighting showed a large amount of significance between the different scenes but overall did have a negative impact on participants comfortability when exploring each environment.

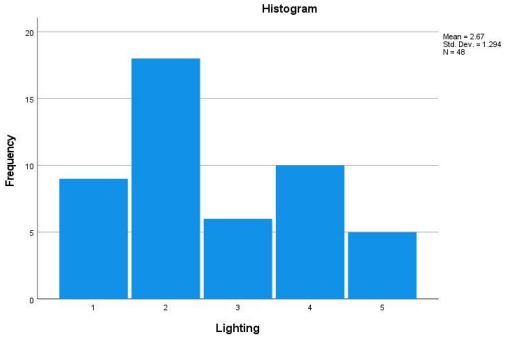
Descriptives

			Statistic	Std. Error
Lighting	Mean		2.67	.187
	95% Confidence Interval for Mean	Lower Bound	2.29	
		Upper Bound	3.04	
	5% Trimmed Mean		2.63	
	Median		2.00	
	Variance		1.674	
	Std. Deviation		1.294	
	Minimum		1	
	Maximum		5	
	Range		4	
	Interquartile Range		2	
	Skewness		.415	.343
	Kurtosis		-1.019	.674

Level Comparisons

Level	Mean	N	Std. Deviation
1	2.31	16	1.078
2	3.31	16	1.352
3	2.38	16	1.258
Total	2.67	48	1.294





Lighting: Descriptive Statistics

Overall Impact: The mean score for sound effects was 2.67, making lighting an element that overall caused discomfort and unease for participants throughout the environments.

Overall Box Plot Analysis: The impact the lighting had varied heavily between levels, with it negatively impact participant's comfort levels in the Train and Shop levels while positively effecting it in the Forest level. In the Train and Shop levels the lighting was much darker which led to player's feeling less comfortable within their surroundings. On the other hand, the forest level took place during a foggy daytime, leading to many participants stating that they found the overall area relaxing to be in.

Level 1 Analysis – Train Station: The box plot graph above illustrates that the train station level had the biggest significance when it comes to negatively effecting participants comfortability in exploring these locations. Multiple participants commented on the lighting in this level with one stating that it had "blaring lights but somehow the environment still feels dark" and another saying that the lighting in the level was "both harsh yet only illuminated a small radius whilst leaving a lot of the environment shrouded in darkness".

Level 2 Analysis – Forest: The forest had the least uncomfortable lighting out of the three environments as seen by the box plot graph. Not many of the participants commented on the lighting itself when discussing the location but a few did state that the location felt the most realistic and relaxing to walk through.

Level 3 Analysis - Shop: The shop also had a significant impact on player's comfortability. The lighting in this environment was commented on a large amount in the user feedback with participants stating that the lighting in the first half of the location made the location feel "sterile" while the later staff only area made them "feel 'rushed' as the red overhead lighting made me think there was an emergency".

Overall Observation: Lighting played a significant role in making participants feel uncomfortable while traversing environment 1 and 3, different shades and uses conveying different emotions to the players. The lighting in environment location 2 however helped in replicating the realistic feel of the location which led to participants feeling more comfortable within it.

Sound effects

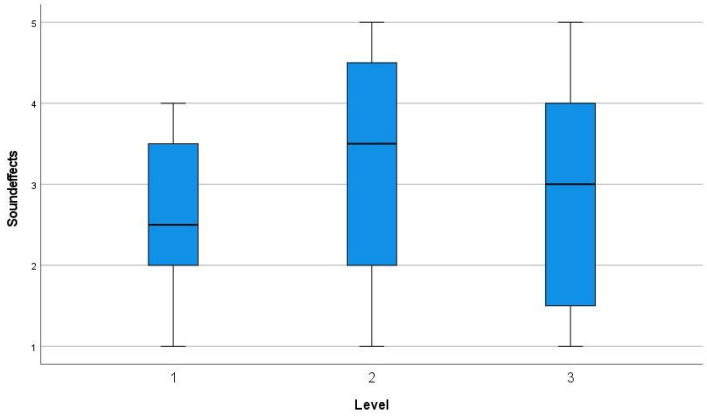
The use of sound effects within the different levels didn't have a clear significant impact on the user's comfortability between the different environments. This is likely caused by the sounds being used in a similar way across the three levels.

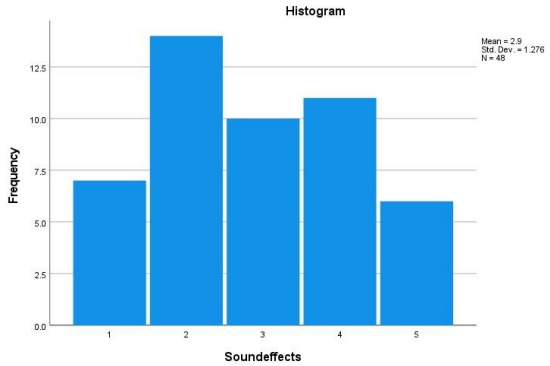
Descriptives

			Statistic	Std. Error
Sound effects	Mean		2.90	.184
	95% Confidence Interval for Mean	Lower Bound	2.53	
		Upper Bound	3.27	
	5% Trimmed Mean		2.88	
	Median		3.00	
	Variance		1.627	
	Std. Deviation		1.276	
	Minimum		1	
	Maximum		5	
	Range		4	
	Interquartile Range		2	
	Skewness		.139	.343
	Kurtosis		-1.070	.674

Level Comparisons

Level	Mean	N	Std. Deviation
1	2.63	16	1.025
2	3.31	16	1.352
3	2.75	16	1.390
Total	2.90	48	1.276





Sound effects: Descriptive Statistics

Overall Impact: The mean score for sound effects was 2.9, slightly below the neutral point, but by an insignificant amount that there is no justifiable conclusion that can be made about it in this study.

Overall Box Plot Analysis: With the mean being 2.9 for all environments, the box plot shows that participants found the sound effects used throughout the experience had little significant impact on affecting a player's comfortability while exploring these environments. With the train station having the lowest scores for sound and the forest having the highest.

Level 1 Analysis – Train Station: The box plot for this environment shows that the sound effects within the train station had the most consistent impact on users' comfortability with the median being below 3. Participants commented on the announcer in this level stating that the "noise made it the most creepy and the muffled announcements" as well as "the background noise (announcement and what sounded like people talking even though no one else was there added a lot here)".

Level 2 Analysis – Forest: Participants overall found the sounds of crows cawing in the background relaxing with it being “constant enough to offset some of the unease”. These comments justify the median being above the 3 midpoint with multiple participants finding the noises made the environment more comfortable to explore.

Level 3 Analysis - Shop: The shop had the largest range in results in feedback about the sound. Many participants commented on the use of a music track escalating how uncomfortable it felt being in an empty location usually full of people and how it made the shop feel “abandoned for a reason in a rush”.

Overall Observation: Participants found the sound of crows cawing in the forest relaxing and companionable, in contrast to the unsettling nature of the train station's announcer. This difference can be attributed to the distortion of the announcer's voice, rendering it simultaneously familiar and unfamiliar, fitting with the overarching concept of liminality.

Absence of others

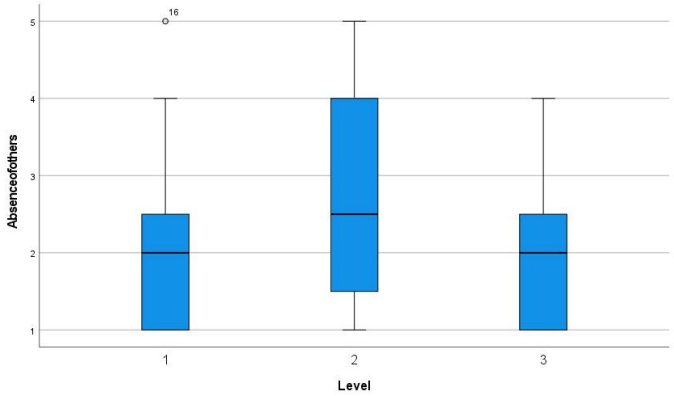
None of my locations included any visible Non-Playable Characters (NPCs) with the goal of replicating the feeling of loneliness in a usually crowded space. Like with sound effects, while there is no significant difference between the different locations, there is an overall impact with the effect the absence of others has on player’s comfortability, with the mean between all three locations being 2.29.

