



**Proteus Affect: The Proteus Effect in Commercial Video Games and Influence on
Depression**

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Abstract

The Proteus Effect refers to an observed phenomenon whereby people alter their behaviour and attitudes as a result of observing features of their avatar's characteristics within virtual environments and video games. Video games are known to produce beneficial mental health outcomes, and avatars are often used in video games as a tool for player interaction. This study investigated whether manipulating the avatars used within a video game could alleviate symptoms of depression and anxiety (via the Proteus Effect). Participants were assigned a hero or villager role and their depression scores were measured a week before and immediately after a 30-minute play session on Minecraft. It was hypothesised that depression scores would be lower after playing the game. It was also hypothesised that there would be a greater reduction in depression scores amongst participants playing a hero character versus a villager character, and amongst non-gamers versus regular gamers. Results replicated previous work in showing that depression measures were significantly lower after gaming. However, neither assigned role nor gamer identity were significant in the reduction of depression scores. These findings contribute to a growing body of research suggesting the potential of gaming in the treatment of depression. The play element in particular has implications for use in therapy for children. Further research could explore using different genres of games, and the application of virtual reality technologies for therapeutic purposes.

Keywords: Proteus Effect; avatars; gamers; identification

Contents

Introduction	4
Methods.....	11
Participants.....	11
Materials	12
Design	13
Procedure.....	13
Results	15
Discussion	17
Conclusion	24
References.....	25
Appendix A.....	35
Appendix B.....	36
Appendix C.....	38
Appendix D.....	40
Appendix E	43
Appendix F	Error! Bookmark not defined.

Introduction

The multi-billion-pound industry of commercial video games has grown considerably since its inception in 1970s, ranging from home consoles and arcade machines to more modern handheld gaming devices and novel virtual reality (VR) technologies. In the United States, statistics show that more than 214 million Americans play video games, with 51.1 million being children (Jovanovic, 2023). This readily available form of entertainment has garnered interest, both positive and controversial, with initial perceptions of gaming being heralded within popular press as addictive and linked to violence. Studies have since reflected on the impact of gaming, with early studies linking the activity to aggression and depression (Anderson et al., 2010), and more recent research by Granic et al. (2014) documenting various cognitive, emotional, and motivational benefits of gaming.

Two reviews documenting the effects of commercial and casual video games on mental health, specifically focusing on anxiety, depression, and low moods, have found them to be effective resources for supplementing or replacing traditional therapeutic treatments (see Kowal et al., 2021; Pine et al., 2020). Positive outcomes were reported after even a minimum time of 30 minutes of a single session of play (Kowal et al., 2021; Pine et al., 2020). Specifically, individuals with clinical depression and co-morbid anxiety were prescribed 30 minutes of playing *Plants vs Zombies*, which in comparison to a group prescribed SSRIs had significantly reduced anxiety symptom severity (Fish et al., 2018). Whilst there is a lack of consistent evidence for the association between serotonin and depression, the accessibility and general low-cost of video games proves itself to be an effective supplement to traditional therapeutic treatments (Moncrieff et al., 2022).

In light of COVID-19, a recent review focused on the effects of video games played during the early stages of the pandemic was able to replicate findings of reduced depression and anxiety via play (Koban et al., 2022). However, it also found an increase of gaming disorder

(GD; Pallavicini et al., 2022). Research has found positive associations between adverse mental health outcomes, extended playing time, obsessive engagement, and habitual gaming (Przybylski & Weinstein, 2017; Przybylski et al., 2009; Hartmann et al., 2012). This suggests that the potential for video games as a mental health intervention for individuals who game frequently may find it less effective and possibly damaging. However, these factors were moderated by individual psychosocial predispositions and vulnerabilities, highlighting the consideration of an individual's current engagement with video games, coping mechanisms, and mental health status.

Games for Health

The implementation of social distancing, quarantining and restricted lifestyle due to the COVID-19 pandemic exacerbated psychological risk factors such as loneliness and poorer mental health (Wang et al., 2020). This highlighted major concern, especially with the prevalence of mental health issues preceding the pandemic: mental health disorders such as depressive and anxiety disorders affect upwards of 14% of the global population (James et al., 2018). The incidence of either is rarely isolated, as depression and anxiety are often experienced simultaneously and lend themselves to physical comorbidities (Vancampfort et al., 2017). Young adults specifically experienced loneliness and mental distress more than older age groups during the pandemic, where a novel study by Sutin et al. (2022) showed that the lifestyle changes and mental distress were linked to personality changes that usually take place over a decade in time. This emphasised a treatment gap in mental health care necessitating a reconsideration to alternate forms of treatment (Kohn et al., 2004). Many individuals reported having increased video game usage during the COVID-19 pandemic where lockdown measures were especially restrictive. As explained by the compensatory model of video game usage, human beings are deeply motivated to achieve and maintain psychological homeostasis (Kardefelt-Winther, 2014). Gaming is used as a coping strategy where behavioural and

cognitive efforts demanded by the game achieve homeostasis (Kardefelt-Winther, 2014; Koban et al., 2022). Gaming has facilitated people in coping with negative emotions caused or exacerbated by the pandemic (Eden et al., 2020; Pearce et al., 2022). However, it is important to consider that - as with other coping mechanisms - using video games as a coping mechanism can have negative effects, depending on factors such as the level of stress faced, or addiction-proneness (Snodgrass, 2022). Video games used as an avoidant coping strategy in this way can also lead to stress relief in "active escapism" (Kuo et al., 2016). Consequently, this leads to a higher incidence of GD and internet addiction. Therefore, present and future awareness on games and game design has an important role in minimising negative outcomes. Knowledge on the mechanisms of gaming in providing positive experiences is beneficial for its utility in a world where games are more widespread. When approached in an informed and healthy manner, gaming can show its efficacy in having a positive impact on people's wellbeing and providing a centre for enjoyable experience if its negative traits are moderated.

