Discovering the Hyperreal in VR as a remedy for Mental Health Issues

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Abstract

This paper investigates the hyper-real in virtual reality (VR) and its associated effects such as awe, connectedness and self-transcendence in an overarching aim to examine how these findings could be used to remedy mental health issues. Awe and its ensuing effects (connectedness and self-transcendence) bring about unique effects such as improving mental well-being and may play a role in targeting key aspects of mental health problems such as depression. Depression is an increasingly prevalent illness, to which new innovative solutions are needed to aid in treating depression. The hyper-real is more than real integrating highly novel experiences which could be particularly effective in evoking awe. This provides VR with a unique platform to help in creating new alternative methods to help treat depression. Using an award winning hyper-real VR installation and conducting semi-structured interviews this paper aims to understand how awe and associated effect presents itself in a hyper-real VR installation and which aspects of this installation are key in evoking awe. It argues for the potential of hyper-real VR in remedying depression, having identified the successful presentation of awe and found its associated to effects to be consistent with research producing positive emotions and improving mental well-being. It also found hyper-real VR to particularly effective in addressing key aspects of depression such as ruminations and disconnection when compared to other forms of VR implemented to help improve mental well-being.

Keywords: Virtual Reality, Hyper-real, Awe, Self-transcendence, Depression, Ruminations, Disconnection

Introduction

Today's world is marked by continuous technological advancements and alongside this, an unprecedented increase in societal challenges. Mental health issues particularly have become a pervasive reality affecting millions of people. As the invisible battles within the mind continue to escalate (Bor et al., 2014), the importance of addressing mental health issues becomes not just a medical necessity but a moral and societal imperative. The profound impact mental health issues have on individual lives, relationships, and overall well-being emphasises the urgency for innovative solutions that go beyond traditional approaches (Connell et al., 2012). For instance, commonly prescribed treatments like anti-depressant drugs make use of selective serotonin reuptake inhibitors (SSRIs), in the Netherlands alone chronic antidepressant use is common not only for depression but for anxiety and non-psychological diagnoses (Verhaak et al., 2019). These SSRIs increase the level of serotonin in the brain, consequently, they help regulate mood, sleep, appetite etc (*Commonly Prescribed Antidepressants and How They Work | NIH MedlinePlus Magazine*, n.d.). These benefits, however, come at a cost. Commonly experienced adverse side effects include sleep disturbance, weight gain and sexual dysfunction, which are clear detrimental side effects which cannot be neglected. An innovative solution could be VR. VR has made huge developments since its first introduction, boasting improved functionality and immersion, these developments create new opportunities for treatment with effects such as awe and the connected ensuing effects garnered from a VR experience.

In the context of this discussion on the escalating mental health challenges and the urgent need for innovative solutions, depression emerges as a particularly prominent concern. Depression has seen a rise in prevalence around the globe, from the US (Keyes et al., 2019) to Australia (Hawthorne et al., 2008). Depression is a mood disorder characterised by a depressed mood or a loss of interest that affects daily life (*Depression*, n.d.). Part of the experience of depression is feelings of disconnectedness and ruminating thoughts. Disconnection is understood as "a psychological phenomenon that involves a sense of detachment, isolation, or estrangement, either from oneself or from others" (Cornwell & Waite, 2009). Ruminations on the other hand are repetitive intrusive thoughts like 'What is wrong with me?', 'Why can't I make friends?' in response to a trigger or the consequences of said trigger, rather than being in the moment (American Psychiatric Association, 2024).

As mentioned above, an innovative solution could be VR. The VR experience produces a variety of emotional states, including awe and other associated effects such as self-transcendence that could combat key aspects of the experience of depression (Monroy & Keltner, 2022).

awe is a feeling that emerges through a cognitive process involving two operations: firstly, the perception of vastness, meaning encountering stimuli beyond self-comprehension; secondly, the ensuing need for accommodation, where an individual undertakes the mental restructuring required to make sense of new information from novel experiences (Chen & Mongrain, 2020).

An interesting dimension of awe is its potential to have prosocial effects. Perceiving something beyond current comprehension consequently reduces focus on personal concerns, effectively making the 'self' small. Considering ruminations, a shift of attention from the self to making sense of an experience could serve to interrupt the repetitive intrusive thoughts brought about by rumination (Perlin & Li, 2020). On top of this, these awe-inducing experiences bring with them positive emotions, such as feelings like joy (Keltner & Oatley, 2022, as cited in Monroy & Keltner, 2022) but also feelings of amusement, compassion, desire, love, and pride (Fredrickson, 2013; Keltner & Cowen, 2021; Shiota et al., 2017, as cited in Monroy & Keltner, 2022). Besides the positive nature of these emotional states, awe has also been found to be useful for improving well-being and health, with studies having found and connected awe to reductions in inflammation, increased oxytocin release, and, reduced sympathetic arousal (Monroy & Keltner, 2022).

Connected to awe and a reduced sense of self is the feeling of self-transcendence. This is the "subjective sense of one's self as an isolated entity can temporarily fade into an experience of unity with other people or one's surroundings, involving the dissolution of boundaries between the sense of self and "other"." (Yaden et al., 2017). It can be theorised that the feeling of being awestruck coupled with a reduced focus on oneself paves the path for self-transcendence to take hold. The mental state of self-transcendence is believed to be experienced along a spectrum, from smaller feelings such as being immersed in a video game to an overwhelming or transformational state such as feeling connected to everything and everyone, and everything else in between. Hence, if presented strongly enough, and in appropriate conditions, these feelings of connection could play a role in the experience of disconnection.