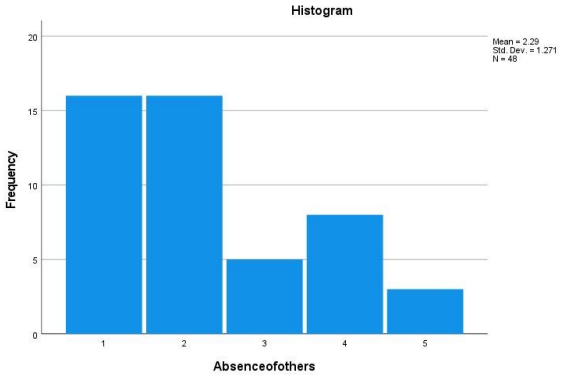
Descriptives

			Statistic	Std. Error
Absence of others	Mean		2.29	.183
	95% Confidence Interval for Mean	Lower Bound	1.92	
		Upper Bound	2.66	
	5% Trimmed Mean		2.21	
	Median		2.00	
	Variance		1.615	
	Std. Deviation		1.271	
	Minimum		1	
	Maximum		5	
	Range		4	
	Interquartile Range		2	
	Skewness		.718	.343
	Kurtosis		-.649	.674

Level Comparisons

Level	Mean	N	Std. Deviation
1	2.06	16	1.181
2	2.81	16	1.471
3	2.00	16	1.033
Total	2.29	48	1.271





Absence of others: Descriptive Statistics

Overall Impact: The absence of visible Non-Playable Characters (NPCs) aimed to evoke a sense of loneliness in crowded spaces, yielding a mean of 2.29 across all locations and a median of 2.

Overall Box Plot Analysis: With the median being below 3 for all environments, the box plot shows that participants found the absence of others uncomfortable in all the environments, especially environment 1 and 3. The box plot for environment 2 shows a larger range in ratings and fits the contrasting comments left by participants.

Level 1 Analysis – Train Station: The box plot for this environment aligns with participant comments, emphasising the impact of the absence of others on comfort during navigation. Notably, the train station evoked comments like "The train announcements and busy sound effects were reassuring, but the absence of people clashed a lot with that.

Level 2 Analysis – Forest: There was a range in results from participants with some enjoying the idea of a walk alone through a forest and others stating that it “probably felt the creepiest, same way being alone in a forest probably would make someone feel.”

Level 3 Analysis - Shop: The shop drew the highest number of comments on the lack of others, with participants highlighting the unease caused by the absence of people in a typically busy setting. This seemed to be elevated by the location being seemingly still being used, with lights on and music playing on the speakers.

Overall Observation: While not statistically significant, the box plot differences, and participant comments suggest that the absence of people in normally bustling places has a more pronounced impact than in quieter locations like an outdoor setting.

Level Theme

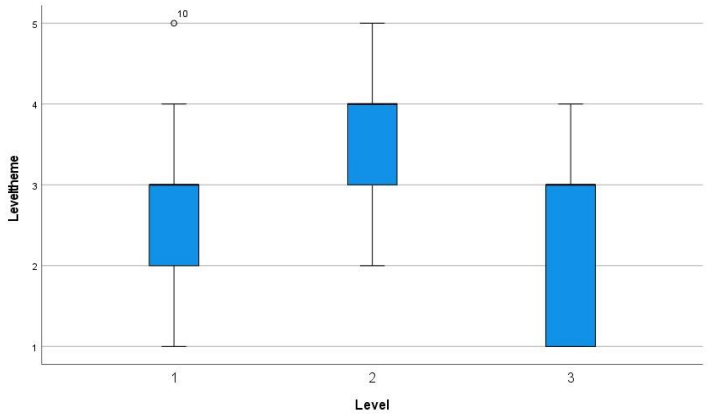
My tests only consisted of 3 different locations, a train station at night, a forest on a foggy day and an empty shop with a bright shop front and a dark back-room area. While testing more locations is ideal in gathering more data about different conditions there was still a statistically significant difference between the level themes and the comfortability of participants.

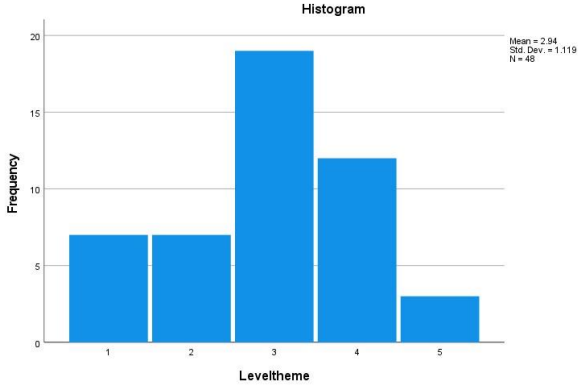
Descriptives

			Statistic	Std. Error
Level theme	Mean		2.94	.161
	95% Confidence Interval for Mean	Lower Bound	2.61	
		Upper Bound	3.26	
	5% Trimmed Mean		2.93	
	Median		3.00	
	Variance		1.251	
	Std. Deviation		1.119	
	Minimum		1	
	Maximum		5	
	Range		4	
	Interquartile Range		2	
	Skewness		-.253	.343
	Kurtosis		-.521	.674

Level Comparisons

Level	Mean	N	Std. Deviation
1	2.81	16	1.047
2	3.56	16	.892
3	2.44	16	1.153
Total	2.94	48	1.119





Level theme: Descriptive Statistics

Overall Impact: The histogram indicates that the majority of participants rated the impact of level theme on comfortability as 3, being neutral, aligning with the mean score of 2.94, which is in close proximity to the neutral point.

Overall Box Plot Analysis: The One Way ANOVA done earlier showed that there was a statistically significant difference between each environment. Through the box plot we can see that the significance is mainly with the third environment being much lower rated than the rest with most participants finding it uncomfortable.

Level 1 Analysis – Train Station: The location theme itself had little notable effect on participants comfortability with the range of results being pretty diverse across the scale and the median being 3, though the results do slightly lean towards the theme making participants feel uncomfortable.

Level 2 Analysis – Forest: The forest theme itself has a positive impact on player's comfortability with the median being at 4. This fits with the participants comment with how the environment "felt quite enriching to walk through".

Level 3 Analysis - Shop: The shop had a large range of votes with the median remaining at 3, which is neutral. However, the shop has the highest number of votes for 1, which means that a large number of participants found the location theme to be a large part of why they felt uncomfortable exploring it. Many participants commented on how the location theme combined with the absence of others largely effected their comfortability while exploring it.

Overall Observation: The range in results, combined with the One Way ANOVA showing that there is a statistically significant difference between the environments, shows that the decision of location theme is important when trying to make an engaging digital environment.

Level layout

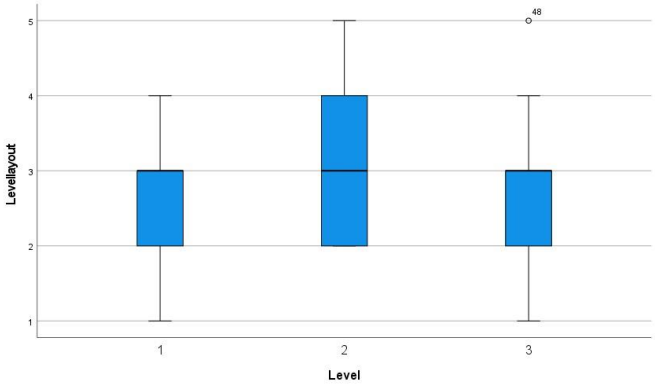
There was no statistically significant difference found between the level layouts in the different environments. This is likely due to the levels mostly consisting of a linear path for the participants to follow to ensure that they didn't get lost or confused while playing. With that said there is still some differences that can be seen when looking at the descriptive comparisons.

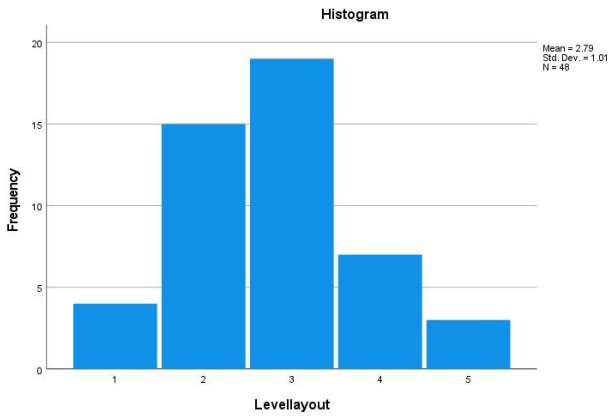
Descriptives

			Statistic	Std. Error
Level layout	Mean		2.79	.146
	95% Confidence Interval for Mean	Lower Bound	2.50	
		Upper Bound	3.08	
	5% Trimmed Mean		2.77	
	Median		3.00	
	Variance		1.020	
	Std. Deviation		1.010	
	Minimum		1	
	Maximum		5	
	Range		4	
	Interquartile Range		1	
	Skewness		.310	.343
	Kurtosis		-.098	.674

Level Comparison

Level	Mean	N	Std. Deviation
1	2.44	16	.892
2	3.19	16	1.047
3	2.75	16	1.000
Total	2.79	48	1.010





Level Layout: Descriptive Statistics

Overall Impact: The mean for the overall impact of the level layout is 2.79 while the median is 3. As seen with other graphs, the layout of level 1, the train station, and 3, the shop, lean towards having a slight negative impact on participants comfort, which is not the case for the forest.

Overall Box Plot Analysis: The box plot show that the median for all 3 levels is 3, which is neutral. Level 1, the train station, and 3, the shop, both have a range between 1 and 4 with it leaning towards making the users uncomfortable. Level 2, the forest, median is also neutral, but more participants stated that it made than feel comfortable with a few even saying it made them feel very comfortable.