Games for Joy

Enjoyment via eudaimonic (e.g., pleasurable) and hedonic (e.g., emotionally moving, meaningful) experiences is the intentional and emotional outcome of gaming. Recent evidence has demonstrated the evocation of positive emotions like joy (Hemenover & Bowman, 2018) and social connectedness especially in online and role-playing games (RPGs), where they are found to be meaningful entertainment experiences (Oliver et al., 2016). Research has shown the usefulness of distraction and reappraisal as methods to combat depressive symptoms, especially anhedonia, a loss of pleasure (American Psychiatric Association, 2013). Anhedonia and chronic low mood are notable symptoms of depression alongside deficits in cognitive control, emotion regulation (Hemenover & Bowman, 2018) and lack of disengagements from negative stimuli (Sanchez et al., 2013). Different types and genres of games offer differing benefits on mental health, as elucidated in a review by Kowal et al. (2021) examining different

aspects such as goal achievement, positive reappraisal, and emotional regulation offered by different genres. A recent study has clarified key processes in games leading to reductions in depressive symptoms including escapism, self-transformation, agentic experience of competence, other-praising emotions (i.e., emotions that arise from others' exemplary actions) and connectedness with a virtual other (Klimmt & Possler, 2021). RPGs in particular have been found to offer multiple benefits. Commercially available games such as *Minecraft* have shown to be effective in fighting loneliness, promoting flow states, and alleviating depressive symptoms (Sweeny et al., 2020). Using VR with video games has also demonstrated increased flow, immersion, and presence (Bodzin et al., 2021), subsequently increasing player engagement and enjoyment (Sweetser et al. 2019). Understanding the experience of video games and their underlying mechanisms is important in clarifying their appeal, allowing for the development of mechanics within games to enable more positive outcomes.

Being Within the Game

The specific mechanics of video games can vary even within genre, though a common feature found within video games and especially RPGs is the avatar. Avatars are defined as visual representations of characters used by gamers to navigate and interact with in a real-time virtual environment to achieve in-game objectives (Bailenson & Blascovich, 2004, p. 65; Szolin, 2022). Various player-avatar relationships (PARs) can emerge during gaming, especially a monadic understanding of PARs, where interactivity in games can override the distance between the player and the character (Possler et al., 2022). An individual can project their physical world selves where personality and appearance affect an avatar's traits (Yee & Bailenson, 2007). The reverse is suggested to be true where the avatar can influence the gamer by integrating into the gamer's sense of self in attitudes and behaviour, creating a sense of "vicarious self-perception", altering players' self-experience during game play (Klimmt et al., 2010, p. 332). In other words, players temporarily feel they are the avatar. Identification with an

avatar has been supported as a cognitive process involved in gamers' responses to video games, as they integrate the avatar's identity within self-concept (Klimmt et al., 2010). The user-avatar relationship appearing in research is known as the Proteus Effect (PE; Yee & Bailenson, 2007).

The Proteus Effect

Yee and Bailenson (2007) coined the term "Proteus Effect" (PE) after the Greek god Proteus, who could change his form to any he desired. The PE refers to the phenomenon whereby observable features of virtual avatars influence the attitude and behaviours of the gamer both within and outside the game. Yee and Bailenson (2007) argue that the player makes inferences about their avatar from its appearance and modifies consequent behaviour in alignment with these characteristics. This occurs independently of another person's perception of their avatar. A prominent example in emergent studies indicated that individuals who play as more attractive and taller avatars act more confident and aggressively, disregarding their real body attributes (Yee & Bailenson, 2007; Yee et al., 2009). This effect was observed to have impact beyond the virtual environment, as alterations in self-concept affect automatic cognition and leave cognitive traces after gameplay (Klimmt et al., 2010; Szolin et al., 2022).

Mechanisms of the Proteus Effect

The phenomenon of the PE is commonly explained via two mechanisms: self-perception theory and priming via schemata (Bem, 1972; Peña, 2011). Self-perception theory suggests that individuals derive identity cues from observation of their own past behaviours, using beliefs and attitudes that follow from this to explain actions (Bem, 1972). In the context of the PE, individuals will observe identity cues of their avatar and assimilate these into attitudinal and behavioural changes.

Alternatively, the priming model posits that the observation of the avatar is connected with pre-existing schemata, influencing behaviour (Peña et al., 2009). An example is the

observation of avatar vocation such as a soldier will trigger concepts from the gamer's memory such as fitness and courage to inform further attitudes (Peña et al., 2016; Hefner et al., (2007). A similar phenomenon coined as "enclothed cognition" by Adam and Galinsky (2012) describes the influence that clothes have on a wearer's cognition and attention processes. Consistent with the priming model, their experiments demonstrated that wearing a lab coat described as a doctor's coat increased sustained attention compared to wearing the same lab coat described as a painter's coat. This clarifies the influence of schemata associated with symbolic meanings via physical experiences.

A recent review examining the theoretical framework of the PE by Praetorius and Görlich (2020) compared the priming and self-perception theories, concluding that while no approach could be favoured, a hybrid of both concepts can be used as each mechanism's effectiveness was determined by the context of the PE. Further studies distinguish three dimensions of avatar identification, known as self-similarity, wishful identification, and embodied presence. Self-similarity enhances the PE when players associate their own traits with that of the avatar, aiding the mental reconciliation between player and avatar (Looy et al., 2012). Embodied presence is a psychological state where the platform of technology is not consciously observed, indicated to have a strong influence on the PE. With wishful identification, the avatar represents desirable traits to the player which results in identification that reduces or removes the discrepancy between the self-concept of the player and the desired traits of the avatar. Higgins (1987) described three domains of self in the self-discrepancy theory: actual-self (traits an individual possesses), ideal-self (traits an individual would like to possess), and ought-self (traits an individual thinks they should possess). Observed discrepancies between actual-self and ideal-self causes negative emotional experiences and disappointment (Li et al., 2011). Klimmt et al. (2010) hypothesised that the link between identification and game enjoyment is mediated by

reduction of players' self-discrepancy. This causes the PE to occur by the adoption of desired traits of the avatar, and undesirable traits lead to no identification.