Current applications of VR to address mental well-being include nature simulations, nature being a strong and common elicitor of awe, also being linked to a variety of mental health benefits (Liu et al., 2023). These nature VR applications have been shown to improve psychological well-being (Qiu & School, 2021). However, they are not effective in improving depression and rumination (Browning et al., 2023). It can be theorised that the simulation of nature in VR is not novel enough and too far removed or too dissimilar to other important factors of immersion when considering the context such as smell, touch etc., and thus calls for alternative VR simulations to aid in producing positive effects of awe. Luckily, there are many other options such as the 'hyperreal'. Effectively, a hyperreal VR experience consists of constructed, more than-real aspects which act as particularly novel features (Barroso, 2022). These novel features could thus result in an even stronger expression of awe ultimately bridging the gap between nature VR and the real experience of nature.

As seen above, the effects of awe and self-transcendence have the potential to influence the experience of depression. To understand why these constructs are important in targeting feelings of disconnection and ruminations, it is necessary to get a better understanding of how disconnection and ruminations function and the role they play in the experience of depression.

Disconnection takes place in two ways, feeling disconnected from yourself or those around you. Self-transcendence has the potential to produce feelings of connection not only to oneself but to others and the environment. By elucidating a self-transcendent experience, those feelings of connection could play a role in tackling the feelings of disconnection, consequently, improving mood and well-being, as disconnection has been linked to a decrease in mental well-being (Cornwell & Waite, 2009). This is supported by Santini et al., 2021, who experienced the same decrease in well-being notably with an increase in depressive symptoms.

Rumination has been considered adaptive as a coping mechanism to stress. In theory, rumination helps identify causes and consequences of a negative event which help us know how and where to improve, however, it has been found to contribute to increasing an individual's vulnerability to depression (t et al., 2022). Also, Kennair et al., (2017) described a correlation between reduced rumination and reduced symptoms of depression. If it is possible to break an individual out of their ruminating patterns, there is potential for these individuals to implement more adaptive methods to cope with, which can be utilised to help target depression. Revisiting awe, its powerful presentation as a feeling and its pro-social effects causing a shift of focus from

the self may be useful in interrupting these ruminations and, consequently, provide a platform for these thoughts to be corrected with more adaptive thoughts to better cope with adversity.

Altogether, the increase in mental health issues experienced has been accompanied by an increased prevalence of depression. Having delved into the experience of depression, the need for intervention is clear. When considering the effects of awe and self-transcendence elaborated upon above, new and interesting solutions to the treatment of depression can be found, but first, an understanding of what is already in place to help solve these issues is required to see the potential awe and self-transcendence may bring. Of the current remedies for depression today, treatment options vary between the different aspects of depression listed above, ranging from pharmacological and neurological treatment to cognitive behavioural treatment and, lastly, mindfulness.

Treatment options targeted at depression, include pharmacological options such as anti-depressant drugs. Unfortunately, drug treatments come with significant side effects and currently serve as a crutch to stand on as chronic use is common highlighting the importance of other treatment options (Verhaak et al., 2019). Neurological solutions include electroconvulsive therapy, this has proven to be effective but also entails a significant number of patients who do not respond (Holtzheimer & Nemeroff, 2006). Mindfulness has been implemented to help treat rumination, by taking an individuals' focus away from reflective questions commonly seen in rumination and instead redirecting their center of awareness towards focusing on their surroundings and feelings, in an attempt to try and remain present in the here and now (Nilsson & Kazemi, 2016). Mindfulness has been found to be effective in reducing rumination (Querstret & Cropley, 2013). Lastly, treatment options targeted at disconnectedness are not plentiful, with little research being carried out. However, positive results emerged from self-monitoring interventions in which participants identified problematic behaviours and learnt new behaviours to replace these, after which they were required to self-monitor to keep up the behaviour (Moses, 2019).

Current treatment exists but there is no gold standard. From where we stand today, the potential to harness VR as a therapeutic remedy holds the promise of transforming mental health care where the convergence of psychology and cutting-edge technology becomes a beacon of hope, offering new dimensions of healing for those navigating the intricate realms of the mind.

A critical review of current research revealed that a lot of research conducted on VR was directed towards anxiety disorders, eating disorders, and post-traumatic stress disorder with no mention of potential depression treatment (Valmaggia et al. 2016). Jerdan et al. (2018) also outlined that the implementation of VR is quite effective for the treatment of anxiety, due to the realistic recreation produced in the VR environment and, surprisingly, was found to be beneficial in pain management. The charm of VR is its immersive environment. It feels as if you are actually experiencing whatever environment you are placed into. This seemingly 'real' environment thus has the power to simulate real experiences and hence potentially 'real' reactions. These unique and novel experiences elicit a variety of emotions and feelings such as awe and self-transcendence experienced in the use of VR technology. However, while VR appears promising to treat depression, the research conducted on it is scarce (Jerdan et al., 2018).

This research makes use of an award winning hyper-real VR installation created by Sjoerd van Acker. An essential aspect of the installation is its 'hyper-real' nature. Hyperreality can be understood as a simulation of reality, which is more real than reality itself (Barroso, 2022). Hyperreality and simulation are connected thereby producing and presenting the copy or image of reality without an objective resemblance to reality. The installation is a representation of a hyperreal world which makes it particularly effective for producing feelings of awe, or potential self-transcendence when compared to other VR tools such as nature VR.