Level 1 Analysis – Train Station: This location featured a series of tunnels at the end for the participants to navigate through with many stated that it felt like a "maze". This layout being less linear stuck out to participants and made them feel more uneasy, with one stating "I felt like a jumpscare could happen at any time, particularly in the underground tunnels".

Level 2 Analysis – Forest: The forest had the most linear layout out of any of the locations, with the actual path the participants go down having little variation or choices, leading to a more comfortable exploration, as seen within the box plot graph.

Level 3 Analysis - Shop: The shop's initial section features an open, well-lit shop floor, allowing participants to explore freely. However, the second half of the level transitions to the dark backrooms of the store. Participant comments frequently highlighted this contrast, aligning with the rating for the level layout, which contributed to a slight feeling of discomfort. One participant specifically mentioned, "the biggest point that made me uncomfortable was, to my surprise, the descending step into the utility room. I was not expecting a shift in perspective, and when it happened, it gave me a bit of a jolt in discomfort."

Overall Observation: The results match the complexity of the level's layouts, with the most linear level, the forest, having a positive impact on participants comfortability while the other two more complex layouts have a negative one.

Navigating

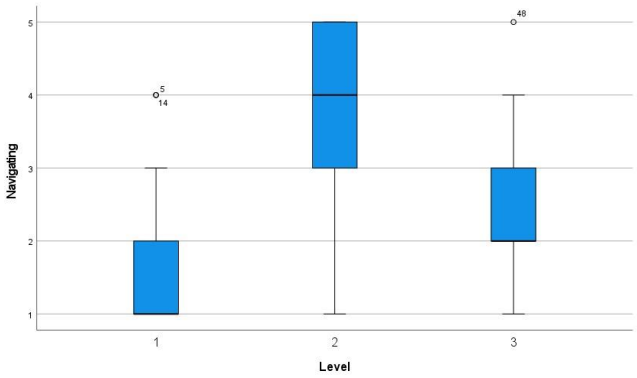
While level layout didn't have a significant difference between environments, navigating did at a significance of < 0.01. This could be because other factors, such as lighting, effected participants more than the actual layouts themselves. It could also be because the two elements were not specifically defined within the feedback sheets leading to participants associating their emotions while exploring with the navigating option.

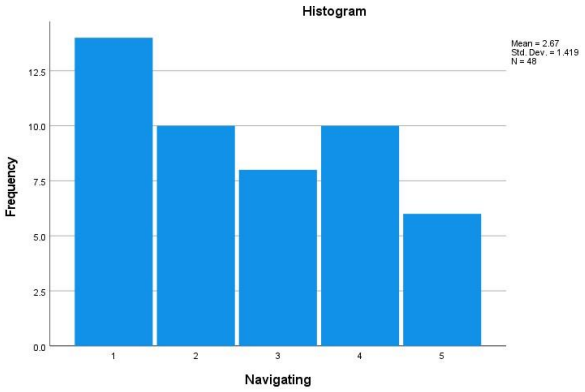
Descriptives

			Statistic	Std. Error
Navigating	Mean		2.67	.205
	95% Confidence Interval for Mean	Lower Bound	2.25	
		Upper Bound	3.08	
	5% Trimmed Mean		2.63	
	Median		2.50	
	Variance		2.014	
	Std. Deviation		1.419	
	Minimum		1	
	Maximum		5	
	Range		4	
	Interquartile Range		3	
	Skewness		.252	.343
	Kurtosis		-1.297	.674

Level comparison

Level	Mean	N	Std. Deviation
1	1.69	16	1.078
2	3.81	16	1.167
3	2.50	16	1.155
Total	2.67	48	1.419





Navigating: Descriptive Statistics

Overall Impact: There was a huge statistically significant difference between navigating through the different environments. As seen within the level comparison report, level 1, the train station, had a mean of 1.69, meaning that participants felt very uncomfortable while navigating through it. On the contrary, level 2, the forest, had a mean of 3.81 which is leaning towards comfortable.

Overall Box Plot Analysis: Each location occupies a different segment of the graph, with varying medians indicating a significant disparity in the gameplay experience across these environments. Each environment was designed to have different layouts and sizes so seeing these results shows these design choices had a big impact on participants.

Level 1 Analysis – Train Station: Similar to level layout section, the train station featured a “maze” of foggy tunnels towards the end for the player to navigate through to the exit. Having a less linear path mixed with the visuals really effected participants with one stating “going through the underground passages made me feel panicky at first as there didn't seem to be an end in sight, felt like a maze, especially in the dark”.

Level 2 Analysis – Forest: Participants stated that navigating through the forest felt relaxing with the visuals paired with the sounds of the crows creating an almost calming experience.

Level 3 Analysis - Shop: The contrast between the first and second sections of the shop effectively contributed to participants feeling uncomfortable, particularly the employee back rooms, which unsettled participants. One individual mentioned, "the passage at the end was uncomfortable due to the sounds and confined space."

Overall Observation: The navigation category represents well how participants felt making their way through the different environments and shows best how impactful changing how players have to navigate through the levels can be.

Narrow Spaces

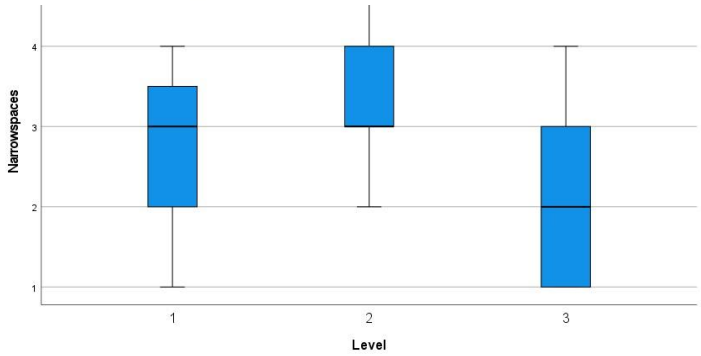
For the creation of my environments, I wanted to ensure I had both open and narrow spaces for participants to explore as they made their way through the liminal environments. This has worked well and has allowed me to test how they affect participants differently.

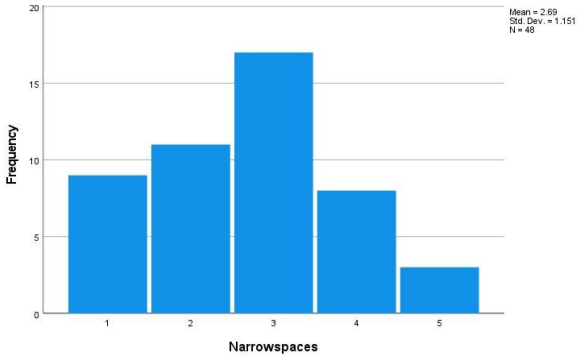
Descriptives

			Statistic	Std. Error
Narrow spaces	Mean		2.69	.166
	95% Confidence Interval for Mean	Lower Bound	2.35	
		Upper Bound	3.02	
	5% Trimmed Mean		2.65	
	Median		3.00	
	Variance		1.326	
	Std. Deviation		1.151	
	Minimum		1	
	Maximum		5	
	Range		4	
	Interquartile Range		1	
	Skewness		.129	.343
	Kurtosis		-.655	.674

Level comparison

Level	Mean	N	Std. Deviation
1	2.69	16	1.014
2	3.38	16	.957
3	2.00	16	1.095
Total	2.69	48	1.151





Narrow Spaces: Descriptive Statistics

Overall Impact: A statistically significant difference was observed in the impact of narrow spaces across the different environments. Overall, narrow spaces had a positive effect on the forest, where such spaces were limited. In contrast, the other two locations, particularly the shop, featured narrow spaces that effectively contributed to participants feeling uncomfortable.

Overall Box Plot Analysis: Location 1, the train station, has a median of 3 and leans towards making the participant uncomfortable. The forest has a mean of 3 and leans towards making the participant comfortable and the shop narrow space's have a large impact on making the participants uncomfortable with a median of 2.

Level 1 Analysis – Train Station: The train station doesn't include many narrow areas, with the only areas being the bathrooms, waiting rooms and tunnel at the end. But even the tunnel itself isn't too narrow or tight. This lack of many narrow spaces shows with the results, and it's mean of 2.69, just below 3 which is neutral.

Level 2 Analysis – Forest: The forest, with a mean of 3.38, includes very few narrow spaces with the area designed to test how open liminal environments affect user's comfortability.

Level 3 Analysis - Shop: The majority of participants noted that the narrow spaces within the shop, specifically the employee backrooms, made them feel uncomfortable while exploring. This is reflected in the mean for this location, which was 2.00.

Overall Observation: Overall, it can see than having narrow spaces did overall impact participants comfortability in a significant way, with the shop environment being the best example of this.