Research indicates that the PE's occurrence increases in likelihood when the player can customise their avatar (Ratan & Sah, 2015). Wishful identification stands as a factor to video game enjoyment, meaning the entertainment value of games can be improved if the role they occupy in the game possesses positive qualities and can be identified with successfully (Hefner et al., 2007). As a result, the promotion of joy, decrease of negative affect and significant reductions to depression and anxiety symptoms can be achieved through video games and the identification with an avatar possessing good qualities.

The Current Study

Video games - beyond pure entertainment value - have been shown to have mental health benefits. Serious games (i.e., games not intending enjoyment as their primary goal) have proven to be effective for beneficial mental health outcomes (Fleming et al., 2017). There is a lack of exploration in the mechanisms of commercial video games within current literature. Therefore, investigating the link between PARs, game enjoyment and the consequent effect on depression and its symptoms is important. Due to video games' entertainment value and widespread availability, the function of enjoyment is the core of questions asked in media psychology, having implications spreading to emotion, behaviour, developmental, and cognitive psychology (Klimmt et al., 2010). Many studies researching identification refer to the PE without the awareness of its establishment, and none without reference to its implications for alleviating depression and anxiety (Praetorius & Görlich, 2020). In pursuing the link, this is the first study (to this author's knowledge) conducted to investigate the effect of manipulating PARs in video games on participant's self-reported depression scores.

The potential for intervention of gaming on depression has already been identified in prior literature, with these occurring in 30-minute sessions over a 4-week period. In seeing if

gaming provides a meaningful experience but in a shorter amount of time, it was hypothesised that

Hypothesis 1 (H1): Depression measures will be lower in one week after playing a video game.

With the occurrence of the PE and principle of enclothed cognition, a player will identify with, pursue, and embody the virtuous qualities of an exemplary character more than an ordinary character. It is thought this will co-occur with wishful identification, reduced self-discrepancy and a joyful gaming experience, counteracting symptoms of depression. Thus, it was hypothesised that

Hypothesis 2 (H2): The Proteus Effect will reduce depression measures more effectively when playing a heroic character versus an ordinary character.

Conversely, consistently using gaming as a hobby and a coping mechanism may reduce the impact of the benefits and the PE in reducing depression. As a result, its intervention potential might be decreased. Thus, the third hypothesis forms such that

Hypothesis 3 (H3): A session of gaming reduces depression measures more in non-gamers than gamers.

For the purposes of this study, since there is no unified definition, a gamer is defined as an individual who plays for 1 or more hours a day or 4 or more in a week.

Methods

Participants

The study consisted of 24 recruited participants aged between 20 and 29 ($M = 23.37$, $SD = 2.58$), with 12 males and 12 females, and 12 gamers and 12 non-gamers amongst the

sample. After gaining ethical approval from the Heriot-Watt Ethics Committee, participants were recruited from the Student Research Participation system (StReP) and “word of mouth”. Participants were evenly divided and randomly allocated into the hero and villager conditions (balanced by gamer and non-gamer identities). Written informed consent was obtained before the experiment began (see Appendix D).

Materials

Beck’s Depression Inventory

A week prior to the session, participants’ depression score was measured by Beck’s Depression Inventory (BDI; Beck et al., 1987). A total of 21 questions were answered from a scale from 0 to 3 in agreement with the question, assessed via total score scale 0 to 63: 0-10 is considered normal, 11-16 is mild, 17-20 is borderline clinical depression, 21-30 is moderate depression, 31-40 is severe depression, and over 40 is extreme depression.

Player-Avatar Identification Scale

After the BDI, participants completed the Player-Avatar Identification Scale (PAIS; Li et al., 2013). The 15-item questionnaire demonstrated satisfactory reliability and validity, used to conceptualise Player-Avatar Identification within video game playing. It is used within this study as a measurement for the PE within a four-factor model: feelings during play, absorption during play, positive attitudes towards the game avatar and importance of avatar to self-identity. Participants respond to statements like “The characters I play influence the way I feel about myself” using a 5-point Likert scale (1=strongly disagree, 5= strongly agree; see Appendix A).

Minecraft

Minecraft is a popular video game developed and published by Mojang Studios, first released in 2011 and accessible on PC, PlayStation, Xbox, Nintendo Switch and mobile. Players are placed in a first-person perspective in a 3D world made of blocks where players can explore, build, fight, etc. There is no set objective due to the “sandbox” nature of the game and it encompasses the traits of many video game genres (RPGs, First-Person Shooters, adventure, simulation, action, multiplayer). The openness and accessibility of the game made it a suitable platform for setting up a game scenario without complication. A village with a small history was built in-game, populated with custom programmed non-player characters (NPCs; see Appendix B). Graphical modifications were added to aid with immersion and clarity.

Design

A mixed experimental research design was used determining the effect of video game play, the PE via role group, and gamer/non-gamer differences on depression. The independent variables (IV) included the role group (Hero or Villager) and gamer identification (Gamer or Non-gamer) as between-subjects factors. Play intervention (Pre-Play and Post-Play) was a within-subjects factor, with all participants being tested a week before and then immediately after the play session. The dependent variables (DV) were BDI score, and PAIS score. Prior PE research like Yee et al.'s (2009) study measured the PE via in-game performance as the increase of character level. Since this study does not assess the outcome of increased performance, PAIS was used as the measure of the PE.

Procedure

After ethical approval, participant consent and briefing, each were given the BDI and PAIS questionnaires in person a week prior to the Minecraft session. For the BDI, they

answered questions regarding their mood over the past week. When answering the PAIS, participants were asked to think of their favourite character from a piece of media such as a video game, television, or movie, then answer the questions in relation to this character. Scores were recorded and a time was arranged the following week to complete the play session. In a quiet room, the experiment was commenced by the researcher explaining the tasks to be completed in-game on Minecraft and their randomly assigned role of hero or villager (for tasks, see Appendix C). Participants chose and customised their avatars prior to play and were given a fifty-minute time limit to complete all the tasks. Participants were given a small tutorial of the game as they commenced play. Verbalised dialogue from the NPCs was read out by the researcher. Tasks involved fishing, crafting, farming, completing requests, and defending the village. Both the hero and the villager role had the same tasks. After completing the session, participants immediately completed the BDI and PAIS questionnaires. Upon completion, they were given a debrief form to read, which was also sent digitally via email. It contained their personal identification code, allowing them to remove their anonymised data at any time before the analysis.

