When worlds collide: Exploring the user-avatar relationship in videogames

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Copyright statement

Statement of originality

I declare that the work presented in this thesis is, to the best of my knowledge and belief, original and my own work, except as acknowledged in the text. The material presented as my own has not been submitted previously, in the whole or in part, for a degree at any other institution.

Statement of contribution of others

In cases in which the work presented in this thesis was the product of collaborative efforts, I declare that my contribution was substantial and prominent, involving the development of original ideas, as well as the definition and implementation of subsequent work. Detailed information about my contribution to collaborative work in this thesis is outlined in Appendix A.

Research outputs from this thesis

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Szolin, K., Kuss, D., Nuyens, F., & Griffiths, M. (2022a). Gaming disorder: A systematic review exploring the user-avatar relationship in videogames. *Computers in Human Behavior, 128* (1), 107124. https://doi.org/10.1016/j.chb.2021.107124

Szolin, K., Kuss, D. J., Nuyens, F. M., & Griffiths, M. D. (2022b). Exploring the user-avatar relationship in videogames: A systematic review of the Proteus effect. *Human–Computer Interaction*, *38*(5-6), 374-399. https://doi.org/10.1080/07370024.2022.2103419

Szolin, K., Kuss, D. J., Nuyens, F. M., & Griffiths, M. D. (2023). "I am the character, the character is me": A thematic analysis of the user-avatar relationship in videogames. *Computers in Human Behavior*, *143*(1), 107694. https://doi.org/10.1016/j.chb.2023.107694

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Szolin, K., Nuyens, F. M., Kuss, D. J., & Griffiths, M. D. (2024). Avatars in videogames: Investigating the association between Gaming Disorder and the Proteus effect (under review)

Dedication

For Winston

Acknowledgments

There are, I'm sure, many people who have contributed to the completion of this PhD, and far too many to list here. I will instead simply acknowledge those individuals who have excelled in their contributions and without whom this project could not have been completed.

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Abstract

Videogames, in one form or another, have existed from as early as the 1950s, with computer systems designed to create simple simulations of games such as noughts and crosses or tennis. Since then, videogames have developed into a multi-billion dollar industry with a very large numbers of players across the world. A key component of many modern online videogames is the avatar, which is the digital representation of the player and the means through which they may interact with or navigate through a virtual environment. However, far from merely being a tool to navigate a virtual world, individuals can often develop strong and complex relationships with their videogame characters. Moreover, while the user may exert a substantial degree of control over their avatar in terms of factors such as appearance and behaviour, this relationship dynamic may also be bi-directional. In particular, videogame avatars may be able to influence and change the attitudes and behaviour of the player through a phenomenon referred to as the Proteus effect (PE).

The overall aims of this thesis were to: (i) examine the user-avatar relationship in videogames; (ii) explore the relationship between GD and the PE; and (iii) investigate how the PE may manifest in videogames. These aims were addressed through two systematic literature reviews and three empirical studies using a mixed method approach.

The first systematic literature review explored the consequences of the PE specifically in the context of videogames. A total of 17 peer-reviewed studies were identified that met this chapter's inclusion criteria. The results showed that the consequences of the PE may affect a user both in-game and post-game in terms of their behaviour and attitudes leading to substantial changes to factors such as socio-political views, gender-conforming behaviours, self-perceptions, and game performance. In addition, this review chapter details a number of factors which contribute to the strength and likelihood of the PE occurring in this context, including immersion, avatar customisation, embodiment, and avatar self-relevance.

The second systematic literature review investigated virtual world avatars and the dynamics of the user-avatar relationship in the context of GD. A total of 15 peer-reviewed studies were identified that met the inclusion criteria. The results showed a consistent positive association between avatar identification and GD across many of the studies. Gamers with GD often design an avatar to resemble their vision of their ideal self, and the avatar can be used as a means to reduce self-discrepancy between the actual and ideal self as well as compensate for

perceived physical-world inadequacies. Moreover, the review highlighted how an individual's view of their ideal self in the context of the user-avatar relationship may extend beyond the limitations of what may be achievable in the physical world and include elements of fantasy derived from a game world.

The first empirical study analysed qualitative data using thematic analysis. Semi-structured interviews were carried out with 12 videogame players from the UK and US aged between 18 and 27 years. The results identified five major themes, comprising: (i) heterogeneity of game worlds; (ii) avatar attachment; (iii) game experiences affecting physical world behaviour and attitudes; (iv) types of self in a virtual world (with the sub-themes of actual self, idealised self, and utopian self); and (v) game difficulty affecting user-avatar relationship. The results showed gamers use their avatars as a means to insert a virtual version of themselves into the videogame or to attain a desired version of the self, sometimes including elements of fantasy. In addition, participants indicated that games with an advanced difficulty and avatar customisation appeared to facilitate stronger bonds to a character. Finally, several avenues of future research are discussed, in particular pertaining to the advancement of research relating to the PE.

The second empirical study was a pseudo-experimental study to explore the PE and the impact that avatar gender can have on an individual's gameplay experience in *Fallout: New Vegas*. A total of 353 participants were recruited using an online survey measuring three previously unexplored gameplay behaviours, comprising (i) number of quests completed, (ii) number of locations discovered, and (iii) number of non-player characters (NPCs) or enemies killed. The results of the study indicated that players controlling an avatar of the same gender to their physical selves demonstrated a significantly greater performance across the variables of quest completion and location discovery than players controlling an avatar of a different gender. Furthermore, a newly identified potential PE consequence was found in terms of the number of NPCs or enemies killed, with players controlling a female avatar achieving a significantly higher score on this measure irrespective of the physical world gender of the user.

The final empirical study was a correlational study using multiple mediation analysis focused on exploring the relationship between the PE and Gaming Disorder (GD) as well as investigating the previously untested potential mediating effects of different facets of the user-avatar relationship. A total of 378 online gamers completed an online survey that

assessed GD, the PE, and the strength of user-avatar relationships. The results of the study indicated a significant positive relationship between GD and the PE, and this was partially mediated by user-avatar relationships. In addition, the domains of core and proto self-presence were individually found to be significant mediators in the relationship between GD and the PE. The findings provide novel insights into the association between GD and the PE.

Drawing together the findings from these two systematic literature reviews and three empirical studies, these studies provide unique and original insight into the relationship that can develop between a user and their videogame avatar. Furthermore, these studies offer new and supporting evidence for the association between GD and the PE as well as greatly expanding current understanding and knowledge of the PE phenomenon using innovative research methods, and provide valuable direction for future research in these topic areas.

Table of contents

List of tables and figures

Chapter 1: Exploring the user-avatar relationship in video games: A systematic review of the Proteus effect

Introduction

Since their commercial introduction in the 1970s, videogames have become an increasingly popular form of entertainment leading to the multi-billion-pound industry seen today (Juniper Research, 2020). The mechanics of videogames can vary significantly, and may require little more than pressing a specific button at the correct time to sweeping narrative-driven epics in vast and dynamic game worlds.

Although not universal, a common and often integral component found in videogames is the avatar. An avatar is a visual representation of a character that the gamer uses to navigate and interact with in a virtual world through which gamer are able to seek out and achieve in-game objectives. Avatars can often be highly customised characters whose visual design and in-game behaviour are controlled by the gamer themselves.

As both a visual representation of the gamer as well as a means of facilitating manipulation of a virtual world, an avatar can be seen as a means through which an individual is able to project their physical world self into a game world (Ducheneaut et al., 2009). This projection of individuals in a virtual world via their avatars has received increasing research attention, and personal aspects such as an individual's personality (Yee et al., 2011; Worth & Book, 2014) and appearance (Messinger et al., 2008; Kafai et al., 2010; Cacioli & Mussap, 2014) have been indicated as factors with the potential to affect in-game avatar appearance and behaviour.

However, while the research evidence indicates that the gamer can, and often does, project elements of themselves into a game world through their avatar, the reverse may also be true and an avatar can impact or influence the gamer. More specifically, it has been suggested that the avatar may become integrated into the gamer's sense of self, allowing for in-game avatar-related characteristics to influence the gamer in terms of both attitudes and behaviour (Ratan & Dawson, 2015; Ratan & Sah, 2015). One specific and increasingly prominent area of research regarding this aspect of the user-avatar relationship is referred to as the 'Proteus Effect' (PE).

The Proteus effect

The term 'Proteus effect' (Yee & Bailenson, 2007) is derived from the mythological Greek god Proteus who had the power of metamorphosis and was able to alter himself to any shape or form he desired in order to avoid showing his knowledge of past, present, and future events. More specifically, in the context of virtual avatars, the PE refers to the phenomenon where the player-observed features of virtual avatars can influence the in-game behaviour or attitudes of gamers.

Simply put, Yee and Bailenson (2007) argued that an individual will make inferences concerning their avatar based on identity cues such as the avatar's appearance, and will then modify their behaviour or attitudes to align with the expected behaviour believed to be associated with these observed attributes or characteristics. For example, research evidence has been found to indicate that individuals who play as taller avatars act more confidently and negotiate more aggressively irrespective of their physical world height (Yee & Bailenson, 2007; Yee et al., 2009).

In addition, research has identified that specific factors can influence the likelihood of the PE occurring as well as its strength. For example, research has indicated that the PE is more likely to occur when an individual is able to customise their avatar (Ducheneaut et al., 2009; Ratan & Sah, 2015), which is due to the greater degree of avatar identification and avatar embodiment that this allows (Li & Lwin., 2016; Song et al., 2014; Ratan & Dawson, 2016). Furthermore, the graphical fidelity of a videogame as well as controller type (i.e., gamepad, keyboard and mouse, motion controllers) has indirectly been shown to potentially affect the strength of the PE through factors such as immersion and avatar embodiment (Blomberg, 2018: Gorisse et al., 2019). Furthermore, these studies have found some support for the claim that the PE can occur not only within the game world, but can transcend the virtual environment and affect physical world behaviours and attitudes of individuals (Yee & Bailenson, 2007; Peña et al., 2009; Yee et al., 2009). However, there is some debate concerning the theoretical components that explain this process.

Theoretical components of the PE

One particularly prominent and widely advocated argument focuses on the importance of self-perception theory as a means of understanding the phenomenon of the PE. Self-perception theory (Bem, 1972) suggests that individuals will first infer and then subsequently assimilate attitudes and beliefs from observing their own behaviour. This theory suggests that

beliefs and attitudes follow from self-observed behaviour, and this process is used by the individual to explain their actions. A frequently cited research example of this process can be found in the work by Valins (1966), who measured the heart rate of participants while viewing pictures of various individuals before asking them to rate each picture based on attraction levels. Participants were found to rate pictures of individuals as more attractive if they were told their heart rate had increased during the picture viewing stage, irrespective of whether this was true. Valins (1966) suggested that this was due to participants assuming their erroneously ascribed increased heart rate had occurred because of an increase in emotional arousal, which subsequently influenced how attractive they rated the pictures of individuals. In summary, the participants observed a behaviour, in this example based on false evidence provided by the researcher, and this in turn influenced their attitudes and behaviour.

In terms of the PE and the user-avatar relationship, Yee and Bailenson (2007) argued that individuals will observe various identity and visual cues concerning their avatar, and assimilation of these cues will lead to attitudinal and behavioural changes in the gamer. Furthermore, it is claimed that the very nature of a virtual world can increase the potency of this process due to factors such as deindividuation and anonymity, whereby an individual experiences some degree of separation from their physical world self and is more reliant on observable external cues found within the virtual world (Yee & Bailenson, 2007).

However, in response to this, it has been argued that any behavioural or attitudinal changes that occur for users within a virtual world are a result of priming and pre-existing schemata triggered by situational cues (Peña et al., 2009; Peña, 2011). For example, when a user observes some visual characteristic of their avatar, such as obesity, learned concepts or schemata will trigger from the user's memory, for example sluggishness, and this will inform their subsequent behaviours or attitudes (Peña et al., 2016).

The key difference between these two perspectives is subtle, but significant in how they describe the user-avatar relationship. Priming models posit that individuals make observations of external stimuli, such as the avatar, and then connect this with pre-existing schemata to influence behaviour. On the other hand, self-perception explanations posit that individuals consider their avatar not merely as some external visual cue, but rather an extension and embodiment of themselves. Consequently, the gamer will then align their

behaviour and attitudes to match that of the avatar, thereby connecting their physical world self with the virtual self (Yee & Bailenson, 2009).

However, while self-perception theory and priming models arguably each appear to provide a strong explanation for this phenomenon, it has also been suggested that these should be viewed as interconnected theories that together explain how and why the PE occurs. Ratan and Sah (2015) argued that using an avatar creates a bond between the gamer and their avatar, and this may lead to a mixing of the gamer's sense of self and the identified characteristics of the avatar (Ratan & Sah, 2015; Ratan & Dawson, 2016).

When this occurs, schema related to the gamer connects with the schema related to the avatar, and the priming of one may affect the other too, and stronger user-avatar relationships increase the likelihood of this occurring (Ratan & Sah, 2015). Therefore, individuals experiencing this associating of user-avatar schemata may engage in behaviours or report attitudes more aligned to their avatar than their selves depending on the current strength and direction of this relationship.

The present study

While there is clearly still some debate concerning the precise theoretical underpinnings that explain how and why this process occurs, since the term 'Proteus effect' was first coined by Yee and Bailenson (2007), there has been a growing body of research evidence to support the existence of the PE with research studies published identifying many different ways this process can take effect. However, to date, there have been very few attempts to synthesise this research in order to explore the impact and consequences of the PE upon individuals. To date, there have only been two studies that have reviewed the PE in the context of avatars, namely a meta-analysis conducted by Ratan et al. (2020) and the related review by Praetorius and Görlich (2020). While each of these analyses provided illuminating insight into the PE, particularly the strength and reliability of this phenomenon based on available research evidence, there is an important reason relating to ecological validity why further review work is needed in this area.

More specifically, neither the analyses by Ratan et al. (2020) nor Praetorius and Görlich (2020) made any distinction between types of virtual environment. In particular, research studies utilising commercially available videogames and studies using bespoke virtual environments that were custom made for a research study were both included and discussed in the analysis of both Ratan et al. (2020) and Praetorius and Görlich (2020) without

distinguishing between these virtual settings. While using bespoke environments allows researchers greater control in determining how the PE may occur, by virtue of this artificial gameplay and avatar experience, these studies do not necessarily provide evidence of how the PE occurs during typical gameplay experiences outside of the research study, and are arguably much less representative of real-world experiences (i.e., less ecologically valid) compared to studies utilising commercially available videogames.

The inclusion of research studies that involve bespoke virtual environments or avatar experiences is not problematic in of itself. However, the issue arises when these studies are seamlessly blended with other forms of research that focus on commercially available videogames and forming overall conclusions based on the aggregated findings. In particular, this may mean that the videogame world experiences that individuals have relating to the PE are not being given due consideration, and in fact any application of the reviews by Ratan et al. (2020) or Praetorius and Görlich (2020) to typical gameplay or avatar experiences may be misleading due to this highlighted potential for low ecological validity of bespoke virtual environments and the authors' decision to merge these different forms of research.

Therefore, while aggregating research findings from across commercially available videogames and bespoke virtual environments involving an avatar custom made for a research study may provide a broad and general outline of the PE, the fact that both Ratan et al. (2020) and Praetorius and Görlich (2020) did not distinguish or attempt to separate these environments potentially means important differences in the strength or outcomes of the PE regarding the specificity of virtual environments were not appropriately considered within the field of research.

In addition, beyond the lowered ecological validity inherent in the merging of videogames and custom-made simulations, a review focused on the PE specifically in the context of commercially available videogames may provide unique insight into the user-avatar relationship that may be of benefit to a range of individuals and organisations within the videogame industry. For example, the strength of the PE is often a strong indicator of the type of relationship a videogame player has with their avatar, and this may affect how much an individual engages with a virtual world, as well as their in-game behaviour, which is likely of interest to games developers and companies when designing virtual worlds in order to optimise and improve videogame player's experiences within their product.

To address this limitation relating to combining commercially available videogames and custom-made simulations, and to gain greater clarity regarding the specific outcomes and nuances of the PE phenomenon relevant to real world gameplay and avatar experiences, the present systematic literature review focuses exclusively on exploring the consequences of the PE specifically in the context of videogames. As such, only commercially available videogames are considered in the synthesis of findings.

Method

Aims and design

The present study aims to synthesise the literature related to the 'Proteus effect' (PE) in the context of videogames in order to highlight and explore the various consequences this phenomenon has on the gamer. To do this, the study is conducted and presented according to the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) guidelines (Moher et al., 2009).

Inclusion criteria

In order to be included in the systematic literature review, all PE studies and papers obtained were required to adhere to a number of different criteria. More specifically, the inclusion criteria were that the studies and conference papers needed to be (i) published since 2007 when the PE term was first coined, (ii) published in peer-reviewed journals and conferences, (iii) written in English, (iv) focused on the PE on the context of avatar research, and (v) based on research conducted using commercially available videogames. More specifically, this meant that all PE studies that were focused on avatar-based chat rooms, social networking applications, or custom-made virtual simulations were excluded from the present study's analysis. In particular, in terms of videogames, only papers that were based on a videogame that was commercially available were included, and any research based on bespoke, custom-made or highly modified videogames were excluded to align with the aims of this literature review.

It should be noted that the term 'videogame' can often be ambiguous and a matter of contention among both researchers and individuals within the videogame industry, and a range of differing definitions can be applied to what may constitute a videogame (Stenros, 2017). For example, Tavinor (2009) defines a videogame in terms of being a form of

entertainment presented in an audio-visual medium, encompassing rule and objective gameplay or interactive fiction. However, this loose definition of videogame would not exclude interactive films where the viewer is given some control and choice in determining how the plot develops, such as *Unbreakable Kimmy Schmidt: Kimmy Versus The Reverend*. Similarly, many individuals may consider 'walking simulations' such as *Gone Home*, which do not contain typical game objectives, as videogames. Clearly, the question of what may be regarded as a videogame remains a contentious issue, and a more robust definition of videogame may be required to separate videogames from other forms of media, and vice versa.

Although there is no current industry definition for what constitutes as a videogame, for the purpose of this literature review, a videogame is defined as (i) an interactive form of audio-visual media, (ii) requires some form of computer device (e.g., videogame console, personal computer or mobile device), and (iii) features a clear fail-state. A fail-state in the context of videogames means that progression in the videogame is not automatic without player input and is in some way reliant on the player's actions, and that there exists the possibility of failing at the in-game objectives. Consequently, the application of these criteria, particularly the fail-state, means that experiences that may be found on a PC or videogame console, such as particular forms of simulation or social networking applications, are not deemed as videogames for the purposes of this literature review.

Information sources and search strategy

Searches for relevant literature were carried out using the following databases: *Web of Knowledge*, *PsycPapers*, *PubMed*, *Pro-Quest*, *PsychInfo*, and *Science Direct.* This was done using the researcher's library *One Search* database search engine. In addition, *Google Scholar* was also separately used as a search engine for locating appropriate studies. However, given the high volume of papers identified, the vast majority of which were not related to virtual worlds or psychology, only the first 500 search results were reviewed.

The search terms used to search for relevant literature in these databases relating to the PE were: (Proteus effect) AND (video game OR gaming). These terms were selected in order to obtain literature specific to the PE while also maintaining sufficient scope to include a wide range of potentially relevant studies.

Study selection and data collection processes

All papers that appeared during the search were initially screened based on their title and abstract, after which the full texts of the remaining studies were inspected in detail and screened based on the previously stated eligibility criteria. This process is presented as a flow diagram (Figure 1). This includes the total number of papers at each stage of this process and reasons for exclusion.

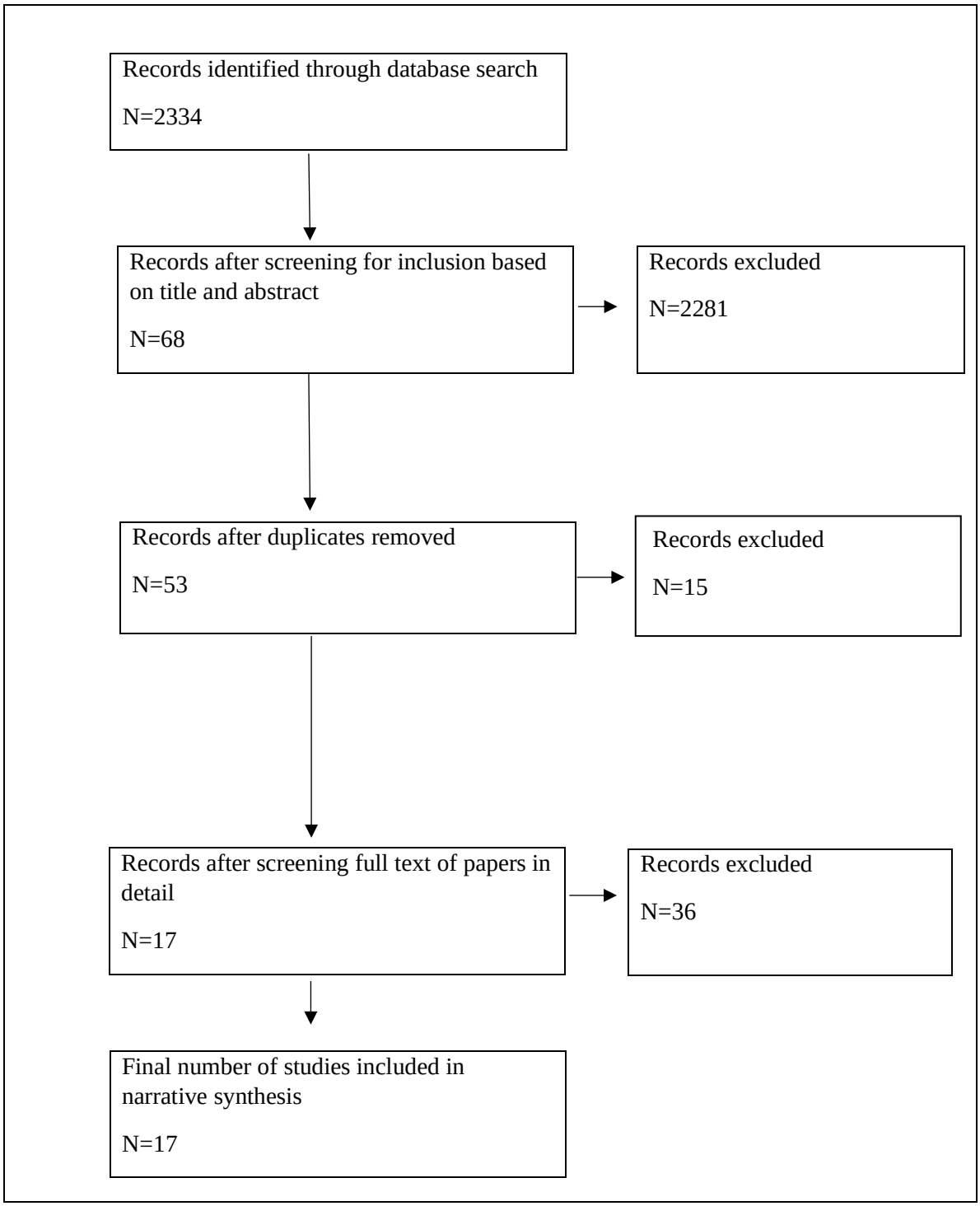

Figure 1: PRISMA flow diagram

Results

Academic literature

After using the search terms to scope the academic literature, a total of 1,334 papers were identified. Of these, 1,129 papers were removed due to not being published in a peer-reviewed journal or conference, and a further 37 papers were removed because they were not written in English. Next, based on the titles and abstract, a further 15 papers were removed due to being either duplicates or not relevant to the aims of this literature review, leaving a total of 53 papers. The full texts of these remaining papers were then read in detail before a further 36 were removed due to not meeting the aforementioned inclusion criteria, including: (i) not meeting the listed criteria for being considered a relevant videogame (*n*=25); (ii) using a combination of virtual worlds within one study which included non-videogame environments (*n*=1); and (iii) not being specifically relevant to the PE (*n*=10). This left a total of 17 papers that were included in the present review, and the general characteristics and results of these are summarised in Table 1. These 17 papers contained a number of different consequences relating to the PE in the context of videogames, and are divided into two sections: (i) in-game PE consequences, and (ii) post-game PE consequences. In-game consequences and post-game PE consequences were separated to differentiate between what may occur within a videogame setting and the physical world, and thereby highlight the unique consequences of this phenomenon in the different environments of the virtual and physical world.

In addition, it should be noted that several of these papers featured more than one study within the paper probing a combination of in-game/post-game attitudes and/or behaviours. These papers are therefore divided into the relevant section of the present review's 'Results' section based on the specific objectives of the individual study within that paper. Finally, and related to this point, a number of papers featured one or more studies that were not relevant to the aims of this present literature review. For example, the study by Yee and Bailenson (2009) contained two separate studies, including one which met the eligibility criteria and one that did not. In these cases, although the paper was included, only the studies within the paper which were pertinent to the aims of this literature review were discussed.

Finally, although the distinction between what may constitute a commercially available videogame is largely unequivocal in the majority of the identified papers, there are several examples identified through the literature search where this difference was less clear due to

varying degrees of game modification. In these examples where a videogame was modified for the purposes of a research study, the study was only included within the final selection if the actual gameplay and in-game objectives remained similar to the unmodified original game on which it was based. For example, although a study identified through the literature search by Peña et al. (2009) was based on the commercially available videogame *Star Wars Jedi Knight II: Jedi Outcast*, the researchers only used the virtual environment and avatar models to run their experiment, and the study itself did not feature any gameplay or in-game rules or objectives that would be found in the original unmodified version of the game, and was consequently removed from the final selection of literature for this review.

Table 1. Results of literature review

Study	Sample size, description and population cohort, and country of study	Proteus effect investigated	Game environment	Measures/instruments	Main results
Ash, 2016	84 students from United States University. 51 females and 36 males, age range 18 to 25 years (M = 20.93, SD = 0.49). Convenience sampling	Avatar race and in-game/postgame aggression	*Xbox 360 Fight Night 4* (boxing sports simulation videogame)	Aggression: cognition, assessed using word completion task (Anderson, Carnagey, & Eubanks, 2003); affect, assessed using state-hostility scale (Anderson, Deuser, and DeNeve, 1995); and behaviour, assessed through in-game behaviour.	No significant effect found for avatar race predicting in-game behaviour, nor any significant effect found for post-game aggression cognition or affect. However, post-hoc analysis showed a stronger PE for participants who experienced higher levels of avatar embodiment.
Bian, Han, Zhou, Chen, & Gao, 2015	92 students (46 high-shy, 46 low-shy). (Participant description not detailed) (Country not detailed)	Avatar attractiveness/participant shyness and social behaviour (social interaction participation and maintenance)	*The Sims 3* (life simulation videogame). PC	Self-report questions evaluating social performance	Significant effect of high avatar attractiveness and greater social participation, marginally significant effect of lower participant shyness and greater social participation. Significant effect of shyness and maintaining-interaction, but no significant effect for avatar attractiveness and maintaining-interaction.

Table 1 (Continued)

Study	Sample size, description and population cohort, and country of study	Proteus effect investigated	Game environment	Measures/instruments	Main results
Li & Lwin, 2016	322 Singapore high school students. 160 females and 162 males. Mean age 12.37 years (*SD* = 2.21). Convenience sampling	Influence of self-avatar in exercise videogame on future exercise intention	*Xbox Kinect Sports* and *Just Dance 3* (exercise videogames)	Self-report questions assessing: self-presence; identification; enjoyment; exergame intention; exercise intention.	Self-presence significantly associated with identification. Identification significantly associated with enjoyment. Enjoyment significantly associated with exergame intention. Exergame intention significantly associated with exercise intention.
Peña & Kim, 2014	96 female United States university students. Age range 19 to 25 years (*M* = 21.07, *SD* = 1.24). Convenience sampling	Influence of avatar weight on in-game physical activity	*Nintendo Wii Virtua Tennis 2009* (sports simulation videogame)	Physical activity measured with accelerometers	Normal-weight-avatar players were significantly more active during gameplay than obese-avatar players. Participant BMI had no significant effect on results.
Peña, Khan & Alexopoulos, 2016	96 male United States university students. Age range 18 to 32 years (*M* = 21.25, *SD* = 2.35). Convenience sampling	Influence of avatar weight on in-game physical activity	*Nintendo Wii Virtua Tennis 2009* (sports simulation videogame)	Physical activity measured with accelerometers	Normal-weight-avatar players were significantly more active during gameplay than obese-avatar players. Participant BMI had no effect on results.

Table 1 (Continued)

Study	Sample size, description and population cohort, and country of study	Proteus effect investigated	Game environment	Measures/instruments	Main results
Peña, Pérez & Khan, 2018	172 United States university students. 149 females and 23 males. Age range 18 to 29 years (*M* = 20.15 years, *SD* = 2.05) Convenience sampling	Influence of avatar job on post-game attitudes towards immigrants	*Papers, Please* (dystopian immigration officer simulator) and *Westport Independent* (newspaper editor simulation videogame). PC	Self-report questionnaire assessing: intention; attitudes; subjective norms; and self-efficacy	Significant decrease in intention, subjective norms and self-efficacy relating to helping immigrants after playing Papers, Please compared to Westport independent
Peña & Pérez, 2019	180 south-eastern Spanish university students. 79 female, 91 male and 10 identified as neither male nor female. Age range 18 to 35 years (*M* = 21.41, *SD* = 10.09). Convenience sampling	Influence of avatar job on post-game attitudes towards immigrants	*Papers, Please* (dystopian immigration officer simulator) and *Westport Independent* (newspaper editor simulation videogame). PC	Self-report questionnaire assessing: intention; attitudes; subjective norms; and self-efficacy	Significant decrease in intention and attitudes relating to helping immigrants after playing Papers, Please compared to Westport Independent
Ratan & Sah, 2015	64 female western university students. Age range 18 to 28 years (*M* = 19.83, *SD* = 2.07). Convenience sampling of females	Influence of avatar gender on post-game gender conforming behaviour	*Nintendo Wii Sports Resort Swordplay* (sports simulation videogame)	Self-report avatar embodiment scale and 10 maths questions from GRE practice material (Educational Testing Service, 1999)	Female participants who customised an avatar but experienced low avatar-embodiment performed significantly better at a maths task than those using a female avatar.