The experience is called 'Elele', of Turkish origin meaning 'hand in hand'. This represents the essence of what the experience aims to be. Though not traditionally simulating a virtual environment as we have commonly come to know it, but instead provides an environment in which you are removed from your surroundings and where you're encouraged to engage and be present with yourself and within the experience.

The installation transports you to a dark 'room' surrounded by aqueducts and stars. Here you are greeted with a render of your hands and only your hands, with which you are able to manipulate to create various shapes and designs. Alongside this, there is calm and inspiring music playing, further immersing you in the experience. Altogether the environment invites you simply to be present and explore yourself, removed from your physical environment. The experience is multiplayer and so at some point another set of hands is spawned in, belonging to the other individual in the experience. The experience itself is timed and is more open to what you make out of it, nonetheless, delivers the same immersive experience.

It provides a unique immersive realness to an experience with many novel features, such as shooting stars, an aurora of colours, great structures and an incredible representation of your hands. Considering the nature of both, disconnectedness and rumination together with the potential effects of awe and what a self-transcended experience produces, the VR installation provides a unique platform for investigating individuals' feelings of connectedness and well-being. On top of this, considering aand its effects, in order to effectively use it as a tool to aid in remedying depression, it is essential to know what exactly produced or enhanced its expression so that if it were to be effective in remedying depression an experience can be tailored to produce the best outcome (Beck et al., 2010).

Summary

Examining the theoretical background provides valuable insights. Firstly, there is a noticeable increase in the prevalence of mental health issues, such as depression. Secondly, current remedies to treat these issues are not plentiful and are not always beneficial. Thirdly, the lack of alternative treatment solutions available to help combat this rise in mental health issues. Lastly, there is growing recognition of the potential of VR as a unique platform to address these challenges by eliciting specific emotional states. Looking at both awe and self-transcendence, and their respective effects, namely the positive emotions, the need to restructure thought processes, and feelings of connectedness, this research aims to investigate the experience of these emotional states and their influence on well-being in an overarching effort to apply these insights to help remedy mental health issues. Therefore, the question is:

Research Question:

What type of positive effects of Awe are present in the experience of hyperreal VR and what elements are key to eliciting Awe?

The research conducted for this contribution aims to address this question by evaluating Elele, a hyper-real VR experience, where two people interact, followed by duo interviews, and the results identify awe in Elele, how this leads to connectedness, and the crucial elicitors of awe.

Methods

Design

This qualitative study explores the hyperreal VR environment and its effects on users with an overarching goal of how these effects could be used for mental health issues. This was accomplished using primary data in a descriptive format. It was conducted in two stages. Firstly,

participants took part in the VR art installation. In this stage, participants went through the experience in pairs, however, were unaware that they were actively participating together. After their experience participants were brought together, and informed that they took part in the experience together.

The second part of the study involved a semi-structured interview conducted with each pair of participants about their experiences. Semi-structured meaning, a general set of questions posed to investigate a general theme (Adeoye-Olatunde & Olenik, 2021), in this case, general open-ended questions directed at the experience overall, but also more specific questions directed toward, awe, self-transcendence, and the feeling of connection. The semi-structured interview served as a pathway guiding the interview along and ensuring all topics are covered while also allowing to gather information directly related to each topic. It also allowed for room for the interviewees to share more non-directly related information enriching data gathered from the interview. These interviews were recorded, transcribed, and analysed using thematic analysis (TA). TA attempts to identify, analyse, and report patterns (themes) within data commonly achieved by either inductive or deductive coding (Braun & Clarke, 2006).

Participants

The study was comprised of 20 participants, between the ages of 18 and 30 years. Participants were gathered through a particular Test Subject Pool System (SONA) of the University of Twente, and convenience sampling, acquired by approaching students on Campus and through social media. Convenience sampling helped compensate for low sign-up rates on the SONA system, this is because it helps easily collect participants as there are no prior requirements individuals would need to meet in order to participate (Jager et al., 2017). The participants were Dutch University Students. To participate in the study, participants were required to be able to understand and speak English, additionally, participants needed to be present in person (in pairs), to connect them both to the VR experience. Other crucial requirements included that all participants did not suffer from motion sickness and were not impaired in a way that hindered them from listening to the audio materials, viewing the visual materials, or putting on and using a VR headset.

Materials

The following materials were used to carry out data collection/analysis. Elele, which served as the VR art experience that participants would use. As Elele is a paired VR experience

relying on new modern motion tracking technology, two meta-quest VR headsets were used. Additionally, a strong and stable internet connection was needed because Elele connects to an online server to create the joint duo experience. Two separate rooms were used. This was needed to allow for enough space for participants to move and be safe from obstacles (common VR practice) and helped create the illusion that participants were alone in the experience. A semi-structured interview was used, as it best matched the goal of this research (Adeoye-Olatunde & Olenik, 2021). Each interview had two interviewers and 2 interviewees in an open conversation where open-ended questions were posed to both participants with room for input from the other participant to elaborate/develop an idea stated. This helped to improve the richness of the data as more information could be gathered this way as opposed to strict closed-ended questions.

To record and transcribe the interviews, a recording device was used. Creating transcriptions was achieved through Amberscript (a transcription software) that then were exported to text files. The transcriptions were imported into Atlas.ti (a coding analysis software) for data analysis.