Results

Table 1. Mean and standard deviation effects on dependent variable groups

	Depression Score (BDI)		Identification Score (PAIS)	
	Pre-Play	Post-Play	Pre-Play	Post-Play
Hero	18.42±11.29	11±8.11	51.83±8.13	51.91±9.49
Role				
Villager	16.58±9.01	12±10.30	53.41±8.01	50.58±7.34
Group				
Total	17.50±10.03	11.50±9.08	52.63±7.93	51.25±8.33

Values are shown in M±SD

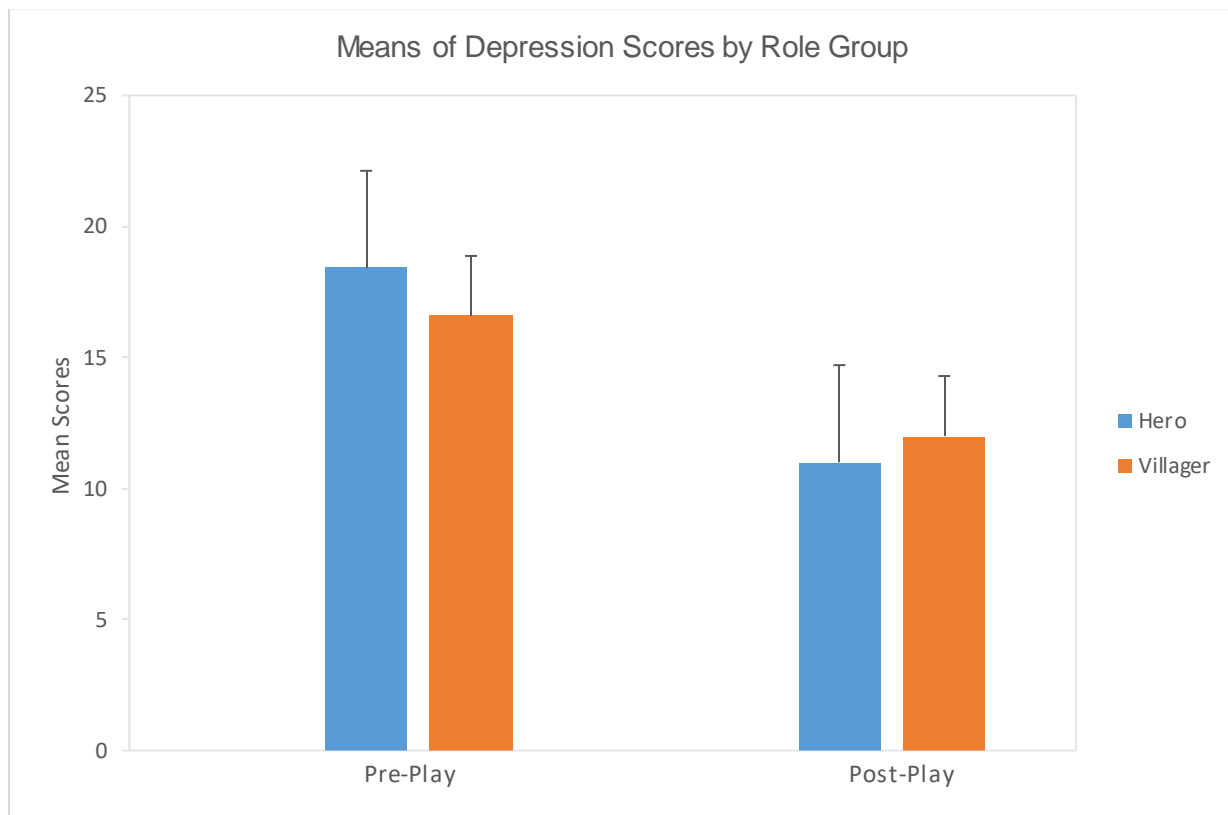
The presence of three independent variables (role, gamer identity and time) and two independent variables necessitated multiple two-way mixed analysis of variance (ANOVAs) to test whether there were significant differences of depression and identification scores via gameplay for H1 and H2. Mauchly's Test of Sphericity checked there was no violation of the assumption of sphericity and Levene's test of Equality of Variances were not significant.

A two-way mixed ANOVA showed a significant main effect of play time on BDI scores $F(1, 22) = 32.67, p < .001, \eta^2_p = .60$. Therefore, playing the game appeared to reduce BDI scores as compared to the previous week's scores.

Additional analyses revealed no significant interaction between play time and assigned role on BDI scores ($F[1, 22] = 1.82, p = .191, \eta^2_p = .76$), and no significant main effect of assigned role on BDI scores ($F[1, 22] = 0.12, p = .92, \eta^2_p = .001$). For identification scores,

analysis revealed a non-significant main effect of play time on identification ($F[1, 22] = 22.69$, $p = .519$, $\eta^2p = .019$), and a non-significant interaction between play time and role on identification, ($F[1, 22] = .483$, $p = .494$, $\eta^2p = .021$). Further analysis reveals no significant main effect of role on identification with character, ($F[1, 22] = .002$, $p = .963$, $\eta^2p = .000$). Finally, a non-significant interaction was found between play time and gamer identity, ($F[1, 22] = .38$, $p = .545$, $\eta^2p = .17$).

Graph 1. Means and SDs of Depression Scores by Role Group



Discussion

The study investigated the Proteus Effect as a potential mechanism in video games in alleviating depression and anxiety. The results of this study provide supporting evidence of video games having a positive influence on mental health, as there was a significant reduction of depression scores after a 30-minute play session of Minecraft with a large effect size. Supporting hypothesis 1, these results are consistent with Granic et al.'s (2014) study on the benefits of gaming and provides further support for Pine et al.'s (2020) study for using video games as an intervention or addition to a treatment plan.