Table 1 (Continued)

Study	Sample size, description and population cohort, and country of study	Proteus effect investigated	Game environment	Measures/instruments	Main results
Ratan & Dawson, 2016	76 female western university students. Age range 18 to 28 years (*M* = 19.83, *SD* = 2.07). Convenience sampling of females	Avatar self-relevance after avatar use	*Nintendo Wii Sports Resort Swordplay* (sports simulation videogame)	Survey measures included proto self-presence and core self-presence scales (Ratan, 2013). Additional HR, SCR and Corrugator EMG metrics recorded with 4-channel MP36 system and Biopac Student Lab software	Significant results indicating: avatar/user gender consistency increases post-use avatar-self relevance; high avatar-emotional connection increases post-use avatar self-relevance; and high avatar-body connection decreases post-use avatar self-relevance
Sah, Ratan, Tsai, Peng & Sarinopoulos, 2017	133 female college students. Mean age 20.26 years (*SD* = 1.34). Convenience sampling of females specifically not restricting their diet. (country not detailed)	Avatar related self-concept influencing in-game and post-game health behaviour	*Yoobot versus YooNot* (healthy eating intervention web based videogame)	Self-report survey measuring: health consciousness; in-game healthy food choice; and post-game healthy food choice	Significant result for ought-self avatar and healthier food choice both within and post-game. No significant results identified for ideal-self and actual-self avatars on healthy food choice within or post-game
Song, Kim & Lee, 2014	72 students from mid-western United States university. 34 females and 38 males. Recruitment based on online survey measuring BID (only included participants scoring in the upper and lower 30% of BID scores). (Ages not detailed)	Avatars and reducing social physique anxiety in-game	*Nintendo Wii* boxing videogame (sports simulation videogame)	Measures for :social physique anxiety (Yao & Flanagin, 2004); perceived exercise enjoyment and exergame experience questionnaire	Significantly reduced social physique anxiety for both high and low BID participants. Significantly higher exercise enjoyment for high BID participants.

Table 1 (Continued)

Study	Sample size, description and population cohort, and country of study	Proteus effect investigated	Game environment	Measures/instruments	Results
Stavropoulos, Rennie, Morcos, Gomez & Griffiths, 2020	404 *World of Warcraft* players. 299 females and 83 males. Mean age 25.56 years (*SD* = 7.61). Online survey using posts on relevant forum sites and social media to recruit gamers.	Associations between avatar race, immersion and offline behaviour	*World of Warcraft* (fantasy MMO). PC	Modified Proteus Effect Scale (Van Looy, Courtois, De Vocht, & De Marez. 2012), and Immersion subscale from UAR Questionnaire (Blinka, 2008)	Significant positive association between immersion and offline PE behaviour. Playing as Drenai character race significantly positively associated with higher immersion and offline PE behaviour.
Stavropoulos, Pontes, Gomez, Schivinski & Griffiths, 2020	1022 *World of Warcraft* players. 202 females and 820 males. Mean age 28.60 years (*SD* = 9.90). Online survey using posts on relevant forum sites and social media to recruit gamers.	PE profiles and the link to disordered gaming	*World of Warcraft* (fantasy MMO). PC	Modified Proteus Effect Scale (Van Looy et al., 2012) and Internet Gaming Disorder Scale–Short-Form (Pontes & Griffiths, 2015)	Three PE classes identified, including: non-influenced gamers (NIGs), perception-cognition influenced gamers (PCIGs), and emotion and behaviour influenced gamers (EBIGs). Reported disordered gaming symptoms were lower for the NIGs and then progressively higher for PCIGs and EBIGs.
Sylvia, King & Morse, 2014	50 male students from northeast United States university. Age range 18 to 24 years ((*M* = 19.76, *SD* = 1.49). Convenience sampling of males	Influence of avatar body type on post-game body dissatisfaction and attitudes	*The Elder Scrolls V: Skyrim* (open world fantasy RPG). Platform not described	The Rosenberg Self-Esteem Scale (Rosenberg, 1965), Swansea Muscularity Attitudes Questionnaire (Edwards & Launder, 2000), and Body Esteem Scale (Franzoi & Herzog, 1986)	Significant result indicating participants controlling a high muscular-avatar reported lower body satisfaction post-game. No significant difference in post-game attitudes towards muscularity

Table 1 (Continued)

Study	Sample size and population cohort, and country of study	Proteus effect investigated	Game environment	Measures/instruments	Main results
Vandenbosch, Driesmans, Trekels & Eggermont, 2017	115 adolescents from secondary school in Belgium. 48 females and 67 males. Age range 11 to 14 years (*M* = 12.63, *SD* = 0.85). Convenience sampling of adolescents	Influence of sexualised avatars on self-objectification	*RuneScape* (fantasy MMO). PC	Self-objectification questionnaire (Noll & Fredrickson, 1998; Vandenbosch & Eggermont, 2012)	Significant result indicating playing as a sexualised avatar increased self-objectification amongst both male and female adolescents
Yee & Bailenson, 2009	76,843 *World of Warcraft* characters. Data collected from in-game automated script performing census of character information across three servers during a seven day period. (No details of game players)	Avatar height and attractiveness on in-game and post-game behaviour	*World of Warcraft* (fantasy MMO). PC	Height/attractiveness (as rated by sample of students) and player performance assessed by player level	Significant result indicating avatar height and attractiveness were positively associated with player performance
Yee, Ducheneaut, Yao & Nelson, 2011	1084 *World of Warcraft* players. 282 females and 802 males. Age range 18 to 65 years (*M* = 27.03, *SD* = 8.21). Posts on relevant forum sites and social media to recruit gamers.	Influence of avatar gender and player gender on gender-conforming in-game behaviours	*World of Warcraft* (fantasy MMO). PC	Healing metric and PVP metric based on in-game character data	Significant effect of avatar gender on healing behaviour. Significant effect of avatar gender on PVP behaviour. No significant effects identified for player gender for either PVP or healing behaviours.

In-game Proteus effect consequences

A total of eight papers (Ash, 2016; Peña & Kim, 2014; Peña et al., 2016; Song et al., 2014; Sah et al., 2017; Bian et al., 2015; Yee & Bailenson, 2009; Yee et al., 2011) identified in the present review contained studies that explored in-game PE consequences, and included in-game behaviour (n=7) and attitudes (n=1). Each of these studies explored a different potential consequence of the PE, and with varying degrees of success.

Firstly, Ash (2016) attempted to identify whether avatar race influenced in-game aggression in a boxing simulation videogame; more specifically, whether playing as a black avatar would result in a greater number of offensive rather than defensive actions within the videogame *Fight Night 4* for *Xbox 360*. This hypothesis was based on racial stereotypes that link African-Americans with aggression and criminality (Maddox & Gray, 2002; Collins, 2005; Ferber, 2007). The analysis of the obtained data did not show any statistically significant results for this hypothesis, suggesting that neither avatar race nor the use of stereotyping of African Americans influenced in-game aggressive behaviour. In addition, analysis showed that avatar embodiment was a potential moderator to the positive relationship between avatar race and in-game aggression with a result that was marginally statistically significant ($p < .10$).

However, a study by Peña and Kim (2014) and the later replication observing male rather than female participants (Peña et al., 2016) reported results that provided statistically significant evidence for the PE. In these two studies, the researchers attempted to identify whether appearance of an avatar in terms of weight would influence in-game behaviour in a tennis simulation videogame. The results from both of these studies showed that players who controlled an obese avatar were significantly less active in-game than players controlling a normal weight avatar, and this effect occurred irrespective of the players' true body mass index. This finding suggests that players were influenced by the appearance of their avatar, and this affected their in-game behaviour. In these two particular studies, the researchers argued that this effect occurred due to priming, and that players associated specific activity-related behavioural traits with the perceived weight of their controlled avatar which influenced their physical activity outcome.

This may also explain the findings from the study conducted by Ash (2016), which did not find a statistically significant result in terms of black avatar use and greater in-game aggression. Whereas the individuals in the studies by Peña and Kim (2014) and Peña et al.

(2016) associated certain activity related behavioural traits with weight, the participants in the study by Ash (2016) may not have associated behavioural traits relating to aggression with African Americans due to their pre-existing schema, which may have subsequently affected the results of this study in regard to racial stereotyping. More specifically, this may mean that the participants in Ash's (2016) study did not link African Americans with aggression through racial stereotyping while in control of their avatars, and that this subsequently meant that there was no recorded statistically significant PE outcome.

The final sports simulation study was conducted by Song et al. (2014), and was also based on a *Nintendo Wii* sports simulation videogame. However, unlike the aforementioned studies, this research was focused on changes to attitudes during gameplay rather than in-game behaviour. More specifically, Song et al. (2014) attempted to identify whether playing a sports simulation videogame would improve social physique anxiety during gameplay and exercise enjoyment for individuals with body image dissatisfaction (BID), both of which were measured using self-report questionnaires. The results indicated significantly reduced reported social physique anxiety during gameplay for both high and low BID participants as well as significantly higher reported exercise enjoyment for high BID participants during avatar use.

The results identified by Song et al. (2014) suggests that, similarly to the studies by Peña and Kim (2014) and Peña et al. (2016), individuals controlling an avatar in a sports simulation videogame change their in-game attitudes and behaviours to align with that of their avatar. In the case of Song et al.'s (2014) study, individuals reported lower social physique anxiety while exercising due to embodiment with their avatar through a shift in self-presence, whereby the individual experienced the virtual self, or avatar, as though it were their physical self (Lee, 2004). This research suggests that, through the PE, individuals during avatar use identify less with their physical world self and instead use their virtual self to inform and direct their in-game behaviour and attitudes.

However, this must be tempered with the results from Ash (2016), which did not identify any significant results concerning the PE. Among the possible reasons for this, it may be suggested that factors important to the occurrence of the PE such as embodiment and immersion were not sufficiently high in the study by Ash (2016) compared to the studies by Peña and Kim (2014), Peña et al. (2016) and Song et al. (2014). Although there may be many

potential reasons for this, one immediately observable and notable difference between these studies concerns the controller type.

The studies by Peña and Kim (2014), Peña et al. (2016) and Song et al. (2014) were each based on games played on a *Nintendo Wii*, which famously employs motion controls whereas the study by Ash (2016) uses a more traditional gamepad. It may be the case that these different controller types may have contributed to factors such as embodiment or immersion, which have been found to be important for the occurrence of the PE (Lee, 2007: Yee & Bailenson, 2007), and subsequently partially explain the difference in results between these studies.

The next study was conducted by Sah et al. (2017) and explored whether self-concepts experienced through a customised avatar influenced in-game health behaviour in *Yoobot versus YooNot*. Participants were required to create an avatar based on either their ideal, actual, or ought-selves before selecting in-game food items for their avatar. More specifically, the ideal-self avatar (n=41) represented how an individual would ideally like to look and act like outside of the game; the ought-self avatar (n=44) represented how an individual should look and act like outside of the game; and the actual-self avatar (n=40) represented how an individual actually looked and acted like outside of the game. The results indicated there was a significant relationship between ought-self avatar and healthier in-game food choice, but not for actual or ideal-self avatars.

While it was predicted by the researchers that this study would not show a significant relationship between the actual-self avatars and in-game healthy food choice, the authors suggest the lack of significant results for the ideal-self avatar may have occurred due to the ideal-self potentially not priming healthy eating behaviour among already healthy individuals, and the majority of participants in this study had either a normal or below normal BMI (85.2%). This explanation is supported by the research by Hoyle and Sherrill (2006), who also identified that the ideal-self does not promote or encourage healthy eating habits for healthy or normal weight individuals. This suggests that whereas playing as an ought-self avatar can act as a motivator for developing healthy food choices, playing as an ideal-self avatar may not be as effective in changing these behaviours for individuals already within a normal or healthy weight range.

These results tentatively suggest that designing and playing as an avatar that reflects how the individual feels they should be like outside of the game can act as a motivator for the

individual to behave in a specific manner that would align with or facilitate the achievement of this goal. Accordingly, controlling an avatar that reflects an individual's ought-self may influence in-game decisions and behaviour patterns to correspond with this particular self-concept.

The next study was conducted by Bian et al. (2015), and attempted to identify whether avatar attractiveness and participant shyness affected in-game social behaviour in *The Sims 3*. The results from this study indicated a significant main effect of avatar attractiveness on social participation, with high avatar attractiveness participants significantly more likely to demonstrate social participation and only a marginally significant result regarding participant shyness on social participation (p=.053), with less shy participants being more likely to engage in social participation. In addition, there was a significant effect of shyness and maintaining interaction with less shy participants being more likely to maintain an interaction, but no significant effect for avatar attractiveness and maintaining interaction.

These results provide insight into the consequences of the PE when viewed alongside pre-existing personality characteristics of the gamer. In particular, based on these results, it appears that the PE can affect individuals' in-game behaviour, despite the actual personality characteristics of the gamer, but that this effect may only be temporary before the physical world personality of the individual and the associated behaviour patterns that stem from this become dominant once more.

In this study, high avatar attractiveness appeared to be the prevailing factor in determining initial social participation. However, when participants were required to maintain this social interaction, the attributes of their avatar assumed a less salient position in informing their behaviour and their physical world personality became the leading factor in maintaining social interaction. This suggests that the PE can influence individuals to act in a manner incongruent with their physical world personality within the game world, but that this effect is either only temporary or of insufficient power to maintain this change during more strenuous situations, such as maintaining rather than just participating in a social interaction.

A study by Yee and Bailenson (2009) also explored the effects of avatar attractiveness on in-game behaviour, but combined this with avatar height. In this large-scale study using data from 76,843 *World of Warcraft* characters, Yee and Bailenson (2009) explored whether the purely non-functional and cosmetic factors of avatar height and attractiveness were associated with player performance as assessed using in-game character level. The results

indicated a significant positive relationship between both avatar height and player performance and avatar attractiveness and player performance. Tall and attractive characters were suggested as showing the strongest performance. This again suggests a link between the PE and in-game behaviour, with cosmetic character elements such as height and attractiveness able to influence in-game behaviour and performance outcomes. However, it should also be noted that other factors may have contributed to this observed result, such as more experienced players spending a greater amount of time customising their characters compared to novice players.

Although these results appear to provide evidence for the PE, it should also be noted that any data concerning the physical world characteristics of the individuals controlling their avatars was not available to the researchers. More specifically, while this research can certainly be viewed in the same light as other similar studies such as Song et al.'s (2014) and Bian et al.'s (2015) studies which indicate that physical world characteristics become less relevant during avatar use than those of the avatar, it cannot be entirely ruled out that physical world height and attractiveness of the gamer may have informed and mirrored their character design. If this was the case, then this would not provide evidence for the PE, but merely indicate that physical world player characteristics can inform videogame performance and behaviour.

A second study that explored the PE in *World of Warcraft* attempted to identify whether avatar gender and player gender influenced gender-conforming in-game behaviours (Yee et al., 2011). In this study, the researchers first identified two in-game gender-conforming behaviours, with healing behaviour identified as a stereotypical female behaviour and player versus player (PVP) behaviour identified as a stereotypical male behaviour. The results indicated both a significant effect of avatar gender on healing behaviour and a significant effect of avatar gender on PVP behaviour, with each avatar gender-conforming to its respective stereotypical behaviour pattern with male avatars more likely to engage in PVP and female avatars more likely to engage in healing behaviours. In addition, no significant effects were identified for player gender for either PVP or healing behaviours.

These results again appear to demonstrate that during avatar use, the gamer identifies less with their physical self and more with their virtual self, and this counteracts the effects of physical world gender and subsequent gender-conforming behaviour. This provides a novel insight into the PE because it suggests that a factor as intrinsically innate and pivotal to the personality and identity of an individual such as gender arguably becomes superfluous to the

point of irrelevance to the virtual gender assumed through an avatar while inhabiting a virtual game world.

This, combined with the other examples of aforementioned research studies, suggests that physical world characteristics of an individual which would ordinarily determine behaviour and attitudes become supplanted by the characteristics of the player-controlled avatar when determining in-game behaviour or attitudes. This arguably indicates that through the PE, it is the characteristics of the avatar rather than the user that has dominance in shaping how a player navigates through a virtual game world, and signals the strength of this phenomenon in influencing behaviour and attitudes.

Post-game Proteus effect consequences

A total of eleven papers (Ratan & Sah, 2015; Ratan & Dawson, 2016; Li & Lwin, 2016; Ash, 2016; Sah et al., 2017; Peña et al., 2018; Peña & Pérez, 2019; Sylvia et al., 2014; Vandenbosch et al., 2017; Stavropoulos et al., 2020a; Stavropoulos et al., 2020b) were identified which contained studies which explored post-game PE consequences, and included post-game attitudes (*n*=7) and post-game behaviour (n=4).

First, a study conducted by Ratan and Sah. (2015) used the *Nintendo Wii Sports Resort Swordplay* videogame to explore whether a player's avatar gender influenced post-game negative stereotypical gender-conforming behaviour after a stereotype threat prompt. Stereotype threat theory refers to the tendency for individuals who are exposed to a negative stereotype connected with their identity or group to perform worse on a task associated with the stereotype (Steele & Aronson, 1995; Ratan & Sah., 2015). In this research example, the negative stereotype induced was that females perform worse at a maths task compared to males. However, it should be noted that in the absence of such effects induced by negative stereotypes, research indicates that there is no relationship between maths performance and gender (Kimball, 1989; Georgiou et al., 2007).

The results indicated that female participants who controlled a customised male avatar but experienced low avatar-embodiment performed significantly better at a post-game maths task than females using a customised female avatar. This suggests that controlling an avatar of a different gender may induce post-game stereotypical gender-conforming behavioural changes after a stereotype threat prompt.

In addition, this research indicated that both customisation and embodiment play an important role in post-avatar use gender-conforming behavioural changes. However, whereas higher levels of customisation led to greater post-avatar use effects, embodiment worked in the opposite manner and participants who scored high for avatar embodiment were significantly less likely to adopt negative stereotypical gender-conforming behavioural changes. Ratan and Sah (2015) suggested that this may have occurred due to the disconnection that happens when an individual is separated from their avatar after experiencing high avatar embodiment, and therefore inhibited avatar influenced post-game behavioural changes while increasing the potential for this to occur during avatar use.

This suggests that, similar to Yee et al. (2011), the gender of the avatar controlled by the player can lead to behavioural changes to align with gender-conforming behaviours connected with negative gender stereotypes, and that this can occur in-game and post-game. However, while avatar gender may influence post-game behaviour, this is tempered with both avatar customisation and embodiment.

In a similar study, also using the *Nintendo Wii Sports Resort Swordplay* videogame, Ratan and Dawson (2016) attempted to identify factors that contributed to avatar self-relevance, the extent to which an individual views their avatar as relevant to themselves, after avatar use. Their results indicated that (i) avatar/user gender consistency increased post-use avatar-self relevance, (ii) high avatar-emotional connection increased post-use avatar self-relevance, and (iii) high avatar-body connection decreased post-use avatar self-relevance. However, and in contrast to Ratan and Sah (2015), avatar customisation was not identified as being significantly related to post-game avatar self-relevance ($p < .10$), although the authors acknowledged that the lack of significant results on this occasion did not necessarily preclude this from potentially being a salient factor as customisation has often been found to be an important contributor to factors related to the PE (Ratan & Sah, 2015; Ducheneaut et al., 2009; Vasalou & Joinson, 2009). In particular, Ratan and Dawson (2016) designed this study using an all-female sample in order to explore avatar gender consistency and avatar gender stereotyping. However, the authors argue that using an all-female sample may have restricted avatar self-relevance for participants customising an avatar of a different gender to themselves compared to participants customising an avatar of the same gender to themselves, and that this may have influenced the collective results for the avatar customisation condition resulting in the lack of a significant finding for the customisation condition of this experiment.

The next study based on a sports simulation videogame was conducted by Li and Lwin (2016) which used both *Just Dance* and *Kinect Sports* for the *Xbox 360* to explore avatar use and motivation. The results from the study indicated that (i) self-presence player's avatar was significantly associated with avatar-identification, (ii) avatar-identification was significantly associated with videogame enjoyment, (iii) enjoyment was significantly associated with exergame (fitness or exercise game) intention, and (iv) exergame intention was significantly associated with exercise intention. Similar to Ratan and Dawson (2016), these findings appear to show a number of potentially important factors which contribute to the development of a user-avatar bond which in turn influences the strength of the PE.

The next study was conducted by Ash (2016), and was focused on avatar race and both in-game and post-game aggression using the boxing simulator videogame *Fight Night 4* for *Xbox 360*. Similar to the aforementioned in-game results, no significant effect was identified for post-game aggression cognition or affect. This again suggests that playing as an African-American avatar did not induce any post-game attitudinal changes based on racial stereotypes. However, and again similar to the in-game results, post-hoc regression tests indicated that high levels of embodiment was found to significantly predict post-game PE.

When this post-hoc result is viewed alongside research by Ratan and Dawson (2016), Li and Lwin (2016), Ratan and Sah (2015) potential explanations for the lack of significant results in the main experiment begin to emerge. It may be the case that participants involved in the study did not experience appropriate levels of avatar identification or embodiment, which has been identified as affecting the strength and likelihood of the PE occurring (Ash, 2016; Ratan & Sah, 2015; Li & Lwin, 2016). Furthermore, in the study, the participants were not able to individually customise their avatars, relying instead on the avatars created by the researchers themselves. Therefore, these factors may have contributed to the lack of any significant results relating to either in-game or post-game PEs.

In addition to Ash (2016), the aforementioned study by Sah et al. (2017) likewise contained elements also pertinent to post-game PE consequences. More specifically, and similar to the discussed in-game PE outcomes, significant results were identified for ought-self avatars and healthier food choice post-game, but no significant results for ideal-self and actual-self avatars on healthy food choice post-game.

Similar to the in-game results, it is perhaps surprising that no significant results were identified for the ideal-self condition in terms of post-game healthy food choice (p= .10), but

this may be explained by the relatively small sample size (*n*= 41). However, analysis again revealed a positive association between ideal-self avatars and post-game healthy food choice in the expected direction. Nevertheless, this study once again provides evidence for the power of the PE in influencing healthy food choices based on playing as an avatar that resembles the ought-self of a player. This can extend beyond the videogame into affecting physical world post-game health-related behaviours and attitudes, although based on this research the effects of using an ideal-self avatar are still questionable.

The next two studies identified were conducted by Peña et al. (2018) and a later replication using a sample from a different country (Peña & Pérez, 2019). Both of these studies attempted to explore the influence of avatar job on post-game attitudes towards immigrants using the dystopian immigration officer simulation videogame *Papers, Please* and the newspaper editor simulation videogame *Westport Independent* as the control.

In the game *Papers, Please*, players assume the role of an immigration officer and are given the task of reviewing immigrants' documents before deciding whether to deny or grant entry to a fictional country. *Westport Independent* has players assume the role of a newspaper editor who must choose what to publish and what to reject. These two games were selected as they both have similar graphics, style and gameplay mechanics despite the different in-game objectives.

The results indicated a significant decrease in intention, subjective norms, and self-efficacy relating to helping immigrants after playing *Papers, Please* compared to *Westport Independent* among the sample of US undergraduate students (Peña et al., 2018), and a significant decrease in intention and attitudes relating to helping immigrants after playing *Papers, Please* compared to *Westport Independent* among the sample of Spanish undergraduate students (Peña & Pérez, 2019).

These results indicate that individuals who perform a job role within a game world may be influenced into changing or adjusting their post-game social and political views to align with their experiences during gameplay. This suggests that, under specific conditions, the PE has the ability to instil notable changes to an individual's attitudes and beliefs concerning important socio-political issues after only a relatively short amount of gameplay time. In addition, while there were some differences identified between the different participant samples from these two studies, such as the attitudes measure, there was an overall significant change in player's socio-political views, in particular concerning intention, regarding

immigrants identified in both studies providing some evidence for replicability and cross-cultural validity.

However, it should be noted that the link between the PE and the studies conducted by Peña et al. (2018) and Peña & Pérez (2019) may be considered contentious given that gameplay in these videogames does not specifically involve a player-controlled avatar. Instead, players take a first-person view from the game character's perspective, and the player-observed surroundings and context provide the visual clues regarding the avatar. Nevertheless, it may still be reasonably argued that these studies provide evidence for the occurrence of the PE through perspective taking in a specific virtual environment and reliance on visual identity clues regarding an individual's avatar beyond the avatar itself, both of which are congruent with the PE.

The next study was conducted by Sylvia et al. (2014), and attempted to explore the influence of avatar body type on post-game body dissatisfaction and muscle attitudes in the videogame *The Elder Scrolls V: Skyrim* among males. The results indicated that participants controlling a highly muscular avatar reported significantly lower body satisfaction post-game than males playing as an avatar of average build, and there were no significant differences in post-game attitudes towards muscularity.

These results suggest that there was not a post-game PE occurrence for individuals who played the videogame as a highly muscular avatar as assessed using a body satisfaction scale, and in fact individuals who played using a highly muscular avatar were more likely to experience post-game body dissatisfaction than individuals using an avatar of average muscular build. More specifically, previous research on the PE would predict that had the PE occurred, then individuals who played as a muscular avatar would experience higher body satisfaction post-game because higher muscle mass is generally seen as desirable and a key component of body satisfaction among men (Sylvia et al., 2014). In particular, the study by Sylvia et al. (2014) shares fundamental similarities to the study by Yee and Bailenson (2009), who found evidence to suggest that individuals who played as an avatar with an increased height negotiated more confidently both during and after avatar use. However, it should be noted that the participants in the study by Sylvia et al. (2014) were not able to customise their avatars, and were instead assigned pre-built avatars designed by the researchers. As customisation has repeatedly been indicated as being important for post-game behavioural

and attitudinal changes (Ratan & Sah, 2015; Ducheneaut et al., 2009), it may be the case that the lack of significant results for muscle attitudes could be related to this.

In addition, despite key similarities between the studies by Sylvia et al. (2014) and Yee and Bailenson (2009) regarding post-game PE consequences, two potentially important differences may also help to explain the lack of a PE occurring in the study by Sylvia et al. (2014). Firstly, Yee and Bailenson (2009) based their study on a VR simulation, whereas participants in the study by Sylvia et al. (2014) played the videogame using a more traditional non-VR monitor display. Therefore, it is possible that participants may have experienced a greater degree of avatar embodiment while using VR as opposed to a non-VR monitor, and this may have affected the strength and likelihood of PE occurrence. Secondly, Yee and Bailenson (2009) used a bespoke VR simulation for their experiment, whereas Sylvia et al. (2014) used the commercially available videogame *The Elder Scrolls V: Skyrim.* Therefore, it is possible to argue that, as a consequence of using a custom-made simulation experience as opposed to a commercially available videogame, the experimental context and environment of the study by Yee and Bailenson (2009) may have been more conducive in eliciting a PE. Furthermore, this comparison between Yee and Bailenson's (2009) and Sylvia et al.'s research (2014) highlights the need to differentiate between custom-made virtual environments and those found in commercially available videogame environments.

Another study investigating avatars and self-body image was conducted by Vandenbosch et al. (2017), and was based on the MMO videogame *RuneScape*. In this study, the researchers attempted to explore the influence of sexualised avatars on self-objectification among adolescents. Specifically, the researchers designed avatars with features that corresponded with previously identified characteristics associated with sexualisation (Dill & Thill, 2007; Zurbriggen et al., 2007), including male avatars with high muscle mass and revealing clothing and female avatars with slim figures and revealing clothing.

The results indicated that playing as a sexualised avatar of any gender significantly increased self-objectification among both male and female adolescents, and suggests that playing a videogame as an avatar with some form of heightened physical attributes, in this example a sexualised avatar, affects an individual's self-body image and self-perceptions. While the results by Vandenbosch et al. (2017) may not initially be seen as relevant to PE research, and in fact self-objectification can occur in a similar manner after exposure to different forms of media (Aubrey et al., 2009), the observed finding by Vandenbosch et al. (2017) that self-

objectification still occurred irrespective of the player and avatar gender incongruence suggests some form of avatar embodiment and PE occurred during this study. In particular, the results by Vandenbosch et al. (2017) suggest that the perceived characteristics of the controlled avatar were observed and embodied by the participants during gameplay and the effects of this persisted after gameplay, and that the experience of being sexualised experienced through playing as a sexualised avatar led to self-objectification due to the occurrence of the PE.

Furthermore, this study highlights an interesting aspect of the PE relating to gender and embodiment. The results indicated that irrespective of either participant or avatar gender, participants still experienced self-objectification. This could be interpreted as meaning that due to successful embodiment of their avatar, the actual physical world gender of the participants was no longer the most salient factor in how participants viewed themselves. While this has been detailed as occurring during avatar use in-game in terms of gender-conforming behaviours (Yee et al., 2011), the fact that the consequences of this cross-gender avatar-embodiment can potentially persist into the post-game world provides a novel insight into how influential the PE can be in terms of behavioural and attitudinal changes.

The next study was conducted by Stavropoulos et al. (2020a) and focused on exploring the associations between avatar race, immersion, and offline behaviour based on the results of an online survey conducted with 404 *World of Warcraft* players. The study reported a significant positive association between immersion and offline PE behaviour. This suggests that the greater degree to which an individual becomes immersed within the game world increases the post-game PE behaviours reported by individuals. The authors argued that through greater videogame immersion, factors important to the development of post-game PE behaviours such as deindividuation and self-perception become more pronounced.

In addition, the study by Stavropoulos et al. (2020a) also explored immersion and the PE in relation to a specific in-game character race. *World of Warcraft* allows players to choose from a number of different character races including humans, elves and other fantasy creatures, each with unique appearances and backstories. The authors reported that playing as the non-human fantasy race of *Draenei* was also associated with higher immersion and offline PE behaviours. The authors suggested that the specific racial backstory and characteristics of the *Draenei* may increase the likelihood of greater immersion within a population of players that either relate to or desire to be like this particular race. This can

increase factors such as avatar embodiment, deindividuation, and immersion, subsequently increasing the likelihood of post-game PE behavioural changes occurring.

The next study, and also based on *World of Warcraft,* was conducted by Stavropoulos et al. (2020b), and was focused on PE profiles and the association with disordered gaming. In this research, three PE classes were identified comprising (i) non-influenced gamers (NIGs) who reported lower perception-cognition and lower emotional and behavioural influences from avatars compared to the other two groups, (ii) perception-cognition influenced gamers (PCIGs) who reported some instances of out of game influences related to avatar use, but without high avatar related emotional or behavioural influences, and (iii) emotion and behaviour influenced gamers (EBIGs) who were the most likely to report out of game feelings and behaviours being influenced by their in-game avatars. The study found disordered gaming symptoms were lower among the NIGs and then progressively higher among the PCIGs and EBIGs.