Open Spaces

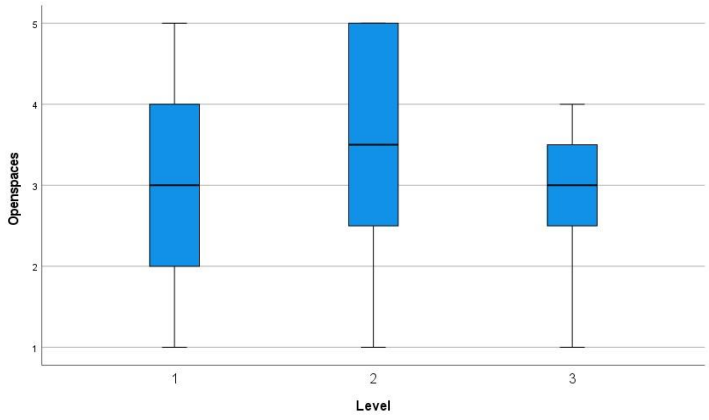
There was no statistical difference between how open spaces affected participants within the different environments, all three environments contain open spaces with the forest being majority open.

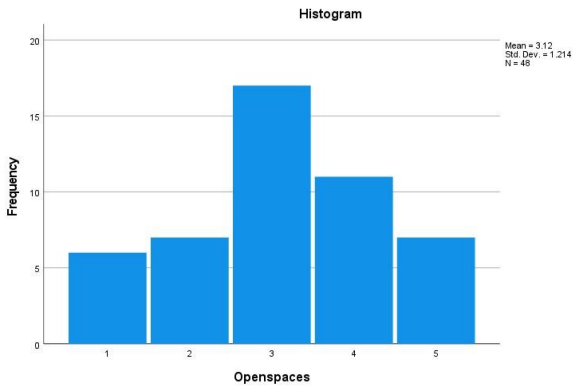
Descriptives

			Statistic	Std. Error
Open spaces	Mean		3.13	.175
	95% Confidence Interval for Mean	Lower Bound	2.77	
		Upper Bound	3.48	
	5% Trimmed Mean		3.14	
	Median		3.00	
	Variance		1.473	
	Std. Deviation		1.214	
	Minimum		1	
	Maximum		5	
	Range		4	
	Interquartile Range		2	
	Skewness		-.175	.343
	Kurtosis		-.679	.674

Means comparison

Level	Mean	N	Std. Deviation
1	3.00	16	1.317
2	3.50	16	1.317
3	2.88	16	.957
Total	3.13	48	1.214





Open Spaces: Descriptive Statistics

Overall Impact: Overall, there was not a statistically significant difference between how the open spaces within each environment effected participants. As seen with the means comparisons, the feedback mainly hovered around 3, which was neutral/no effect.

Overall Box Plot Analysis: The box plot graph shows that the majority of results were around 3, being neutral, with there being a few participants who felt that the open spaces made them felt more comfortable in the forest environment.

Level 1 Analysis – Train Station: Location 1, the train station, had a median of 3 and with most participants stating that it didn't significantly affect them. The train station only contains one open area at the start of the level, overshadowed by the later tunnel section, which could explain this result.

Level 2 Analysis – Forest: The forest, with the highest mean of 3.50, was mainly made up of open spaces. Participants expressed feeling relaxed while navigating through it, likely contributing to its positive rating in terms of comfortability.

Level 3 Analysis - Shop: The shop had the lowest mean result being 2.88, just below neutral. The start of the shop takes place on an open shop floor with blaring lights and is where a lot of participants stated they felt strange due to the lack of others around. The space also lacked clear direction which one participant commented on saying "starting in a place where there wasn't an outright obvious path forward felt more daunting and thus made me more uncomfortable."

Overall Observation: Overall, open liminal spaces are an area that could use looking more into, with the results from this testing varying between locations.

Overall ambience

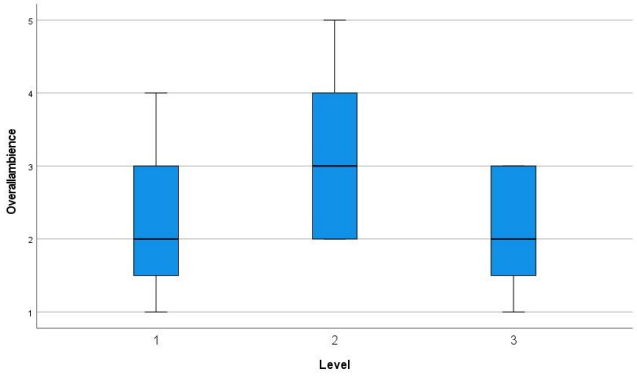
The overall ambience had a large impact on participants with it having a significance of 0.008 between the locations. This makes sense following the other comments from participants about how each location overall made them feel.

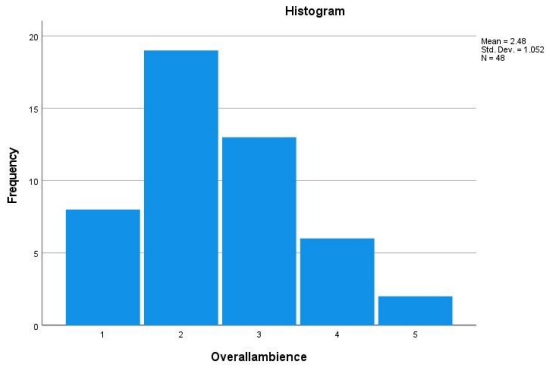
Descriptives

			Statistic	Std. Error
Overall ambience	Mean		2.48	.152
	95% Confidence Interval for Mean	Lower Bound	2.17	
		Upper Bound	2.78	
	5% Trimmed Mean		2.43	
	Median		2.00	
	Variance		1.106	
	Std. Deviation		1.052	
	Minimum		1	
	Maximum		5	
	Range		4	
	Interquartile Range		1	
	Skewness		.515	.343
	Kurtosis		-.175	.674

Report

Level	Mean	N	Std. Deviation
1	2.19	16	.911
2	3.13	16	1.147
3	2.13	16	.806
Total	2.48	48	1.052





Overall Ambience: Descriptive Statistics

Overall Impact: Overall, there was a statistical significance in how the overall ambience affected the participants between the different environments.

Overall Box Plot Analysis: The box plot graph shows that both location 1, the train station, and location 3, the shop had an overall uncomfortable ambience with the median being 2, uncomfortable/uneasy, for each of them. The forest's ambience had little effect on the participants with the median of results being 3, neutral, though it does slightly lean towards it being comfortable.

Level 1 Analysis – Train Station: Location 1, the train station, had a median of 2 with a range between 1 and 4. The comments about the train station refer to it being uncomfortable, especially the latter half down the train station tunnels towards the exit, explaining where this rating from overall ambience comes from.

Level 2 Analysis – Forest: The majority of participants stated that the forest was relaxing overall, with multiple participants stating that “the only unnerving part was the sound of the swing”.

Level 3 Analysis - Shop: The shop overall had the most unnerving ambience for participants with the lowest mean of 2.13. Many participants stated that the overall ambience worked really well on them with it being an empty version of a place that’s usually has at least staff members about.

Overall Observation: Overall, the results of the ambience of the environments reflects well as an overall opinion of each of the locations and how well they work in making the participants feel uncomfortable.

Design of objects

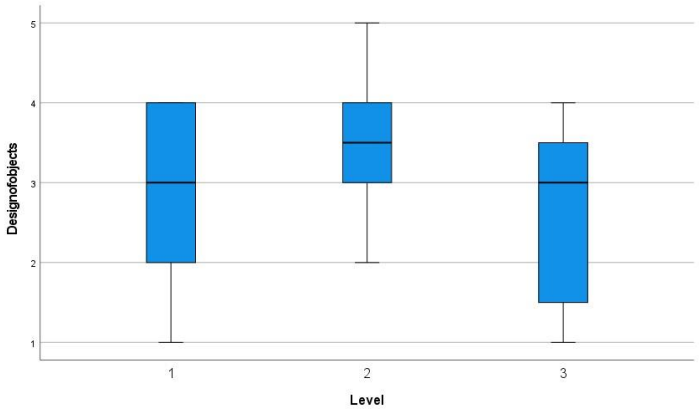
The goal of the project was to replicate liminal spaces within a digital setting and therefore the design of objects was important in recreating these feelings in participants. While all objects were created using the same tools, the absence of a statistically significant difference between environments, while not surprising, was still worth investigating.

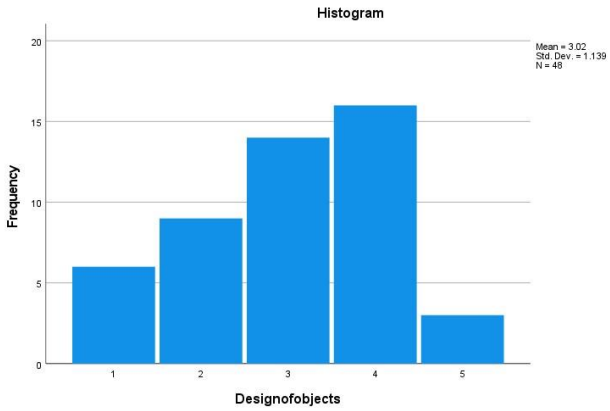
Descriptives

			Statistic	Std. Error
Design of objects	Mean		3.02	.164
	95% Confidence Interval for Mean	Lower Bound	2.69	
		Upper Bound	3.35	
	5% Trimmed Mean		3.02	
	Median		3.00	
	Variance		1.297	
	Std. Deviation		1.139	
	Minimum		1	
	Maximum		5	
	Range		4	
	Interquartile Range		2	
	Skewness		-.313	.343
	Kurtosis		-.752	.674

Means comparison

Level	Mean	N	Std. Deviation
1	3.00	16	1.095
2	3.50	16	1.033
3	2.56	16	1.153
Total	3.02	48	1.139





Design of objects: Descriptive Statistics

Overall Impact: Overall, there was not a statistical significance in how the design of the objects affected participants in the different environments.