Hypothesis 2 was not supported. Where past research has found the influence of the Proteus Effect on an individual's cognition during and after gameplay (Blake et al., 2012; Yee & Bailenson 2009; Szolin et al., 2022), the present study did not find a significant difference between depression measures in participants assigned to a hero role versus a villager role. Additionally, participants did not identify significantly more with a hero than they did with a villager. This indicates that the Proteus Effect did not have a significant influence on depression measures and did not significantly change in participants because of play.

Hypothesis 3 was also not supported. Further findings indicate no difference between gamers and non-gamers in the reduction of depression scores. This could suggest that there is no reduced effectiveness in using gaming as a method to alleviate depressive symptoms should an individual be a gamer.

This was the first study to this author's knowledge that conducted an experimental investigation into the potential mechanism of the PE on depression. The sample was also balanced in gender, and gamer and non-gamer identities for a more reliable analysis. Despite limitations in several areas, the study also employed a pre-designed scenario with programmed NPCs that was able to encompass most or all of the traits of an RPG also provided by the game.

Hypothesis 2 lacked support - the PE did not appear to mediate reductions in depression. This finding has a few possible explanations. The short amount of time playing the avatar does not allow for a deeper PAR to develop between the player and the avatar. Previous findings have shown that gamers who spend more time playing with their avatar experience higher identification (Lee, 2007). Players may have engaged dyadically (i.e., parasocial relationship or character liking) to the avatar, where the player perceived the avatar as a different entity to the user (Klimmt et al., 2006). Thus, it could be that insufficient time was given to the player to integrate the avatar's identity into their self-concept to allow it to influence their post-game cognition and mental wellbeing.

Another possible explanation can be found in the key differences between this study and Yee et al.'s (2009) study, which found significant results for the PE. Yee et al.'s (2009) method involved a VR monitor whereas this study used a non-VR monitor. This may have affected the PE's occurrence, since VR allows an individual to feel more immersed within the virtual environment (Bodzin et al., 2021). Moreover, Yee et al.'s (2009) study used an MMORPG (Massive Multiplayer Online Role-Playing Game) where this study used Minecraft, which is classified as an RPG. While they contain similarities, the key difference is the lack of other player entities and social interaction aspect. Since this study was populated by NPCs and Yee et al.'s (2009) had other human participants involved, this could have affected the strength of the PE. A previous study by Bian et al. (2015) showed that the PE was moderated by social interaction contexts and affecting its occurrence. Since there was no social interaction, this serves as a possible explanation to its null finding.

Alternatively, the non-significant difference of the identification measure indicates a limitation of the PAIS measurement tool. Where previous studies (Yee & Bailenson, 2007, Ratan & Sah, 2015) measured performance in a mid-game or post-game task to test for the PE, this study used a self-report measure explicitly questioning their level of identification. A recent

study by Qi et al. (2023) provides evidence that PARs can be a low-level cognitive process that still involves the integration of the avatar as an important feature of the self-concept. The study found that identification influenced the priorities of attention and perceptual processing of avatar-related stimulus. Earlier studies have found that stimulus related to the self are prioritised and processed faster in human cognition (Tong & Nakayama, 1999). Therefore, when measuring identification via the self-report measure, implicit identification may not be accounted for.

Again, hypothesis 3 was also not supported. No significant difference in the reduction of depression scores as a result of the intervention was observed between those identifying as gamers versus those identifying as non-gamers. This could have promising implications for the use of video games in therapeutic interventions, suggesting they are equally effective in both groups. However, it is important to acknowledge limitations in the study design and measurement. The study only tracked participants over the course of one week. The effectiveness of a gaming intervention may be decreased over a longer period of time especially by those who game more often, have GD, or have a maladaptive relationship to gaming. Furthermore, there is a lack of a cohesive measure of the gamer identity since the definition has varied from previous studies (Green et al., 2020; Possler et al., 2022). A generalised measure for the gamer identity that allows for the distinction between its approach as a hobby, lifestyle, or coping mechanism would be beneficial for future research to make a more accurate comparison by drawing inferences from an individual's intentions to engage with video games (Yim et al., 2023). This serves as a possible explanation for the study's differing results from a study by You et al. (2017) that found depressive symptoms to be correlated with avatar identification which is correlated with game addiction. However, You et al.'s (2017) study was different in observing these differences in adolescents and MMORPGs.

Limitations

Several limitations were present in the study. It is important to note that when interpreting any significance or non-significance within the study, the small sample size should urge caution. While the sample was gender balanced, future studies might replicate with larger samples and age differences, since between groups, the analysis may have insufficient power to draw significance. Finding significance in H1 but not H2 or H3 is possibly a type II error due to a very small sample of 12 analysed in comparison. Previous studies that found significant results for the Proteus Effect had higher sample sizes such as Peña et al. (2016) having 96 participants.

The sample was also limited to young adults between the ages of 20 and 27. We should therefore be cautious in generalising findings beyond this group. For instance, older adults who are less familiar with video gaming may have difficulty getting used to game mechanics, and therefore experience less therapeutic benefits.

Furthermore, the study only accounting for one week of time influences both measures of depression and identification. Specifically, the significant reduction of depression scores over one week do not account for other mediating factors in an individual's life, circumvented by a longer study's ability to average out these factors.

Further, it is not clear for how long the reduction in depressive symptoms persisted following intervention since measures were taken immediately after the play session ended and no subsequent follow-up measurements were taken. Future studies might consider using a longitudinal design, taking measures in the weeks following intervention to fully account for the effectiveness of a gaming intervention.