In addition to reporting novel associations between disordered gaming and profiles of gamers in the context of therapeutic formulation and intervention planning, important insight was also provided in terms of different gaming group's characteristics and susceptibility to post-game PE behaviours. Of particular note is the NIG group, which, despite above average videogame participation and achievement scores relative to other groups, were less prone to exhibiting post-game PE behaviours than the other two groups. This indicates that factors such as amount of time playing a videogame do not necessarily determine the likelihood that post-game PE related behaviours will occur, and instead factors such as individual perception and cognition are more relevant the development of post-game PE behaviours.

Discussion

The present systematic literature review located and organised the extant psychological literature relating to the PE in the specific context of videogames in order to explore what the consequences of this phenomenon are and how this affects the gamer both in-game and post-game. In terms of in-game consequences that may arise due to the occurrence of the PE phenomenon, a number of novel attitudinal and behavioural changes were identified in the peer-reviewed published literature. For example, two of the included studies (Bian et al., 2015; Yee & Bailenson, 2009) explored the effects of playing as an attractive avatar. In these studies, it was found that player performance and social participation were both significantly associated with higher avatar attractiveness. This indicates that the appearance of an avatar in

terms of beauty and aesthetics can impact an individual's gameplay experience, which, in these reported cases, means gamers will perform better and be more likely to participate socially in-game. However, it should be noted that in terms of social participation, these effects only impacted initial social contact, and when an individual is required to maintain this social performance, the strength of the PE appears to diminish and the individual's physical world personality once again becomes the dominant factor (Bian et al., 2015).

In addition, the observed physical characteristics of an avatar in terms of weight were also identified as affecting individuals during gameplay in several key ways. This included (i) activity during gameplay (Peña & Kim, 2014; Peña et al., 2016), (ii) healthier food choices in-game (Sah et al., 2017), and (iii) reduced social physique anxiety (Song et al., 2014). Taken together, these studies all appear to indicate that during gameplay, individuals experience a substantial degree of avatar embodiment, and this in turn can affect individuals behaviourally and attitudinally.

In particular, it appears that the observed physical attributes of an avatar can affect in-game behaviour, and appropriate customisation of an avatar can lead to altered in-game decisions. Furthermore, in cases where an individual experiences some degree of social physique anxiety exercising in the physical world, this anxiety significantly subsides when exercising in a virtual game world despite playing the game while being physically accompanied by others.

Finally, and of particular note, is a study relating to avatar/user gender crossing and gender-conforming in-game behaviour. It was reported in the study by Yee et al. (2011) that individuals were significantly more likely to perform gender-conforming in-game behaviours based on the gender of their avatar, and irrespective of their physical world gender. While this initially appears to simply mirror the previously discussed studies relating to avatar appearance affecting in-game behaviour and attitudes, it is arguably indicative of something more significant.

Avatar appearance in terms of attractiveness, weight, and other similar cosmetic features are all subjectively appraised and not necessarily stable in the physical world. However, gender is comparatively much more constant, unchanging, and objectively assessable for the majority, although certainly not the entirety, of individuals in the physical world. Furthermore, through unique experiences and various innate differences, gender can be viewed as being a fundamental component of who an individual is and can subsequently have

a large role in determining behaviour and attitudes. Therefore, in the study by Yee et al. (2011), it is noteworthy that the participants would put aside their physical world gender and perform gender-conforming behaviours in line with their avatar's gender. However, this is only one study concerning this specific aspect of the PE, and drawing such conclusions should be avoided until further empirical evidence is available. Nevertheless, it does tentatively suggest a novel component of the PE in terms of gender fluidity in a game world.

This study, combined with the research on avatar attractiveness and other physical characteristics (e.g., weight), signals the strength and varied effects of the PE in terms of in-game attitudes and behaviours due to purely cosmetic and non-functional factors relating to an avatar's appearance. However, in addition to in-game consequences, the research identified in this systematic literature review also indicates that the PE can likewise affect an individual's post-game behaviour and attitudes.

For example, two of these studies (Peña et al., 2018; Peña & Pérez, 2019) reported evidence suggesting that individuals can be influenced into changing their post-game attitudes and beliefs based on experiences within a videogame. More specifically in these research examples, individuals playing a videogame as a dystopian immigration officer subsequently reported decreased intention to helping immigrants after gameplay. This indicates that under specific conditions, the PE has the power to influence and change an individual's post-game socio-political views. This suggests that the PE can be a potentially powerful mechanism in influencing shifts in post-game attitudes and beliefs concerning physical world events and individuals. Furthermore, the study by Peña and Pérez (2019) represented one of very few examples of a replication study: despite some differences in results, this particular study identified consequences of the post-game PE which can arguably be more confidently asserted in terms of cross-cultural validity than the majority of other studies concerning this phenomenon.

In addition to changes in socio-political views, the present review also identified that the PE can lead to post-game changes to an individual's body image. For example, research has identified that playing as a sexualised avatar is significantly associated with greater self-objectification irrespective of the gender congruence between the player and their avatar (Vandenbosch et al., 2017). Similar to the research based on in-game PE outcomes relating to avatar appearance, this suggests that the physical appearance of an avatar can be an important

factor in influencing behavioural or attitudinal changes in an individual in-game and post-game.

In particular, based on this research, it appears that playing a videogame with an avatar comprising heightened or potentially desired physical characteristics can lead to problematic or negative post-game self-perceptions. While these studies provide some insight into how the physical characteristics of an avatar can affect an individual's attitudes or beliefs post-game, these studies did not assess any behavioural changes that could occur as a consequence of this.

When these studies are viewed alongside the work by Sah et al. (2017), it is possible to make the argument that these consequences represent the first stage to a change in behaviour. More specifically, in the study by Sah et al. (2017), participants' physical world behaviour appeared to be influenced by playing a videogame using an ought-self avatar, which is how the individual felt they ought to appear in life outside the game. Given the particular experimental manipulation used in these studies, it is possible that after gameplay, participants may have felt their avatars represented an element of their ought-selves, and may have experienced some degree of behavioural changes in an attempt to align themselves with this avatar represented self-concept after the experiment.

It must be acknowledged that this assertion is little more than speculation given the available evidence. However, when considered alongside other related research, an argument may be made in support of this prediction, and this may serve as the basis of future research. In addition, a further aspect of note concerning the study by Vandenbosch et al. (2017) concerns the observation that self-objectification occurred regardless of the gender of the avatar and gamers. More specifically, the results from this study indicated that male participants were still significantly likely to report self-objectification post-game irrespective of the gender of the avatar they controlled, and the same was true for female participants.

In addition, the post-game effects of avatar gender crossing are supported by the study by Ratan and Sah (2015). In their study, female participants playing as a male avatar performed significantly better in a post-game maths task than those using a female avatar due to stereotype threat. These two studies link back to the research by Yee et al. (2011) concerning avatar gender and in-game behaviour, and suggest that avatar gender may become dominant over physical world gender in terms of perceived stereotypical behaviour patterns both in-

game and post-game. This again signals the strength of the PE in influencing behaviour and attitudes both in-game and also, perhaps more surprisingly, post-game.

However, although these studies indicate that the PE can alter an individual's gender related behaviour and attitudes to align with their avatar's gender, this is primarily in the context of conforming to gender stereotypes. This may mean that when an individual manifests an avatar, any behavioural or attitudinal changes that occur through avatar use are based on pre-existing schemas held by individuals concerning gender that are derived from or informed by gender stereotypes. This is similar to the research relating to avatar attractiveness and avatar height (Bian et al., 2015: Yee & Bailenson, 2009), both of which also involve applying these stereotype-derived behaviours or attitudes to themselves in-game and post-game, and indicate the important role of pre-existing schemata in the occurrence of the PE.

Finally, and in addition to these in-game and post-game PE consequences, several of the studies included in the present review identified important factors that appear to contribute to the likelihood of the PE occurring. For example, factors such as avatar customisation (Ratan & Sah, 2015), player immersion (Stavropoulos et al., 2020a), avatar self-relevance, and emotional connection (Ratan & Dawson, 2016) appeared to affect the strength and likelihood of the PE occurring in videogames.

In addition, the study by Sah et al. (2017) indicated that an avatar modelled on a particular version of an individual's self, namely the ought-self, was significantly more likely to influence both in-game and post-game changes behaviour and decision-making. Furthermore, Ratan and Sah (2015) found that while high avatar embodiment was associated with greater in-game PE consequences, this in fact appeared to inhibit the post-game consequences.

On the other hand, a number of these studies identified various factors that did not appear to affect the likelihood of the PE occurring. For example, the physical characteristics of the gamer in terms of weight were not found to significantly affect the PE consequences related to the user-perceived body weight of an avatar (Peña & Kim, 2014; Peña et al., 2016), nor was the occurrence of the PE necessarily linked to the amount of time an individual plays a game, but rather individual factors such as cognition and perception (Stavropoulos et al., 2020b). In addition, several of these studies found evidence which indicated that the physical world gender of an individual did neither affect immersion or post-game PE behaviours (Stavropoulos et al., 2020a), self-objectification (Vandenbosch et al., 2017) nor in-game or post-game gender-conforming behaviours (Yee et al., 2011; Ratan & Sah, 2015).

However, and in contrast to these studies, the research by Ratan and Dawson (2016) found evidence to suggest that avatar/user gender consistency improved avatar self-relevance, which is an important factor in determining the strength and likelihood of the PE occurring. Taken together, this indicates that while gender-crossing in a videogame may not necessarily inhibit the PE, playing as an avatar consistent with the individual's physical world gender may improve the likelihood of the PE occurring.

A final point that should be noted in terms of the likelihood of the PE occurring relates to duration and the physical world personality of the gamer. The study conducted by Bian et al. (2015) found evidence to suggest that avatar attractiveness influenced initial social participation irrespective of the gamer's physical world personality, but that these effects diminished while maintaining social contact over a period of time and the physical world personality of the participants again became dominant. This suggests that although the PE can trigger substantial changes to an individual's behaviour and attitudes both in-game and post-game, the duration of these changes may only be relatively short and temporary. This question concerning the duration and permanence of the PE has received very limited research attention to date, and would benefit from further exploration in the future.

However, while the present review was able to identify a number of novel ways the PE may manifest in gamers, it must be noted that among these identified studies, there are a number of important limitations indicating any findings discussed must be viewed with a degree of caution. For example, most studies included in the present review only used students as their research participants. In fact, of the 19 studies across 17 papers, 15 were based on a sample of students as participants, and these were predominantly university students from the United States. While research within psychology has a longstanding tendency to use university students due to the relative ease with which they can be recruited, this does impact the extent to which the results from these studies can be generalised to wider populations and cohorts. In particular, it has long been acknowledged that university students differ from the general population in various key ways, and research carried out solely among this population can lead to limited generalisability, a potentially incomplete or narrow range of findings, and even misinformation (e.g., erroneously ascribed effects of a phenomenon) (Sears, 1986; Peterson, 2001; Henrich et al., 2010). This suggests that until further research is conducted using a wider range of participants, the generalisability of the results of these discussed studies is relatively limited. However, given that PE research is still a relatively new area of

psychological investigation, this limitation is not unique to this topic area and merely indicates a need for further empirical investigation.

A second limitation concerns the videogames and videogame systems used in the studies included. Firstly, in terms of videogame genres, there appears to be a very limited range of videogames included in the reviewed studies, with a tendency for *Wii Sports* simulation videogames or *World of Warcraft*. These videogames are undeniably popular, but still only represent two videogame examples in an arguably over-saturated market where a large collection of different game worlds are available to research and which may yield differences in terms of any PE consequences. While this may mean that the results from this literature review are only applicable to these specific and limited game environments, more concerning is simply the missed opportunities to obtain novel research data from a plethora of available game worlds, many of which having an innate videogame design that lends itself well to PE research. For example, and perhaps most surprising, is the near-total absence of single-player open-world RPGs studies, with only one such study based on the game *The Elder Scrolls V: Skyrim* (Sylivia et al., 2014) identified in the present review. Many of these videogames offer a number of easy to manipulate options that could probe into the consequences of the PE both in-game and post-game, including substantial avatar customisation, deep immersion due to graphical fidelity, perspective options and gameplay mechanics, and often player-based decision-making regarding in-game events and relationships. These factors would lend themselves well to any PE research, and the notable lack of these videogames in this research area indicates a significant under-utilisation of available resources.

Finally, and related to the previous point, the majority of the videogame console studies included in this literature review were based on videogames played either on the *Nintendo Wii* or *Xbox 360*. At the time of writing, both of these videogame consoles are now two generations old and largely obsolete. This means these consoles and the videogames available are substantially inferior in terms of both graphical fidelity and gameplay mechanics, which may potentially impact factors important to the occurrence of the PE, such as immersion and avatar-embodiment (Gorisse et al., 2019). Furthermore, this literature review did not identify any PE studies based on commercially available videogames that utilised a VR headset. Although VR videogaming is still a relatively recent innovation, there now exists a wide library of titles that could be appropriately used in this field of study, and which may provide useful research evidence relating to the PE in VR settings while maintaining the greater ecological validity inherent in research involving commercially available videogames.

While this does necessarily detract from the research contribution made by these previous studies, it does suggest that future research using more up-to-date technology may yield different results in terms of the strength and likelihood of the PE occurring in videogames. Furthermore, this signals a need for PE research to both build on previous research study methods as well as align itself with videogame technological advancements in order to contribute relevant and up-to-date research evidence of this phenomenon.

Limitations and future research

The present systematic literature review identified a number of key findings concerning the in-game and post-game consequences of the PE in the context of playing videogames. However, the present review contained several limitations that must be noted. Firstly, as the review was the first such study to separate the various forms of virtual worlds and focus specifically on videogames, no attempt was made to differentiate between potentially important differences between videogames such as different forms of player input and avatar perspective.

In terms of player input, the review identified several different types of videogame controls being used. For example, a large number of the studies were based on *Nintendo Wii* videogames, which characteristically employ motion controls, while others used more traditional gamepads or a computer keyboard and mouse. It is possible that differences exist between these controller types that may affect factors such as immersion and avatar embodiment (Ratan & Sah, 2015). The studies identified in this review used a variety of game perspectives, including: first-person, where an individual observes the game world through the eyes of the avatar; third-person, where an individual views their avatar from behind; or top-down, where the avatar is viewed from above. No attempt was made to differentiate between different game perspectives which may also potentially affect factors important to the likelihood of the PE occurring (Gorisse et al., 2019).

In addition, the present review focused specifically on peer-reviewed journal papers and conferences, and did not include any 'grey literature' or non-English texts, unpublished PhD theses, and papers published in other non-peer reviewed outlets. This may have led to an under-representation of the available research on this topic as well as increasing the risk of publication bias. In particular, while relying solely on peer-reviewed journal papers may have been useful in ensuring the validity, quality and scientific robustness of the included literature, the findings presented in this review paper were skewed towards positive and

confirmatory results concerning the PE. Consequently, a wider and less restricted search of the PE literature may have presented the strength and consequences of the PE in a different light, but any such conclusions would be tempered by the fact that the quality of these studies would not have necessarily been subjected to the rigour and scrutiny of the peer-review process. Furthermore, it may be argued that the search terms used to obtain the studies included in this review were limited, which may have meant specific potentially relevant studies relating to the PE were not included. However, while this may indicate a limitation with the present literature review, it also signals an opportunity for future research to explore the PE in the context of commercially available videogames with inclusion criteria that includes a wider and less restricted array of research literature in order to complement and expand this field of study.

Furthermore, and related to the previous point, the number of studies that were included in the present systematic literature was limited as only 17 were found to meet the criteria for inclusion in this paper. In addition, many of these studies used a wide range of different methods, materials, and outcome measures. For example, and as previously noted, a large number of these studies focused on a single videogame title or specific outcome relating to the PE, and any follow-up study or similarly designed research was rare among the included literature. This means that many of the results and conclusions relating to the PE discussed within the present chapter should be treated with some caution in lieu of supporting and confirmatory research. However, while this limited research may be viewed as a potential limitation, it must also be acknowledged that the field of research relating to the PE in the context of videogames is a relatively new and still developing area of psychology, and that the present literature review provides a novel first attempt at synthesising this research and provides a basis for future reviews once the research base increases.

Finally, and based on the research findings from the various studies included here, a number of avenues of future research have been identified that may help direct and increase the relevant literature relating to the PE in the context of videogames. In particular, and as previously discussed, future research concerning the PE should attempt to explore videogames in a wider context in terms of genre, gameplay mechanics, and game systems. The findings of the present review identified that very few single-player open-world RPGs have been used as the game environment for PE research, despite being especially well-suited for research into this phenomenon. Furthermore, the present chapter identified that the relatively few examples of MMOs were predominantly based on *World of Warcraft*, which

represents only one of a large range of online game worlds each with unique features and mechanics that may potentially impact the PE. Therefore, future research should both explore a wider variety of videogames and genres in order to fully utilise the available resources as well as investigate whether differences exist between different game worlds within the same videogame genre.

In addition, there were no commercially available videogames that utilised VR identified in this review, despite relatively wide adoption of this technology by both consumers as well as software developers. Given the greater levels of immersion experienced through VR compared to traditional monitor displays and the importance this has in the occurrence of the PE (Gorisse et al., 2019), research based on commercially available videogames would benefit from utilising VR in future studies.

Finally, this review identified that very few studies made any attempt to explore how long the PE persists either in-game or, more importantly, post-game. While this particular avenue of investigation represents an opportunity to expand the knowledge base concerning the PE in videogames, it may also become an important ethical issue. The question of ethics in PE research is exemplified in the studies conducted by Peña et al. (2018) and Peña and Pérez (2019) which indicated that individuals' post-game physical world socio-political perspectives appeared to be influenced as a consequence of the PE. However, these researchers did not assess how long these effects lasted, and indeed whether or not any changes were permanent. If participants experienced any long-term effects of this research that went beyond the videogame and affected their life and personal values, then this would potentially conflict with ethical guidelines detailed by organisations such as the British Psychological Society Code of Human Research Ethics. The argument can be made that, given that these are commercially available videogames, the participants are not necessarily being exposed to anything they would not experience ordinarily in real life. Nevertheless, should the consequences of the PE be found to be long-term or permanent, it appears prudent to at least acknowledge this when designing and implementing research into this phenomenon, and signals a need for future research to investigate this potential issue relating to ethical treatment of research participants.

Conclusion

The present systematic literature built on the extant literature relating to the PE by specifically focusing on the consequences of this phenomenon in the context of videogames,

and is the first research to do so. Through the review of the available literature, several novel in-game and post-game consequences of the PE were identified that may affect an individual behaviourally and attitudinally, and include changes to factors such as socio-political views, gender-conforming behaviours, self-perceptions, and game performance. In addition, a number of important factors contribute to the likelihood of this phenomenon occurring, such as immersion, avatar customisation, embodiment, and avatar self-relevance. Furthermore, through the exploration of the extant literature, several key limitations commonly found among this type of research were highlighted and future avenues of research have been discussed that will expand the current knowledge base relating to the PE in videogames. These limitations include: an over-reliance on obsolete hardware; an under-utilisation of available videogame titles and genres; and issues relating to the limited range of participant samples commonly used in PE research. Finally, the present systematic review also highlights the ethical issues of conducting videogame and avatar research based on the PE, which has consistently been overlooked in other PE literature reviews and research (Ratan et al., 2020; Praetorius & Görlich, 2020; Peña et al., 2018; Peña & Pérez, 2019). Moreover, as videogame consumption rises and the role of technology and avatars continues to take a progressively critical role in society, these findings relating to the PE will be of increasing relevance and importance in understanding the relationship that can develop between an individual and their virtual world avatar.

Chapter 2: Gaming Disorder: A systematic review exploring the user-avatar relationship in videogames

Introduction

Videogames have increasingly become a popular entertainment staple of modern culture, with a rise of approximately 700 million players globally in just the past five years with a projected estimate of 3.01 billion players worldwide by the year 2023 (Statista, 2020). Furthermore, videogames have developed into much more than entertainment platforms, and have also seen successful applications in educational, medical, and sports settings (Bavelier & Green, 2019; Cole & Hooley 2013).

With the growth in videogame use and popularity, increasing research attention has focused on the effects or consequences of engaging with videogames and has shown a range of benefits to the gamer. For example, research has identified that gamers engage in videogames to experience pleasure and enjoyment (Boyle et al., 2012) and challenge (Denisova et al., 2020). However, research has also indicated that playing videogames can yield far more substantial benefits to an individual than merely entertainment or passing time. For example, previous studies have demonstrated that videogame use can enhance cognitive skills such as perception, attentional control and decision making (Reynaldo et al., 2021) as well as motivation (Pront et al., 2018) and educational success (Vlachopoulos & Makri, 2017). In addition, research has shown that videogame use can provide a means of coping with and escaping from the stresses or life challenges of the physical world (Melodia et al., 2022; Villani et al., 2018). Furthermore, online videogames and their often intrinsic social component have been shown as an important motivator for engagement with online videogame use (Frostling-Henningsson, 2009; Pontes et al., 2019) and can provide benefits to an individual's social well-being (Raith et al., 2021).

However, although videogame use can be an enjoyable and beneficial experience for many individuals, providing an often harmless and stimulating activity, this is not the case for all gamers. For some individuals, videogaming can become excessive and uncontrollable, leading to various negative physical and psychological effects. In extreme cases, this has been termed as Gaming Disorder (GD).

Gaming Disorder

GD is defined by the World Health Organization (WHO) in the 11th edition of the International Classification of Diseases (ICD-11) as impaired control over gaming behaviour that takes precedence over other life activities and continues or escalates despite occurrence of negative consequences, and causes significant impairment to social, occupational, personal or other area of functioning (WHO, 2018).

A wide variety of different terms have been used to describe the problematic and addictive use of videogames (Pontes & Griffiths, 2014), including, among others: internet gaming addiction, pathological gaming, videogame dependency, and problematic gaming. Although many names have been used to describe excessive and problematic videogame use, literature reviews suggest that these terms have largely been used interchangeably and all point to the same disorder (Petry et al., 2015).

However, differences in conceptualisation and diagnostic criteria exist among these different terms. For example, Internet Gaming Disorder (IGD), detailed in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5, American Psychiatric Association, 2013), comprises nine diagnostic criteria: preoccupation with gaming, withdrawal symptoms, tolerance, loss of control, loss of interest in other activities, continued overuse, deceiving others about amount of gaming, use of gaming to alleviate negative feelings, functional impairment. Of these nine criteria for IGD, five must be met over the past year to be diagnosed with the disorder, whereas GD listed in the ICD-11 comprises three symptoms (i.e., impaired control over gaming, increasing priority given to gaming, continuation or escalation of gaming despite the occurrence of negative consequences) for an individual to be diagnosed with GD. Furthermore, the biological components related to IGD, such as withdrawal symptoms, are not included the ICD-11 in favour of the criterion concerning functional impairment (Jo et al., 2019). This indicates that some differences are present between the various terms for disorders related to excessive and problematic gaming, in particular in terms of their diagnostic criteria and conceptualisation of terms.

Before the formal inclusion of IGD in the DSM-5, many terms (e.g., problematic gaming, pathological gaming) had been used for the concept of problematic or excessive gaming (Kuss & Griffiths, 2012). This inconsistency of terms has led to some debate concerning the prevalence of this disorder (Burleigh et al., 2018). However, research conducted by Stevens

et al. (2020) indicates that the worldwide prevalence rate of GD to be 1.96% of the global population, and affects males more often than females.

Nevertheless, despite the debate in the field and inconsistency of terms used, a large body of research has developed focused on the associated problems and negative consequences associated with GD, and has found evidence that highlights specifically how GD can have a significant and detrimental impact across several domains of functioning in line with diagnostic criteria (Guglielmucci et al., 2019). For example, research has indicated that GD is associated with a loss of interest in activities outside of gaming and depression (Burleigh et al., 2018), poor social skills (Gentile et al., 2011), and low self-esteem (Niemz et al., 2005). Moreover, these negative consequences may also include decreased academic achievement (Jeong & Kim, 2011), disruption of work and social relationships (Griffiths et al., 2004; Yee, 2006) and social isolation (Yee, 2006). In addition, GD has also been associated with maladaptive coping (Hussain & Griffiths, 2009) and auditory and visual hallucinations (Ortiz de Gortari & Griffiths, 2014).

Clearly, GD can have a detrimental impact on the lives and functioning of individuals suffering from this disorder, and GD has been identified as one of the major factors of videogame use to negatively affect well-being (Mancini et al., 2019). However, relatively few individuals who play videogames develop GD, as indicated by the study on prevalence of GD conducted by Stevens et al. (2020), which showed a prevalence rate of 1.96% of the global population. While this number is not insignificant, it is nevertheless clear that GD affects only a minority of individuals.

To account for why not all gamers are affected by GD, one explanation has been proposed suggesting that individuals with specific pre-existing psychosocial and personal factors may be predisposed to developing this disorder, including impairment or issues relating to an individual's self-concept (Leménager et al., 2020; Smahel et al., 2008). The self-concept broadly refers to how individuals view themselves based on perceived skills, abilities, appearance and other personal attributes or behaviours (Leménager et al., 2013). More specifically, the self-concept is divided into three parts, including the actual self (i.e., how a person realistically views themselves), ideal self (i.e., how a person would ideally like to be) and the ought self (i.e., how a person feels they ought to be; Higgins, 1987). Higgins (1987) argues that individuals will feel distress if there is substantial distance or discrepancy between their actual self and ideal self, and will be motivated to attempt to reach a state

where these two versions of the self are in alignment. When applied to GD, it has been suggested that individuals with low self-esteem or other similar psychosocial dysfunctions may attempt to create an avatar that aligns with their version of their ideal self to compensate for perceived deficits present in their actual self (Leménager et al., 2020; Smahel et al., 2008).

In videogames, most notably Massively Multiplayer Online Role-Playing Games, individuals create and design an avatar which is both their visual representation within the game and the means with which they interact with the virtual world and other players. However, this is not solely restricted to videogames, and similar processes occur across social media platforms, virtual simulations, and other forms of virtual worlds that involve an avatar (Nowak & Fox, 2018). In designing and customising avatars in these different contexts, individuals will base their decisions on various factors relating to both how they see themselves and how they would like to be perceived by others. In addition, individuals may shift between using avatars that represent their ideal, ought or actual selves depending on which aspects of their personality or self they wish to convey to other game players. Furthermore, customisation of an avatar can be influenced by factors such as social influence, conformity, and context (Triberti et al., 2017). For example, individuals may choose to use an avatar deemed more attractive, and therefore more akin to ideal self, if entering a virtual dating scenario (Lin & Wang, 2014; Toma et al., 2008).

In the specific context of videogames, creating an avatar to be an idealised version of an individual's self is quite common and frequently occurs across the spectrum of gamer populations (Sibilla & Mancini, 2018), and is certainly not unique to individuals with depression, low self-esteem, or other similar difficulties. However, problems can arise when significant avatar identification and attachment occurs, which has been shown to be positively associated with depression and negatively associated with social skills and self-esteem (You et al., 2017). Consequently, it has been proposed that individuals who create an idealised self-inspired avatar to compensate for an undesirable or negative actual self may use videogames as a medium in which to close the distance and discrepancy between these two versions of the self (Leménager et al., 2020). More specifically, in the virtual world, individuals are given the opportunity and means to possess a virtual version of their ideal self and thereby circumvent or negate the undesirable qualities attributed to their physical world actual self.

A further component vital to this process is avatar identification, which is the extent to which an individual identifies with and feels connected to their avatar (Bowman et al., 2012), and this has often been positively associated with GD and idealised avatar creation (Mancini et al., 2019; Smahel et al., 2008; You et al., 2017; Zhong & Yao, 2013). Consequently, when the components of avatar identification and self-concept are considered alongside each other, it is possible to see how GD may develop and be maintained for specific individuals with pre-disposing factors.

More specifically, it may be posited that individuals who experience some form of psychosocial dysfunction, be it depression, poor social skills, or other related problems, who begin engaging in an online videogame may construct an avatar that aligns with their version of their ideal self. There have been various studies highlighting the association between psychosocial dysfunction and this form of avatar creation (Sioni et al., 2017; You et al., 2017), although the temporal precedence of GD or similar technology-based disorders and mood disorders such as anxiety or depression is difficult to firmly establish (Floros et al., 2014). Nevertheless, this ideal self-avatar creation then acts as a compensatory measure for their negative perception of their actual self, meaning that within the online world and while inhabiting the body of their avatar these individuals are able to reduce the discrepancy between their ideal and actual self through high levels of avatar identification. In this way, videogames become the domain in which these individuals feel closest to their ideal self and provide a means to circumvent the perceived inadequacies of their actual self. Furthermore, self-discrepancy theory suggests that these individuals will be motivated to continue this behaviour in order to maintain this reduction in self-discrepancy (Higgins, 1987), which, as a consequence, can lead to either the development and/or maintenance of GD.

The present study

The role of the avatar can be argued as often being an important component in the development and maintenance of GD given the described link between this disorder and virtual world characters (Mancini et al., 2019; You et al., 2017), and this topic has received increasing research attention. However, despite this, there have been very few attempts to synthesise this research and explore the relationship between individuals with GD and their in-game avatar. Currently, there are three systematic literature reviews conducted that are broadly relevant to this, but they do not specifically explore the role and features of the user-avatar relationship in the context of GD.

Firstly, a systematic literature review by Sibilla and Mancini (2018) explored the user-avatar relationship in Massively Multiplayer Online Worlds. However, in this review, the authors investigated the user-avatar relationship in general terms without using any criteria concerning any specific population. Although gaming addiction was discussed within the paper, it was in the context of relating the user-avatar relationship to various psychological variables such as sociality, motivation, and attitudes, and forms only a relatively minor part of the discussed results within the present review.

This means that while Sibilla and Mancini (2018) provide illuminating insight into the user-avatar relationship in the context of Massively Multiplayer Online Worlds, as well as providing some discussion of gaming addiction, their focus was predominantly on broad-spectrum gamer populations and not specific to gamers with GD. Given the discussed critical role of the avatar in the formation and maintenance of GD, a bespoke review study concerned solely with the user-avatar relationship and the link with GD may help shed light on the relationship between this specific gamer population and their avatars in a manner only hinted at by Sibilla and Mancini (2018).