Overall Box Plot Analysis: The box plot graph shows a similar theme to the other elements with location 2, the forest, having a positive impact on participants comfortability and a median higher than 3, the neutral point. The other locations have a median of 3 being neutral with the shop having a greater negative impact on comfortability.

Level 1 Analysis – Train Station: Location 1, the train station, has a median of 3. This overall surprised me a bit as I expected the artificial posters to have a bigger impact on participants comfortability as many noted in the comments about them, with one stating “the posters dotted around on both levels made me feel uneasy” and another saying about them that “there was this almost mystique to them that felt like something was off.” Though one participant did say “the posters around the train station were nice to look at” which may explain the mixed result.

Level 2 Analysis – Forest: Participants in general commented that the forest made them feel relaxed and comfortable, with the design of objects likely helping in that. The overall design was done to mimic a walk through the forest on a foggy day, which it turns out many participants found relaxing.

Level 3 Analysis - Shop: The shop's design had the biggest impact with a median of 2.56, being under neutral. A large part of this seems to be with the overall design of the shop elements itself, with multiple participants commenting on the meat cooler, with one stating that it made them feel "disgusted" and another saying it looked "weird".

Overall Observation: Overall, with the design of objects being mainly consistent between environments, it is not surprising that there is no statistical difference between how it impacted participants. Though the impact the shop elements had are still worth looking into.

Averages

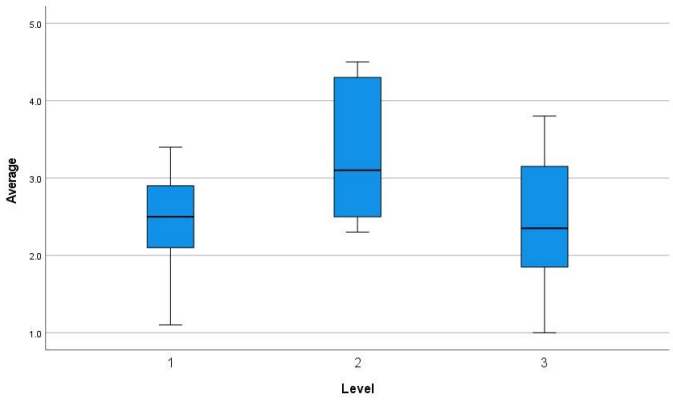
This section is made up of the averages of each of the other elements, which is useful in seeing how each environment performed overall in comparison to the others. There is statistically significant difference between the results, which is not surprising seeing the stats for the other sections.

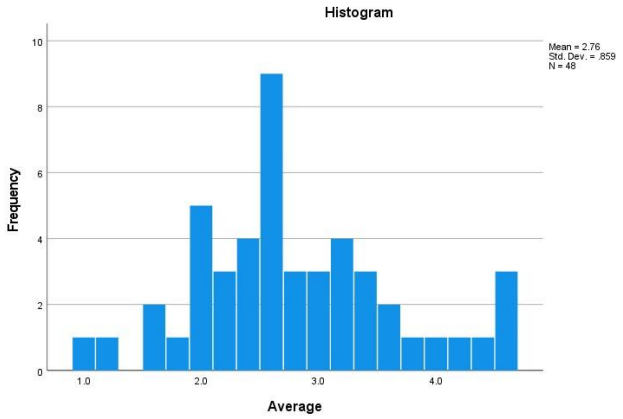
Descriptives

			Statistic	Std. Error
Average	Mean		2.756	.1240
	95% Confidence Interval for Mean	Lower Bound	2.507	
		Upper Bound	3.006	
	5% Trimmed Mean		2.749	
	Median		2.550	
	Variance		.738	
	Std. Deviation		.8592	
	Minimum		1.0	
	Maximum		4.5	
	Range		3.5	
	Interquartile Range		1.1	
	Skewness		.366	.343
	Kurtosis		-.156	.674

Level means comparison

Level	Mean	N	Std. Deviation
1	2.481	16	.5890
2	3.350	16	.8687
3	2.438	16	.8041
Total	2.756	48	.8592





Level Averages: Descriptive Statistics

Overall Impact: Overall, there is a large significant difference between how participants felt on average when exploring these different locations. The histogram shows that the highest common response for element impacts was between neutral and uncomfortable. With the median for location 1, the train station, and 3, the shop being below 3, neutral, it shows that these locations overall made the majority of participants uncomfortable. Location 2, the forest, however, overall leaned towards making participants feel comfortable while exploring.

Overall Box Plot Analysis: Overall the box plot graph clearly mimics what has been seen in the other sections with participants stating they overall found location 1 and 3 generally uncomfortable, but location 2 comfortable and relaxing to explore.

Level 1 Analysis – Train Station: The box plot graph shows that the was a very tight range of responses on average for the shop level with the majority of them being under 3, which is neutral. This means that the shop overall performed well in making participants feel uncomfortable while exploring it.

Level 2 Analysis – Forest: Participants overall found this location relaxing to explore which is shown through the median being above 3. While a couple participants said it was the scariest location for them the majority found it relaxing being in an open nature area alone.

Level 3 Analysis - Shop: The shop had the lowest median overall with participants finding it uncomfortable to explore, though it did have a higher overall range in results when compared to the train station environment.

Overall Observation: Overall, there is a clear difference in the overall impact of the different environments on participants, which shows that different themes and elements work best when trying to replicate different emotions in players.

Discussion of Findings

The findings show statistically significant differences between the environments and what elements worked best in making participants uncomfortable and comfortable while exploring them. On average, both the train station and the shop worked well in creating an unsettling environment as supported by the participant's feedback. On the other hand, specific elements of the forest environment led many to feel relaxed while walking through it.

The train station's second half was commented on the most and appeared to work best in creating an uncomfortable liminal experience. Participants commented on how this area, with its maze-like design and foggy dim lighting, led to an unnerving experience that constantly kept them on their toes. The first area in comparison was rarely commented on with the main element talked about being the announcer creating a disorienting experience.

The forest overall failed at creating an unsettling experience for the majority of participants. Many participants commented on the theming of the levelling being relaxing to them and the absence of others had a much lesser impact. The biggest flaw when creating this level with the goal of creating an uncomfortable experience was the use of a constant noise of birds cawing in the background. Many participants commented on this cancelling out any feeling of loneliness they had while exploring it.

Although marginal, the shop had the most noticeable impact on average discomfort, with a mean of 2.438. The theme effectively unsettled participants, as a shopping environment typically involves crowds. Unlike the train station, both sections of the level equally affected participants, as reflected in numerous comments. The contrast between the sections, in particular, appeared successful in creating a range of emotions in participants.

Chapter 6: Results and Discussion:

Overall Project Results

Overall, the project was successful in creating a range of liminal environments with varying impacts on participants comfortability. Two of the three liminal environments, the train station and the shop, significantly scored below the neutral line of 3 on average. Participants found navigating through these environments to be especially uncomfortable with the environments having different sections with varied lighting and design.

Means Comparison Test

Level		Lighting	Level theme	Navigating	Narrow spaces	Overall ambience	Average
1 (Train)	Mean	2.31	2.81	1.69	2.69	2.19	2.481
	N	16	16	16	16	16	16
	Std. Deviation	1.078	1.047	1.078	1.014	.911	.5890
2 (Forest)	Mean	3.31	3.56	3.81	3.38	3.13	3.350
	N	16	16	16	16	16	16
	Std. Deviation	1.352	.892	1.167	.957	1.147	.8687
3 (Shop)	Mean	2.38	2.44	2.50	2.00	2.13	2.438
	N	16	16	16	16	16	16
	Std. Deviation	1.258	1.153	1.155	1.095	.806	.8041
Total	Mean	2.67	2.94	2.67	2.69	2.48	2.756
	N	48	48	48	48	48	48
	Std. Deviation	1.294	1.119	1.419	1.151	1.052	.8592

The means comparison test, as shown above, shows how many of the significant elements varied between locations. This analysis sheds light on the specific elements that were most effective in each environment, contributing to environment's overall impact. The average table shows a good overall comparison of each location's ability to relax or discomfort participants. The standard deviation of each element serves as a valuable metric, offering great insights into the consistent impact of various factors on participants within different locations. This measure not only highlights the average influence but also shows the amount of variability in participant responses.

The standard deviation of the total is also very useful for analysis, providing an overview of how significantly each element's impact varied between locations. Overall navigating had the biggest impact on participants, with the differences being largely in the results between the train station and forest environments. This shows the role navigating has in shaping participants' experiences, with its impact varying significantly depending on the specific liminal context.