Implications

The study suggests multiple theoretical and practical contributions. Firstly, previous studies (Russoniello et al., 2013; Fish et al., 2018) find beneficial mental health outcomes over

four weeks using video games as an alternative to SSRIs. This study found significant reductions in depression scores after one week and one gaming session, which contrasts Russoniello et al.'s (2013) study where significant differences were only found after four weeks playing casual video games (CVG). One explanation for this is that this study differed in the game used for the intervention. Whereas Russoniello et al.'s (2013) gaming intervention featured a 2D space with no avatar (using Bejewelled), this study employed a controllable avatar in a 3D space that the player can customise. Turkay and Kinzer (2015) showed that the customisation of an avatar caused players to identify more with their avatars. Additionally, it is possible that as a result of the visual features of the game used in the present study (including graphical modifications), awe was elicited by the perception of vastness and can cause eudaimonic and hedonic experiences (Klimmt & Possler, 2021). According to Possler et al., (2018) video games with beautiful aesthetics and audio have the potential to cause awe and positive emotions (Possler et al., 2019). This could explain why we observed significant reductions in depression scores following just one session.

Second, the analysis between gamers and non-gamers highlights the potential efficacy of gaming as an intervention, as there was no disparity in reduced depression scores between the two identities. This suggests that despite the exposure of higher amounts of gaming, the positive outcomes are still experienced. As this helps to explain why gaming is used as a coping mechanism by those experiencing poor mental health (Kuo et al., 2016), the controlled and pre-set play time by the study's design facilitates the benefits and avoids negatives like maladaptive gaming.

More practically, this study makes two contributions. It emphasises the potential utility of commercial video games with avatars in the treatment of depression, having positive effects indiscriminate of a person's current identity as a gamer or how much they play. Given video games are low-cost and accessible, they provide a promising basis for the delivery of

therapeutic interventions, particularly to historically under-serviced groups. This is especially important in the context of rising incidences of mental health issues worldwide (James et al., 2018).

It may be particularly fruitful to explore using commercial video games in play therapy for children. Structured talking therapies may not have the same beneficial effects across populations due to the environment they are conducted in (Cooley et al., 2020) or possible difficulties talking and processing within individuals (Porter et al., 2009). Play is an important process in developmental psychology (Nicolopoulou, 1993) and an excellent therapeutic mode since children especially may have difficulty articulating their thoughts and feelings (Porter et al., 2009). Using commercial video games, play therapy can help children process through an avatar, provide an avenue for experiencing social interactions, and alleviate depressive symptoms (Zayeni et al., 2020). Specifically, gaming with children with disabilities achieves the goal of encouraging independence and developing coping skills (Carmichael, 1994). This supports results from previous studies that found close PARs can help promote self-development, growth, and self-expansion (Aron et al., 2013; Possler et al., 2022).

Finally, significant differences in depression being found after a week using a pre-designed Minecraft scenario, in comparison to previous studies using CVGs using 2D spaces and no avatar (Russoniello et al., 2013; Fish et al., 2018), indicate the importance of game design choices - significant reductions were found over four consistent weeks whereas this study found these reductions in one week. Specifically, the combinations of avatars, narrative, task completion, feedback loops, competence, immersion, awe, and general enjoyment may have contributed to the results. These mechanics, present in the game and the creation of the scenario, emphasise the effects of these mechanisms on depressive symptoms. This is consistent with and supplementing previous studies that highlight these features as important in

maintaining long-term engagement with therapeutic interventions using video games (Tao et al., 2021; Turner et al., 2016).

Future Directions

Future studies must measure the differences in gamer identity, addiction, and difference in the game used (such as genre) for intervention to replicate these results reliably. Specifically, investigating potential reduction in effectiveness over longer periods of time for people who game more or have GD - for instance via a longitudinal study design - would be effective. This could explore the intervention capability of gaming, applied across a wider population. A larger sample size including older adults and adolescents is also necessary to ensure results are generalisable to the large age range of the gamer population (Jovanovic, 2023). Maintaining the gender balance of this study is recommended.

In exploring the PE, future studies could include the completion of tasks and performances, or the development of a measure that is able to capture the more subtle cognitive processes of identification to measure the PE appropriately. This could be beneficial in researching the PE by capturing other factors of the PE left unaccounted, and for the design of therapeutic interventions to measure the extents an intervention is effective for the individual. Moreover, other agents for social interaction to facilitate the occurrence of the PE should be included.

Finally, studies should involve the usage of VR and narrative effects. VR has found positive effects in clinical medicine (Li et al., 2017), supported by evidence that VR use for the PE improves performance (Kocur, 2022). This extends to having physical bodily effects, where embodying a God-avatar exhibited heart rate deceleration and a lower skin conductance response (Kocur et al., 2020; Frisanco et al., 2022). This could help to alleviate some of the physical comorbidities experienced with depression and anxiety. Furthermore, entertainment narratives were shown to alleviate psychological demands of the self through enjoyment

(Johnson et al., 2015). Future research should employ both to test if narrative and VR used together in a video game can improve mental health outcomes, contributing evidence for Klimmt and Possler's (2021) multiprocess model of video game entertainment, where involvement with a narrative lead to active escapism and hedonic enjoyment.

Despite the limitations, this research can be seen as the first step towards the integration of the Proteus Effect and mental health outcomes that to our knowledge has not been directly linked.

Conclusion

This study was the first in investigating how the Proteus Effect could be manipulated in a commercial video game to alleviate symptoms of depression. The assignment of different roles in gameplay did not find significant differences in the reduction of depression scores. However, it was found that depression scores were significantly reduced in a week after one gaming session with no differences found in a gamer and non-gamer identity dichotomy. These findings provide evidence that a gaming intervention using commercially available video games has significant short-term effects that is not affected by an individual's current gaming habits. They have implications for the design of video games, their usage in therapeutic contexts especially with children, and VR applications that is following suit in its accessibility and availability.

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Appendix A

Player-Avatar Identification Scale, from Li et al. (2013).

Fifteen items of PAI used in the study.