Secondly, a systematic literature review was conducted by Leménager et al. (2020) which explored self-concept and avatar identification in GD. However, in this review paper the authors included several studies that investigated avatar identification, but were not linked to GD. In addition, many of the studies included in their review did not explicitly investigate videogame avatars but instead look at factors such as emotional self-concept within general videogame use without reference to avatars. For example, one included study that exemplifies this issue was that of Wartberg et al. (2019), which identified that low self-esteem was linked with GD, but any link to the user-avatar relationship or reference to avatars was never explicitly stated or discussed within the paper.

Accordingly, the merging of research specifically focused on avatars with studies which explore aspects of the gamer's personality with GD (e.g., Wartberg et al. 2019) but which do not discuss avatars means that the conclusions drawn regarding the user-avatar relationship are often arguably tenuous, and instead may refer to relationships with videogames more generally rather than specifically avatars. Consequently, although the paper by Leménager et al. (2020) provides some detail on elements of the user-avatar relationship, the fact that this is frequently merely alluded to with indirect research indicates a notable limitation with their review paper.

The issue of including research that does not reference avatars present in the review by Leménager et al. (2020) is largely addressed by Green et al. (2020), who explored avatar and self-related processes in the context of GD. In particular, these authors specified in their inclusion criteria that only research that references avatars was included in their analysis. However, the purpose of the review paper by Green et al. (2020) was to evaluate research on avatar and self-related processes to understand individual level determinants and risk factors associated with GD to be considered in the context of assessment and treatment of this disorder. While this review by Green et al. (2020) provides some insight into the association between GD and the relationship between a user and their avatar, the actual dynamics of this relationship remain unexplored, and this indicates a notable gap in the GD and user-avatar literature base. More specifically, previous reviews such as the one conducted by Green et al. (2020) do not explicitly discuss how an individual and their avatar interact, the personal role the avatar plays in the users' virtual and physical life world, and the precise details of how and why these user-avatar relationships develop and are maintained.

Consequently, and to address the gap in the current literature, the purpose of the present systematic literature review is to explore in detail the user-avatar relationship in the specific context of GD. While associations between elements such as avatar identification and self-concept processes with GD will be discussed, the main focus of the present review is to explore what this means in terms of the relationship dynamic that develops between a user and their avatar and provide an account of both why this occurs and how it is maintained.

Method

Aims and design

The present study aimed to synthesise the literature related to the avatar-user relationship in the context of GD and videogames in order to highlight and explore the various consequences this phenomenon has on the gamer. To do this, the study was conducted and presented according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines (Moher et al., 2009).

Inclusion criteria

In order to be included in the systematic literature review, all studies obtained were required to adhere to a number of different criteria. More specifically, the inclusion criteria were that

the studies had to have been (i) published since 2000 to align with the sixth generation of videogame consoles and the popularisation of online videogaming as well as substantial improvements to graphical fidelity, (ii) published in peer-reviewed journals, (iii) written in English, German, or French (languages spoken by the authors), (iv) specifically investigating avatars, (v) focused on videogames, but with no restriction on the type of videogame in regards to genre, platform and/or online capability, and (vi) focused on GD.

Information sources and search strategy

Searches for relevant literature were carried out using the following databases: *Web of Knowledge, PsycPapers, PubMed, Pro-Quest, PsychInfo* and *Science Direct* using the researcher's library *One Search* database search engine, and *Google Scholar*. The search terms used to search for relevant literature in these databases relating to avatar-user relationships in the context of GD were: avatar AND (self* OR identit*) AND gam* (disorder* OR addict* OR problem* OR obsess* path* OR compuls* OR depend* OR excess*). These terms were selected in order to obtain literature specific to the avatar-user relationships in the context of GD. In particular, a range of terms for problematic or disordered gaming were used to obtain a wide scope of pertinent literature given their largely synonymous meaning and interchangeable usage within this research area.

Study selection and data collection processes

All papers that appeared during the search were initially screened based on their title and abstract, after which the full texts of the remaining studies were inspected in detail and screened based on the previously stated eligibility criteria. This process is presented as a flow diagram (Figure 1). This includes the total number of papers at each stage of this process and reasons for exclusion.

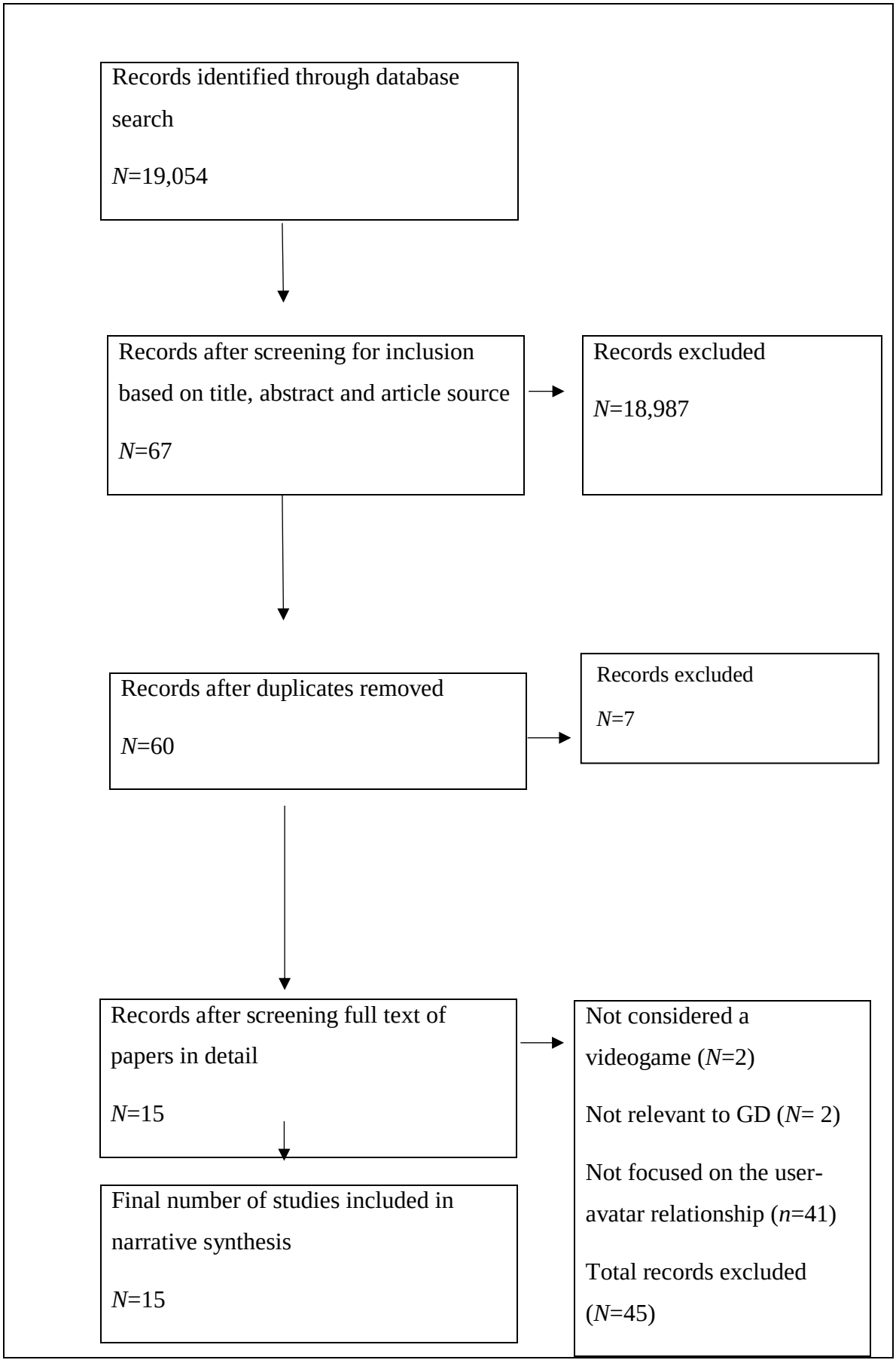

Figure 2: PRISMA flow diagram

Results

Academic literature

After using the search terms to scope the academic literature, an initial 19,054 papers were identified including 870 from *Google Scholar*. Of these, 11,582 were removed due to either not being published in a peer-reviewed journal or because they were not written in English, German, or French. Next, based on the titles and abstract, 7,405 papers were removed due to not being relevant to the aims of this literature review, and an additional seven were removed due to being duplicates, leaving a total of 60 papers.

The full texts of these remaining papers were then read in detail before removing 45 due to not meeting the aforementioned inclusion criteria, including: (i) not considered a relevant videogame (e.g., social media application) (n=2); (ii) not being relevant to GD (n=2); and (iii) not being specifically focused on the user-avatar relationship (n=41).

In terms of focus on the user-avatar relationship, the application of this criterion meant that any studies that discussed GD and videogames, but which did not make explicit mention of avatars were not included. For example, although the study by Collins et al. (2011) which explored personality traits associated with problematic videogame use was initially identified as being potentially relevant to the present review, closer examination showed that this study did not specifically mention avatars nor any synonymous terms for player-controlled game characters. Therefore, in accordance with the aims of this review paper to explore the user-avatar relationship, studies such as Collins et al. (2011) which may explore videogames and GD or similar related terms but which do not explicitly discuss avatars were removed from the final selection of studies.

This left a total of 15 studies that were included in the present review, and the general characteristics and results of these are summarised in Table 1. These 15 studies contained a number of different aspects of the user-avatar relationship in the context of GD and videogames, and were subsequently divided into three sections: (i) identification, (ii) self-concept, and (iii) functional magnetic resonance imaging (fMRI) studies.

Although the fMRI studies identified in the present review were primarily concerned with avatar identification, these studies used avatar-related stimuli to measure brain responses in order to obtain neurobiological data whereas the other identification studies were based on self-report measures. Accordingly, and given the notably different methods employed and the

subsequent form of research evidence obtained, these fMRI studies are presented in a separate and bespoke fMRI category.

Identification studies

A total of ten studies (Burleigh et al, 2018; Liew et al., 2018; Lopez-Fernandez et al., 2019; Mancini et al., 2019; Müller & Bonnaire, 2021; Sioni et al., 2017; Smahel et al., 2008; Stavropoulos et al., 2020; You et al., 2017; Zhong & Yao, 2013) focused on identification between individuals with GD or related disorders and their virtual world avatar.

Table 1. Results of literature review

Study	Sample size and population cohort	Avatar relationship domain explored	Research aims	Measures/instruments	Main results
Burleigh et al., 2017	125 MMO/MMORPG players, including: 64 online cross-sectional respondents (age range 18-29, *M* = 23.34, *SD* = 3.39), 49 males and 15 females; and 61 offline face to face longitudinal respondents (age range 18-29 years, *M* = 23.02, *SD* = 3.43), 29 males and 32 females	Avatar identification	Explore association between depression, gamer-avatar relationship and gaming disorder	Internet Gaming Disorder Scale–Short Form 9 (IGDS-SF9) (Pontes & Griffiths, 2015); Beck Depression Inventory–Second Edition (BDI-II) (Beck et al., 1996); Self-Presence Questionnaire (SPQ) (Ratan & Dawson, 2016)	Stronger GAR significantly associated with increased IGD risk. High depression and GAR are significantly associated with greater risk of IGD than depression with low GAR
Dieter et al., 2014	32 participants, including: 15 addicted (A) and 17 non-addicted (NA) MMORPG players, 26 males (A = 13, NA = 13) and 7 females (A = 3, NA = 4), (M_{age} = 26.72, *SD* = 6.30)	Avatar Identification and self-concept (fMRI)	Explore differences in brain activations during avatar-reflection relative to self-reflection and during ideal self-reflection relative to avatar reflection	Checklist for the Assessment of Internet and Computer Game Addiction (AICA_30) (Wölfling et al., 2010); Giessen Test (GT) (Beckmann et al., 1990)	A showed significantly higher bilateral angular gyrus brain activation while reflecting on their avatar during both avatar versus actual self-reflection and significantly higher left-angular gyrus activation reflecting on their avatar during avatar versus ideal self-reflection.

Table 1 (Continued)

Study	Sample size and population cohort	Avatar relationship domain explored	Research aims	Measures/instruments	Main results
Green et al., 2021	991 videogame players recruited from online gaming forums. 725 males and 266 females (18+ years old, *M* = 26.4, *SD* = 8.1)	Self-concept and avatar identification	Explore relationship between avatar identification, self-concept clarity and problematic gaming (PG)	Problematic Gaming Checklist (PGC) (Petry et al., 2014); Player Identification Scale (PIS) (van Looy et al., 2012); Self-Concept Clarity Scale (SCS) (Campbell et al., 1996)	Avatar identification was significantly positively associated with PG and significantly negatively associated with self-concept clarity, and self-concept clarity was significantly negatively associated with problematic gaming. There was a significant indirect relationship between avatar identification on problematic gaming mediated through self-concept clarity
Leménager et al., 2013	45 participants, with 15 addicted (A), 15 non-addicted (NA) and 15 naïve/inexperienced (N). 30 males and 15 females evenly distributed between groups (M_{age} =26.33, *SD* = 4.9)	Self-concept	Explore differences in self-concept dimensions between N, NA and N participants	GT (Beckmann et al., 1990); Fragebogen zum Körperbild (body image questionnaire) (FKB-20) (Clement & Löwe, 1996); Emotional Competence Questionnaire (EKF) (Rindermann, 2009); Rosenberg Self Esteem Scale (RSES) (Rosenberg, 2015)	A demonstrated a significantly more negative body appraisal and lower self-esteem compared to N and NA. A showed significantly higher discrepancy between ideal self and actual self as well as significantly lower discrepancy between avatar and ideal self compared to NA and N across nearly all dimensions

Table 1 (Continued)

Study	Sample size and population cohort	Avatar relationship domain explored	Research aims	Measures/instruments	Main results
Leménager et al., 2016	38 participants, with 19 pathological gamers (PG) (14 males and 5 females, M_{age} =25.68, *SD* = 6.69) and 19 non-addicted internet users (NA) (7 males and 12 females, M_{age} =27.68, *SD* = 7.95). Recruited through advertisements and clinical patients	Avatar identification (fMRI)	Explore the neural basis of avatar and self-identification in addictive use	AICA (Wölfling et al., 2010); FKB-20 (Clement & Löwe, 1996); Social Anxiety and Social Competence questionnaire (SASKO) (Kolbeck & Maß, 2009); GT (Beckmann et al., 1990)	PG showed significantly greater rejection of own-body image and rated themselves as less attractive compared to NA. PG showed significantly greater social anxiety symptoms compared to NA and significantly higher brain activation in left angular gyrus compared to NA during avatar and self-reflection
Liew et al., 2018	125 participants (64 online and 61 face-to-face) (online composed of 49 males and 15 females aged 18-29 years old, *M* = 23.34 years, *SD* = 3.29) (face-to-face composed of 45 males and 16 females aged 18-29 years old, *M* = 22.53 years, *SD* = 3.04)	Avatar Identification	Explore relationship between IGD, avatar identification and physical activity	IGDS-SF9 (Pontes & Griffiths, 2015); Proto-Self-Presence subscale SPQ (Ratan & Dawson, 2016); active minutes assessed with FitBit Flex (FBF)	Cross sectional and longitudinal data both indicated a significant positive association between PSP and IGD. Longitudinal data also showed PA and PSP significantly interacted (buffering effect) in predicting IGD

Table 1 (Continued)

Study	Sample size and population cohort	Avatar relationship domain explored	Research aims	Measures/instruments	Main results
Lopez-Fernandez et al., 2019	625 female gamers (n = 6 addicted) (M_{age} = 26.87, *SD* = 6.9). Recruitment via online posts on game related online forums.	Avatar identification	Explore female gamer profiles, predictors, prevalence and characteristics	IGDS-SF9 (Pontes & Griffiths, 2015); Embodied Presence (EP) Subscale of PIS (van Looy et al., 2012); Antecedents of Identification (AOI) (Cohen, 2001)	Significant positive association between IGD scores and EP and IGD scores and AOI.
Mancini et al., 2019	770 participants, with 530 male and 240 females (age range 14-62 years old, *M* = 27.48, *SD* = 9.30). Recruited through online gaming forums and social media sites. 119 participants, with 46 male and 73 female university students (age range 19-35 years old, *M* = 23.71, *SD* = 3.86). Recruited from within Italian university	Avatar identification	Explore relationships among virtual self-discrepancy (VSD), avatar identification (AI), and gaming addiction (GA); Explore relationships among virtual self-discrepancy (VSD), AI, and GA	Embodied Presence subscale of PIS (van Looy et al., 2012); Inclusion of the Avatar in the Self (IAS) (Gabbiadini et al., 2014); intention to continue playing game additional item; Big Five Inventory (BFI-10) (Rammstedt & John, 2007); Avatar Identification subscale (AIS) (van Looy et al., 2012); Gaming Addiction Scale (GAS) (Hussain & Griffiths, 2009)	High avatar identification significantly associated with likelihood to continue playing game irrespective of avatar type. Intention to continue to play the game was higher in the participants that customised an idealized avatar and identified with it than those that customised a utopian avatar and did not identify with it; AI and VSD both had a positive significant effect on GA, whereas using a utopian avatar did not unless the participant highly identified with the utopian avatar

Table 1 (Continued)

Study	Sample size and population cohort	Avatar relationship domain explored	Research aims	Measures/instruments	Main results
Morcos et al., 2021	404 World of Warcraft players, with 299 females and 83 males (M_{age} = 25.56 years, *SD* = 7.61). Online survey using posts on relevant forum sites and social media to recruit gamers	Self-concept	Explore association between *Draenei* race, compensation of real-life deficits through gaming and IGD	IGDS-SF9 (Pontes & Griffiths, 2015); User-Avatar Questionnaire (UA-Q) (Blinka, 2008)	Significant positive relationship between compensation and IGD. Choosing the *Draenei* race was significantly associated with increased compensatory behaviour, which in turn associated to higher IGD risk
Müller & Bonnaire, 2021	140 young adult participants (53 females and 87 males) (age range 18-25, *M* = 21.02, *SD* = 1.65) and 61 adolescents (21 females and 40 males) (age range 12-17, *M* = 14.43, *SD* = 2.90). Recruited through Facebook groups and a Parisian school	Avatar identification	Explore the relationships between the process of identity formation, emotion regulation, avatar identification, and gaming	Player-Avatar Identification Scale (PAIS) (Li et al., 2013); Dimension of Identity Development Scale (DIDS) (Zimmerman et al., 2015); Utrecht-Management of Identity Commitments Scale (U-MICS) (Zimmerman et al., 2012); Identity subscale of the Erikson Psychosocial Stage Inventory (EPSI) (Rosenthal et al., 1981); Difficulties in Emotion Regulation Scale (DERS) (Gratz & Roemer, 2004); Emotion Regulation Questionnaire for Children and Adolescents (ERQ-CA) (Gullone &Taffe, 2012); Interpersonal Regulation Questionnaire (IRQ) (Williams et al., 2018); GAS (Hussain & Griffiths, 2009)	Factors associated with high avatar identification were consistently significantly associated with game addiction, as well as across various emotional and social factors detailed in scales

Table 1 (Continued)

Study	Sample size and population cohort	Avatar relationship domain explored	Research aims	Measures/instruments	Main results
Sioni et al., 2017	394 participants, with 197 males and 197 females (age range 18-77, *M* = 34.3, *SD* = 11.6). Recruited from online gaming forums	Avatar identification	Explore relationships between IGD symptoms and social phobia and player-avatar identification	Internet Gaming Disorder scale (IGDS) (Lemmens et al., 2015); Social Phobia Scale-Short Form (SPS-SF) (Peters et al., 2012); PAIS (Li et al., 2013);	Significant positive relationship between social phobia, avatar identification and IGD
Smahel et al., 2008	548 MMORPG player participants (84 females, 464 males) divided into 3 age groups (adolescents, 12–19 years and 26.9% of the sample; young adults, 20–26 years and 36.3% of the sample; and adults 27+ years and 36.8% of the sample). Recruited from international game servers	Avatar identification	Explore how player relationship to their character affected potential gaming addiction	Custom made questionnaire composed of 64 items, including 14 items related to potential MMORPG addiction, and 10 items on user-avatar relationship (Smahel et al., 2008)	Significant relationship between avatar identification and addiction scores. Measures of avatar pride and shame were both significantly associated with game addiction

Table 1 (Continued)

Study	Sample size and population cohort	Avatar relationship domain explored	Research aims	Measures/instruments	Main results
Stavropoulos et al., 2020	1022 World of Warcraft players, with 202 females and 820 males (M_{age} = 28.60 years, *SD* = 9.90). Online survey using posts on relevant forum sites and social media to recruit gamers	Avatar identification	Proteus effect profiles and the link to disordered gaming	Proteus Effect Scale (PES) (van Looy et al., 2012); IGDS-SF9 (Pontes & Griffiths, 2015)	Three PE classes identified, including: non-influenced gamers (NIGs), perception-cognition influenced gamers (PCIGs), and emotion and behaviour influenced gamers (EBIGs). Reported disordered gaming symptoms were lower for the NIGs and then progressively higher for PCIGs and EBIGs
You et al., 2017	163 participants, with 71 male and 92 female students. Recruited from third-year middle school at two South Korean schools	Avatar identification	Explore the relationship of various psychosocial variables and avatar identification (AI) to online game addiction (GA)	The Self-esteem Scale (SE-S) (Rosenberg, 1965); Centre for Epidemiology Studies Depression Scale (CED-S) (Radloff, 1977); Interpersonal communication Inventory (ICI) (Bienvenu, 1971); Avatar Identification measurement (AI) (You et al., 2017); Game Addiction measurement (GA) (Lee & Ahn, 2002)	Self-esteem and social skills had significant negative link with GA and AI. Depression had a significant positive relationship with GA and AI. Depression had an indirect effect on GA via AI. Social skills had both indirect (via AI) and direct effects on GA

Table 1 (Continued)

Study	Sample size and population cohort	Avatar relationship domain explored	Research aims	Measures/instruments	Main results
Zhong & Yao, 2013	217 student participants, with 94 male, 97 female and 28 undisclosed gender (age range 18-37 years, M_{age} = 21.64, *SD* = 2.29). Recruited from two Hong Kong universities	Avatar identification	Explore the effects of gaming motivations and avatar self-identification (ASI) on symptoms of online game addiction (GA)	Gaming Motivation questionnaire) (Zhong & Yao, 2013); Avatar Self-Identification Scale (ASIS) (Zhong & Yao, 2013); Game Addiction Test (GAT) (Huh & Bowman, 2008)	ASI is significantly positively associated with the problems and salience dimension as well as the uncontrollable game-play dimension of GA. ASI also significantly associated with relaxation and socialisations gaming motives.

Burleigh et al. (2018) explored depression and the gamer-avatar relationship (GAR) as potential risk factors for the development of IGD for young and emerging adults (aged 18-29 years old) using both cross-sectional and longitudinal data across three time points over a three-month period. The results of this study indicated that stronger GAR and higher depression scores were significantly associated with increased IGD risk, GAR moderating the relationship between depression scores and IGD. In addition, longitudinal data indicated that an increase in GAR score at time one significantly predicted an increase in IGD score at time three. These results indicate that GAR and depression may both act as risk factors for the development of IGD, and GAR increases the effects of depression scores in the development of IGD.

This suggests that emerging adults who identified strongly with their online avatar and who experienced greater depression symptoms appeared to be at greater risk of developing IGD, indicating that these individuals have a strong bond with their virtual world avatar. In particular, the researcher's measurement of GAR was the Self-Presence Questionnaire (Ratan & Dawson, 2016), which examines different areas of avatar identification. High scores across these three domains were significantly associated to IGD, suggesting that the relationship between individuals with IGD and their online avatar transcended beyond a mere superficial closeness or attachment to this virtual character. Instead, the separation between user and avatar becomes distorted and begins to merge, transforming the avatar into a virtual representation of the user rather than simply controlling a character.

The next study was conducted by Liew et al. (2018) and was focused on the interplay between the user-avatar relationship and physical activity on IGD. Similar to the previous study by Burleigh et al. (2018), this study also focused on IGD among emerging adults and used both cross-sectional and longitudinal data. However, although this study also used the Self-Presence Questionnaire, only one aspect of avatar identification was explored, namely proto self-presence which considers user-avatar physical body identification. The results of the study demonstrated a significant positive association between proto-self presence scores and IGD behaviours using the cross-sectional data. This association was further supported by the longitudinal data which also found a positive significant relationship between proto-self presence and IGD. In addition, a significant interaction effect was identified between proto-self presence and physical activity in affecting IGD behaviours. More specifically, it was found that the IGD scores of individuals with high proto-self presence scores decreased if they also presented with high physical activity scores.

Furthermore, the results of this study found a significant moderating effect of physical activity on IGD among individuals who scored highly on avatar identification, indicating higher physical activity had a buffering effect and weakened the risk of IGD behaviours amongst individuals with high proto-self presence scores. Potentially, this may be due to physical world activity being a distraction to the virtual world, and thereby separating the user from their virtual self in favour of their physical self. In addition, elements often associated with physical activity, such as goal achievement, initiation, and strengthening of personal relationships, and pleasure derived from being active may compete with the rewards and benefits seemingly proffered by virtual world participation (Liew et al., 2018). This suggests that potentially the relationship between the user and avatar in the context of IGD may be based on compensatory measures, and that users with low PA may use the virtual world accessed via their avatar to gain these benefits seemingly associated with physical world PA. Accordingly, the avatar becomes the means with which factors such as goal achievement, personal relationships and even pleasure are obtained, therefore reinforcing the bond between user and avatar. However, this relationship is also seemingly weak and compensatory in the face of an alternative opportunity of deriving these benefits, as can be seen by the lowering of IGD and PSP through the introduction of physical activity.

The next study was conducted by Lopez-Fernandez et al. (2019), and explored female gamer profiles and the predictors, prevalence, and characteristics of IGD among this population. While many aspects of this study were not specifically relevant to GD or the user-avatar relationship, several parts of this study's analysis were pertinent to these elements. In particular, the results indicated a positive significant association between IGD scores and embodied presence, which refers to how connected an individual feels to their avatar. In addition, the study also reported a positive significant association between IGD scores and antecedents of identification, which refers to an individual's experiences with their avatar during gameplay. These results indicate that female gamers who score highly on IGD have a strong and highly connected bond to their avatar. Furthermore, in a field of research often dominated by male participants, the study's results provide a unique perspective into the user-avatar relationship among female gamers, and this bond between a user and their virtual world avatar in the context of disordered gaming appears relatively stable across genders based on the available evidence.

The next study identified was conducted by Mancini et al. (2019) focused on avatar identification and gaming addiction in the context of utopian and idealised avatars, and

comprised two studies (i.e., a survey and an experiment). In both studies, idealised avatars were defined as avatars designed to reflect an individual's idealised version of their self, whereas utopian avatars were defined as having traits or characteristics that the user could not have in the physical world. The survey study explored avatar identification, gaming addiction (GA) and virtual self-discrepancy, which refers to the difference between the virtual and physical world selves of the gamer. The results indicated that avatar identification and virtual self-discrepancy both had a positive significant relationship with GA scores, whereas using a utopian avatar did not unless the participant highly identified with the utopian avatar. This suggests that identifying strongly with an avatar, irrespective of whether this is an idealised or utopian avatar, is associated with higher gaming addiction risk.

The second part of Mancini et al.'s (2019) paper also explored avatar identification through an experimental design. Here, participants were asked to play a Massively Multiplayer Online Role-Playing Game (i.e., *World of Warcraft*) and completed measures assessing personality, avatar identification as well as their intention to continue playing after finishing the experiment which was designed to be indicative of potential gaming addiction risk. The results indicated that participants who identified with their avatar were more likely to continue playing the online game irrespective of using either idealised or utopian avatar, but this result was not significant (p =.054). In addition, intention to continue to play the game was higher among participants who customised an idealized avatar and identified with it than among participants who customised a utopian avatar and did not identify with it. However, it should be noted that the assessment of future gaming disorder risk in the study by Mancini et al. (2019) relied on intention to continue to play the game. While intention to continue playing a game may be a precursor to gaming disorder for some individuals, it is certainly not the case for most gamers and is a potentially poor indicator of future gaming disorder risk. Nevertheless, the results across both studies by Mancini et al. (2019) indicate that identification with an avatar is not necessarily predicated on perceived similarity with the avatar, but can still occur when the avatar holds characteristics that extend even beyond the idealised version of the self. This means that a strong relationship may still develop between a user and avatar irrespective of whether that avatar conforms to an idealised vision of the individual or is constructed using a utopian image (Mancini et al., 2019).

The next study was conducted by Müller and Bonnaire (2021) and also explored avatar identification as well as the relationships between the process of identity formation, emotion regulation and problematic gaming (PG) among young adults (18-25 years old) and

adolescents (12-17 years old). The results indicated that factors associated with high avatar identification were consistently significantly associated with problematic gaming, as well as significantly lower emotional regulation across age groups. This suggests that there is a positive association between high avatar identification and PG risk. Furthermore, an association was identified between PG and lower emotional regulation. However, based on these data alone, it is impossible to determine the existence or direction of the causal link (i.e., whether PG negatively impacts emotional regulation or whether poor emotional regulation makes individuals more susceptible to PG).

The next study by Sioni et al. (2017) also investigated the relationships between IGD and player-avatar identification as well as social phobia. The results indicated that social phobia was significantly positively associated with both avatar identification and IGD, and that avatar identification was also significantly positively associated with IGD. In addition, further analysis indicated that avatar identification mediated the relationship between social phobia and IGD.

The study by Sioni et al. (2017) provides important insight concerning the relationship between individuals with social phobia and their avatar in the context of IGD. Previous research has indicated that individuals with social phobia have a wide discrepancy between their perceived actual self and ideal self (Moore & Johnson, 2009). In a videogame, an individual has the ability to create a new version of themselves through their virtual world avatar that is more closely aligned to their ideal self, and, through this, socially phobic individuals can reduce this self-discrepancy and adopt a more idealised version of themselves as their identity. This may help to explain the high levels of avatar identification among this group, and indicates that for these individuals the relationship they have with their avatar is based on assuming a new identity that is more closely aligned with their ideal self. As such, this transcends a mere relationship with a character seen as separate from the individual, but rather signals a merging of the physical world and virtual world identities of the game player to achieve a state of contentment with their identity.