The first created environment, an empty train platform set at night with an unintelligible announcer playing on repeat, received positive responses by participants with how impactful it was. The response to the tunnel section of the train station, designed to be liminal and un-linear, highlighted its ability to induce discomfort, as reflected in the lowest navigating feedback score of 1.69.

The environment of an empty, open shop front and a dark, claustrophobic back-room area, worked well in creating discomfort throughout the whole experience with the overall theming, scoring a low 2.13, and the backroom areas, likely contributing to the low narrow space score of 2.00, being especially impactful for participants. Overall, the shop environment achieved a mean score of 2.44. The bright and empty design of the shop floor, lacking distinct personality, was noted by multiple participants as appearing 'sterile,' contributing to an overall sense of unease.

The last environment, being a walk-through nature littered with abandoned structures on a foggy day, while not creating discomfort for the majority of testers as planned, still provides great insight into what elements do create a comfortable environment to be in. Participants noted the pleasantness of being alone in the overall forest setting, citing the calming effect of sound and visuals. Although the abandoned playground caused some discomfort, noted by several participants, the forest as a whole offered a positive and enjoyable exploration experience, as seen in its high navigating rating of 3.81.

Participants Feedback and Reactions

Both quantitative and qualitative data was obtained during this study via a Google Form that was filled out during the participants testing. Overall, the feedback was incredibly useful in seeing which specific elements and environments worked best and allowed great insight for future development of liminal spaces. The qualitative responses highlighted how important level feeling and overall level ambience is in creating an engaging liminal environment, as well as enriching our understanding of participants' experiences within digital spaces. The sample size of 16 participants contributed to the robustness of the data, providing a diverse perspective on user reactions. Overall participants responded well to the study with the majority of them asking for the overall findings to be shared with them once released.

Implications of Results

The results from this study provide great insight and contribute to existing theories of liminality and the creation of engaging digital liminal environments. By specifically identifying key elements within these environments that create strong participant responses, this research gives future creators knowledge to enhance the engagement of their liminal experiences. The findings not only shed light on the dynamics of liminal spaces but also has broader implications for comfortability in other forms of media beyond liminality. Designers and creators across different industries, scope and sizes can use these insights to optimise user experiences and emotional responses.

Professionals will be able to benefit from these studies by knowing which specific elements can create certain responses in participants. For example, if a creator wanted to create a relaxing nature walk for users to go through, they know that sound plays a key part in this with animals not needing to be seen nor to be felt. On the contrary, designers trying to elicit a strong negative response from users can look into the results from the other two environments to see how they achieved in making participants feel uncomfortable.

Looking ahead, it’s recommended that future research could look into all of these elements in other locations and settings, as well as how different gameplay features or participant demographics can affect the overall impact of each environment.

Comparison with Objectives

Below is the set of objectives I sought out with this study and how my research responds to each of them.

1. **Explore the nature of digital liminal spaces:**

   The nature of liminal spaces was discussed thoroughly throughout this report, especially within the literature review. Exploring the nature of digital liminal spaces was important in highlighting what elements work well in replicating the liminal feeling in a digital environment, as well as seeing what preexisting media does with the concept of liminality. The core concept found through these studies was that liminal spaces are spaces that often include uncanny elements and come across as both familiar and not at the same time. Capitalism and rise of brands and chains of establishments has led to a rise in the feeling of liminality within our daily lives.

2. **Examine user comfort dynamics:**

   User comfort was examined throughout this study to see what environments and specific individual elements affected it the most. Measuring comfortability is a great tool for testing engagement with media with neutral responses likely meaning that the user didn't find the work impactful. With this in mind, I'm happy to see that all three of my environments had an impact on participants comfortability, even if a positive correlation was not intended during the design of the forest environment.

3. **Identify design elements impacting user comfort:**

   The use of statistical tools like SPSS allowed me to statistically find significance between the elements and environments as a whole, and to see which design elements impacted users the most. User comments were specifically useful in pinpointing the exact elements or design decisions with the greatest impact. The levels that had the biggest impact in affecting comfortability in users were level theming, lighting, narrow spaces, navigating and overall ambience.

4. **Assess user responses and experiences:**

   The use of user testing allowed me to see how others responded to my environments and I'm overall very thankful for the 16 participants who took part in it. Both user's quantitative and qualitative data has been accessed and analysed throughout this chapter, with both providing great insight into how users responded to the experience as a whole.

5. **Compare comfort levels across different digital environments:**

   Three different environments making use of different elements and theming were used to test how comfort levels varied in different locale. The train station and the shop, both public locations, worked best in replicating the liminal feeling partly thanks to the use of lighting, spacing and absence of others around. The

forest environment overall created a comfortable and relaxing exploration experience for participants with the theming, sounds and overall navigating experience calming for participants.

6. **Develop advice for creating immersive liminal environments:**
   Advice for creating immersive liminal environments has been discussed above with advice based on feedback gathered through extensive research into the field as well as user testing on digital liminal environments created using knowledge and concepts gathered through research into academic articles as well as preexisting media.

7. **Contribute to theoretical frameworks:**
   The findings from this report provide great insight into the creation of liminal environments and the impact they can have on players. The findings of this study should be specifically useful for those looking into creating liminal environments or interested in the concept of liminality as a whole.

Comparison with Research Objectives and Hypothesises

Below is the set of research questions I set out to answer through this study and whether the results achieve in answering them:

1. To what extent do participants' comfort levels vary across different digital liminal environments?

   The study answered this by having participants go through three different digital liminal environments and then have them record how comfortable each element made the environment feel, with the overall average for each element being able to be used to overall compare each environment.

2. How do users perceive and navigate the designed digital liminal spaces in terms of comfortability?

   The study also answered this by having participants go through three different digital liminal environments and then have them record how comfortable each element made the environment. The qualitative answers within the Google Form were very useful for seeing how participants specially perceive different elements and navigate differently because of it.

3. What role do individual elements play in influencing users' comfort within digital liminality?

Each individual element plays a huge part in influencing participants comfort within digital liminal spaces. Participants stated within their comments that the forest environment would have made them feel uneasy if it wasn't for the sound of crows cawing. This one element heavily affected the overall impact the environment had on users. Participants also commented more about specific elements than others, with them often noting the absence of people and level theme but rarely the impact open spaces were having on them.

4. Is there any difference in participants' experiences of digital liminality based on the order in which they engage with the environments?

   There appears to be no difference in participants' experience of digital liminality based on the order in which they play the environments with each environment having a clear impact and there being a large difference in results for the train and shop level compared to the forest level.

5. What set of variables within liminal environments affect participants the most?

   Lighting and navigation were the two elements that had the highest standard deviation between locations and were the ones that affected participants the most in making them feel comfortable or uncomfortable. This difference was mainly between the forest and the other levels. Each used the same elements in different ways creating opposite results.

Below is the set of hypotheses is set to test through this study and whether the results support them:

1. **Hypothesis 1 (H1):** There will be significant variations in participants' comfort levels across different digital liminal environments based on changes within different environmental elements.

   Each environment has been designed with a different theme in mind and makes use of design elements differently. For example, the bright shop floor strongly contrasts the dark surroundings of the train platform. From the results we can see that participants responded significantly different to these environments with participants finding the train platform and shop environment overall uncomfortable to explore, which is opposite to the forest environment which most found comfortable and relaxing to be in.

2. **Hypothesis 2 (H2):** Specific locations based on certain themes will be affected more by specific elements, such as lack of other occupants or lighting.

   This hypothesis was confirmed true by multiple elements, especially the absence of others. Participants found that the lack of others within a commercial environment like the shop made them feel uncomfortable

and uneasy. On the other hand, the absence of others within a nature setting was expected and felt relaxing for participants to explore through. In the end lighting, level theme, navigating, narrow spaces and overall ambience had a significant variation in results between the different locations.

3. **Hypothesis 3 (H3):** Each location will have an overall effect of making the participants feel uncomfortable and uneasy.
   This hypothesis ended up not being true, due to the unexpected result of participants finding the forest environment overall relaxing to be in. While this was not an intended result, thanks to the feedback from participants, it does provide us with great insight into what works well in creating comfortable environments and what not to do if the opposite is the intended emotion you're hoping to elicit.

4. **Hypothesis 4 (H4):** Specific design elements within the digital liminal environments will be identified as significant contributors to users' comfort levels.

   This hypothesis was confirmed true with specific elements being more impactful for participants comfort levels than others. Overall level ambience, theming and absence of others played a significant role in effectively making player's uncomfortable or comfortable. On the other hand, elements like level layout and design of objects had little impact in the majority of levels.

5. **Hypothesis 5 (H5):** The order in which participants engage with the digital liminal environments won't have a measurable impact on their overall experiences, with earlier or later exposure not influencing reported comfort within that location.

   This hypothesis is confirmed as true as there is a clear statistically significant difference between the environments, with the train platform and shop making participants uncomfortable and the forest being a relaxing experience. This was the case for participants no matter which order they saw these environments in.