Procedure

Participants signed up on SONA, where they were instructed to sign up on timeslots with an already participating individual (if this was not the case they were allowed to sign up on any open timeslot). Alongside this, convenience sampling was used (Jager et al., 2017), approaching other university students while asking if they could either fill in on timeslots or whether they wanted to join. Once all participants were present at a timeslot, they were instructed on what would be happening while participating, including a general plan and what was expected of them. Every participant signed an informed consent. Afterwards they were guided into their own separate room under the pretence that they would be doing the experience alone. They were then given instructions informing them about how to use the VR equipment, how to start the application, that it is time-limited, and that they would be informed when the time runs out. As this is an intuitive application, they were not instructed on how to use the application, or what to do, they instead had to make sense of it on their own. Importantly, they were not informed that they will be paired in the experience. After completing the experience, the pairs were led back into the initial meeting room, where they were informed that they took part in the experience together. Afterwards, both participants were interviewed on their experiences of the installation. Altogether the interview started by asking about their initial impressions. This was done to get a

good overview of what and how participants experienced the installation without being influenced by the topics that would be discussed later. After this, questions on awe were asked to get a better understanding of whether awe was experienced, and if so, how it was experienced if not made clear earlier. Interviewees were then asked about feelings of connectedness, again seeing if it was experienced and if so, how it was experienced. This was then followed by questions directed towards self-transcendence. Lastly, the interviewees were fully debriefed on the goals of the study and were given opportunity to ask questions or withdraw their participation.

Data Analysis

Data analysis occurred in two steps. Firstly, all recordings from the interviews were transcribed. The transcriptions were analysed using thematic analysis. Codes were derived using both deductive and inductive coding. Deductive codes are pre-determined codes aimed at investigating a set idea or theme whereas inductive coding is more emergent, focusing on themes/patterns that come up (Bingham, 2024).

Deductive coding was used by identifying larger/collective terms surrounding the themes of awe, self-transcendence, and connectedness. Relevant synonyms were also included which served to help fully capture the nature of an awe experience. On top of this, codes were also created to identify the presence of positive/negative emotions, together with more neutral feelings or emotional states like calm, feeling relaxed, all relevant to an awe experience (Monroy & Keltner, 2022).

Inductive coding was used to help identify various aspects, such as new mentions of the key themes which were not identified by deductive coding, but also to fully capture the VR experience, taking note of key themes or unique experiences relevant to each respective theme, and relevant to hyper-real VR application as a tool to aid in mending mental health issues.

Altogether the codes were used to analyse the transcriptions to investigate how awe, self-transcendence and connectedness were presented in hyper-real VR and their effects but also to identify common themes or unique experiences relevant to its application. Coding was done using ATLAS.ti, a coding software.

Results

When asked about their experience of Elele, feelings of awe, self-transcendence and connectedness multiple common experiences were identified. These experiences being, the

experience of awe, connectedness and self-transcendence, and key triggers for awe and connectedness/transcendence.

Theme 1: Experience of Awe

The feeling of awe as an experience is transformative, it starts from a state of confusion about what you are seeing/sensing, this is succeeded by attempting to understand this stimulus. In this process, if the stimulus meets these needs awe is induced, and with it, there are associated effects, such as improved mental well-being, accompanied by an emotional response (i.e. positive or negative). In the case of Elele, the hyper-real VR installation, the experience of awe was identified in three ways. First, through the bizarreness, second, the environment and third being removed from 'everydayness'. Additionally, in the art experience, almost all participants experienced awe, expressing feelings of confusion, alongside these feelings of awe were positive emotions such as excitement, feeling at ease/being calm. Lastly, participants also reflected on the art experience as very positive, with feelings similar to those mentioned above, but also felt that it had generally improved their overall mood and helped to alleviate stressors they encountered during their day before participating in the Elele experience.

Awe is triggered by the experience of something vast, or something that is beyond our current level of comprehension (Chen & Mongrain, 2020). This is followed by restructuring thoughts to try and make sense of what is being experienced. In the following quote participant Franky was asked to recount her initial experience of Elele. This quote illustrates the process of how awe is triggered by novel experiences such as the environment of the Elele installation.

> *"For the first experience I think I was very curious and also a bit scared. Because the first surrounding was very dark, and I don't really like the dark, but then when the, visuals started, I was very fascinated. I, like, forgot where I actually am and what I'm doing. I was just. Yeah, very much in awe of what's happening around me."*

Franky shares her experience of awe during the installation, how she was curious and scared, directed towards features of the environment such as light intensity, the surroundings, and visual features. Franky mentions how these aspects fascinated her and how she felt in awe because of them. Together these aspects were responsible for elucidating her feeling of awe. These aspects

of Elele are hyper-real and thus are highly novel, which is necessary to effectively elicit awe (Barroso, 2022).

Awe is elicited from markedly novel experience which produces a state of confusion or unfamiliarity between what an individual is experiencing and what they know (Chen & Mongrain, 2020). This is vital to the elicitation of awe as well as influencing the impact of an awe experience. In the following quote, participant Hailey was asked to recount her experience. This response from Hailey illustrates that she experienced awe, evoked by the novel environment produced by Elele.

> *"I found it a kind of funny experience. At one point I almost started laughing out loud. Just like what? What? Just because it's bizarre. Basically. Yeah. Um. Yeah. And I just general maybe very, very positive, very happy idea just because it all looks so amazing."*

Hailey mentions the experience to be 'funny', in the context of the interview, this referenced the absurdity or ridiculousness they experienced while in the Elele. More clearly followed by mentioning the installation to be bizarre. Together these mentions show how Hailey was trying to get a grasp of what she was experiencing indicative of the transformative awe experience of being exposed to a novel stimulus and then trying to make sense of it but feeling confused and uncertain about exactly what it was that she experienced.