The next study identified was conducted by Smahel et al. (2008) examined how player identification to their character affected potential gaming addiction. The results indicated a significant positive association between avatar identification and game addiction. In addition, there was a significant positive relationship between game addiction and feelings of pride and shame towards the avatar. This identified tendency for individuals who scored highly for IGD

to experience greater levels of shame as well as pride towards their avatar is particularly noteworthy in the context of the user-avatar relationship for two key reasons. Firstly, it suggests that individuals with IGD may have a tendency to experience stronger emotional ties to their in-game avatar, which may be indicative of a closer bond or relationship with their in-game character. Secondly, the indication that individuals who score highly for IGD experience seemingly opposing emotions, namely pride and shame, suggests this relationship is highly nuanced and multi-faceted.

In particular, the findings of Smahel et al. (2008) indicate a fluctuating and contradictory relationship with the avatar. On the one hand, feelings of pride may be interpreted as being a result of time spent nurturing and honing this character to excel within the game world, potentially leading to both a vicarious experience of goal achievement through their avatar as well as a reduction in self-discrepancy through creating and perfecting what may be perceived as an idealised version of the individual's self. Conversely, feelings of shame may occur in parallel to this through acknowledgement that the virtual representation of their self is indeed separate to the physical world self, in which case the avatar becomes both a vehicle to realise an individual's ideal self as well as being a staunch reminder of the inadequacies of their physical world self and their dependence on the virtual world to achieve their ideal self.

The next study was conducted by Stavropoulos et al. (2020), and examined avatar identification in the specific context of the Proteus Effect (PE) and how this associated with disordered gaming. The PE refers to the phenomenon whereby individuals are influenced attitudinally or behaviourally by the perceived characteristics of their avatar (Yee & Bailenson, 2007). This process is heavily reliant on the user's identification with their avatar, which can lead to disruption to the individual's self-concept and assimilation of the attributes or characteristics of their controlled avatar, and can affect the user both during and after gameplay (Yee & Bailenson, 2009; Peña et al., 2009). The results of Stavropoulos et al.'s (2020) study indicated three separate classes comprising: non-influenced gamers (NIGs), perception-cognition influenced gamers (PCIGs), and emotion and behaviour influenced gamers (EBIGs). Of these three classes, disordered gaming symptoms were lower for the NIGs and then progressively higher for PCIGs and EBIGs. More specifically, (i) NIGs reported lower perception-cognition and lower emotional and behavioural influences from avatars compared to the other two groups, (ii) PCIGs reported some instances of out of game influences related to avatar use, but without high avatar-related emotional or behavioural

influences, and (iii) EBIGs were the most likely to report out of game feelings and behaviours being influenced by their in-game avatars.

These results suggest that avatar identification seen through PE activation is associated with IGD behaviours and symptoms, and high susceptibility to the PE is positively associated with an increased risk of IGD. In particular, it indicates that gamers who are more influenced by their avatar become increasingly more likely to exhibit IGD symptoms. Furthermore, the results highlight another interesting facet of the user-avatar relationship, namely a double-sided permeability in terms of influence in both the avatar and user. More specifically, whereas previous research (e.g., Burleigh et al, 2018; Liew et al., 2018; Lopez-Fernandez et al., 2019; Mancini et al., 2019; Müller & Bonnaire, 2021; Sioni et al., 2017; Smahel et al., 2008) indicated that the avatar can be influenced and moulded to become a means for an individual to live out their ideal self, the research by Stavropoulos et al. (2020) suggests that the avatar can in turn also influence the user. This suggests that as an individual becomes more closely connected to their avatar, the avatar itself becomes a potentially more dominant force over the user.

The next study conducted by You et al. (2017) investigated the relationship between a number of psychosocial variables (e.g., self-esteem, social skills, depression) and avatar identification on online game addiction. The results indicated that self-esteem and social skills both had a significant negative association with gaming addiction. In addition, depression had a significant positive relationship with both gaming addiction and avatar identification. Finally, depression had an indirect effect on gaming addiction through avatar identification, and social skills had both an indirect effect through avatar identification and a direct effect on gaming addiction. These results indicate that both high avatar identification and gaming addiction are positively associated with depression and poor social skills and low self-esteem. Furthermore, through mediation analysis, it appears that depression is associated with gaming addiction through avatar identification, which suggests that gaming addiction alone is not indicative of depression, but is in fact associated with avatar identification which is associated with depression. This suggests that individuals with depression are more likely to identify with their avatar and then this in turn may increase their vulnerability to develop gaming addiction.

As discussed, You et al. (2017) found that social skills were both directly and indirectly associated with game addiction through avatar identification. In terms of the user-avatar

relationship, this suggests that individuals may use their avatar or time in a virtual world to compensate for (or distract from) potential social inadequacies found in the physical world. Individuals with poor social skills may turn to the virtual world in order to obtain relationships that are difficult to find and manage in the physical world or simply to divert their attention away from any social problems they may have (Goodman et al., 2018; Kuss et al., 2013). Here, the avatar becomes either a conduit for relationships or a means of coping with a lack of social contacts, which may in turn lead to the development or maintenance of an addictive or disordered relationship with videogame playing.

The final study in this section examining avatar identification was conducted by Zhong and Yao (2013) who explored the effects of gaming motivations and avatar self-identification in relation to symptoms of gaming addiction. The results indicated that avatar identification was significantly positively associated with both the salience and uncontrollable game-play dimensions of gaming addiction. This indicates that gaming is an important activity for individuals with gaming addiction and that they find it hard to control the amount of time they spend gaming. In addition, Zhong and Yao. (2013) identified that avatar identification was also significantly associated with both relaxation and socialisation motives for gaming. These results concerning an association with socialisation fit well with the findings by both You et al. (2017) and Sioni's (2017). More specifically, Sioni et al. (2017) indicated that individuals with social phobia may use their avatar as a means of socialising in a controlled and easier to manage environment found in the virtual world, and You et al. (2017) found evidence that high avatar identification was associated with poor social skills. When the findings of these three studies are combined, it may be argued that gamers may use their avatar and virtual relationships as an alternative to physical world relationships. In this way, the avatar becomes more than a player-controlled virtual character, and can be seen as the primary key to obtaining and managing relationships for these individuals.

Self-concept studies

Three studies (Green et al., 2021; Leménager et al., 2013; Morcos et al., 2021) were based on aspects of the user self-concept and the association this has with their online game avatar, including: self-concept (Green et al., 2021), compensation through an avatar (Morcos et al., 2021), and self-image and self-esteem (Leménager et al., 2013). While several of these studies also included some measure of avatar identification, the primary focus of each of these studies was based on elements of self-concept or considered avatar identification within the context of self-concept.

The first study was conducted by Green et al. (2021), and explored the relationship between self-concept clarity and problematic gaming as well as avatar identification. More specifically, the study focused on whether avatar characteristics affected identification, and whether this was mediated by self-concept clarity. The results indicated that avatar identification was significantly positively associated with problematic gaming and significantly negatively associated with self-concept clarity. In addition, self-concept clarity was significantly negatively associated with problematic gaming. There was also a significant direct and indirect relationship between avatar identification and problematic gaming mediated through self-concept clarity. Self-concept clarity here refers to the extent to which individuals hold beliefs or schemas concerning themselves that are clear, stable, and confidently defined (Green et al., 2021). This indicates that individuals with a poorer sense of self are more likely to identify with their avatar potentially as a mean to compensate for instability or deficiencies in their physical world identity, which in turn leads these individuals to become more vulnerable to problematic gaming. This may mean that individuals rely on their avatar as a means of personal identity confirmation due to a maladaptive physical world self-concept, and highlights the importance of avatar identification as a process as well as the potential reasons for this process to occur, namely to achieve a more stable and clearly defined self-concept.

In addition, Green et al. (2021) found that avatar identification was not significantly associated with the type of avatar in terms of being human or a non-human creature. However, identification was found to be significantly higher among females than males, higher among gamers utilizing both first-person and third-person camera perspectives compared to just one option, and higher among gamers who customised and had the option to customise their avatars.

The next study identified was conducted by Leménager et al. (2013) and examined self-concept deficits in the context of Massively Multiplayer Online Role-Playing Game and gaming addiction among addicted players, non-addicted players, and individuals who did not have any prior experience with Massively Multiplayer Online Role-Playing Games. The results indicated that addicted players demonstrated a significantly more negative body appraisal and lower self-esteem compared to non-addicted and naïve players. In addition, addicted players showed significantly lower discrepancies between ideal self and avatar ratings as well as a higher discrepancy between their actual and ideal self on nearly all domains of the self-concept compared to non-addicted and naïve players.

These results suggest that addicted or disordered players have both lower self-esteem and a more negative body image than non-addicted or naïve players. Furthermore, addicted players create and use avatars that are more closely aligned with their image of an ideal self and there is considerable distance between their ideal and actual self compared to non-addicted and naïve players (Leménager et al., 2013). These results suggest that individuals with game addiction may demonstrate a substantial distance between their actual self and their vision of their ideal self, and that this distance is reduced through creation and customisation of an avatar that aligns with this ideal self. Accordingly, the avatar may be a means of achieving and maintaining an ideal self, and thereby reducing the distress that occurs through self-discrepancy (Higgins, 1987).

The final study that explored aspects of the self-concept was conducted by Morcos et al. (2021). In this study, the researchers investigated the association between playing as the *Draenei* race (i.e., blue, anthropomorphised beast-creatures), compensation of real-life deficits through gaming, and IGD. The results showed a significant positive relationship between compensation behaviours and IGD. In addition, choosing to play as the *Draenei* race was significantly associated with increased compensatory behaviour, which in turn was associated with higher IGD risk. These results indicate that individuals who rely on their avatars as a means of compensating for physical world deficits or inadequacies are at greater risk of developing IGD, and this can occur even when playing as an avatar which does not visually reflect the game player's physical world self.

Moreover, the study by Morcos et al. (2021) also indicated a significant association between playing as the *Draenei* race in *World of Warcraft*, compensatory behaviour and IGD, which provides a link to the studies by Green et al. (2021) and Mancini et al. (2019). More specifically, Green et al. (2021) found that avatar identification was not significantly associated with the type of avatar in terms of being a human or a non-human creature, and Mancini et al. (2019) found that playing as a utopian avatar, that is an avatar that does not resemble how a user looks in the physical world, did not negatively affect risk of IGD providing the user was able to identify with this avatar type. The blue, anthropomorphised beast creatures of the *Draenei* race in *World of Warcraft* appear to have relatively little in common visually with physical world humans. Consequently, the identified result that playing as this race of creatures is significantly associated with avatar-user compensatory behaviour (Morcos et al., 2021) appears to provide some support for both Green et al.'s (2021) and Mancini et al.'s (2019) findings, and suggests that using a physical world template

of an ideal self is not the only form of avatar that a user can develop a close bond with that can compensate for physical world inadequacies and deficits.

Functional magnetic resonance imaging studies

Two papers (Dieter et al., 2014; Leménager et al., 2016) were identified that explored the user-avatar relationship in the context of online videogames and GD using fMRI. More specifically, both of these studies examined the neural basis and regions of brain activation during avatar and self identifications.

Firstly, Dieter et al. (2014) examined differences between addicted and non-addicted videogame players during reflection of their avatar and versions of their self-concept using fMRI scans. The results indicated that addicted gamers showed significantly higher bilateral angular gyrus brain activation while reflecting on their avatar during both avatar versus actual self-reflection and significantly higher left-angular gyrus activation reflecting on their avatar during avatar versus ideal self-reflection. The left-angular gyrus is a brain region often associated with self-identification, processing and distinguishing individuals from others (Decety & Chaminade, 2003; Decety & Grezes, 2006) and has previously been shown to demonstrate increased activation during long-term Massively Multiplayer Online Role-Playing Game player's reflection of their avatar compared to their self, their friends, or individuals distant to the participant (Ganesh et al., 2012). This results obtained by Dieter et al. (2014) suggest that addicted gamers identify more strongly with their avatar compared to either their actual self or their ideal self.

The second fMRI study by Leménager et al. (2016) explored the neural basis of avatar and self-identifications among pathological internet gamers. The results indicated that pathological gamers showed significantly greater rejection of own-body image and rated themselves as less attractive compared to the control group. Pathological gamers also showed significantly greater social anxiety symptoms compared to control group gamers. Finally, pathological gamers demonstrated significantly higher brain activation in the left angular gyrus compared to healthy controls during avatar and self-reflection.

In both of these studies, greater neural activity was identified in regions of the brain during reflection of a user's avatar compared to both their actual self (Dieter et al., 2014; Leménager et al., 2016) as well as compared to reflection of a user's ideal self (Dieter et al., 2014). This offers support for the previously discussed studies identified in the present review concerning avatar identification by providing fMRI-based data that corresponds with the conclusions

drawn from studies using self-report methods. The fMRI research appears to indicate that users with GD identify more strongly with their virtual world avatar than both their actual self and even their vision of an idealised self. This suggests that to these users their virtual world identity experienced through an avatar is their primary identity, to which their physical world self assumes a subservient and perhaps even superfluous position. This indicates the important role the avatar has in the user-avatar relationship, providing not only an opportunity for an individual to realise their vision of an ideal self unrestricted by the constraints of the physical world, but also potentially subjectively more 'real' to the user.

Discussion

The present systematic literature review identified and organised the psychological literature relating to virtual world avatar research in the context of GD in order to provide a detailed account of the relationship that develops between a user and their in-game virtual character, which were discussed in terms of avatar identification, self-concept, and fMRI studies.

The ten studies included in this review relating to avatar identification (Burleigh et al., 2018; Liew et al., 2018; Lopez-Fernandez et al., 2019; Mancini et al., 2019; Müller & Bonnaire, 2021; Sioni et al., 2017; Smahel et al., 2008; Stavropoulos et al., 2020; You et al., 2017; Zhong & Yao, 2013) consistently demonstrated an association between high avatar identification and high GD using various different instruments and scales to assess these factors. This indicates that the avatar is something substantially more personal than simply a means for a player to complete in-game goals and objectives or a vehicle with which to navigate a virtual environment, although it also certainly encompasses these elements. Instead, the avatar may be seen as a virtual world extension of the player's identity.

In addition to avatar identification, three studies were identified in this review paper that focused on the self-concept in the context of GD and avatars (Green et al., 2021; Leménager et al., 2013; Morcos et al., 2021). While each of these studies individually provided some insight into the user-avatar relationship in the context of GD, they become particularly insightful when combined with the previously discussed research concerning avatar identification.

For example, results obtained by Green et al. (2021) found that low-self-concept clarity was associated with GD. When combined with the research by Sioni et al. (2017) concerning social phobia, a clearer picture of the user-avatar relationship begins to emerge. Videogame users with social phobia or similar anxiety may create an avatar that reflects their ideal self

(Leménager et al., 2013) which is held as a truer representation of their self that is unconstrained by perceived physical world limitations and inadequacies, and this process is facilitated by a poor self-concept clarity. As such, a user may then increasingly identify with their avatar as a truer representation of their self and consequently be progressively reliant on their virtual world alter ego as a form of compensatory measure for physical world shortcomings. This aligns well with consistent results relating to avatar identification and the association this has with GD (Burleigh et al., 2018; Liew et al., 2018; Lopez-Fernandez et al., 2019; Mancini et al., 2019; Müller & Bonnaire, 2021; Sioni et al., 2017; Smahel et al., 2008; Stavropoulos et al., 2020; You et al., 2017; Zhong & Yao, 2013). In addition, further support for this comes from research by Leménager et al. (2013). In this study, it was found that players with GD create and use avatars that are more closely aligned with the user's image of an ideal self and that there is considerable distance between their vision of their ideal and perceived actual self. This supports the argument that the avatar is a means with which an individual can create and merge with their vision of their ideal self, and is therefore a likely compensatory measure for physical world inadequacies and perceived personal limitations.

However, there is also a further and unexplored aspect to the user-avatar relationship in the context of avatar creation using an ideal self template that is tentatively hinted at when various studies included in the present review are combined, namely the amalgamation of utopian and idealised avatars. An idealised version of the self is described as how an individual would ideally like to be (Higgins, 1987), whereas Mancini et al. (2019) describe a utopian avatar as possessing characteristics that the user could not have in the physical world. As such, utopian avatars are detailed as being beyond the idealised self and therefore should be separate and unaffected by self-discrepancy theory (Mancini et al., 2019). Consequently, the results in the study by Mancini et al. (2019) which indicated that the type of avatar an individual uses (be it utopian or idealised) is irrelevant in terms of GD risk as identification, and the subsequent emotional bond that occurs, appeared to be the prevailing factor for GD risk.

This research by Mancini et al. (2019) concerning avatar type initially appears to simply provide support the importance of the role of identification in terms of a user developing a relationship with their avatar. However when this is viewed alongside the research by Morcos et al. (2021) and Green et al. (2021), a further interesting component of the ideal self and the user-avatar relationship emerges. Green et al. (2021) found that avatar identification was not significantly associated with the type of avatar in terms of being a human or non-human

creature, which initially appears to support the conclusions drawn by Mancini et al. (2019). However, this association becomes more complicated when considered alongside the research by Morcos et al. (2021) who found that playing as the *Draenei* race (i.e., anthropomorphised beast creatures present in *World of Warcraft)* was significantly associated with increased compensatory behaviour which in turn was associated with higher GD risk.

As aforementioned, an idealised avatar is likely a means with which an individual compensates for physical world inadequacies and perceived personal limitations in relation to the self. However, Morcos et al. (2021) indicated that playing as the *Draenei* is significantly associated with compensatory behaviours, despite being unrepresentative of how an individual could appear as in the physical world and would therefore be described as a utopian avatar. This may mean that within the virtual world the distinction between utopian and ideal self avatars does not necessarily exist for all users, and that an individual's vision of their ideal self may take on characteristics that are impossible to achieve in the physical world. This is supported by the findings of Green et al. (2021) indicating that identification with an avatar can appear irrespective of avatar appearance in terms of physical world human characteristics.

Consequently, Mancini et al.'s (2019) findings suggesting that avatar type was irrelevant in terms of GD development and risk may in fact mean that those users involved in the study saw their utopian avatar as an idealised version of their self. If this is the case, then it means that an avatar is not only a means to achieve an idealised version of the self, but that this ideal self has a much broader template in the virtual world than the physical world and may incorporate elements of fantasy derived from the game world. One possible explanation for this may be an error in defining what an ideal self is, and that there is in fact no such thing as a utopian avatar. While early research concerning types of self and self-discrepancy (Higgins, 1987) does not pre-date computer games, it does harken back to a time of limited computer graphics, capabilities, and audiences. Furthermore, it does not necessarily incorporate the merging of the virtual, and inherently fantasy, world and physical world, evidence of which has directly or indirectly been provided by all the studies included in the present review as well as numerous other studies exploring avatars and gaming more generally. As such, with the amalgamation of virtual world fantasy and physical world reality, either of which can appear as 'real' as the other depending on the perceptions of the individual, it is perhaps limiting to think of the ideal self as only being able to conform to the template of what is possible in the physical world. With this in mind, a further dimension is added to the user-

avatar relationship, chiefly that an avatar can be a vehicle to not only achieve an ideal self that conforms to the realities of what can be achieved in the physical world, but also a vision of an ideal self that is no longer constrained by these restrictions.

In addition, research concerning the *Draenei* race by Morcos et al. (2021) also opens up an element of the user-avatar relationship not yet explored in the research identified in this review, namely the assimilation of the pre-existing identity of the avatar. It is perhaps assumed that all avatars begin as a blank canvas and are then moulded and shaped in their entirety according to the desires and intention of the user. However, this is not the case for all videogames, and in fact many such videogames offer a selection of different species or factions as possible characters, often with deep and intricate in-game histories and backstories. While players can choose how much attention they pay to their avatar's racial or faction history and backstory, if this is a consideration for individuals who are creating an idealised version of themselves, then this may impact the user-avatar relationship in a multi-directional manner when considered alongside research based on the PE. More specifically, an individual may choose an avatar race with characteristics that align with their vision of their ideal self, but rather than simply mirroring this ideal self the perceived characteristics of the avatar may in fact then influence the user attitudinally and behaviourally. In this way, the user not only chooses an avatar to align with their ideal self, but the avatar itself then begins to exert influence on the user through the PE, thereby potentially reinforcing these desired characteristics and creating a stronger and more stable ideal self. This potentially means that the user-avatar relationship is not necessarily only one-dimensional, and that the avatar is not just a template on which to draw an idealised self, but also a means of actively reinforcing this version of the self via the PE.

Finally, two studies examined the user-avatar relationship in the context of GD using fMRI methods (Dieter et al., 2014; Leménager et al., 2016). Specifically, in explaining the user-avatar relationship, the findings from Dieter et al. (2014) and Leménager et al. (2016) are particularly noteworthy for two key reasons. Firstly, they support the previously aforementioned discussed studies that focus on avatar identifications and self-concept by providing data that are arguably more objective in nature and less susceptible to participant manipulation or unintentional inaccuracy. The common theme inherent in studies focused on exploring the user-avatar relationship included in the present review is the reliance on self-report measures and scales. This is potentially problematic while assessing the validity of such studies because it requires the individuals involved to be both honest and introspective.

While it seems unlikely that any participants would be motivated to answer such questions in a dishonest manner and the degree of introspection and self-reflection required would be arguably largely minimal in the measures and scales often employed, validity nevertheless remains a consideration, albeit a small one. However, the inclusion of concurring research based on fMRI data provides some additional credibility to these studies and strengthens the conclusions drawn concerning avatar identifications and self-concept. Secondly, the results obtained by Dieter et al. (2014) indicated higher angular gyrus activity during reflection of an individual's avatar compared to their ideal self. This suggests that the avatar may not only be a realisation of an individual's ideal self, but that this arguably more tangible version of the ideal self is identified with more strongly that the incorporeal mental image of an individual's ideal self, which further illustrates the close bond between user and avatar.

In addition, the results from Leménager et al. (2016) appear to support a number of previously discussed studies pertaining to specific elements of avatar identifications or self-concept, including the association between social anxiety, GD, and identifications (Sioni et al., 2017; You et al., 2017), and issues with body-image (Leménager et al., 2013). This consequently strengthens the credibility of this previous research relating to these areas of avatar identifications and self-concept by providing fMRI data that support the results seen in self-report-based studies.

However, while the present review was able to highlight a number of features of the user-avatar relationship in the context of GD, a number of limitations consistent throughout the research were also identified. Firstly, the majority of the studies included in the review neither comment on the specific game world being investigated, nor whether a number of different game worlds were included within a single study. This is potentially problematic as it seemingly treats all videogame players homogenously, with no attempt to distinguish between different game players and game worlds. More specifically, identification with an individual's character or the bond that develops between user and avatar may be affected by factors such as gameplay mechanics (Papale, 2014), customisation options (Li & Lwin, 2016), and even graphical fidelity (Gorisse et al., 2019), and the differences in these factors could vary substantially between games. Of the relatively few studies that provided some indication as to the game world being investigated, these were solely based on the game *World of Warcraft*. This may signal a further issue given the potential for differences between games and the as yet largely unexplored effect this may have on the user-avatar relationship.

Related to this point, a second limitation may be seen in relation to the type of game being investigated by GD research. The majority of research relating to GD or any similar term are based on online games such as the Massively Multiplayer Online Role-Playing Game *World of Warcraft*. However, these games represent only a fraction of potentially relevant videogame environments that include an avatar and in which a user may develop a relationship with their virtual world character. Furthermore, it seems likely that differences may exist between these online and offline virtual worlds in terms of both GD and the user-avatar relationship. For example, in a Massively Multiplayer Online Role-Playing Game, a user's avatar is frequently viewed and interacted with by other players, but this would clearly not be the case in an offline game where the virtual world is a private environment. As such, the presence of other players may influence how an individual customises their avatar and which version of their self an individual chooses to display or to what extent they are prepared to experiment with their virtual world identity, which in turn could affect factors such as avatar-identification, the user-avatar relationship and potentially even GD. Accordingly, this indicates a notable gap in the current literature base, and future research will benefit from exploring GD in the context of offline games and the differences that may exist between online and offline virtual worlds.

Finally, a further limitation present in the research identified in the current review relates to study characteristics. Although specific aspects of the study characteristics of this collection of research provide strength to the overall conclusions drawn, such as the wide range of participant samples and recruitment methods employed, one particular and consistent issue is present among this research that presents a notable limitation, namely the use of different measurements and terms for GD and related disorders. As previously discussed, a myriad of different terms for GD are used in this field of study (Pontes & Griffiths, 2014), and despite largely pointing to the same condition (Petry et al., 2015) these often have varying conceptualisations and diagnostic criteria. For example, the description of GD in the ICD-11 (WHO, 2018) and IGD in the DSM-5 (American Psychiatric Association, 2013) seemingly describe the same condition. However, the ICD-11 presents GD as an addictive disorder, and removes the biological components such as withdrawal introduced by the DSM-5 and provides a different set of diagnostic criteria (Jo et al., 2019). Within the present review, a range of different measurements for IGD, GD and various other forms of videogame-related disorders are present, all seemingly pointing to the same condition but each using a different assessment tool. Whilst it is difficult to precisely determine to what extent this may have

affected the results from each individual study, this lack of uniformity in the field of videogame-related disorders and addiction does present a limitation when synthesising and drawing conclusions from a large body of research.

Limitations and future research

This present literature reviewed a number of key findings relating to the user-avatar relationship in the context of GD. However, the review also contained a number of limitations that should be acknowledged. Firstly, the search terms used in this paper may have potentially limited the number of relevant studies included, in particular given the wide variety of different terms for GD. Consequently, although care was taken to include a number of different terms for GD, it is possible that potentially relevant studies were not included.

Secondly, the eligibility criteria used in this review paper to separate relevant from non-relevant papers may have limited the number of studies included in this review. This paper strictly determined only studies that focused on the user-avatar relationship were included. However, this meant that a large number of studies that investigated videogames but did not specifically mention the avatar were not included. While this ensured that only studies strictly relevant to the user-avatar relationship were included, it may be argued that excluded studies may have provided the opportunity to infer some insight concerning this relationship dynamic even if this was indirect or assumed rather than explicitly relevant. In addition, the present review focused specifically on peer-reviewed journal papers and did not include any 'grey literature' or non-English, French or German texts, unpublished PhD theses, and papers published in non-peer reviewed outlets. This may have led to an under-representation of the available research on this topic and may have increased the risk of publication bias.

Finally, and based on the findings presented in the present review paper, several avenues for future research have been identified. Firstly, and in line with the identified limitations present in the present review, future research may benefit from using a less restricted search strategy. In particular, future research may identify a larger number of relevant studies using appropriate synonyms for an avatar, such as 'character' or 'icon'. Whilst these are not used as widely or extensively as the term 'avatar' in videogames, they may nevertheless be present in the literature. In addition, and as previously discussed, the present review only included studies that were published in peer-reviewed journals, and future research may also benefit from exploring relevant papers from a wider set of outlets to include unpublished PhD theses, and papers published in non-peer reviewed outlets. However, some care should be taken

when utilising this ‘grey literature’ as the quality of these papers cannot be as readily assured as those found in peer-reviewed journals.

Secondly, in terms of utopian and idealised avatar types, this review indicates a potential overlap between these two avatar templates that is as yet unexplored. Based on the combined findings from Mancini et al. (2019), Morcos et al. (2021) and Green et al. (2021), an argument may be made that within the context of avatars and the virtual world, an individual’s vision of their ideal self may have substantially greater freedom in available desirable characteristics compared to the ideal self of the physical world. If this is the case, then there are likely important implications concerning the user-avatar relationship, the self-concept and self-discrepancy and the role of the virtual world specifically in how this environment may allow individuals to experiment with and achieve a sense of self that cannot occur in the physical world. While this assertion is largely speculative given the available evidence, this may prove an interesting avenue of future research that may hold important implications to the user-avatar relationship and avatar research more generally.

Thirdly, throughout the review, avatar identification was consistently strongly associated with GD, and which also forms a critical role in the occurrence of the PE. In all the studies identified here, only one paper (Stavropoulos et al., 2020) explored GD in this context. The results indicated an association between GD symptom severity and PE susceptibility, suggesting that individuals who score highly on a measure of GD are more likely to experience some form of PE consequence from gaming.

This association between GD and the PE is supported by the array of included literature concerning avatar identification present in this review (Burleigh et al., 2018; Dieter et al., 2014; Leménager et al., 2016; Liew et al., 2018; Lopez-Ferndandez et al., 2019; Mancini et al., 2019; Müller & Bonnaire, 2021; Sioni et al., 2017; Smahel et al., 2008; Stavropoulos et al., 2020; You et al., 2017; Zhong & Yao, 2013), and how avatar identification is often associated as a critical component of the PE (Li & Lwin, 2016; Ratan & Dawson, 2016; Song et al., 2014)). This suggests that any research focused on exploring the consequences of the PE may benefit from using individuals with GD as their sample for two key reasons. Firstly, as has been aforementioned, individuals with GD have a tendency to influence their avatar to align with the user’s version of their ideal self. However, in line with the PE, it may be that the avatar is also simultaneously exerting influence on the user and may affect them attitudinally and behaviourally both in-game and outside of the game-world. This means an

interesting component of the user-avatar relationship in the context of GD remains unexplored, but may play a critical role in influencing behaviour and attitudes among these individuals.

Finally, researchers focused on exploring the PE may find using a sample of individuals with GD beneficial to strengthening the observed consequences of this phenomenon. More specifically, any study investigating an aspect of the PE may potentially see results more extreme while using a sample of GD compared to comparatively healthy individuals due to their recorded increased susceptibility to this phenomenon. The extant research combining GD and the PE is as yet largely unexplored, with only one such study identified here (Stavropoulos et al., 2020). Consequently, given the relationship between GD and the PE, this signals a potentially informative avenue of future research that may benefit both topic areas.

Conclusion

The present systematic literature review has built on and expanded the extant literature relating to factors such as avatar identification and self-concept domains and processes in the context of GD by specifically considering this research in terms of the user-avatar relationship in virtual world environments. Through the review of the available literature, several key aspects of this relationship dynamic have been uncovered. This includes the indication that users with GD will often design an avatar to resemble their vision of their ideal self, and through playing as this virtual world character, players reduce the discrepancy between their physical world actual self and ideal self as well as compensate for perceived physical world inadequacies. Furthermore, research shows this virtual world self inhabited through an avatar is identified with more deeply and meaningfully than the user's physical world identity, and occurs even at a neurophysiological level through greater activation of the angular gyrus region of the brain. In addition, this review provides tentative evidence that in the context of videogame avatars, an individual's concept of their ideal self may incorporate elements of fantasy inherent to game worlds but unobtainable in the physical world, and thereby potentially adding a new dimension to theories on self-concept. Finally, several limitations present in this area of research were discussed as well as different avenues of future research to expand the knowledge base of GD and avatar research as well a potential and largely unexplored association to PE research which may yield valuable research data and expand both these fields of study.