Chapter 7: Conclusion:

Summary of Key Findings

The key findings from this study, gathered via participant feedback from testing three separate digital liminal environments, found a significant difference in how each environment impacted participants comfortability while navigating the environments, as well as significance difference in how each design element effected each environment. Both the empty train station and shop environment, designed to replicate a usually populated and

social space, had the greatest results in making participants feel uncomfortable while exploring it. The forest nature walks, taking place on a foggy overcast day, had the highest impact in making participants feeling relaxed and comfortable while exploring.

The elements that effected participants the most were level ambience, theming, and absence of others, all of which played a significant role in effectively making players uncomfortable or comfortable. These elements were commented on the most during the qualitative portion of the participant feedback and received the greatest results during the statistical analysis. The elements that affected participants the least were the level layout and design of objects.

Sound and visuals played a large part in making the forest level relaxing with the bright foliage and sound of birds cawing cancelling out any impact the lighting or level design had in creating an uncomfortable location for participants. The locations that had multiple areas that highly contrasted with each other, like the shops bright, open shop front and dark, narrow employee only area were commented on extensively in the user feedback and had great results in impact on comfortableness during the quantitative feedback.

The study also revealed a symbiotic relationship between level theming and absence of others with these elements going hand in hand in impacting the users. Having a level theme, like the forest within this study, that has few people around to begin with meant that the absence of others had little effect on participants. In contrast, having locations usually bustling with people makes the emptiness stick out a lot more to participants. Multiple participants commented on the lack of people with the shop as being mysterious and intriguing leading to a more engaging experience.

The impact that level ambience, theming, and the absence of others has had on participants' comfort levels not only highlights their significance in digital liminal environments and the impact they can have on users navigating through them, providing great insight for future creators aiming to create engaging digital liminal environments. Additionally, the symbiotic relationship between level theming and the absence of others shows the importance of coherence when designing a level and the impact it can have on the overall user’s experience.

The results of this study align closely with many existing theories on liminality and uncanniness as discussed in the literature review. Several scholarly sources highlighted how public spaces lacking others can create feelings of discomfort and unease. This idea was reflected by the findings of my study, where environments set in public settings had the most discomfort among participants, while the solitary nature walk environment had the least. Furthermore, the literature review revealed that corridors, with their narrow and claustrophobic nature, often created discomfort in individuals. This observation resonated with the experiences reported by participants in my study, particularly in reference to the tunnel in the Train level and the staff-only area in the shop level. Overall, the findings from both the literature review and this study contribute to our understanding of liminality and uncanniness, demonstrating their

applicability across various environments and media formats and showing their potential in creating exciting and impactful experiences.

Contributions to the Field

This report contributes to the niche area of digital liminal experiences and should provide guidance for creators looking to create engaging liminal digital experiences, as well as provide insight into digital environment creation overall and what elements have the greatest impact on users. The identification of key elements, such as level ambience, theming, and the absence of others, provides useful knowledge for designers seeking to evoke specific emotional responses from users. This knowledge can allows creators to optimise their environments, making the exploration experience more engaging, and allowing for greater control of player's comfortableness when designing their experiences. This insight has the potential to inform choices in the creation of diverse digital environments beyond the scope of liminality.

Limitations of the Study

This study was limited by the number of participants taking part in the study, this is largely due to the testing Unity application being quite intensive to run, leading to a lot of potential participants being unable to test the experience due to a lack of efficient hardware, reducing the overall participation sample size. The testing period for this study was also quite short relative to other studies with the testing only taking place over the matter of a couple weeks. A prolonged testing period could have led to more participants being able to take place in testing leading to richer results.

The study was also limited by the number of locations I was able to create within the span of the project. While three environments were developed at the targeted quality level, the limitation in the number of elements accommodated in each location could affect the comprehensiveness of the study. Some locations incorporated multiple styles to test various elements, introducing the possibility that specific sections, such as the tunnel in the train station, might disproportionately influence the overall impact of the location, potentially overshadowing other aspects and areas.

Recommendations for Future Research

To build upon the insights gained from this study, future research should look further into the impactful elements noted here and see how they affect users within different settings. The largest recommendation for future research involves extending this study to explore how different environments impact players' comfortability. It's important to keep in mind that this project only looked into how environmental design affected player's comfortability when exploring a location and used elements of liminality and uncanniness when designing and creating these locations.

Sound and design of objects were two elements that could be further explored to see how they specifically can affect user's comfort and overall engagement within a location. Sound plays a huge part in engaging players and providing

environmental storytelling and was not fully explored within my testing. These elements, paired with liminal environment create, could lead to incredibly engaging experiences. Sound within this study mainly consisted of only a couple sounds per environment and were often commented on within the feedback when they appeared. This was mainly due to limited resources as well as time when creating these environments as I wanted to spend the time working on the visuals and overall aesthetics for each of them over the sound as more of the tested elements would be affected by it.

Additionally, exploring different gameplay styles, perspectives, and thematic approaches can contribute to a more comprehensive understanding of what does and doesn't work when creating impactful digital liminal environments. Testing other perspectives, such as third person or top down, would be interesting to see if players react to specific elements differently or if the experience as a whole is less engaging. Furthermore, changing the graphical style of the experience would also be interesting to see how it impacts player comfortability. For example, we know from this study that the shop environment works well in creating an impactful liminal experience, but would it still be as impactful if created in a cartoon or low polygon aesthetic?

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Appendix

Appendix A – Digital consent form

An interactive exploration into virtual liminality and the impact it has on users.

UNIVERSITY of York

School of Arts and Creative Technologies

Participant Consent Form

Thank you for your interest in this project. This research activity will be used to help me delve deep into the intricate dynamics of these digital transitional spaces, focusing particularly on the emotional and psychological responses they elicit from users, with a strong emphasis on examining the ways in which these liminal spaces can evoke emotional responses from players.

Some participants may be randomly picked and asked to conduct a 1 on 1 interview online via Zoom after their testing has concluded. If you're happy to have the chance to be interviewed after, please tick the appropriate box below.

Please read the following statements carefully and tick the appropriate box:

	YES	NO
I have read the information sheet about this project		
I agree to take part in this project		
I consent to playing a digital liminal space experience		
I consent to my anonymized data being deposited in a Google Drive		
I understand my right to withdraw and/or have my data destroyed from this project at any time		
I understand that my participation in this project will be treated anonymously		
I am over the age of 18		
I consent and am happy for a 1 on 1 online interview taking place after my play test has concluded, with the audio being recorded and stored on a secure Google Drive		

Participant Name:

_____

Participant Signature:

_____

Date:

___/___/_____

Researcher Name:

_____

Researcher Signature:

_____

Date:

___/___/_____

If you wish to be informed about the outcomes from this project, please provide your email address:

_____

Appendix B – Information Sheet

An interactive exploration into virtual liminality and the impact it has on users.

UNIVERSITY of York

School of Arts and Creative Technologies

Participant Information Sheet –Anonymous Research

Project background

The University of York would like to invite you to take part in the following project: An interactive exploration into virtual liminality and the impact it has on users.

Before agreeing to take part, please read this information sheet carefully and let us know if anything is unclear or you would like further information.

What is the purpose of the project?

This project is being performed by Nathan Bray (nmb535@york.ac.uk), an Interactive Media MSc research student whose project focuses on liminality and the effect it can have within digital media. The project is being supervised by Sanjit Samaddar (sanjit.samaddar@york.ac.uk) and Nick Jones (n.jones@york.ac.uk).

The work is being conducted according to restrictions that have been subject to approval by the ACT Ethics committee. The Chair of the ACT Ethics committee can be contacted on ACT-ethics@york.ac.uk.

This research consists of a comprehensive exploration of digital liminal spaces and their impact on individuals as they navigate through these virtual spaces. The primary objective is to delve deep into the intricate dynamics of these digital transitional spaces, focusing particularly on the emotional and psychological responses they elicit from users, with a strong emphasis on examining the ways in which these liminal spaces can evoke emotional responses from players. By investigating these responses, I aim to shed light on the specific underlying elements that shape user experiences within digital liminality and hope to use this to contribute valuable insights to digital design, psychology, and human-computer interactions.

Please note that to comply with the approved Ethics requirements of this work, we do not intend to discuss sensitive topics with you that could be potentially upsetting or distressing. If you have any concerns about the topics that may be covered in the research study, please raise these concerns with the researcher.

Your participation in this project is voluntary. If you wish, we will provide you with access to the report that we submit after our marks have been confirmed. If you would like to receive access to these, you can indicate as such on the consent form.

Why have I been invited to take part?

You have been invited to take part in this study because I'm hoping to find a diverse range of interested and passionate participants from various backgrounds, academic disciplines, and demographics. This diversity enriches the study by ensuring a broad spectrum of perspectives and experiences.

Do I have to take part?

No, participation is optional. If you do decide to take part, you will be given a copy of this information sheet for your records and will be asked to complete a participant consent form. If you change your mind at any point during the research activity, you will be able to withdraw your participation without having to provide a reason. Please remember that you have the option to withdraw from this study at any time, and you are not obliged to provide a reason for your decision. On the Google form at the end of the play session you will be asked for a memorable word. Should you choose to withdraw, please inform a member of the research team, and provide them with the memorable word given so that your specific data can be found. In the event of your withdrawal, all data collected from your participation will be promptly and securely deleted.