Awe is also connected to improved mental well-being and improved mood (Monroy & Keltner, 2022. This is primarily achieved through the diversion of focus when trying to understand something one is unfamiliar with (Perlin & Li, 2020). The shift of focus from the self to the moment helps remove one from monotonous 'everydayness' in that one is no longer focused on the self but instead absorbed by the novel experience. In the following quote, participant Alice was asked to reflect on how the Elele has impacted her mood and overall well-being.

> *"I think it really improved my mental status at this moment, because just this week has been super busy for me, and there's quite some stress. And with this, I really, like got sucked back into the moment and just experiencing the moment and kind of like the beauty of things and how like there's a world full of beauty, basically. So it really*

improved that. [..] it improved because it gave me I think this, this hopeful feeling, I guess, where it's just like, yeah, see there's also the other beautiful things."

The quote shows clearly how Alice was removed from her everyday life, mentioning directly that she was sucked back into the moment, and forgot of her other stressors. Not only was Alice removed from her everyday life, but she also felt a feeling of hope showing an improvement in her mental well-being with a new focus on the beauty out there in life and a reduced focus on the daily life stressors she experienced. Additionally, Alice mentioned in her recount of her experience prior to this quote how she was fascinated by the novel stimulus and then tried to make sense of it but ultimately forgot temporarily where she was or what she was doing. This represents the shift of focus mentioned above, clearly highlighting the effect of awe, where she was exposed to novel stimuli, that when trying to make sense of them her focus shifted outward away from herself.

Responses identified the successful elicitation of awe, with Elele satisfying the prerequisites of awe in its hyper-real environment and features, which created a need to restructure and accommodate what was perceived. This is seen in direct reference to feeling in awe, mentions of how bizarre Elele was and being fascinated by what they saw. The responses also indicate positive emotions were produced as a result of the experience, mentioning wanting to laugh and it being very positive, as well as negative emotions such as fear, both associated with the experience of awe. Again, participants described the experience as positive directly mentioning a positive change in their mental state due to being removed from their everydayness and the feeling of being in the moment

Theme 2: Connection

VR can help/ bolster feelings of awe. Another important aspect of awe is its prosocial effects in which awe produces the feeling of connectedness (Perlin & Li, 2020). Achieved through the shift of focus from the self toward the novel stimulus which consequently helps foster feelings of connection. In Elele connection was seen in three ways, firstly being connected to the self, secondly being connected to others, and lastly being part of something bigger. When posed with novel experiences such as the hyper-real these feelings of connectedness can create a sense of self-transcendence, in which individuals feel a greater feeling of connectedness to oneself, others and the environment. Self-transcendence is connected to awe, where awe

precedes and is necessary for the elicitation of the transcendent experience. Altogether both experiences had positive emotions associated with them.

When in a state of awe, the diversion of focus to what is happening around you, alongside the strength of awe helps direct and boost one's current experience (Perlin & Li, 2020). In Elele, where participants are presented with stimuli such as the environment and later another set of hands, their focus is shifted outward and directed to these aspects increasing feelings of connectedness towards them. In the following quote, participant Ana was asked to reflect on her feelings of connection to either herself, to others or to the environment.

> *"I felt really part of that space basically and very connected. And then I think as soon as the hands came in, that was also like I felt connected to someone else, at least. And it still had to get that it was you (other participant). But, I really felt connected and maybe also with myself"*

Immediately Ana states she felt very part of the space and connected to it. For Ana this feeling of connectedness starts with the introduction of parts of the environment in Elele, mentioning that she felt part of the space, this was followed by the introduction of new hands, after which she then felt connected to others. It is worth noting that Ana mentions that she still had to figure out it was her partner in the experience. This could indicate that the introduction of specific features of the environment and the hands are where her focus was shifted towards and consequently played a role in enhancing the respective feelings of connection.

When feelings of awe become particularly strong, it can produce feelings similar to self-transcendence (Perlin & Li, 2020). In this state, individuals feel as if they are no longer their own entity but connected to and feel part of something bigger than themselves. In the following quote participant John was asked follow-up questions on their initial experience. From his initial response John mentioned feeling in awe, as well as feeling part of something bigger than himself.

> *"the feeling of not me perceiving myself as like an own entity, but as a part of a bigger. I feel like it's giving me a lot of peace, you know, like whenever I have this experience, I'm always thinking it's not necessarily positive, but it's very meaningful."*

As seen above, John immediately shared that he felt in awe during his experience of Elele. In the quote, John clearly states he felt as if he no longer perceived himself as his own entity and instead part of something bigger than himself. John's experience of awe shifted his focus away from himself enhancing his feelings of connection, consequently, helping him progress him to a stage of self-transcendence ultimately creating a meaningful experience for him.

Responses suggest that connection occurred in multiple ways, with direct mention of feeling connected to the environment, to the other participant as well as to themselves. Connection was enhanced by the experience of awe due to the shift in focus outward to external stimuli such as the environment or hands. Participants also directly referenced feelings representative of self-transcendence with mention of feeling part of something bigger. Importantly, it was shown that an awe/self-transcendent experience needs not to be explicitly positive to produce a meaningful outcome.

Theme 3: **Critical aspects to inducing Awe.**

To induce awe requires the presence of something beyond our current level of comprehension (Chen & Mongrain, 2020). A common trigger of awe is incredible environments, such as a sunset or in this case a hyper-real environment. Previously, we saw Franky experience awe as a result of her environment. However, music also appeared to be an important factor in enhancing feelings of awe with many mentions of how music made participants feel in awe. Participants also mentioned that music helped them experience feelings of connectedness and self-transcendence. We also found fear took away from the experience of awe.