Chapter 3: Methods

Overview of thesis

The overall purpose of this thesis is to explore the relationship that develops between a user and their avatar in the context of commercially available videogames. In particular, the thesis is focused on the Proteus effect (PE) and the relationship this phenomenon has in regard to Gaming Disorder (GD). Accordingly, the precise aims of this thesis are to:

- Examine the user-avatar relationship in videogames
- Explore the relationship between GD and the PE
- Investigate how the Proteus effect may manifest in videogames

In order to explore the discussed aims of this thesis, a mixed methods approach was adopted for the research detailed in this body of work. To begin with, two systematic literature reviews were conducted to explore the current state of the literature in regard to (i) the PE and (ii) the user-avatar relationship in the context of GD. Based on the findings and conclusions of these two systematic literature reviews, three separate research studies were conducted to explore the research aims of the thesis.

Firstly, a qualitative study using thematic analysis as the method of analysis was conducted to examine the user-avatar relationship in videogames as well as participants' subjective experiences of the PE. Secondly, a quantitative survey study using mediation analysis was conducted to explore the strength and direction of the relationship between GD and the PE. Finally, a quasi-experimental study using multiple analysis of co-variance (MANCOVA) analysis was conducted to investigate the influence of avatar gender on a user's in-game behaviour. The purpose of this current chapter is to explore and justify the use of the mixed methods approach and the individual research methods included in this thesis.

Quantitative and qualitative research

Broadly, there are two main approaches to research, namely quantitative and qualitative methods. Quantitative approaches in research refer to the collection and analysis of numerical data to test hypotheses, make predictions, and explore relationships between variables with the aim of generalising obtained results and conclusions to wider populations (Morgan, 2013). Quantitative methods typically involve obtaining numerical data through surveys,

polls, observation or experimental manipulation of variables. Quantitative methods are often underpinned by a positivism paradigm, centred on the ontological belief that interpretations of reality should be based on what is objectively observable and measurable (Doyle et al., 2012). Positivist researchers argue that social phenomena should be investigated in the same manner as physical phenomena, using empirical and objective methods free from bias and emotional attachment from the researcher in order to uncover general laws and descriptions of reality (Johnson & Onwuegbuzie, 2004; Wiggins, 2011).

Conversely, qualitative approaches in research are focused on the collection and analysis of non-numerical data (i.e., interview transcripts, diary entries) to describe and explain social phenomena and human experience (Doyle et al., 2012; Pope et al., 2000). Qualitative research is based on a constructivist or interpretivist paradigm which assumes the ontological position that reality is subjectively experienced and often uniquely constructed by individuals (Johnson & Onwuegbuzie, 2004), and studies should aim to capture and understand an individual's perspective and interpretation of their lived experiences (Flick, 2014). Furthermore, qualitative research often requires involvement from the researcher at a deeper and more active level compared to quantitative approaches, particularly in terms of the analysis in which the subjectivity and personal interpretation from the researcher may play a crucial role.

Clearly, quantitative and qualitative methods in research take very different approaches to data and analysis, with the former focused on objective measurement and generalisation and the latter concerned with individual interpretations of experiences. However, while traditionalists and purists of quantitative and qualitative methods may claim that the differences in procedure and philosophical standpoint between these approaches means they are incompatible with one another, it has also been argued that these highlighted differences do not mean that they are mutually exclusive (Doyle et al., 2012; Johnson & Onwuegbuzie, 2004) and can be appropriately combined into mixed methods approach to research.

Mixed methods research

Mixed methods refers to the approach in research to conduct a single study or series of studies utilising both quantitative and qualitative methods of data collection and analysis (Bishop, 2014). Mixed methods approaches are becoming increasingly prevalent as a research method and recognised as a third research paradigm (Johnson et al., 2007), with its

own unique philosophical assumptions and technical procedure separate to quantitative and qualitative approaches.

Mixed methods often takes a pragmatist philosophical position in terms of epistemology (Johnson et al., 2007), with a pluralistic approach to paradigms. Simply put, mixed methods approaches take the viewpoint that the research question is of primary importance (Tashakkori & Teddie, 2003), and that selection of a method should be based on what is most suitable and appropriate to answer that question. This means that the philosophical standpoints from both quantitative and qualitative methods are embraced by researchers through the use of multiple methods of analysis to explore a phenomenon or answer a research question, and arguably provide a means of capturing the complexity of human experiences far beyond what may be achieved using a single method (Sandelowski, 2001).

In addition, combining quantitative and qualitative approaches can often provide researchers with a number of benefits that are inherently unique to mixed methods, including: triangulation (i.e., corroboration of quantitative and qualitative results) (Doyle et al., 2012); offsetting weaknesses or limitations of an individual approach (Bryman, 2006); answering research questions that cannot be appropriately addressed by a single method (Creswell & Clark, 2017); and hypothesis testing and development (Doyle et al., 2012).

Finally, it is also necessary to highlight the importance of mixed methods research procedures, and specifically choices regarding the ordering of studies. Mixed method research involves conducting two or more studies using different forms of data collection and analysis, and there have been a number of typologies and methods conceptualised to structure this design decision. For example. Morgan (1998) proposed four mixed methods design choices to guide research based on sequencing and importance of each study (see Table 1). The purpose of these design choices are to guide research in a complementary and effective manner in relation to the specific aims of the overall research and enhance the quality of both the data collected and final interpretation of the results (Morgan, 1998).

Table 1. Mixed method research design options (Morgan 1998)

1. qual followed by QUANT	2. quant followed by QUAL
3. QUANT followed by qual	4. QUAL followed by quant

*Upper case denotes primary and lower case denotes secondary method

However, although the design choices put forward by Morgan (1998) can be used to effectively guide mixed methods research, the specific four options posited are not exhaustive of the possibilities available when conducting mixed method research. For example, the four design choices proposed by Morgan (1998) each assume a hierarchy of value and importance in regard to the methods of data collection and analysis, with one part acting as primary and the remaining parts consigned to a complementary and supporting position. While the approach posited by Morgan (1998) to mixed methods research does have some strengths in terms of guiding research and ensuring results can be combined in a relatively easy and coherent manner, there are other approaches to mixed method research such as convergent designs where each method is considered to be of separate but equal importance (Creswell & Clarke, 2010). Using a convergent approach removes both priority of importance and the necessity for sequencing, and considers each method as providing unique insight relating to the overall research aims that can act independently as well as be appropriately synthesised and combined with the other methods. The applicability and suitability of each of these mixed methods designs will vary depending on the specific context, circumstances, and overarching aims of the research study, and will require the researcher to be conscious of these factors in order to guide their approach (Creswell & Clarke, 2010)

Research designs

A combination of both quantitative and qualitative studies was included in this thesis in order to appropriately address the aims of this body of work, namely to: (i) examine the user-avatar relationship in videogames; (ii) explore the relationship between GD and the PE; and (iii) provide new insight on how the Proteus effect may manifest in videogames.

This use of a mixed methods approach was selected for this thesis to provide a wide and detailed account of the dynamics of the user-avatar relationship in videogames and expand the current literature on this topic, with a specific focus on the PE and GD. In particular, and as highlighted in the results of the two systematic literature reviews conducted for this thesis,

the field of research relating to the PE is still developing with only a very limited number of studies previously conducted. Furthermore, to date, there have not been any previous attempts to explore the PE in a qualitative manner, with all previous research focused solely on quantitative methods. To address these limitations and gaps in the literature, this thesis conducted research involving both qualitative and quantitative methods of analysis in order to better understand the nuances and complexity of the user-avatar relationship in the context of the PE. More specifically, this thesis used thematic analysis to analyse the qualitative data from Study 1, multiple mediation to analyse the quantitative data from the survey in Study 2, and MANCOVA to analyse the quantitative data from the quasi-experimental design of Study 3.

This thesis adopted a convergent mixed methods approach with concurrent data collection (Creswell & Clarke 2010; Creswell & Creswell, 2017). The convergent mixed methods approach involves merging and synthesising complementary research from both qualitative and quantitative methods in order to provide an overall explanation or interpretation of a phenomenon or research question. Convergent approaches are particularly well suited to situations where separate research studies each provide equal value as well as unique insight regarding answering a research question, and that data collection can occur both concurrently and independently (Creswell & Clarke, 2010).

In terms of this thesis, data collection and analysis for each of the three included studies were conducted independently from each other, with a final integration of results used to answer and address the aims of this thesis. The convergent mixed methods approach used in this thesis meant that although each study was broadly based on the PE and user-avatar relationships, each individual study investigated this topic in a unique manner in terms of aims, method and research design. For example, Study 1 was designed as a qualitative study using thematic analysis to investigate gamer's subjective experiences of both the PE and user-avatar relationship more generally, while Study 3 was designed as a quantitative study using objective numerical data obtained from participants pre-existing game save files to explore how the PE may manifest. Although these studies ran independently of each other, they were each based on an over-arching research theme (i.e., the PE and user-avatar relationship) which meant that the obtained results and conclusions could be appropriately amalgamated in the final discussion to provide a comprehensive and detailed account of the complexity and dynamics of the user-avatar relationship in the context of GD and the PE that extends beyond what could be achieved using a single form of research method.

The procedure for a convergent mixed method approach follows four key steps. Firstly, both quantitative and qualitative data are collected from two or more research studies. These studies occur concurrently but independently from each other, and are frequently seen as providing equal or similar value in terms of addressing the overall research aims and questions. Secondly, analysis of each of these studies are conducted, and this analysis is also performed independently and separately to each of the other studies. The third step involves merging the two or more sets of results, which may require either direct comparison or transformation of the data. Finally, the fourth step involves the researcher exploring the combined results, with a focus on convergence, divergence, and how they join together to explain or answer the overall research aims and questions (Creswell & Clarke, 2010).

Using a convergent mixed method approach has a number of strengths, including being a highly efficient method of conducting research. More specifically, in a convergent design, data are collected at the same time and independently from other research studies, which means several studies may be conducted at the same time. In addition, and related to the previous point, any unexpected delays or interruptions to one study is unlikely to have an impact on the other studies and means the overall research is not disrupted. Furthermore, using a convergent mixed method approach can lead to high calibre results in the final merging that is less likely to occur using other mixed method approaches. In particular, due to the inherent separation and independence of individual studies in both the data collection and initial analyses phases, subsequent merging and synthesis of these studies can lead to unexpected or even contradictory results (Creswell & Clarke, 2010). While conflicting results can be problematic in terms of the overall amalgamation and analysis of results from several studies, and may require further collection of additional data, it nevertheless arguably provides new and unique insights into a topic that methods employing a sequential means of data collection may not be able to uncover.

Outline of Study 1

The first study of this thesis was based on a qualitative research design. More specifically, the study involved conducting interviews with a number of videogame players to investigate participants' subjective experiences of the PE as well as components of the user-avatar relationship more generally. In terms of rationale, this type of research method was selected to be included in this thesis for two key reasons. Firstly, this study addresses a significant gap in the current literature relating to the PE, namely the lack of any qualitative accounts of individual's experiences of this phenomenon. The previous research on the PE in the context

of commercially available videogames has exclusively focused on quantitative methods of analysis, which means that only the directly observable aspects of the PE have been recorded and discussed, while aspects relating to how an individual experiences this phenomenon have previously been neglected. Secondly, and in terms of justifying the use of mixed methods research, combining qualitative and quantitative research findings can provide a more detailed and nuanced understanding of a topic, with each method offsetting the limitations present in the other method.

The specific form of analysis used in Study 1 was thematic analysis. Thematic analysis has been described as a means to identify, analyse and report patterns or themes in qualitative data (Braun & Clarke, 2006). Thematic analysis was chosen as the method of analysis for this study for several key reasons. Firstly, thematic analysis allows for in-depth exploration of an individual's perspectives and lived experiences, and is a flexible research method in terms of both practicality and theoretical frameworks (Clarke et al., 2017). In particular, the flexibility of thematic analysis means that whereas other qualitative methods are more rooted in specific theories or technical knowledge (i.e., conversation analysis, interpretative phenomenological analysis or discourse analysis) (Javadi & Zarea, 2016), thematic analysis allows for flexibility in the researcher's choice of theoretical framework (Braun & Clarke, 2006). Furthermore, the unique flexibility of thematic analysis also extends to practical matters of conducting research, and may be appropriately modified to suit the needs of various different studies in terms of participants, sample size, research questions, and form of qualitative data (Braun and Clarke, 2006; Lorelli et al., 2017).

Secondly, and related to the previous point, thematic analysis can be used in either an inductive or deductive manner in regard to analysis of the data (Braun & Clarke, 2006), and the use of this method of analysis as an exploratory tool was particularly well-aligned to the aims of this study. More specifically, although there was some pre-existing theory and literature relating to the PE and user-avatar relationships, these were generated primarily, or solely in the case of the PE, on previous quantitative research. The aims of Study 1 were focused on exploring the subjective experiences of individuals in regard to the PE and the user-avatar relationship, and any existing theory relating to these topics were used in an explanatory manner rather than the results of the study being used to either confirm or generate new theories. This again aligns with and justifies the use of thematic analysis over other qualitative methods for this specific study given the exploratory and descriptive aims of this research.

However, it should be acknowledged that, despite these discussed advantages that advocate the use of thematic analysis both in general and for this specific study, this method of analysis does contain a number of inherent limitations and weaknesses. Firstly, thematic analysis is susceptible to researcher bias and too simplistic interpretation and analyse of the data (Braun & Clarke, 2006; Javadi & Zarea, 2016), which can lead to weak results that reflect what the researcher wanted to see rather than an account of the participant's subjective experiences and perspectives. However, thematic analysis is not the only qualitative analysis tool to be vulnerable to bias from the researcher, and this represents a potential weakness of qualitative research rather than this specific method of analysis. Secondly, although thematic analysis is a popular and widely used method of analysis, there is less available literature on this thematic analysis compared to other methods such as grounded theory or phenomenology (Lorelli et al, 2017), and this can arguably lead to potential issues relating to rigour in thematic analysis research for novice researchers. Finally, although the flexibility of thematic analysis may be seen as a key strength of this method, this can also prove to be a disadvantage and lead to inconsistency and incoherence in the development of themes from the datasets (Holloway & Todres, 2003). However, the issue of inconsistency and incoherence can be addressed through the researcher explicitly taking and promoting their epistemological stance and centring themes on a main topic or subject area (Lorelli et al, 2017; Nowell et al., 2017).

Outline of Study 2

The second study of this thesis was based on a quantitative research design. More specifically, the study was based on numerical data collected from a survey that explored GD severity, occurrence of the PE, and strength of an individual's relationship with their avatar, and was analysed using multiple mediation analysis. This method of analysis was chosen to explore the strength and direction of the relationship between GD and the PE, as well as the potential mediating effects of the user-avatar relationship across three separate domains. This research approach was chosen in order to provide objective and generalizable data concerning the relationship between GD and the PE and how different facets of the user-avatar relationship affect this association.

Surveys are among the most commonly used methods of obtaining quantitative data in research, and can assess behaviours and trends from groups and before generalising these results to larger populations (Miller et al., 2010). The key element of survey research that separate it from experimental research is the focus on naturally occurring phenomena rather

than intentional manipulation of variables, which highlights a potential limitation of this method, namely that cross-sectional survey studies are not able to establish causality between variables. In addition, a further limitation of survey research may be identified in how data are collected, and the typical reliance on participant self-report (Miller et al., 2010). In particular, the responses provided by participants while completing surveys may be influenced by factors such as social desirability bias, poor introspection skills, ordering of questions, inaccurate recollection of events, and issues relating to wording of questions such as misinterpretation of question meaning.

However, despite these limitations, survey studies also provide a number of key benefits. In particular, survey studies allow for researchers to explore relationships between variables and generalise these findings to large populations to explore and explain behaviours and trends (Miller et al., 2010). In addition, surveys often facilitate large numbers of participants, which means greater power for statistical analyses (Jones et al., 2013). Furthermore, surveys also have greater ecological validity compared to the artificial settings of a laboratory experiment, and consequently provide an excellent means of exploring behaviours in real-world settings.

In terms of rationale, this study was designed in this manner as a means of extending and advancing the previous limited research relating GD in the context of the PE. In particular, the second systematic literature review conducted for this thesis identified a theoretical potential link between GD and the PE based on a number of key similarities between this disorder and the PE. In addition, the two previous examples of quantitative research on this topic (i.e., Byrne et al., 2022; Stavropoulos et al., 2020) both identified a significant association between GD and the PE, but with disagreement on the direction of this relationship. Through the use of mediation analysis, both the direction and strength of the relationship between GD and the PE could be objectively observed. Furthermore, mediation analysis also allowed for the potential mediating effects of aspects of the user-avatar relationship to be observed and recorded, a component that was the basis of the theoretical link between GD and the PE discussed in the aforementioned systematic literature reviews. This study addresses both the conflicting results previous results on this topic as well as providing evidence to support the conclusions made in the systematic literature reviews of this thesis.

Outline of Study 3

The third study included in this thesis was also based on a quantitative design. More specifically, this study was based on a quasi-experimental design that used numerical data obtained through an online survey that obtained participants' pre-existing save file data for the videogame *Fallout: New Vegas*, and was analysed using MANCOVA. This method of analysis was selected in order to explore how gender is constructed in a specific virtual world, and the implications this has in terms of manifestations of the PE.

More specifically, the study asked participants to detail in-game recorded metrics relating to particular behaviours demonstrated during their time playing the game, as well as questions relating to their gender identity and the gender of their avatar in order to explore the interaction or influence between a player's virtual world avatar gender and their physical world gender identity on specific gameplay behaviours. A MANCOVA was selected as the analysis method because it allows for multiple independent and dependant variables to be observed, as well as controlling for extraneous or confounding variables. In Study 3, the independent variables were avatar gender (male and female) and participant gender (male and female), the dependant variables were (i) number of quests completed; (ii) number of locations discovered; and (iii) number of NPCs or enemies killed, and the controlled confounding variable was time spent playing the game.

The metric data used for the dependant variables were based on pre-existing save-file data which meant that this study was not a 'pure' experiment, but rather a quasi-experiment. Typically, a traditional laboratory experiment involves placing participants into groups (e.g., through random allocation or matched-pairs grouping) and then manipulating the independent variable and finally assessing the outcome on the dependent variable to establish causal relationships between variables (Miller et al., 2010). Laboratory experiments in psychology have a number of clear strengths, including the ability to provide strong evidence for causality between variables, higher internal validity through greater control of the research setting, and higher replicability (Podsakoff & Podsakoff, 2019). However, in Study 3, participants were not allocated to groups in order to observe manipulation of the independent variable, but instead were asked to provide pre-existing game file data and in essence selected their own group before the experiment began. Conducting Study 3 using this quasi-experimental design meant that specific key limitations arose regarding the data collected and conclusions drawn, particularly in regard to establishing causality due to the employed method of participant group allocation.

Nevertheless, despite some issues relating to establishing causal relationships, conducting Study 3 using a quasi-experimental design provided several key benefits that would not have been possible using a traditional experimental design, and arguably far outweigh the limitations introduced by this design choice. Firstly, using pre-existing save file data completely eliminated any potential for demand characteristics or other forms of researcher-induced bias to influence the data collected, thereby improving the internal validity of the obtained results. Secondly, the data collected were based on individual's experiences in a natural and non-laboratory setting, thereby improving the ecological validity of the results. This point regarding ecological validity is of particular importance given the focus of this thesis on commercially available videogames, which, as a consumer product, are overwhelmingly for home and personal use which improves the alignment of these results with the aims of this thesis. Finally, using pre-existing save file data rather than asking participants to take part in a traditional experiment markedly reduced the time and commitment required of each participant, which likely had a positive effect on the number of gamers willing to participate in this study and thereby improving the strength and generalisability of the statistical analyses conducted for this study.

Conclusion

The aims of this thesis are to: (i) examine the user-avatar relationship in videogames; (ii) explore the relationship between GD and the PE; and (iii) provide insight on how the Proteus effect may manifest in videogames. The thesis uses a mixed methods approach, including two quantitative and one qualitative study. These studies were conducted using a convergent mixed methods approach, with studies running concurrently and independently of each other, but with over-arching common themes that address the aims of the thesis and which make later amalgamation and integration of the identified results from each study possible during the general discussion of this thesis. This convergent mixed methods approach was selected in order to provide a range of different forms of complimentary data that can be appropriately collated together to form a detailed and comprehensive account of the intricacies and nuances of the PE, GD and user-avatar relationships in videogames.

Chapter 4: "I am the character, the character is me": A thematic analysis of the user-avatar relationship in videogames

Introduction

Videogames can take a variety of forms in terms of size, complexity and gameplay, from simple puzzle games to highly intricate and sophisticated simulations of physical world activities. Although it is not a necessary component of videogames, a feature that is often present is the avatar. An avatar in the context of videogames refers to the visual representation of the player and is the means with which they may interact with the virtual world or other players in the case of online or multiplayer games, and connects the physical self of the player to the virtual world (Nowak & Fox, 2018; Szolin et al., 2022a). In some cases, an avatar will be pre-designed by the game's development team, and may already have a substantial history and personality attached to it, such as the character 'Lara Croft' from the *Tomb Raider* series. In other cases, the avatar can be highly customised and personally designed by the individual gamer themselves (Cacioli & Mussap, 2014), with some videogames offering customisation options for almost every conceivable visual aspect of the avatar.

However, the avatar is not merely a means with which the gamer interacts with the virtual world in order to complete the in-game objectives, but can also take on a much more personal and important role for the gamer. For example, research suggests that instead of being a mere passive digital tool for navigating a virtual world, the avatar has the potential to become part of a mutual social relationship with the user (Banks, 2015). More specifically, it is argued that in cases where an individual differentiates themselves from their avatar, there is the potential for the avatar to be seen as a social other leading to emotional intimacy with the virtual character (Banks, 2015). Furthermore, relationships with an avatar can also occur when the user considers the virtual character to be either an object, a representation of the gamer or part of a symbiotic partnership between user and avatar (Banks & Bowman, 2016). This research on user-avatar connections indicates that although the form and strength of the social relationship that occurs between user and avatar varies depending on how the user uses or views their avatar, these digital characters can nevertheless become members of authentic human relationships.

A further component of the user-avatar relationship concerns how the avatar can be used as a form of identity creation, management, and exploration in videogames that allow personal avatar customisation (Szolin & Griffiths, 2022). For example, research indicates that gamers will often design their avatar to resemble their vision of their ideal self (Ducheneaut et al., 2009; Messinger et al., 2008). The term ideal self is rooted in self-discrepancy theory (Higgins, 1987) and refers to an individual's idea of how they would ideally like to appear, and this appears to be a common guiding motivation in gamers designing their avatars (Sibilla & Mancini, 2018). This use of the ideal self as an avatar template provides support for the personal relationship between a user and their avatar, indicating that these virtual world representations are more than just tools needed to play the videogame, but rather a way for the user to present a better and more idealised version of their self in a virtual world.

However, it should also be noted that user-intention is not the only guiding force in construction and design of an avatar. More specifically, McArthur (2018) posits that self representation through an avatar is guided by more than how a user wishes their avatar to appear, and is impacted by four key components: the self (i.e., how avatars are constructed to represent some form of self-identity), affordances (i.e., actual and perceived availability of customisation options), aesthetics (i.e., boundaries imposed by developers to ensure alignment with the intended game world experience, such as limiting playable races), and co-situated play (self-representation choices affected by other players through a desire to play together, such as choosing the same faction or team). This research suggests that while an individual has control over the appearance of their avatar, this is tempered by a number of potentially limiting constraints imposed by the game's system, design choices of the developers, and even the desire for co-operative gameplay.

In addition, research also indicates that transferring elements of the gamer's self to their avatar not only comprises physical characteristics, but also occurs in regard to a gamer's personality traits and behaviour. For example, research investigating personality traits and behaviour of both gamers and their avatars indicates that avatars will often display similar characteristics in game to those of the player outside of the game (Sibilla & Mancini, 2018), albeit less inhibited (Messinger et al., 2008) and, similar to physical appearance, more in line with their ideal version of their self (Bessière et al., 2007). This research shows that gamers will frequently use a template of their ideal self to guide both the visual design of their avatar as well as how the avatar behaves within the videogame, which demonstrates the extent to which gamers can mould and influence their virtual world avatar. However, there is a

burgeoning area of research that argues that the process of a gamer influencing their avatar may in fact operate in both directions, and that there is potential for the avatar to influence the gamer in a phenomenon termed the 'Proteus effect'.

The Proteus effect

The term 'Proteus effect' (PE) in the context of videogames refers to the phenomenon whereby gamers modify their behaviour or attitudes to align with the perceived characteristics of their in-game avatar. More specifically, it is suggested that the PE occurs when a gamer makes specific inferences based on observable characteristics or attributes of their avatar and then adapts their in-game behaviour to align with these expected behaviours (Yee & Bailenson, 2007). For example, research has indicated that individuals who control an avatar that is deemed to have a 'normal' weight are more active during a sports game than individuals who control an 'overweight' avatar (Peña & Kim, 2014), and that individuals who control taller avatars act with greater confidence in-game compared to shorter avatars (Yee & Bailenson, 2007).

However, while the PE may potentially result in notable changes to the gamers' behaviour and attitudes, the strength and likelihood of this phenomenon occurring in a videogame may often be influenced by a number of factors (Szolin et al., 2022b). For example, research has indicated that the PE is more likely to occur when an individual is able to customise their avatar (Ducheneaut et al., 2009; Ratan & Sah, 2015) due to the greater degree of avatar identification and avatar embodiment that this allows, which have all been identified as factors vital for the occurrence of the PE (Li & Lwin., 2016; Song et al., 2014; Ratan & Dawson, 2016). Furthermore, even the graphical fidelity of a videogame has indirectly been shown to potentially affect the strength of the PE through factors such as immersion (i.e., the feeling of being present in a videogame due to technology) and avatar embodiment (Gorisse et al., 2019).

Moreover, in addition to affecting in-game behaviour and attitudes, research has also found that the PE and the influence of the avatar can extend beyond the virtual world and impact the gamer outside of the game (Peña & Hernandez Perez, 2020; Yee & Bailenson, 2007). For example, Peña et al. (2018) – and the later replication by Peña and Hernandez Perez (2020) – found evidence that participants who played the videogame *Papers, Please* (i.e., a dystopian immigration officer simulation game) reported a decreased intention towards helping immigrants after gameplay. The accumulated research relating to the PE provides strong

indication that the relationship in terms of influence between a gamer and their avatar is multi-directional, and that although gamers may sculpt avatars to resemble some facet of themselves, unbeknownst to the gamers, their avatar may also be shaping their behaviour and attitudes both during and after gameplay. Furthermore, research on the PE indicates that these changes to behaviours and attitudes can be substantial (Szolin et al., 2022b), such as the occurrence of stereotypical gender-conforming behaviours aligning with a user's avatar's gender over the existing gender identity of the gamer (Yee et al., 2011). However, despite growing research relating to the PE in the context of videogames, research has to date been singularly concentrated on quantitative methods of analysis and no studies have attempted to explore this specific topic using qualitative methods as a way of getting more in-depth data regarding this behaviour.

The present study

The aim of the present study was to explore how gamers experience their user-avatar relationship in videogames, with a particular focus on elements relating to the PE both during and after gameplay using thematic analysis. Thematic analysis has previously been used in a number of studies relating to various aspects of videogame playing and videogame avatars, including experiences of female gamers (McLean & Griffiths, 2013; McLean & Griffiths, 2018); attitudes, feelings, and experiences of online gamers (Hussain & Griffiths, 2009); motivation and the game-self (Kartsanis & Murzyn, 2016); experiences relating to videogame challenge (Petralito et al., 2017); videogame 'modding' (i.e., player alterations to videogame data files to change aspects of the game; Curtis et al., 2022); reactions to self-representational avatars (Baysden et al., 2021); problematic gamers' player-avatar interactions (Green et al., 2020); and Game Transfer Phenomenon (GTP – i.e., transfer of virtual gaming experiences to the physical world through sensory perceptions, mental processes, and involuntary changes to behaviour or automatic actions); Ortiz de Gortari et al., 2011). Although these studies have provided valuable insight into various aspects of videogames and the user-avatar relationship, to date there has not been any attempt to specifically explore the PE in videogames using qualitative methods, despite the accumulated quantitative research evidence demonstrating that this phenomenon can have a notable effect on gamers both during and after gameplay.

In particular, there are a number of quantitative studies that have explored the strength and likelihood of the PE occurring across a number of different areas relating to behaviour and attitudes (Szolin et al., 2022b), and this helped to codify and define this research area. However, while these quantitative studies provide evidence of how the PE may manifest, the

subjective experiences of individuals have been left unexplored in relation to this phenomenon. More specifically, qualitative research that explores gamers' personal experiences of the PE as well as the user-avatar relationship in general may complement the existing quantitative research and help provide a more detailed and nuanced account of this phenomenon to further understanding and knowledge of this research topic. Therefore, the present study attempted to address this gap in the literature by investigating the occurrence of the PE in the context of videogames using qualitative methods of analysis, as well as exploring the wider aspects of the user-avatar relationship in videogame playing.

Method

Participants

A total of 12 participants were recruited for the present study, with an age range of 18-27 years and a specific requirement that they have a history of videogame use. Basic demographic information for these participants included: place of residence (six based in the UK, and six based in the US); gender (seven males, one female, four transgender females, and one non-binary); GD status (three currently undergoing treatment and nine not seeking/requiring treatment); and employment status (eight students, one employed and three unemployed). Participants' characteristics are summarised in Table 1. All the participants indicated that they had routinely been playing videogames from early childhood to the present time, with the exception of three participants who were currently undergoing treatment for Gaming Disorder at a US clinic for technology addiction and therefore had not played videogames during the course of their current treatment.

Participants were recruited primarily through convenience and snowball sampling methods using online forums to advertise the study, and were each awarded a £10 (or equivalent US dollar amount) *Amazon* voucher for their participation. In addition, three participants were recruited directly through volunteer sampling at a US clinic for treating technology addiction.