- FL1 When my character is facing danger in the game, I feel nervous
- FL2 I feel the same disappointment when my character experiences a failure in the game
- FL3 When my character achieves his/her goals, I feel happy
- FL4 I feel the same joy my character experiences when a task is accomplished
- AB1 I have forgotten my surroundings during the game
- AB2 I have forgotten myself during the game
- AB3 I feel as if I am physically in the game world during the game
- PA1 I never regret that I play my game character
- PA2 I am proud to play the character I am playing now
- PA3 Other gamers are happy to be friends with my game character
- PA4 My co-gamers have high respect for my character
- ID1 The characters I play reflect who I am
- ID2 My character and I are one and the same
- ID3 The characters I play influence the way I feel about myself
- ID4 The characters I play are important to my sense of what kind of a person I am

Appendix B

Minecraft Task Session

Figure 1

Beginning of Minecraft session



Figure 2

The first task: fishing

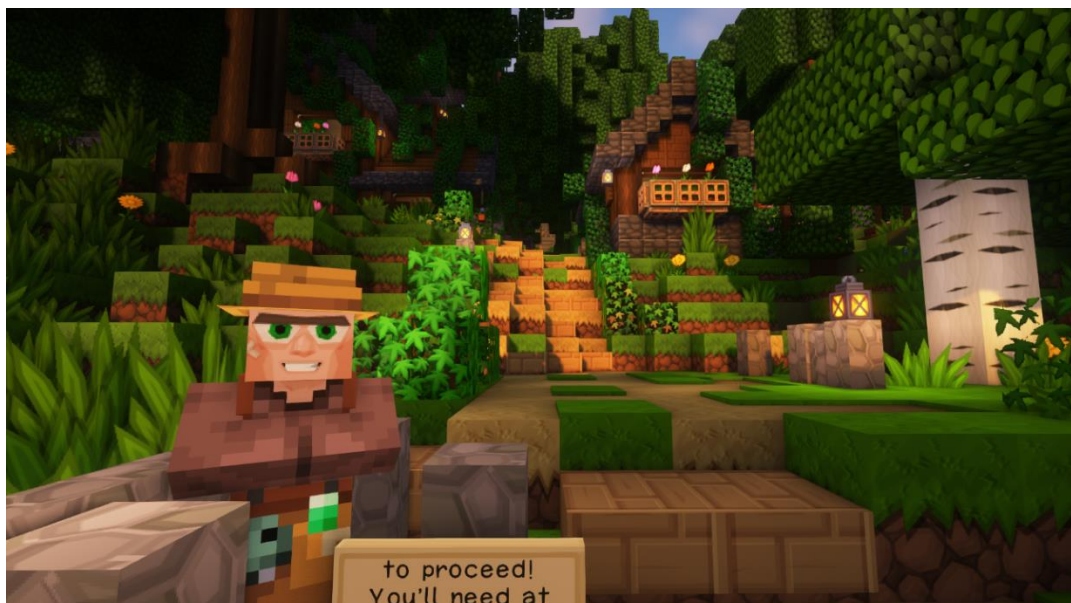


Figure 3

Inventory screen

**Figure 4**

The final task: shooting the target



Appendix C

Minecraft Task List and Dialogue

1. Get a fishing rod from Squisher Fisher.

2. Fish and obtain either cod, salmon, or pufferfish.

3. Trade these for emeralds, six fish are needed.

“Thank you! Every little helps! I think the Artful Armourer was wanting some emeralds to trade – I’m sure they’ll give you some goods in return.”

4. Go to the Artful Armourer’s house and trade emeralds for a sword and armour.

5. Across, go to the Wavy Woodcutter’s house and purchase an axe. Back towards the dock, there is a small grove of birch trees. Chop these down to use for wood later.

“I hear there is a slime infestation in the library. The Loving Librarian must be in danger!

6. Break through the woollen barricade and defeat the two slimes. Talk with the Librarian.

“Have you killed the slimes yet? I think I’ll stay in here for a bit. Thank you for saving my life. I just remembered – the Cartographer was wanting a book describing the local area – can you deliver it for me The Cartographer was last seen teaching in the school upstairs.”

7. Trade the mapbook to the Cartographer and they will make you a map detailing where the invaders will come from.

“If the enemy were to invade, they would come from the west. Collect some beetroot and wheat from the western fields to clear the fields for the farmer. If you’re extra generous, you can make some of that wheat into bread.”

8. Go to the west part of the village and collect 12 beetroots and 12 wheat. Bake the wheat into bread by making and using a crafting table.

9. Go to the Funky Farmer and trade the beetroots and the bread.

“Thank you for that! I think I saw some ill begotten people up in the hills wielding crossbows! I would recommend crafting a shield. This leather is the best I have currently. Craft a batch of

leather armour, take it to the Lackadaisical Leatherworker next door so that he can be inspired to start armouring us up!”

10. Craft a set of leather armour, then give it to the lackadaisical leatherworker. He will give you flint and feathers.

“You’re doing our job better than we can! Thanks for the help. Here, use these to make some arrows, I think Fletcher the Fletcher would like to have some for the upcoming battle. He’s just down the road.”

11. Make some arrows using the flint, feathers, and sticks from the wood you gathered earlier. Give some to Fletcher and obtain a bow.

“Hey, be quick. Just in time. My bird scouts have detected a scouting group and an enemy unit just behind them in the hills to the west. Luckily, we’ve planted some explosives on the hillside that will cause an avalanche onto the enemy down below. You’ll have to fight through the scouts and trigger the explosives by shooting the target. Follow the blue torches up to the hill and be careful. If we don’t make everyone panic, this’ll be a breeze. Good luck!”

12. Fight your way up the hill and shoot the target to detonate the explosives.

Appendix D

Participant Consent and Information Sheet



PARTICIPANT INFORMATION SHEET

PROJECT TITLE: The Proteus Effect within Video Games and Emotional Enjoyment

INVITATION

You are being asked to take part in a research study on video games and emotional impact. The research is supervised by Professor Gnanathusharan (Thusha) Rajendran. The investigator is Bryan (Kirby) Lipardo. The project has been approved by the School of Social Sciences Ethics Committee at Heriot-Watt University.

WHAT WILL HAPPEN

In this study, you will be asked to complete a questionnaire regarding depressive feelings and tendencies, followed by an additional questionnaire to how you identify with and feel towards game experiences and played characters. A week later, you will be instructed to complete small tasks that suit the designated role given to you within the game in the block simulated game Minecraft to achieve an overall goal. Afterwards, you will complete the same questionnaires.