The music present in Elele played a critical part in helping participants experience awe and connection. In the following quote, participant Adam mentions that the music and syncing rhythmically with the music and the other individual in the experience enhanced his feeling of awe.

> "*so once we like started to like play around with the music and like try to integrate like the environment. Like I had the feeling the music was part of the environment. And like once we try to integrate in that motion, that was also where I completely forget everything.*"

Here in this quote, Adam says as the pair started dancing together and synching with the music, he felt this feeling of 'wow', followed by stating 'now were trying to do something' insinuating that it was then that they felt connected to their partner. On top of this, Adam felt as if the music was part of the environment potentially indicating that it also played a role in his feelings of connection. Lastly, Adam mentioned that this is when he completely forgot everything, this is similar to the progression of awe to self-transcendence, showing music was significant in producing and enhancing feelings of awe.

Awe is associated with positive emotions but is also associated with negative emotions such as fear or feelings of being overwhelmed negatively (Keltner & Oatley, 2022, as cited in Monroy & Keltner, 2022). It can be theorised that due to the novelty of the experience, awe is presented to a high degree which could mean these feelings of being overwhelmed are too much to cope with and produce feelings of fear. In the following quote, participant Beth was asked follow-up questions on her experience after initially sharing she felt overwhelmed, and a bit panicked in her experience. At the end of the interview when asked to reflect on her experience overall, Beth shared she does not feel worse but does not feel calmer, identifying aspects which do not induce a positive awe experience such as the strength of the stimulus.

> "*I think both of the times I was overwhelmed. In the beginning it was like, whoa, this is really dark? And then my hands were like, glowing. Um, and then when that became, like, normal for me, there were like another set of hands. So I was overwhelmed again, like, "oh, what's happening?" because I finally had like, control, because I understood it kind of. And then the second pair of hands came and I didn't know what was happening. The hands were moving, I was confused, I tried to like, move away from it but I couldn't because it kept following me*."

Beth immediately stated she felt overwhelmed by the experience. She elaborated on this stating that once she felt somewhat accustomed, she was immediately presented with another overwhelming change. It can be reasoned that Beth experienced too much awe and as a result felt overwhelmed and unsettled. Interestingly, Beth also mentions that it was because she also felt as if she had no control over what happens. This could indicate that control plays a role in the temperament of the experience of Elele and the hyper-real. Understandably when posed with

novel hyper-real elements, their unfamiliar nature could come across as threatening and a lack of control could negatively strengthen this. This is also seen in participant Danielle, who shared similar feelings of being overwhelmed and slightly frightened where she states, "I'm a bit mistrustful towards other people in the beginning." showing how uncertainty, similar to control, influences her behaviour.

Responses suggest that key parts of Elele and the experience of awe entailed the music, and aspects of the environment (e.g. colours, moonlight, as well as features of the environment such as the mirrored floor), either producing or enhancing feelings of awe, connectedness and self-transcendence. Collaboration induced awe, with participants referencing this as what put them in awe, but also this being the moment they felt a sense of forgetting where they were. Together with collaboration, music also helped foster feelings of connection. When integrating with the music and partner, participants felt connected to the environment, to others as well as to themselves producing feelings similar to self-transcendence. Relevant to inducing awe, are factors that do not induce awe. The feeling of being overwhelmed appears to reduce the experience of awe. This was mentioned in certain interviews, however, only once was this feeling presented strongly enough to remove the participant from the feeling of awe. In all interviews, this did not produce significant discomfort.

Discussion

What type of positive effects of awe are present in the experience of hyperreal VR and what elements are key to eliciting awe? To answer this question, semi-structured interviews were conducted with individuals who took part in a VR art installation and were asked about their experiences, and other questions directed to awe, self-transcendence, and the feeling of connection. Three themes were identified, the feeling of awe, feelings of connection and factors critical to inducing awe.

Altogether, the interviews identified that, Elele, the VR installation successfully elicited awe directly linked to its novel hyper-real nature and features. The experience of awe produced by Elele created overwhelmingly positive experiences, while also creating a positive change in participants' mental state removing them from their 'everydayness' and placing them in the moment. Negative emotions were experienced but in a minority of participants. Elele, as a result of awe also produced feelings of connection, namely, feeling connected to the environment, to

other participants and to themselves. Importantly, awe was also presented strongly enough to produce feelings of self-transcendence.

Key aspects which helped Elele evoke the feeling of awe included the music, aspects of the environment (e.g. colours, moonlight, as well as features of the environment such as the mirrored floor). Collaboration in such a novel context also helped produce feelings of awe and connectedness by further removing the participants' focus on themselves outward to what they were experiencing.

Considering the prior research, awe is thought to be pro-social, increasing feelings of connection. This works by experiencing something novel, such as Elele, and consequently needing to make sense of the experience. This shifts focus outward away from the self and directs it toward novel stimuli being perceived and as a result makes the 'self' small (Perlin & Li, 2020). As a result of Elele, participants felt connected to the environment, to the other participant and themselves. This can be explained by this shift of focus, in Elele, immediately you are greeted with an extremely novel environment, starting out pitch black, and slowly integrating new features in the environment such as large aqueducts, vibrant colours, all the way to mirrored floors. These features have stunned participants leaving them awestruck, but significantly, captured their focus. It is because of these stimuli that participants felt connected to the environment. Similarly, after some time Elele introduces the new set of hands (when you connect to the other user), again shifting the focus toward the hands. The pair of hands represent human like features creating this connection to the other person. This coupled with the information that this was in fact another person in the experience again creates the feeling of connection.