Table 1. Participant characteristics

Participant	Age	Nationality	Gender	GD Status	Employment status
P1	21	US	Male	Currently undergoing treatment	Student
P2	19	US	Male	Currently undergoing treatment	Unemployed
P3	23	US	Male	Currently undergoing treatment	Unemployed
P4	20	US	Male	Not seeking/requiring treatment	Student
P5	21	US	Male	Not seeking/requiring treatment	Student
P6	27	US	Male	Not seeking/requiring treatment	Student
P7	18	UK	Female	Not seeking/requiring treatment	Student
P8	18	UK	Male	Not seeking/requiring treatment	Student
P9	21	UK	Non-binary	Not seeking/ requiring treatment	Student
P10	21	UK	Transgender female	Not seeking/ requiring treatment	Employed
P11	20	UK	Transgender female	Not seeking/requiring treatment	Student
P12	22	UK	Transgender female	Not seeking/requiring treatment	Unemployed

Procedure

After initial contact, each participant was provided with a participant information sheet and asked to sign a consent form before any interviews were conducted, with further verbal consent being obtained during the interview. The interviews were semi-structured, and were conducted online through the *Microsoft Teams* video call function, with each interview lasting between 30 and 60 minutes.

Each interview began with the interviewer reading through the information sheet and consent form with the participant, and provided them with an opportunity to ask any questions they may have about the interview process and study. Then, and in addition to the previously acquired written consent, participants were asked to confirm their name and that they agree to be part of the study. The next phase of the interview involved asking participants the questions from the interview schedule. As these interviews were semi-structured, the interview schedule was used as a guide, and any new or branching topics brought up by the participants were appropriately investigated and explored. After each interview finished, every participant was fully debriefed during the video call as well as being provided with a debrief sheet through email. All interviews were recorded using both *Microsoft Teams* as well as an external voice recorder, and then transcribed and analysed using the *N-Vivo 12* data analysis software package.

Interview schedule

The interviews were guided by a semi-structured interview schedule. This interview schedule comprised questions that encouraged participants to recall their experiences of videogame use and reflect on their relationship with their avatar. In particular, to probe these user-avatar experiences, the interview schedule used a number of questions found in the Self-Presence Questionnaire (SPQ; Ratan & Hasler, 2009). The SPQ explores the extent to which individuals experience a sense of self-presence within videogames and through their avatar to provide a numeric score to represent the user-avatar relationship, with self-presence referring to the extent to which an individual feels extended into or represented within a virtual world and synchronised with their avatar (Ratan & Hasler, 2009). An example of a question used in the SPQ was *"When playing the game, how much do you feel like your avatar is an extension of your body within the game?"* In addition, a key aim of the study was to specifically investigate the experiences of the PE in the context of videogames, and a number of questions included in the schedule asked participants to discuss and reflect on whether time spent controlling an avatar influenced their attitudes or behaviour during or after videogame use.

An example of a PE questions used in the study was *"Does your avatar ever affect your behaviour inside the game?"*

Ethics

Approval for the study was provided by the researcher's university ethics committee and the study adhered to the Helsinki Declaration guidelines. Each participant provided both verbal and written consent to be involved in the study, with all appropriate supplementary materials being provided by the researchers (e.g., participant information sheets, consent forms, debriefing sheets). Included with this information were: aims of the research; how the data would be used; contact information for the researchers; guidance on how to obtain support or help post-interview; and the participants' rights, including their right to withdraw their data and the procedure for doing so. Each participant was provided with a pseudonym, and all other identifiable information (e.g., locations, names of relatives) in the transcripts were appropriately changed in order to protect the participants' identities and ensure their anonymity.

Data analysis

The data collected in the present study were analysed using thematic analysis, an approach that can be used to explore the experiences and perspectives of individuals within and across rich datasets. Thematic analysis was selected because it provides a highly flexible method of analysing qualitative data in terms of both practicality (i.e., sample size, data collection method, research question) as well as theoretical frameworks (Clarke & Braun, 2017), and allows summation of qualitative data in the form of themes that highlight individuals' lived experiences.

In particular, the present study was guided by a constructionist epistemology which recognises the importance of both repeated occurrence of a theme alongside the meaningfulness of the theme from the standpoint of the participant as well as the researcher and the research aims. In addition, this present study's data are analysed with a combination of both a deductive theory-driven approach as well as an inductive data-driven approach, as is often found in thematic analysis studies (Byrne, 2021). More specifically, although this study predominantly employed an inductive approach to analysis through the use of open-coding and attaching weight to individual participant and data meaning, deductive analysis was also used to align data and themes to the research aims of the study.

Analysis of the data was guided by the six-phase approach to thematic analysis detailed by Braun and Clark (2012). After data collection, the first phase of thematic analysis involved the first author reading through the interview transcripts several times in order to become familiar with the data as well as making initial notes on the data. The second phase involved generating initial codes from the datasets in order to identify and provide a label for any parts of the data that appear to be relevant to the research question of the study, and occurred at both a semantic and latent level. In particular, content was initially considered at a descriptive surface level as communicated by the participants as a precursor to more interpretative analysis that explores the deeper meaning of the data content and guided by the researcher's active role in analysis and interpretation of data. The third phase involved developing initial themes, and this was achieved by looking for areas of overlap and patterns in the codes. More specifically, codes were examined across datasets to explore where and how they may be clustered before organising these into themes that encapsulated an overarching broader topic relevant to the research questions. Finally, the themes identified in the third phase were organised into a thematic table outlining these themes in preparation for the fourth phase and to aid in viewing how these themes related to the overall data and any connections between themes. The fourth phase involved reviewing these identified themes in the context of the other potential themes, the overall data set and research questions as well as individual codes. In particular, progressing through the fourth phase resulted in some themes either being collapsed or split into sub-themes based on how they connected with the other themes and overall narrative presented through the data sets. Following on from this, the fifth phase involved defining and naming the themes. In more detail, the first author reviewed and defined the identified themes to ensure they were focused, relevant to the research questions and overall narrative of the data without repetition and substantial overlap between themes, as well as providing a cohesive and clear story representative of the data. Finally, the sixth phase involved the production and writing up of the study.

As a final note, it is worth briefly discussing the positionality and experiences of the authors as this necessarily influenced this study from initial conceptualisation through to data collection and analysis. All authors were actively involved in videogame research at the time of writing, and all four authors have varying levels of personal experience with playing videogames. These academic, professional, and personal experiences meant that researcher engagement with the data occurred at a more meaningful and deeper level, and guided later interpretation and synthesis with prior theory and literature.

Results and preliminary discussion

Five main themes were identified through analysis of the interview transcripts, as well as several sub-themes. These comprised: (i) ‘heterogeneity of game worlds’: (ii) ‘avatar attachment’; (iii) ‘game experiences affecting physical world behaviour and attitudes’; (iv) ‘types of self in a virtual world’ (with the sub-themes of ‘actual self’, ‘idealised self’, and ‘utopian self’); and (v) ‘game difficulty affecting user-avatar relationship’. These themes, their frequency and details of contributing participants are summarised in Table 2.

Table 2. Theme details

Theme	Number of supporting extracts	Participants supporting the theme
Heterogeneity of game worlds	28	P1, P2, P3, P7, P9, P10, P11, P12
Avatar attachment	22	P1, P2, P3, P4, P5, P7, P8, P9, P10, P11, P12
Game experiences affecting physical world behaviour and attitudes	23	P4, P5, P6, P7, P8, P9, P10, P11, P12
Types of self in a virtual world sub-theme: Actual self	13	P1, P3, P4, P5, P6, P10
Types of self in a virtual world sub-theme: Ideal self	27	P1, P4, P6, P7, P8, P10, P11, P12
Types of self in a virtual world sub-theme: Utopian self	6	P7, P8, P9, P12
Game difficulty affecting user-avatar relationship	17	P1, P2, P3, P5, P8, P9, P10, P11, P12

Theme 1: Heterogeneity of game worlds

The first theme identified from analysis of the interview data relates to the heterogeneity of videogame worlds, and how different game worlds can lead to notable differences in how gamers connect with their avatar and the degree of immersion they experience while playing videogames. This is highlighted in the following extract:

Extract 1: "*I think it depends on the game. It depends on the exact sort of part of the game*" (P10).

The participants detailed a number of factors that could affect how immersed they felt within the game world and the connection they experienced with their videogame avatars. Among these factors were the gameplay mechanic of in-game consequences of player actions, as detailed in the following extract:

Extract 2: "*Consequences for your actions-my actions is an important thing…It feels like the decisions I'm making matter and have a real effect on both the world I'm playing a game in and also the avatar itself, like the decisions I make as the avatar affect what happens to them*" (P9).

This extract shows that the incorporation of some form of observable reaction to the players' actions, be it through changes to the avatar or even the game world itself, are seen as an important element of videogames, and the inclusion of this mechanic can improve the level of immersion and attachment to an avatar experienced by gamers. More specifically, this extract indicates that videogames that attach weight and consequence to the decisions made by the player's character through the use of a dynamic game world that adapts to these in-game choices provides a more meaningful experience for the individual than games that do not include this mechanic. However, this is not the case for all videogames, and even seemingly similar videogames from the same franchise can provide very different experiences as highlighted by the following extract:

Extract 3: "*I think for [Fallout] New Vegas I was just more invested in the mechanics of the game and like trying to do well in it because it was more captivating, in Fallout 4 I just very much took the route of 'let's see how much fun I can have with this', and eventually when I went to go and do like the main story it started feeling like a slog…it felt like they had gutted a lot of the cool systems that they had in New Vegas because they went back to the Fallout 3 way of doing things*" (P3).

This extract shows that even in a series of videogames with very similar game mechanics, minor differences in the implementation of these in-game systems and mechanics can have a significant impact on the experience of the gamer. In particular, although the videogames *Fallout 3*, *Fallout: New Vegas* and *Fallout 4* (i.e., all post-apocalypse action role-playing games) contain some variations between titles (e.g., new gameplay mechanics and improved graphical fidelity with newer releases), the similarities between these games arguably far outweigh the differences. This suggests that viewing videogames homogenously can be problematic as even videogames within the same franchise can invoke notably different reactions in regard to player enjoyment and desire to play, and consequently factors such as immersion, sense of presence within the game world and avatar relationship strength. Furthermore, an additional aspect that can affect game experiences and an individual's relationship with their avatar relates to player input in the form of videogame controls, as highlighted in the following extract:

Extract 4: *"I suppose also in some ways, how the game controls as well, sort of how natural it feels to control this avatar and be this person. If it feels very disjointed and doesn't quite do what you want, it can really bring me out of it"* (P9).

Extract 4 shows that how an individual controls their in-game avatar can affect the degree of immersion they experience while playing a videogame. More specifically, this highlights how factors such as controller input and responsiveness can have a notable impact on an individual's experience within a videogame world, and thereby affecting elements relating to the development of a user-avatar relationship, such as immersion. This again shows that viewing even relatively similar videogames as homogenous may not be appropriate, and that elements of videogame design ranging from in-game systems that track and respond to player decision-making to controller input can have significant effects on factors such as immersion as well as the user-avatar relationship.

Theme 2. Avatar attachment

The next theme identified from the data relates to the process of a gamer developing a sense of attachment to their avatar. Although videogames often share a number of similarities in terms of content with other forms of media, such as films and books, a key separating and distinguishing feature relates to the interactivity inherent in videogames (Bowman et al., 2012). Gamers are often given substantial control over their avatars in a number of ways

which can help develop a sense of attachment between a user and their character, including customisation options, and this is highlighted in the following extract:

Extract 5: *"It's fun to customise them. It's fun to make them look cool…like how you want them to look, and you do begin to form a bit of an emotional connection"* (P3).

In Extract 5, the participant discusses their interactions with their avatar through character customisation. More specifically, the participant details the pleasure and enjoyment they gain from designing an avatar that visually displays characteristics the participant considers "*cool*" as well as having the control to craft a character in the manner they desire. The participant expands on this point, and suggests that through this character design process, they form an emotional connection to their avatar. Through this character customisation, it appears the participant developed a sense of connection and attachment to their avatar. Customisation of an avatar can be instrumental in users becoming immersed in a virtual world and developing a connection and/or an individual identifying with their avatar (Birk et al., 2016; Mohd-Tuan et al., 2017), and this is further highlighted in the following extract:

Extract 6: *"Yeah definitely, a character you've created. You must be attached to it because it reflects you, just in the virtual world"* (P5).

In Extract 6, the participant stated that they felt a sense of attachment to their avatar, and that this was because the avatar reflected the participant within the virtual world. In particular, the participant described how designing an avatar created not only a sense of ownership over the avatar, but in being afforded the opportunity to customise their appearance, the participant created a representation of themselves within the virtual world. Extract 6 suggests that character customisation may allow the relationship between a user and their avatar to transcend beyond merely that of an individual using a tool to navigate a virtual world, but instead allows the user to insert themselves within the virtual world by virtue of this deepened user-avatar relationship structure. Through this, a greater sense of attachment to an avatar can develop.

Theme 3: Game experiences affecting physical world behaviour and attitudes

The next theme identified from the data concerns experiences within a videogame affecting the player in the physical world. More specifically, this theme is concerned with how controlling an avatar can lead to changes in behaviour or attitudes outside of the videogame. While it is clear that the user can influence their avatar within a videogame, this relationship

can work both ways and an avatar can likewise influence the gamer. This is highlighted in the following extract:

Extract 7: *"So sometimes the avatar has a very tasty hairstyle. So because it is in the virtual world I try to bring it in the real world, so you kind of go to the barber shop and you just run that hairstyle, yeah. And two, take for example the clothing styles, sometimes the clothes are just nice and decent, so you just try to go out and pick some just to try an imitate the avatar"* (P5).

In Extract 7, the participant describes how playing as their videogame avatar can influence their physical world behaviour. In particular, the participant discusses how controlling an avatar with a desirable or "*tasty*" hairstyle can lead to them trying to bring this out of the virtual world and attempting to replicate this in a physical world hair salon. Furthermore, this is a behaviour that is not restricted to hairstyling, and the participant also discusses how seeing their avatar in particular clothes can then lead to them attempting to imitate that look in the physical world.

This behaviour pattern may be interpreted in one of two ways. Firstly, mimicking the appearance of a virtual world avatar in the physical world in the manner described by this participant may be viewed as the avatar purposely being used as a template or model on which the user can try out different looks to find something they like before then replicating this in the physical world. Alternatively, the user may have chosen these customisation options for their avatar solely because they felt it looked good on the avatar while playing the videogame, and that the desire to mimic this occurs later after controlling their avatar for some period of time. While these two explanations may appear similar, the key difference relates to intention: either the participant knowingly chose to use their avatar as a model for clothing and hairstyle, or the participant was influenced by their avatar to replicate their appearance. While it is unclear from this extract alone which of these reasons caused the behaviour, the direction of this behaviour pattern is illustrated more clearly in the following extract:

Extract 8: *"I think the primary example would be like I found out stuff in real life I like. So, for example, I've been really into astrology and herbal-well botany. I occasionally read science texts about plants, like harvest seasons, crop circles. All that stuff wouldn't have come naturally to me if I hadn't taken that interest in playing as this avatar"* (P8).

In Extract 8, the participant discusses how controlling a videogame avatar has led to changes in their physical world behaviour. More specifically, the participant details how they have previously played as an avatar that engaged in in-game activities relating to botany and astrology, and that this then influenced them to exploring these subjects in the physical world. On the surface, and similar to the previous extract concerning hairstyling and clothes, this may simply appear to be drawing inspiration from behaviours and appearance exhibited by an avatar and replicating this in the physical world. However, arguably, this may be considered as a potential consequence of the PE.

The PE suggests that individuals make observations about their avatar based on appearance and other observable cues, and this will then influence the gamer's behaviour and attitudes either within the game world or in the physical world after they have finished playing the game (Yee & Bailenson, 2007). In these described cases, it may be interpreted that the participants viewed observable characteristics of their avatar (e.g., a scholar of botany or wearing particular clothes) and then after playing as these avatars, the participants were influenced into replicating this behaviour (e.g., learning about botany or buying particular clothes).

While these links to the PE are somewhat tenuous, it does nevertheless potentially indicate an interesting aspect of the user-avatar relationship in videogames. In particular, these described cases of being influenced by an avatar and then imitating this behaviour in the physical world signals that relatively minor aspects of videogames, such as clothing customisation and in-game activities, can lead to observable and notable changes to an individual's physical world behaviour. However, in addition to avatar-influenced physical world behaviour changes relating to the PE, extended avatar use can also lead to perceptual changes in the physical world caused by associations between physical world stimuli and videogame experiences in a process referred to as Game Transfer Phenomenon (GTP; Ortiz de Gortari et al., 2011). This is highlighted in the following extract:

Extract 9: *"There are times in games after I've just been foraging for stuff and I'll be going out down to town and I'll be looking in trees for birds' eggs and stuff like that"* (P7).

In Extract 9, the participant discusses how after playing particular types of videogames that involved elements relating to the gathering of materials in order to meet in-game objectives, they experienced an altered sense of perception relating to physical world stimuli. More specifically, the participant detailed that their experiences within the videogame continued

into the physical world, and led to automatic thoughts relating to carrying out the same behaviours that they would in the virtual world. In this case, the participant began to see physical world trees within the context of the videogame world, namely that these trees may have presented an opportunity to gather relevant materials for their virtual character.

The experiences described by the participant in this extract appear to align with GTP (Ortiz de Gortari et al., 2011). GTP refers to the transfer of videogame experiences into the physical world typically after intensive use, and may include: auditory, tactile, and visual hallucinations; dissociative experiences; automatic thoughts or actions; altered perceptions of physical world stimuli; and changes to behaviour (Ortiz de Gortari et al., 2016; Ortiz de Gortari & Diseth, 2022). More specifically, GTP occurs when an individual is exposed to a videogame virtual setting and begins to experience involuntary disruption or changes to their senses, thoughts and behaviours that permeate from the videogame. For example, an instance of GTP occurring may be when an individual sees images from a videogame when blinking or trying to fall asleep. These identified effects of GTP are characterised as involuntary or non-volitional, and the likelihood of experiencing this phenomenon is positively associated with greater length of exposure to a videogame (Ortiz de Gortari & Diseth, 2022). Furthermore, GTP is mostly considered a positive experience by individuals, and may occasionally be purposely induced for relaxation purposes, although it should be noted that this phenomenon may induce distress in some individuals particularly in regard to dissociative experiences (Ortiz de Gortari & Diseth, 2022).

Based on the above extract, the participant appears to be demonstrating elements relating to GTP, namely through their automatic thoughts and altered perceptions of physical world stimuli (i.e., trees as a source of in-game material gathering). In particular, the participant described how their experiences in the physical world were altered and influenced by their videogame experiences. In the example of P7, through GTP, the participant appeared to show convergence or even harmonisation with their virtual character and assimilation of videogame objectives to physical world experiences. This extract, alongside those previously discussed, indicates that the avatar can be a powerful force in affecting physical world attitudes and behaviour, ranging from influencing an individual's physical world appearance and interests to altering perceptions of everyday stimuli.

Theme 4: Types of self in virtual world

Another important element to the user-avatar relationship related to how an individual designed their virtual world character. Avatar customisation and the degree of similarity between character and player appeared to vary significantly between different interview participants, as did the motives underlying these decisions. In particular, these different ways of customising an avatar are considered from the perspective of self-discrepancy theory (Higgins, 1987), a framework that is often used in exploring the user-avatar relationship in videogames (Szolin et al., 2022a), and are divided into the subthemes of (i) actual-self, (ii) idealised-self, and (iii) utopian-self.

Subtheme 4.1: Actual self

Firstly, the subtheme of 'actual self' relates to how an individual may design their videogame character to visually appear as similar to the physical self of the gamer as possible, using the actual-self of the gamer as a template when choosing the appearance of the avatar. This design choice is highlighted in the following extract:

Extract 10: *"For my character, first of all I go with mostly I do like a virtual appearance of me, -I'm not a big bodied person so I'll go with something with a small body. Then with the type of hair I like to choose a hairstyle that is similar to mine, and clothes like the clothes I like are sneakers and t-shirts and trousers. So mostly I do choose the appearance of the character according to how I do in real life"* (P4).

In Extract 10, the participant discusses how they make avatar-related design choices based on their own physical world appearance. More specifically, the participant considered themselves as "*not a big bodied person"*, and so purposely chose to create an avatar that was of a smaller stature to align with their actual self outside of the virtual world. Furthermore, and of particular note, the participant not only selected parallel anatomical aspects such as body build or height, but also made design choices aimed at mirroring their external and controllable appearance such as haircut and clothing preference. This indicates that for this participant, the crux of similarity between themselves and their avatar does not end with physical world anatomical comparisons, but also includes elements of their personality and identity expressed through aspects such as clothing and haircut preferences. Clearly, designing an avatar that is representative of their physical world actual-self was important to some participants, and the reasons for this are explored in the following extract:

Extract 11: "*For me you can alter the appearance, so I want to experience that feeling that you're in the virtual world, so making the avatar looking close to my appearance is very special because I can see myself in the virtual world. So yeah, it's fun"* (P6).

In Extract 11, the participant discusses why they chose to design their virtual world avatar to align with their physical world actual-self. In particular, the participant detailed that designing an avatar to look as similar to themselves as possible provided a sense of presence in the virtual world, and that having that feeling of personally being in the videogame world was something the participant actively strived for because it forms an important part of their enjoyment of the gaming experience.

Designing an avatar to resemble a gamer's physical world actual-self is not the most common form of avatar design, with this usually being based on the idealised-self (Sibilla & Mancini, 2018). Furthermore, the tendency for using this particular form of avatar is highlighted in Table 2, where the most commonly described form of self-representation through an avatar is the ideal-self. However, research has indicated that controlling a character based on the gamer's self-representation can be related to increasing an individual's sense of presence in a videogame and avatar embodiment (Gorisse et al., 2019). Furthermore, it has been posited that this choice of character design can reflect the gamer's attitudes towards the virtual world. More specifically, research suggests that gamers who control an avatar that is similar to their physical world self may view the virtual world as an extension of the physical world rather than distinctly separate (Costello, 2012; Parmentier & Rolland, 2009). This means that gamers who design an avatar to reflect their actual-self in the physical world may choose to do this in order to gain a greater sense of presence in the virtual world, and this forms a part of their enjoyment of playing videogames. In addition, designing an avatar in this manner may also reveal how a gamer views the virtual world in relation to the physical world, and may consider each to be an extension of the other.

Subtheme 4.2: Idealised self

The next subtheme concerning types of self in the virtual world related to the idealised self. The idealised self in the context of avatar creation refers to designing a virtual world character that reflects how the user would ideally like to be, and this is highlighted in the following extract:

Extract 12: *"Because my avatar is, like I say, an improved me, how I always dream of looking. So, I can say that I have this feeling that I wish I could be like my avatar. I don't know if it's emotional or something like that"* (P6).

In Extract 12, the participant describes their avatar as an improved version of themselves, and visually appears as possessing features and qualities that the participant would like to have. Furthermore, the participant expands on this feeling of the avatar being an improved version of themselves by stating that they wish they could be like their avatar.

Self-discrepancy theory (Higgins, 1987) posits that individuals experience distress when their actual and ideal selves differ greatly from each other, and that individuals are motivated to close this distance between the different versions of the self in order to reduce this discomfort. In the context of videogames, designing an avatar to be an idealised version of one's self provides a relatively easy way to achieve parity between an individual's actual and ideal self. More specifically, creating and customising an avatar in a virtual world is a quick and relatively simple process, whereas addressing one's perceived physical world inadequacies related to their actual self in order to close the distance to their ideal self requires substantially more time and effort. Therefore, videogames can be seen as providing a means for a gamer to create a virtual version of their self that conforms to their vision of an idealised self that would be difficult to accomplish in the physical world. This idea of using a videogame avatar as a means of becoming closer to one's idea of an idealised self is further highlighted in the following extract:

Extract 13: *"I think a lot of it was just like for me a lot of the MMORPG (Massively Multiplayer Role-Playing Game) experience was like, for my pattern at least with it, was like making these characters were just like the idea of who I wanted to be…So basically being able to like get closer to that ideal than I am in real life"* (P1).

In this extract, the participant discusses how a key motivation for playing online videogames was to create a character that represented who they wanted to be in the physical world. The participant elaborated on this point, and detailed that their incentive for this behaviour was to "*get closer to that ideal than I am in real life".* This extract aligns with the previously discussed self-discrepancy theory explanation for creating an idealised self-avatar, and suggests that gamers may create avatars in this manner as a means of closing the distance between their actual and idealised selves.

Furthermore, research has indicated an association between using an idealised avatar and factors such as depression and low self-esteem (Bessière et al., 2007: Sibilla & Mancini, 2018). This may mean that individuals who demonstrate some form of distress occurring as a result of the discrepancy between their ideal and actual selves in the physical world, such as depression or low self-esteem, may choose to create an avatar in a videogame to represent their ideal self as a means of addressing these negative feelings. In this way, videogames can be seen as providing an easily accessible virtual world that is free from the constraints of the physical world, and allow individuals to explore a version of their idealised self. However, beyond issues relating to depression and low self-esteem, idealised avatar creation can also be used as a means of addressing issues such as gender dysphoria, and this is discussed in the following extract:

Extract 14: *"So myself, I'm part of the transgender community in way, not the typical way, so for me a lot of videogame customisation is often about kind of representing what you wished you looked like in a way"* (P11).

In Extract 14, the participant describes how customising a character in a videogame provides a way for them to create an image of how they would ideally like to appear as in the physical world, and that their transgender identity may contribute to this form of avatar design choice. In particular, this extract indicates that the participant feels that videogames provide a means for transgender, gender diverse or gender-questioning individuals to create a virtual representation of how they wished they could be in terms of appearance through creation of their avatar, and that this may be seen as a form of gender exploration in a virtual world.

Previous research has indicated that videogames can provide a relatively safe environment for individuals to test out and explore their gender identity (Griffiths et al., 2016; Hussain & Griffiths, 2008; Morgan et al., 2020), and that using videogames can have therapeutic benefits for this community (Arcelus et al., 2017; Strauss et al., 2017). Potentially, an element of these therapeutic benefits may relate to self-discrepancy theory (Higgins, 1987), and that videogames provide a means for transgender, gender diverse or gender-questioning individuals to obtain a degree of parity between their actual and ideal selves through avatar creation and customisation. More specifically, transgender, gender diverse or gender-questioning individuals may not only design their videogame avatar as a means of exploring their gender identity before coming out in the physical world (Morgan et al., 2020), but may also use their avatar as a template to design and virtually inhabit their vision of their ideal self

and thereby reduce the distress that occurs through the discrepancy between their actual and ideal selves.

Subtheme 4.3: Utopian self

The final sub-theme relating to types of self in the virtual world concerns 'utopian avatars'. Utopian avatars are described as substantially transformed versions of the user, and possessing attributes that are not possible to acquire in the physical world (Mancini et al., 2019: Sibilla & Mancini, 2018). For example, avatars based on an individual's idealised self may include changes relating to an individual's desire for greater muscle mass or lower body weight. A utopian avatar may be based on an individual's desire to appear as a fantasy race such as an elf. This desire to create an avatar that takes on the qualities of a fantasy race is highlighted in the following extract:

Extract 15: *"Not necessarily a human, I've always went for elf…I don't know why. Maybe it's because I look good in elf ears, but I don't know. I've always felt that to be a bit more accurate"* (P12).

In Extract 15, the participant discusses the appearance of their avatar. In particular, the participant notes how they have a tendency to select elves as the race for their avatar, and that this is due to the physical attributes of elves, such as their ears (e.g., long and pointed), as being more desirable and looking better than human ears. Furthermore, the participant expands on this point and details that the look of elves feels more accurate to them than a human appearance. This appears to mirror the process and motivations relating to idealised self-avatar creation in which an individual creates an avatar to align with their idea of their idealised self, although in this case, encompassing attributes that extend beyond the realm of possibility in the physical world. This point of creating a utopian avatar is further discussed in the following extract:

Extract 16: *"I think it's somewhere between my ideals and something completely separate because it's a cat girl. You can't exactly create those in real life so it's somewhere between an ideal as in ideally what looks like every day and something completely separate"* (P8).

In Extract 16, the participant describes their avatar as a "*cat girl*", and that this avatar contains elements of both the fantasy world and physical world. More specifically, the participant acknowledges that a "*cat girl*" neither conforms to what is achievable in the physical world, nor is this creation pure fantasy. Instead, this avatar contains idealised

attributes that are present in the physical world and then extended beyond this into the world of fantasy to incorporate elements of both. In doing so, the participant has created a virtual representation of themselves that is both an idealised self and a utopian self.

The extant literature often describes utopian avatars as being separate from idealised self-avatars and should be unaffected by factors such self-discrepancy theory due to this distance between versions of the self (Mancini et al., 2019). More specifically, an idealised avatar considers how a person wishes to be, whereas a utopian avatar possesses characteristics that the user could not have in the physical world (Mancini et al., 2019). However, Szolin et al. (2022a) discuss how this may not be an accurate way of viewing utopian avatars. More specifically, Szolin et al. (2022a) suggest that in the context of videogames, utopian avatars and idealised avatars may functionally be the same, and that an individual's idea of their ideal self does not necessarily have to conform to what is achievable purely in the physical world, but can contain elements of the fantasy world. With this in mind, the functions and motivations of using a utopian avatar may be largely similar, if not directly analogous, to idealised avatar use in the context of videogames.

Theme 5: Game difficulty affecting user-avatar relationship

The final theme identified relates to how the difficulty or challenge of a particular videogame can affect the degree to which the participants' felt immersed and connected to either the virtual world or their videogame avatars. This feeling of connection is highlighted in the following extract:

Extract 17: "*In Dark Souls you make a character and because those games are so hard you really kind of get used to every action being very natural, just like an extension of yourself, because it kind of needs to be. You need to make a lot of very quick decisions or be punished severely for it*" (P9).

In Extract 17, the participant makes reference to the videogame *Dark Souls* (i.e., an action fantasy role-playing game), a franchise notorious for its high level of difficulty and punishing gameplay. However, rather than seeing this as negatively affecting enjoyment of this game, the participant considers this high level of difficulty as instrumental in their avatar being seen as an extension of themselves and subsequent feeling of presence within that virtual world. This feeling of presence within a virtual world is further highlighted in the following extract:

Extract 18: "*I think that's the biggest thing going into like Fallout: New Vegas. Made a character, uses guns, except I got the stats wrong so I can't use guns that well. They wobble a lot and my accuracy is down, which means I have to myself physically aim really well and try really hard and I think that that does actually feel like it's me because I am having to pay so much attention to my movements and things*" (P10).