AIM OF THE PROJECT

The aim of the study is to learn more about how identification with a game character and game enjoyment can affect behavioural and emotional associations when transferred to real life emotional states.

TIME COMMITMENT

The study typically takes one hour of your time.

PARTICIPANTS' RIGHTS

You may decide to stop being a part of the research study at any time without explanation. You have the right to ask that any data you have supplied to that point be withdrawn until the data is fully anonymised. Full anonymisation of your data will only happen once the data has been analysed. You have the right to omit or refuse to answer or respond to any question that is asked of you.

BENEFITS AND RISKS

There are no known benefits or risks for you in this study.

COST, REIMBURSEMENT AND COMPENSATION

Your participation in this study is voluntary; there is no compensation for your participation in this study except for reimbursement for travel to Heriot-Watt University labs if you are a non-HWU student or for STREP credits as detailed in the experiment announcement if you are a HWU student.

PRIVACY AND CONFIDENTIALITY

Heriot-Watt University is the data controller for the personal data collected in this project. We will collect and use your personal data for this project only with your consent. You can withdraw your consent at any time until the data is fully anonymised by contacting the researcher, supervisor or the data protection team.

We will keep your personal data securely and ensure that no one will link the research data you provide to any identifying information you may supply.

Once we have analysed the information you provide, we will completely anonymise your personal data so that it will not be possible to identify you from any information in the remaining dataset. After the project ends, we may use the anonymous dataset for research outputs such as articles and conference presentations.

If you would like to know more about what Heriot-Watt University does with your personal data and your rights under privacy law, please visit our data protection web pages at <https://www.hw.ac.uk/uk/services/information-governance/protect/privacy-and-your-data-rights.htm> or contact our Data Protection Officer by email at dataprotection@hw.ac.uk.

FOR FURTHER INFORMATION

Prof Thusha Rajendran will be glad to answer your questions about this study and provide additional information on results if requested. You may contact them at t.rajendran@hw.ac.uk.



PARTICIPANT CONSENT FORM

By signing below, you are agreeing that:

- You have read and understand the Participant Information Sheet and Consent Form
- You understand that there are no expected potential risks to you in your participation
- You are taking part in this research study voluntarily (without coercion or remuneration).
- You consent for any personal data¹ collected to be used as part of this study
- Any questions you may have about your participation in this study have been answered satisfactorily

¹Personal data refers to information in any format about an individual who can be identified directly or indirectly from that information. It includes but is not restricted to factual information such as date of birth, ID number, or location and may include sensitive information such as health, ethnicity and opinions expressed. Once personal data has been completely anonymised so that it is impossible to re-identify the individuals concerned it ceases to be personal data. The University may use anonymised data as summary statistics or for analyses but only where it is truly anonymous..

PARTICIPANT

DATE

Participant's Name (Printed)

Participant's signature

Name of person obtaining consent (Printed)

Signature of person obtaining consent

Appendix E

Participant Debrief Sheet



PROJECT TITLE: [PROJECT TITLE – The Proteus Effect within Video Games and influence on Depression]

INVESTIGATORS

We are a group of researchers studying the Proteus Effect within video games and how it affects depression. The research is supervised by Professor Gnanathusharan (Thusha) Rajendran. The investigator is Bryan (Kirby) Lipardo.

INTRODUCTION

This study explores how you enjoy a game and identify with the character to investigate the effects of these mechanisms on depression and its symptoms. The phenomenon known as the Proteus Effect, coined by Yee and Bailenson, posits that individuals conform to the behaviour that is expected of the appearance of their virtual avatar (Yee & Bailenson, 2007). Evidence for the benefits of playing commercial video games has been increasing where a review by Kowal et al. (2021) concludes that video games are beneficial methods to address symptoms of depression and anxiety.

AIM OF STUDY

The aim of this study was through to see if the successful completion of a task within a video game, Minecraft, allowed you to identify with your character, enjoy the playing the game, and to see whether these factors incorporated into your behaviour, self-perception, and ultimately alleviating symptoms of depression.

PROCEDURE

In this study, you were asked to complete two questionnaires regarding your current identification with characters and a depression questionnaire. You then were assigned a role and a set of tasks corresponding within the Minecraft video game after being taught brief instructions. After the task was completed, you were asked to complete the same two questionnaires again.

FOR FURTHER INFORMATION

Professor Gnanathusharan (Thusha) Rajendran will be glad to answer your questions about this study and provide additional information on results if requested. You may contact them at t.rajendran@hw.ac.uk.

Heriot-Watt Counselling, Student Support Services and Advice Hub are also available should you require any support.

For participants not within Heriot-Watt University, NHS Lothian offers a helpline at 0131 537 8688. Further resources can be found here https://www.health-in-mind.org.uk/resources/need_help_now/d175/.

PRIVACY AND CONFIDENTIALITY

Heriot-Watt University is the data controller for the personal data collected in this project. We are using your personal data for this project only with your consent. You can withdraw your consent at any time until the data is fully anonymised contacting the researcher, supervisor or the data protection team.

We will keep your personal data securely and ensure that no one will link the research data you provide to any identifying information you may supply. Once we have analysed the information you provide, we will completely anonymise your personal data so that it will not be possible to identify you from any information in the remaining dataset. After the project ends, we may use the anonymous dataset for research outputs such as articles and conference presentations.

If you would like to know more about what Heriot-Watt University does with your personal data and your rights under privacy law, please visit our data protection web pages at <https://www.hw.ac.uk/uk/services/information-governance/protect/privacy-and-your-data-rights.htm> or contact our Data Protection Officer by email at dataprotection@hw.ac.uk.

REFERENCES

Kowal, M., Conroy, E., Ramsbottom, N., Smithies, T., Toth, A., & Campbell, M. (2021). Gaming your mental health: A narrative review on mitigating symptoms of depression and anxiety using commercial video games. *JMIR Serious Games*, 9(2), e26575.

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