Altogether, the increased feelings of connection are important when considering disconnection, bearing in mind that disconnection is understood as a sense of detachment, isolation, or estrangement, either from oneself or from others (Cornwell & Waite, 2009). Seeing that Elele was successfully able to produce feelings of connection not only to the environment but others as well as oneself, its potential to help those suffering from disconnection cannot be ignored.

Along with producing feelings of connection, Elele improved participants mood and helped them forget their worries, such as bad exams grades, important deadlines etc, shared in the interviews. This was achieved through making the self small, as consequence of awe. Participants came into the experience with these thoughts and feelings, but when presented with

Elele, the novel nature of the installation captured their attention and required them to make sense of it, this consequently removed them from consistently thinking or worrying about their problems, shifting their focus away from themselves and making the self small. This is important when considering ruminations. As seen earlier ruminations are repetitive intrusive thoughts triggered by negative experiences which are hard to get rid of (American Psychiatric Association, 2024). Having seen how Elele was able to remove participants from their ruminative thoughts, this shows the immense potential hyper-real VR and awe hold in helping interrupt ruminations as theorised earlier.

Considering the positive emotions experienced by the participants, research into awe has confirmed that positive and negative emotions, as well as increased mental well-being all arise as a result of experiencing awe (Monroy & Keltner, 2022). Important to mention however, as could be logically reasoned too, is that what is presented to the user impacts the nature of a VR experience. In this case, the two participants who mentioned feeling overwhelmed also indicated that the darkness contributed to their initial negative impression and affected how they perceived the remainder of the experience. This is important to keep in mind when considering which elements to include in a future hyper-real VR experience.

Addressing the second part of the research question; what elements are key to eliciting awe? If identifiable patterns can be drawn out, they could provide insights into how aspects of a VR installation like Elele influences the elicitation or experience of awe. This in turn could help in informing future design choices if VR were to be introduced in the treatment of depression and therefor, this was investigated in Elele. Features which played a critical role in evoking awe entailed the music, and aspects of the environment (e.g. colours, moonlight, as well as features of the environment such as the mirrored floor). Other than this, the collaboration with the other set of hands in Elele also significantly impacted the experience of awe.

Keeping in mind that to evoke awe one needs highly novel features or experiences, this considered Elele created a good platform to elicit awe. Having provided this platform to be in awe, introducing further novel features like the other pair of hands appeared to create the sense of another entity being present on which participants focus could be shifted to. This shift of focus consequently helped produce feelings of connection to others, given the hands indirectly represent another person. On top of this, the fact that Elele is a paired experience, the feedback from the other pair of hands were representative of a human, as it was in fact another person.

This seems to have pushed the experience to the next level and helped create a true and authentic connection to the other set of hands. Attempting to replicate an authentic human interaction thus seems to be critical in creating feelings of connection. On top of this, unique applications of features such as music can serve to enhance this experience as was related by participant Adam where this significantly influenced his awe experience, putting him in awe and helping him feel connected to the other set of hands.

With this in mind, future hyper-real VR installations can make use of extremely novel aspects as Elele did and incorporate features such natural human interaction like the use of the other set of hands. This would help produce awe, consequently, interrupting ruminations and making room for other consequential effects such as connection to take place, though importantly, the use of features which would naturally produce connection seem to play an important role in creating feelings of connection seen in VR. Also significant to note however is that prior experience with VR could lessen the strength at which awe is elicited, this was seen once in the interview process where a participant mentioned that he was familiar with VR and so this was not as mind blowing to him as it may be to others. Though it did not significantly reduce feelings of awe; it highlights that habituation may impact the effectiveness of hyper-real VR. There are however potential solutions to this, for example, a tailored experience may negate these effects for example, the participant mentioned earlier stated that though the VR was not as novel, what was novel to him was the newer technology seen in the Meta quest headset, and that this enhanced the feelings of awe which were presented as strongly earlier. Hence, tailoring an experience to include aspects relevant to each user could help improve outcomes. Another solution lies in the nature of the experience itself, seeing that a hyper-real VR experience is not limited to reality because it is more than reality itself, the ability to create new and different experiences is thus theoretically endless and only limited by our imagination.

Implications

These findings bring important implications, namely hyper-real VR has potential to act as a good platform for assisting in targeting ruminating thoughts. Ruminations are repetitive *intrusive* thoughts, meaning they may be difficult to interrupt alone and thus when using VR to disrupt these ruminative thoughts in tandem with tested treatment such as self-monitoring interventions (Moses, 2019) or mindfulness (Querstret & Cropley, 2013) their combined outcomes could be particularly effective in treating depression.

On top of this, it also serves as a good platform to increase feelings of connection. Importantly, it appears that dedicated features such as indirect human interaction as seen in Elele, or potentially other forms of naturally connection inducing experiences are needed to take the effects of awe to the next level and produce authentic feelings of connection.

Other than this, hyper-real VR, like other VR applications do bring about a positive change in overall well-being which cannot be ignored, thus attention should be paid to try and implement and incorporate VR in the treatment of depression.