What will I do if I take part within this research?

If you decide to participate within this research, you will then be invited to take part in a session in which you will explore 3 different 3D digital spaces created within Unity. This session will take place from your computer, with all the files you need to run the Unity application being sent to you and shouldn't take more than 20 minutes maximum. During your exploration of all three locations, you will be asked to fill out each section of a digital questionnaire aimed at gathering your feedback on specific aspects of these spaces. The questionnaire will particularly focus on your insights regarding what aspects successfully evoke the liminal feeling.

Some participants will also be randomly picked to conduct a 1 to 1 interview online via Zoom after the gameplay has concluded which will involve more open-ended questions about your gameplay experience. No confidential information will be gathered during this interview, but the interview will be recorded to be used during the write up stage of my project. It will then be stored securely on Google Drive and deleted once my project has been completed. Being a part of these interviews is not a necessity for this test, participants are able to decide whether they would be happy or not to have a chance to interviewed on the attached digital consent form.

stored digitally and securely within a Google Drive and used within a report to discuss whether the project succeeded in its goal to evoke an emotional reaction through the use of liminal spaces.

Who do we share your data with?

This Google Drive will only be shared with my supervisors during the creation of my report and once this report has been fully written and submitted all data within the Google Drive will be permanently deleted.

As well as this, we use computer software or systems to hold and manage data. Other companies only provide the software, system or storage. They are not allowed to use your data for their own reasons.

We have agreements in place when we share data. These agreements meet legal requirements to ensure your data is protected.

How do we keep your data secure?

The University is serious about keeping your data secure and protecting your rights to privacy. We don't ask you for data we don't need, and only give access to people who need to know. We think about security when planning projects, to make sure they work well. Our IT security team checks regularly to make sure we're taking the right steps. For more details see our security webpages.

How do we transfer your data safely internationally?

If your data is stored or processed outside the UK, we follow legal requirements to make sure that the same level of privacy rules still apply.

How long will we keep your data?

The University has rules in place for how long research data can be kept when the research project is finished. Your information will be kept for 4 months and after this time an anonymised version will be kept. As this will be fully anonymous, it will not be possible to identify you in any way from this data.

What rights do you have in relation to your data?

You have rights over your data. This sheet explains how you can stop participating in the study, and what will happen to your data if you do. This information is in the section 'Do I have to take part?'.

Will I be identified in any outputs?

No. Your participation in this research activity will be treated anonymously and you will not be identified in any outputs.

Privacy Notice

This section explains how personal data will be used by an interactive exploration into virtual liminality and the impact it has on user at the University of York.

For this project, the University of York is the Data Controller. We are registered with the Information Commissioner's Office. Our registration number is Z4855807.

What is our legal basis for processing your data?

Privacy law (the UK General Data Protection Regulation (GDPR) and Data Protection Act 2018) requires us to have a legal reason to process your personal data. Our reason is we need it to perform a public task.[1]

This is because the University has a public function, which includes carrying out research projects.[2] We need to use personal data in order to carry out this research project.

Information about your health, ethnicity, sexual identity and other sensitive information is called "special category" data. We have to have an additional legal reason to use this data, because it is sensitive. Our reason is that it is needed for research purposes.[3] All research projects at the University follow our research ethics policies.

How do we use your data?

All data collected is anonymised with no personal or confidential information being asked for from the survey. Once the data is collected it will then be

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[1]This refers to UK GDPR Article 6 (1) (e): processing is necessary for the performance of a task carried out in the public interest or in the exercise of official authority vested in the controller

[2] Our charter and statutes states: 4.f. To provide instruction in such branches of learning as the University may think fit and to make provision for research and for the advancement and dissemination of knowledge in such manner as the University may determine.

[3]This refers to UK GDPR Article 9 (2) (j): processing is necessary for archiving purposes in the public interest, scientific or historical research purposes or statistical purposes in accordance with Article 89(1) based on Union or Member State law which shall be proportionate to the aim pursued, respect the essence of the right to data protection and provide for suitable and specific measures to safeguard the fundamental rights and the interests of the data subject.

If you want to get a copy of your data, or talk to us about any other rights, please contact us using the details below.

Questions or concerns

If you have any questions or concerns about how your data is being processed, please contact If you have any questions about the research itself, then please feel free to contact me at any point before, during, or after the research has been conducted at nmb535@york.ac.uk. My telephone number is 07450918219

If you have any questions about how your personal data will be handled then please feel free to contact either of my supervisors, Sanjit Samaddar (sanjit.samaddar@york.ac.uk) or Nick Jones (n.jones@york.ac.uk).

If you have further questions, the University's Data Protection Officer can be contacted at dataprotection@york.ac.uk or by writing to: **Data Protection Officer, University of York, Heslington, York, YO10 5DD**.

Right to complain

If you are unhappy with how the University has handled your personal data, please contact our Data Protection Officer using the details above, so that we can try to put things right.

If you are unhappy with our response, you have a right to complain to the Information Commissioner's Office. You can also contact the Information Commissioner's Office by post to **Information Commissioner's Office, Wycliffe House, Water Lane, Wilmslow, Cheshire, SK9 5AF** or by phone on **0303 123 1113**.

Appendix C –

Questionnaire

Playtest questions for An interactive exploration into virtual liminality and the impact it has on users.

Hello and thank you for being a part in testing my MSc in research project. Your participation is invaluable to our research. Please take a moment to complete each section of this form once you've finished a level of your online playtest. There will be a screen to promopt you when it is time to do so. Your feedback is crucial to our understanding of virtual liminality.

Participants have the option to opt into a more in-depth interview. This is your chance to provide deeper insights into your experience. Feel free to include your contact email at the end of the form if you'd like to participate.

If you have any questions or need further clarification, don't hesitate to reach out. You can contact me at nmb535@york.ac.uk, or one of my supervisors at sanjit.samaddar@york.ac.uk and n.jones@york.ac.uk.

Read each item and decide how much that element within the level affected how comfortable you felt exploring each location.

The numbers below should be interpreted as:

1 = Very uncomfortable/very uneasy

2 = Uncomfortable/uneasy

3 = Neutral/No effect

4 = Comfortable/relaxed

5 = Very comfortable/very relaxed

Appendix C – Questionnaire

Complete this section after finishing your first level - Which level was your first level?

- ◯ Train Station
- ◯ Forest
- ◯ Shop

Read each item and decide how much that element within this level affected how comfortable you felt exploring the location, with 1 being very uncomfortable/very uneasy and 5 being very comfortable/very relaxed. *

	1	2	3	4	5
The lighting	◯	◯	◯	◯	◯
The sound effects	◯	◯	◯	◯	◯
The absence of others	◯	◯	◯	◯	◯
The level theme	◯	◯	◯	◯	◯
The layout of objects and spaces	◯	◯	◯	◯	◯
The design and textures of objects	◯	◯	◯	◯	◯
Navigating	◯	◯	◯	◯	◯
Narrow spaces	◯	◯	◯	◯	◯
Open spaces	◯	◯	◯	◯	◯
The overall ambience	◯	◯	◯	◯	◯

Are there any extra comments you have about this environment and how it made you feel exploring it?

Your answer

Appendix C – Questionnaire

Read each item and decide how much that element within this level affected how comfortable you felt exploring the location, with 1 being very uncomfortable/very uneasy and 5 being very comfortable/very relaxed. *

	1	2	3	4	5
The lighting	○	○	○	○	○
The sound effects	○	○	○	○	○
The absence of others	○	○	○	○	○
The level theme	○	○	○	○	○
The layout of objects and spaces	○	○	○	○	○
The design and textures of objects	○	○	○	○	○
Navigating	○	○	○	○	○
Narrow spaces	○	○	○	○	○
Open spaces	○	○	○	○	○
The overall ambience	○	○	○	○	○

Are there any extra comments you have about this environment and how it made you feel exploring it?

Your answer

Are there any extra comments you have about this environment and how it made you feel exploring it?

Your answer

Appendix C – Questionnaire

Complete this section after finishing your third level - Which level was your third level?

- ◯ Train Station
- ◯ Forest
- ◯ Shop

Read each item and decide how much that element within this level affected how comfortable you felt exploring the location, with 1 being very uncomfortable/very uneasy and 5 being very comfortable/very relaxed. *

	1	2	3	4	5
The lighting	◯	◯	◯	◯	◯
The sound effects	◯	◯	◯	◯	◯
The absence of others	◯	◯	◯	◯	◯
The level theme	◯	◯	◯	◯	◯
The layout of objects and spaces	◯	◯	◯	◯	◯
The design and textures of objects	◯	◯	◯	◯	◯
Navigating	◯	◯	◯	◯	◯
Narrow spaces	◯	◯	◯	◯	◯
Open spaces	◯	◯	◯	◯	◯
The overall ambience	◯	◯	◯	◯	◯

Are there any extra comments you have about this environment and how it made you feel exploring it?

Your answer