Limitations

The all-embracing aim of this paper was to investigate the effects of VR and the hyperreal on mental well-being. The setup and data analysis of this research was effective in assessing this goal. However, this study had a short-term focus, assessing only short-term effects. Long-term effects matter as this allows you to have a measure of true effectiveness (Duryea et al., 2007), this becomes particularly important when dealing with illnesses such as depression which have a time aspect attached to them, compared to other biological illnesses. To truly assess the full effect of VR and the hyperreal on mental well-being this study could have benefited from a longitudinal study design to investigate the long-term effects VR would have on mental well-being. Together with this, future research could be directed to assessing more concrete effects, while this study focused on capturing the experience of VR and its impacts, future research could take a quantitative design to measure direct cause and effect, such as contributors to elicit awe and consequently identifying which contributors are most effective in eliciting awe (Verhoef & Casebeer, 1997). This research could serve as a good base for investigating these contributors as it confirms VR to be effective in producing awe as well as identifying key contributors to this experience.

Other areas in which this study could be improved are the sampling method and the environment where the study was conducted. Although, the use of convenience sampling posed no problems, other sampling methods such as purposive sampling could be beneficial when used to target those with depression, this would allow for more insight into the effects of VR when applied directly to the eventual target group (Gill, 2020). A common theme was being aware that people could potentially see them (participants) while in the experience. A setting more representative of where individuals would usually conduct this activity would be more appropriate in gathering more ecologically valid information. Lastly, this study made use of a

semi-structured informal interview, this was used to provoke more conversation between participants and interviewers for a richer understanding of their experiences. This could however influence their responses due to social pressure and so a different design could produce different outcomes.

Conclusion

The study investigated the positive effects of awe and identified aspects that elicit awe in VR experiences by conducting semi-structured interviews with participants of the VR art installation called Elele. This installation elicited awe through the environment, music and other features of the installation. This produced both positive emotions, such as laughter and joy, and negative emotions, like fear. While the overall experiences were positive, a minority of participants mentioned that feeling overwhelmed occasionally diminished their feeling of awe, though it did not cause significant discomfort. Ultimately the experience led to an improved mental state. Elele enhanced feelings of connection to the environment, other participants, and themselves, aligning with the concept of self-transcendence. Key contributors to awe included the music, environmental elements such as colours, moonlight, mirrored floors, and interactive components like hand collaboration. This study contributed to understanding how VR can be implemented to assist in remedying mental health issues such as depression. It confirms that hyper-real VR can effectively evoke awe, fostering positive emotions, connection, and improve overall mental well-being. It also confirms that awe impacts key aspects in the experience of depression such as ruminations and disconnection and has the potential to aid in remedying depression through hyper-real VR. More research is needed that fosters the above findings; altogether however, VR may prove to be beneficial for patients in comparison to anti-depressants use with fewer, and less severe side effects attached it.

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Appendix

Interview Questions Elele

Initial Experience

- What were your initial thoughts and feelings as you first entered the virtual reality environment?
- What were your initial thoughts and feelings as you started the two phases of the experience?
    - Phase 1, experiencing it yourself.
    - Phase 2, being connected to another.

Awe

Initial Awe-inspiring Moments:

- Can you recall any specific moments during the virtual reality experience that were specifically special or left you in awe?
    - Did you feel in awe of the experience?
    - What was it about those moments that stood out to you?

Personal Shifts in Perception:

- Did the virtual reality environment lead to any changes in the way you perceive the world or yourself?
- Were there instances where you felt a sense of awe that influenced your perspective on anything?

Comparison to Real-life Moments:

- How did the virtual nature of the experience contribute to or differ from any awe-inspiring moments you might have encountered in real life?

Positive emotions as a result of Awe

- How do you feel after the virtual experience?
- Did you experience any positive emotions during the virtual experience? (Or negative emotions)
    - Which emotions did you experience?

Connectedness

Introduce the construct "connectedness": a state of feeling connected to self, others, and the wider world" based on The Watts Connectedness Scale

Connectedness to yourself:

- How did you experience yourself and your hands?
- To what extent do you feel more connected to yourself?

Connectedness to others:

- How did you experience the other pair of hands?
- To what extent did you feel more connected to others?

Connectedness to the world:

- How are you connected to the world around you?
- How does it differ from what you experience outside of VR?

Self-transcendence

Initial Impact:

- How did the VR experience influence your initial perception of yourself and your surroundings?
- Can you describe any immediate thoughts or emotions that stood out to you?

Expanded Awareness:

- Did the VR installation contribute to a sense of expanded awareness or a connection to something beyond your usual experience? If so, could you elaborate on that experience?

Shift in Perspective:

- Did the VR environment shift your perspective on yourself or the world around you?
- Were there any moments where you felt a sense of transcendence or a departure from your everyday mindset?

Other ideas:

- Can you describe a situation in which you felt deeply connected to others in the installation?
  - Ask first if there were any moments in which the hand was closer or more distant to the participant, then ask about the how and why.
  - Take a 3 person's perspective. Prime the question in a way: How would you explain to a close friend how you felt here?

Debriefing

Overall Impressions:

- How would you describe your overall experience with the virtual reality installation and the interview process?
- Were there any aspects that stood out to you, positively or negatively?
- What are your thoughts on the visual and audio aspects of the VR experience? Did the quality contribute to or detract from your overall enjoyment?
- What is your overall impression of the experience?

Long-term Reflection:

- How do you anticipate the impact of this experience on your thoughts or feelings in the long term?
  - Are there aspects that you think will stay with you, or that you may continue to reflect on?

Suggestions for Improvement:

- Are there any aspects of the virtual reality experience or the interview process that you think could be improved?
- Do you have any suggestions for making the overall experience more effective or engaging?

Additional Comments:

- Is there anything else you would like to share or discuss that wasn't covered in the interview?
- Do you have any additional thoughts, reflections, or insights you would like to express?