Extract 18 details how the participant experiences a sense of embodiment with their avatar due to the difficulty of the gameplay mechanics relating to aiming and firing a gun in a virtual world. More specifically, the participant indicates that their avatar feels like an extension of themselves because they need to concentrate in order to perform gameplay tasks, and the difficulty they experience increases their sense of presence and connection to their virtual world avatar. This participant further elaborates on this point in the following extract:

Extract 19: "*It's definitely you do feel that kind of I am the character, the character is me, the character is very bad at shooting people*" (P10).

In Extract 19, the participant emphasises the merging of the physical world player with the virtual world avatar, leading to a strong sense of presence within the game world. Of note, the participant describes their poor in-game gunplay from the position of the character, detailing that the character is bad at this task. This complements the previous extract where the discussion of skill is described from the position of the player, and when both extracts are taken together, they show the amalgamation of these two entities within the virtual world. More specifically, neither the character nor the player is seen as singularly at fault for the poor marksmanship and gun control, but rather the responsibility lies with both due to the integration of these two entities. Furthermore, in addition to affecting feelings of presence within a virtual world, advanced game difficulty can also lead to stronger emotional ties between the player and their avatar, as shown by the following extract:

Extract 20: "*In a game like Skyrim it can be a bit of a pain in the arse if you're on 'regular'. If you're on 'survival' it can be absolutely heart breaking because it's just gone and that's it*" (P12).

In Extract 20, the participant details their experiences of losing game progress through the death of their character in different game modes (i.e., 'regular' and 'survival') in the videogame *The Elder Scrolls V: Skyrim* (i.e., a fantasy role-playing game). The participant discusses how dying in the videogame is considered an annoyance in a 'regular' mode, but during 'survival' mode (i.e., an option to add various realistic gameplay mechanics such as

requiring regular food, warmth and, in this case, permanent death) losing progress becomes much more emotionally charged because of the higher stakes involved. More specifically, the participant describes the experience of losing a character in this mode as "*heart breaking*", which indicates that the level of emotional connection the participant has for their avatar is notable, and seemingly deriving from the fragility of their avatar brought about by the game difficulty. This suggests that playing a videogame that imposes higher stakes through advanced difficulty options, such as permanent death, facilitates the development of stronger and more meaningful emotional ties between the player and their virtual world avatar.

Discussion

The present study was designed to explore the components of the user-avatar relationship in videogames, with a particular focus on the Proteus Effect (PE). Through the use of thematic analysis, a total of five major themes were identified from the interview data that were pertinent to either the features of the user-avatar relationship or factors that influenced this bond that occurs between gamers and their characters. These five themes comprised: (i) 'heterogeneity of game worlds'; (ii) 'avatar attachment'; (iii) 'game experiences affecting physical world behaviour and attitudes'; (iv) 'types of self in a virtual world' (with the sub-themes of 'actual self', 'idealised self', and 'utopian self'); and (v) 'game difficulty affecting user-avatar relationship'.

Types of self in a virtual world and avatar attachment

In terms of the user-avatar relationship, one of the key distinguishing features of using a virtual world avatar was the ability of gamers to insert a version of themselves into the game world. However, instead of serving a single purpose, the gamers involved in the present study used their avatars in a myriad of ways depending on how they chose to customise their characters. For example, some participants chose to base their game characters on a realistic version of their physical world self. The participants that customised their avatar in this manner indicated that this was to facilitate a sense of presence within the virtual world, and that seeing themselves through their avatar helped to increase their enjoyment of the game.

Other participants instead chose to base the appearance of their game avatars on an idealised version of their physical world self, selecting attributes and characteristics that represented how they wished they could appear as in the physical world. The participants who created idealised avatars discussed how designing a character in this manner provided a means to

attain physical characteristics that they wished they could have and close the distance between their actual appearance and desired appearance, albeit in a virtual world context. This form of avatar customisation suggests that a videogame world can provide individuals with an opportunity to inhabit a body that represents how they would ideally like to appear, but are unable to in the physical world, thereby demonstrating a sense of freedom and control over one's self that is not present, or at least as easily obtainable, in the physical world.

Finally, some participants involved in the present study expanded on idealised avatars and created avatars that contained features that are impossible to obtain in the physical world, a process referred to as utopian avatar creation. More specifically, these utopian avatars contained elements of fantasy, such as elf ears or human-animal hybrids. Interestingly, the participants indicated that despite containing elements of impossible fantasy, these utopian avatars nevertheless represented how they wanted to appear. As discussed in previous research (Szolin et al., 2022a), this desire of participants to have characteristics and physical attributes of impossible fantasy races may be indicative of an overlap between utopian and idealised avatars that occurs exclusively within virtual worlds. More specifically, it may be posited that utopian and idealised self-avatars are in fact functionally the same thing in so far as they both represent how an individual ideally wishes to appear, with the only distinction being that the features of a utopian avatar only naturally exist within the game world.

However, it should also be stated that various forms of cosmetic surgery exist that allow physical world humans to alter their appearance to align closer with creatures traditionally found in fantasy, such as the previously discussed elf ears found in Extract 15. However, while this ability to cosmetically mimic specific characteristics of fantasy races is true in some cases, such as humanoid elves, the extent to which this is possible varies based on how divergent the fantasy race is to physical world humans, although arguably this gap is closing as medical and cosmetic sciences advance. This means that the separation between utopian and idealised avatars is increasingly feeble, and that not only can an individual use the virtual world of videogames to inhabit a body with elements of fantasy, but this is also becoming a possibility within the physical world. Furthermore, this highlights how the avatar can be used as a form of testing ground for changes to an individual's appearance in the physical world, and that a gamer can use their experiences of controlling a videogame character as a means to try out a new look before implementing this in the physical world through cosmetic surgery to mimic a fantasy race.

In addition to providing an opportunity to insert a version of one's self into the virtual world, the findings also indicated that avatar customisation is a key element in avatar attachment. More specifically, the participants involved in the present study indicated that having the opportunity to design and customise their own avatar provided a sense of enjoyment, but also gave participants a feeling of emotional connection and ownership over their characters. Through this, participants viewed their avatars as more than simply tools used to navigate a game world, and became strongly attached to the characters that they created.

Heterogeneity of game worlds and gameplay difficulty

Next, in terms of elements that affected the user-avatar relationship were the two themes of heterogeneity of game worlds and game difficulty affecting user-avatar relationship. Firstly, the participants involved in the study frequently discussed how specific elements of videogames can affect their sense of immersion, enjoyment, and connection to their characters. For example, some participants noted how having consequences to their avatar's action increased their sense of presence and immersion within the game. In addition, several participants also discussed the importance of controller input as a factor that affected their enjoyment and involvement in a game, with several participants indicating that fluid and natural-feeling controls increased their sense of connection to their avatar, whereas disjointed controls negatively impacted their immersion within the virtual world.

Related to these points concerning game mechanics affecting immersion and the user-avatar relationship were the consistent comparisons made by the participants regarding the differences between various videogame worlds. More specifically, most of the participants in the present study frequently discussed how videogame worlds were not homogenous and their experiences could differ substantially between different game titles. Moreover, several participants stated how even games created by the same game developer and, from a cursory glance, appear functionally very similar or even from within the same franchise may in fact offer entirely different experiences that affected an individual's relationship with their avatar.

While the association between videogame immersion and elements of gameplay such as controller input, graphical fidelity, and other factors have been highlighted by previous research (Gorisse et al., 2019), the question of how videogame worlds differ in terms of the effects on the user-avatar relationship is less well understood. Based on the interview data collected in the present study, it appears that participants' experiences in regard to their immersion, sense of presence, and connection to their avatar varied greatly between different

videogame genres or worlds, even those that are seemingly very similar. However, research into the user-avatar relationship in the context of videogames rarely acknowledges this lack of heterogeneity in regard to research findings (Szolin et al., 2022b), when in fact this may be a crucial consideration in regard to both research design and applicability of research findings in this field of study.

In addition, and related to the point on heterogeneity of videogame worlds, was the theme of how videogame difficulty could also affect the participant's user-avatar relationship. Similar to the research by Petralito et al. (2017), the participants in the present study discussed how high stakes (such as a character's permanent death) and advanced game difficulty facilitated greater in-game sense of presence and connection to their avatars. More specifically, participants described how greater game difficulty and mechanics meant that they concentrated more on their character and controls, and this in turn helped to create a stronger sense of presence within the game world through their avatar. This links well with the previously discussed theme of heterogeneity of videogame worlds, and how differences found within particular videogames (i.e., gameplay difficulty, permanent death) can lead to different player experiences and consequently affect the strength of the user-avatar relationship.

Game experiences affecting physical world behaviours and attitudes

The final theme identified through the interview data relates to game experiences affecting physical world behaviour and attitudes. Many of the participants discussed how exposure to their avatar through gameplay often influenced them to mimic specific characteristics of the avatar in the physical world. For example, several participants described how they would attempt to imitate visual characteristics of their avatar outside of the game, including elements such as hairstyle and clothing choice. More specifically, the participants detailed how seeing their avatar with clothing apparel or physical stylistic choices that the participant considered desirable encouraged them to seek out similar clothing items in the physical world or choose to style their hair in a similar manner to their game character.

Imitating an avatar's clothing or physical characteristics in this manner may be interpreted in one of two ways. Firstly, the participants may have purposely chosen these stylistic choices for their avatar as a method of trying it out in a virtual world before attempting to copy this in the physical world, in which case the avatar may have been used as a form of virtual self-mannequin. Using an avatar and virtual worlds as a form of testing ground for personal

choices relating to appearance has been previously identified in other research, including gender-dysphoric gamers using game worlds to safely try out new gender identities (Arcelus et al., 2017; Griffiths et al., 2016). This is highlighted in Extract 14, where the participant discusses how character customisation allows members of the transgender community to create a representation of how they would like to present as in terms of their appearance, which may then act as a precursor to attempting to recreate this look in the physical world. In this sense, the avatar may be used as a form of testing ground for appearance in terms of either relatively minor stylistic choices to much more significant changes to an individual's gender identity or even adoption of characteristics associated with fantasy races such as elves. Furthermore, the ability for an individual to use their avatar as a form of virtual mannequin highlights how videogames can be seen as a free and open space for individuals to explore aspects of themselves, whether that be in terms of gender identity or merely stylistic choices of hairstyle.

Alternatively, it may be the case that these participants designed and customised their avatars without any premeditated intention to later mimic their avatars in the physical world, but were instead later influenced by their avatars after extended gameplay. This potentially signals an interesting aspect of the user-avatar relationship, namely the bi-directional nature of the bond that develops between an individual and their videogame character. More specifically, this suggests that while gamers can influence their avatar in terms of appearance through character design and customisation, it may also be the case that an avatar can in turn influence the appearance and stylistic choices of the player outside of the game.

Furthermore, it was identified through analysis of the interview data that several participants were not only influenced by their avatar into changing their physical world appearance, but were also drawn towards new behaviours as well. For example, one participant detailed how after playing as an avatar that engaged in botany and astrology as they had done so within a videogame, they became interested in these topics and pursued further knowledge of these subjects in the physical world. This further highlights the bi-directional user-avatar relationship structure, and suggests that playing as a videogame avatar can lead to notable changes to an individual's physical world appearance and behaviour. Pursuant to this aspect of the user-avatar relationship, there are a number of key and potentially highly valuable ways that this relationship dynamic can be applied to a range of topics and issues. For example, the potentially high susceptibility of individuals towards avatar influence may be used as a means of encouraging individuals into developing an interest in and pursuing

specific academic subjects, such as the previously discussed example of botany. Furthermore, the application of this bi-directional relationship dynamic may also be useful to areas such as marketing within videogames, namely through parallel consumer goods that are available in both the virtual world and the physical world.

As a final note on the theme of game experiences affecting physical world behaviour and attitudes, it was found that a small number of participants carried experiences from the perspective of their avatar into the physical world. For example, in Extract 9, the participant described how engaging in specific in-game behaviours for an extended period of time (e.g., foraging for items) led to an altered sense of perception and reaction to physical world stimuli that mirrored the behaviour of their avatar in a process that appeared to align with GTP. While the occurrence of GTP is not specific to avatar use, and can occur in videogames which do not contain virtual characters such as *Tetris* (a puzzle-block game), in this context it may reveal an interesting facet of the user-avatar relationship. More specifically, individuals who engage in a virtual world activity as their avatar may begin to see their physical world reality altered by that experience, which highlights the permeable and bi-directional relationship that occurs between a user and their avatar and how a virtual world character can influence the videogame player in the physical world through altered perceptions and reactions to stimuli.

The Proteus effect

In addition, and in regard to the original aims of the present study, it should be acknowledged that the analysis did not identify any themes explicitly relating to the occurrence of the PE. More specifically, although the study was designed to explore the user-avatar relationship in a wide and general sense, a key consideration while designing the interview schedule was to investigate how the avatar can affect the user both during and after gameplay. Although several themes were identified from the data that were related to this bi-directional relationship dynamic, the specific occurrence of the PE was not detailed by any of the participants. However, rather than potentially being seen as a limitation, another interpretation of this absence of explicit PE occurrences may in fact highlight an interesting, albeit tenuous, aspect of the PE in the context of gamers, namely the hidden and subliminal nature of the activation of this phenomenon.

More specifically, the extant research relating to the PE in the context of videogames suggests this phenomenon occurs quite frequently, with the vast majority of studies identified

some form of PE consequence (Szolin et al., 2022b). However, while the majority of the research on this topic identifies the PE occurring in various settings and with a range of individuals, none of these studies explicitly explore the extent to which the participants are aware of being influenced by their avatar in this manner. In light of this, it may be the case that the PE occurs without an individual's knowledge, and may in fact be reliant on the gamer being unaware that they are being influenced by their videogame character. While this interpretation is a tenuous conclusion to be drawn based merely on the absence of data, it does nevertheless potentially highlight an integral and as of yet unexplored aspect of the PE.

Relationship between groups and themes

As a final note, it is perhaps worth discussing a number of common trends identified in the present study regarding specific participant groups and themes. However, it must first be acknowledged that any points raised here are at best anecdotal, and should not be considered as reliable evidence for any links or relationships between participant groups and behaviours or attitudes regarding videogame use. Nevertheless, despite the tenuous nature of these points, several potentially interesting links can be made that may illuminate specific aspects of gaming and the user-avatar relationship. Firstly, avatar attachment appeared to be the most universally discussed theme among this sample of participants, and was raised by 11 out of 12 participants. This may indicate that avatar attachment and the importance of character customisation in developing a user-avatar relationship affects videogame players irrespective of membership of any specific videogame population, such as transgender gamers or individuals with GD. Furthermore, the prolificacy of the theme of avatar attachment may also be seen as highlighting that the development of a relationship between a user and their avatar, and facilitated through customisation and the sense of ownership that seemingly imparts, is a key and fundamental aspect of videogame playing for many individuals.

Secondly, it is also worth noting that there was some overlap between participants providing quotes for each of the sub-themes of relating to types of self in a virtual world, specifically the actual-self, idealised-self, and utopian-self forms of avatar customisation. More specifically, several participants have discussed more than one form of avatar creation, and that this was in fact more common than a participant discussing just one category. To explain this tendency for participants to contribute to multiple categories in this manner, it may be that these forms of self-representation should be seen as fluid rather than fixed and separate. More specifically, it may be the case that the actual-self, ideal-self, and utopian-self in the

context of videogames are on a spectrum rather than uniquely distinct, and that aspects of one form of avatar creation can permeate through to other categories.

For example, while a participant may choose to design their avatar to mostly align with a representation of their actual-self, they may also add several minor idealised-self-improvements (e.g., an alternative desired hairstyle). In this example of minor idealised-self additions to an actual-self template, it would perhaps be incorrect to now identify the avatar as being solely based on the idealised-self, and a more fluid approach to seeing the avatar as being an actual-self-avatar with elements of an idealised-self may be more appropriate. Furthermore, this fluid method of viewing categories of self-representation in videogame avatars aligns well with the previously discussed point regarding the lack of unique distinction between utopian and idealised-self-avatars, and that considering avatar creation as permeable (and on a spectrum) rather than in a purely fixed and distinct manner may be more appropriate to view this phenomenon.

Finally, a further trend identified regarding participants and their contributions to themes relates to the apparent homogeneity of gamers. In particular, despite the participants belonging to several potentially distinct groups relating to gender identity, employment status, nationality, and GD status, there does not appear to be any notable pattern or distinctiveness in their contributions to themes. This lack of discernible pattern or trend in theme contribution may indicate that lifestyle choices, experiences, and innate differences among participants may be largely irrelevant in terms of the user-avatar relationship and its components. More specifically, these apparent similarities in user-avatar experiences may point to the label or identity of videogame player as being of more relevance in terms of the user-avatar experience than individual group differences, and that individuals may develop largely similar bonds to their virtual character irrespective of membership to certain specific branches of the videogame community.

However, to temper this assertion, it should be noted that these facets of the user-avatar relationship (i.e., avatar attachment) were not assessed in terms of intensity and strength and that this anecdotal evidence consists of only a very small sample of individuals. Therefore, it may be that differences in these facets of the user-avatar relationship may appear in a quantitative study with a larger sample that specifically measures not just occurrence but also the strength of these phenomena. For example, while the majority of participants across

individual groups discussed that game difficulty affected their user-avatar relationship, this may be more pronounced among specific groups when examined in more detail.

Limitations and future research

The present study identified a number of themes that highlight the components of the user-avatar relationship in videogames. However, a number of limitations must be acknowledged in regard to the study. Firstly, a key issue relating to the methodology used is the inherent subjectivity of the role of the interviewer and interpretation of the data, and the potential for different researchers to draw alternative conclusions from the same dataset. While this subjectivity is a largely unavoidable aspect of qualitative research, it does nevertheless mean that these results are not necessarily generalisable, and should be considered as a single interpretation of the experiences from one set of gamers. However, while the subjectivity of the researcher may be considered as a limitation in terms of generalisability, this was also an important element of the coding and analysis of the study. More specifically, the experiences, positionality, and subjective interpretation of the data by the researchers was a vital part of the process that guided the coding and formation of themes alongside their unique interpretation during the analysis.

Furthermore, while a range of participants were chosen in terms of gender identity, it should also be acknowledged that this comprised a fairly small age range of emerging adults (i.e., 18 to 27 years old) and only two nationalities (British and American). In light of this, it may be useful for future research to investigate the experiences of gamers from alternative age groups as well as other nationalities.

In addition, and related to the previous point, detailed observation of the specific characteristics of the sample of participants involved in the present study may appear to be largely heterogeneous, with notable differences concerning factors such as GD status, gender identity and employment status. However, and as previously discussed, through observing trends in the data in terms of themes and contributing participants, there appeared to be little in the way of clustering of participant groupings (e.g., GD status, gender identity) and specific themes. This lack of noticeable separation in experiences of participants indicates that while these individuals can be distinguished from one another across a range of factors that initially appears to present the total sample as heterogeneous, the fact that they each identity as videogame players appears to take precedent over these differences and provides uniformity to their experiences

Moreover, a further limitation that may be identified in the present study relates to the absence of any pre-study assessment of videogame use in terms of frequency or content preference. This lack of pre-study measure ensuring homogeneity of the sample in regards to specific videogame use meant that while a range of videogames experiences were included in this study, some of the data in regard to the user-avatar relationship were not of relevance to this specific topic. For example, some of the participants indicated that the games they preferred to play featured only limited use of avatars in terms of customisation and game play mechanics (e.g., the first-person shooter *Call of Duty*) compared to games played by other participants (e.g., the action role-playing game *Fallout: New Vegas*). This meant that while the participants who favoured genres such as first-person shooters were able to discuss videogame use in general, their experiences specifically relating to avatar use, and by extension the PE, were more constrained than other participants whose typical game preference leaned towards role-playing games that inherently contain greater user control over an avatar's appearance and behaviour.

Finally, it should be noted that the participants with GD were not currently engaged in any videogame activity as a requirement of their treatment programme, and instead reflected on their experiences prior to seeking treatment for GD. This meant that, unlike the other nine participants included in this study, the participants with GD were relying on their memories of experiences of videogame use based several years prior to the interview, which may have led to some distortion in terms of their descriptions and recollections of their videogame experiences.

Nevertheless, despite these limitations, the results of the present study highlight a number of avenues for future research, in particular concerning the PE in the context of videogames. Firstly, one of the major themes discussed in the present chapter relates to the heterogeneity of videogames in regards to the development of a user-avatar relationship. More specifically, participants consistently described how experiences relating to their user-avatar relationship could alter significantly between different videogames, even those from the same franchise and development team. However, research conducted on the PE frequently uses only a small range of videogames genres and titles, with *World of Warcraft* (a fantasy MMORPG released in 2004) and sports simulation titles (e.g., *Wii Sports Resort*) on the currently largely obsolete *Nintendo Wii* videogame console (released in 2006, and known for its use of motion control technology) being amongst the most used in this research (e.g., Ratan et al., 2020; Praetorius & Görlich, 2020; Szolin et al., 2022b). Based on the experiences of the participants involved

in the present study, future research may benefit from investigating the PE in a wider range of videogame contexts as well as directly comparing the results from different videogame worlds.

In addition, and related to the point of diversity of videogames in PE research, another theme identified in the present study concerned how difficulty in a videogame can also affect the user-avatar relationship. More specifically, participants discussed how videogame difficulty and inclusion of gameplay mechanics that increased a game's challenge created a greater sense of immersion and self-presence within the virtual world as well as strengthening the bond between a user and their character. Factors such sense of presence, avatar attachment and emotional connection have been identified as key elements for the occurrence of the PE (Ratan & Dawson, 2016; Stavropoulos et al., 2020). Therefore, based on the described experiences of these participants that videogames with advanced difficulty options appear to facilitate elements conducive to the occurrence of the PE, future research may benefit from not only employing a wider range of videogame titles and genres but also specifically to focus on videogames that are considered more challenging in terms of gameplay.

Finally, a further avenue and consideration of future research on the PE relates to the previously discussed point concerning the potentially subliminal nature of this phenomenon. Previous research has indicated that the PE is not a rare occurrence, and has been recorded across a relatively large number of studies and with a range of different participant groups (Szolin et al., 2022b). However, despite the present study specifically investigating this phenomenon, no data explicitly pertaining to the PE were identified from the interview transcripts. This lack of data regarding the PE may tenuously be interpreted as indicating that the occurrence of this phenomenon is not necessarily consciously known by the individuals experiencing this process. Therefore, future research may benefit from both investigating whether the occurrence of the PE is subliminal and hidden to those experiencing this process and whether this is a necessary factor for the PE to affect individuals. Future research exploring the potentially subliminal nature of the PE will not only provide useful information that will expand the research area, but may prove invaluable in how wider PE research is conducted. In particular, the potentially subliminal nature of the PE may have significant implications in regard to any studies that employ self-report measures that assess the occurrence of this phenomenon as participants may not be aware that this process has occurred despite experiencing changes to their behaviour or attitudes in line with this process.

Conclusion

The analysis presented in the present study highlights a number of aspects of the user-avatar relationship in videogames and potential factors that affect the strength of this relationship. Participants consistently used their virtual character to insert some form of their self into the videogames, whether that be their actual self, idealised self, or utopian self. This use of the avatar as a vehicle to personally inhabit the game world was seemingly done to increase their sense of presence in the game and to allow the gamer an opportunity to realise a version of their self that more closely aligns with how they would ideally like to appear, and in some cases, this includes elements of fantasy.

In addition, participants spoke of the differences found between videogame titles and genres, how advanced difficulty and challenge could impact their relationship to their avatar, and the role character customisation had in regard to avatar customisation. Furthermore, participants also discussed how their avatar could be used as a source of influence towards their physical world behaviour, ranging from mimicking their character's hairstyle and appearance to taking an interest physical world topics and hobbies that align with their character's in-game behaviour.

Finally, and based on these identified themes, the present study highlighted a number of potential avenues for future research specifically in the context of the PE, including employing a wider range of videogame titles and genres as well as conducting research with videogames that are based on titles considered to present a greater challenge in terms of difficulty.

Chapter 5: The Proteus effect in *Fallout*: Investigating gender-conforming behaviours in videogames

Introduction

Videogames are a widely accessed and popular entertainment medium, with thousands of new titles being released each year. For example, on the digital distribution platform *Steam*, over 10,000 videogames were released in 2021 alone (Statista, 2023). These games can now be played on traditional videogame consoles and specialist PCs, as well as smartphones and tablets, with even the most graphical intensive games available to a wide audience through cloud-based gaming services (Laghari et al., 2019; Madiha et al., 2020). Part of this rising popularity of videogames and a key element in their global growth is the wide array of options and accessibility for playing videogames, with games played on smartphones and tablets now accounting for a significant proportion of the gaming market (Laghari et al., 2020).

Furthermore, and facilitated by this wide accessibility, many of the more popular videogames released can reach a global audience with large sales figures, such as *Grand Theft Auto V* (i.e., a crime focused action-adventure online game) with over 169 million copies sold (IGN, 2022). Along with the plethora of videogame content there is also a multitude of choice for any game genre, ranging from platformers (e.g., *Psychonauts)* to intricate role-playing games (e.g., *Elden Ring*) and even simulations of mundane physical world activities such as renovating a house (e.g., *House Flipper*). However, although each videogame has some form of unique game mechanic or content, a feature that is common and often intrinsic to many games, but certainly not all, is the avatar.

An avatar in the context of videogames refers to a character or digital representation of the player that an individual uses to interact with and navigate a videogame world (Lin & Wang, 2014; Nowak & Fox, 2018). Different videogames provide different levels of player input and control over their avatar, with some games limited to simply controlling when a character performs an action to other games that allow the player to determine the physical appearance, attributes, and how that character interacts with the digital world (Szolin et al., 2022a). However, although a game player always exerts some degree of influence over their avatar, whether that be customising their eye colour or simply choosing when to jump over an obstacle, this relationship dynamic can also be viewed as being bi-directional. More

specifically, although a user may influence their avatar, research suggests that the opposite may also be true and that avatars can influence the user in a phenomenon referred to as the Proteus effect (PE; Yee & Bailenson, 2007).

The Proteus effect

The PE in the context of digital avatars refers to the process where an individual may be influenced by the observed characteristics or attributes of their avatar and this can affect their behaviour and attitudes in a virtual environment (Yee & Bailenson, 2007). More specifically, it is suggested that when an individual controls an avatar, they will make specific assumptions and inferences based on available identity cues, and that this will then lead to the user attempting to mimic and align their virtual world behaviour and attitudes to correspond with their avatar. For example, Yee and Bailenson (2007) found evidence to suggest that individuals who control an avatar seen as physically attractive adopted behaviour patterns associated with greater extraversion, namely disclosing more personal information and approaching confederates more closely compared to individuals controlling less-physically attractive avatars. The researchers argued that the recorded difference in avatar behaviour based on levels of attractiveness was due to the expectation that extraversion is positively linked with beauty (i.e., the more attractive an individual is the more likely they are to display extraverted behaviour patterns – Yee & Bailenson, 2007). Furthermore, research evidence indicates that the PE not only occurs while in control of an avatar, but may also transfer to post-avatar use. For example, individuals who control taller avatars will negotiate more aggressively irrespective of their physical world height both while in control of an avatar during a virtual world task as well as afterwards during a physical world task (Yee et al., 2009).

The theoretical basis for the occurrence of the PE is rooted in self-perception theory (Bem, 1972; Frank & Gilovich, 1988), which suggests that individuals will infer information about themselves through self-observation and this will then guide or influence behaviour and attitudes. In the case of virtual environments, individuals may experience a sense of embodiment and connection with their avatar (Ash, 2016; Yee & Bailenson, 2007), which can lead to the avatar being viewed as an extension of the individual (Szolin et al., 2022b). Through this process of identification and connection with an avatar, individuals may begin merging their physical world self with their virtual world avatar and aligning their behaviours and attitudes accordingly (Sun et al., 2024). For example, research on the PE has indicated that individuals who control an avatar of a different gender to their physical world self will

alter their behaviour both during and after gameplay to align with pre-existing schema or beliefs regarding that gender (Ratan & Sah 2015; Yee et al., 2011). This gender-based PE research suggests that even something as intrinsic to an individual's physical world identity such as gender can be temporarily replaced by the adopted gender, and subsequent behaviours relating to this gender based on pre-existing schema, of a virtual world avatar (Szolin et al., 2022b).

In the specific context of videogames, there has been a growing number of research studies highlighting the various ways that the PE may manifest, including: food choice (Sah et al., 2017); maths performance (Ratan & Sah, 2015); body satisfaction (Sylvia et al., 2014); attitudes towards immigrants (Peña et al., 2018; Peña & Hernandez Pérez, 2020); physical activity (Peña & Kim, 2014; Peña et al., 2016; Song et al., 2014); social participation (Bian et al., 2015); and gender-conforming behaviours (Yee et al., 2011). In addition, research has also indicated a number of factors that may affect the strength and likelihood of this phenomenon occurring, including: the option to customise an avatar (Ducheneaut et al., 2009), player immersion (Stavropoulos et al., 2020a), emotional connection to an avatar (Ratan & Sah, 2015), and avatar identification (Ratan et al., 2020; Stavropoulos et al., 2020b). However, although research relating to the PE has highlighted a number of key ways this phenomenon can occur as well as factors that may facilitate this process, a number of crucial limitations remain in this field of study.

In particular, in a systematic literature review by Szolin et al. (2022b) which evaluated research regarding the PE in the context videogames, a number of important limitations were identified. Most notably, Szolin et al. (2022b) discussed how the majority of PE videogame research is conducted using a very narrow range of videogame titles and genres, with the majority of research being focused on *World of Warcraft* (i.e., a fantasy massively multiplayer online role-playing game) and *Wii Sports Resort* (i.e., a sports simulation game using motion controls). This limited selection of games and genres represents only a fraction of the vast array of titles available, and means that only a small collection of videogame worlds are represented in current PE research. Furthermore, and related to the previous point, Szolin et al. (2022b) noted that only one study was based on a single-player role-playing game, namely *The Elder Scrolls V: Skyrim* (an open-world role-playing game) (Sylvia et al., 2014). This highlights an important limitation with the current accumulation of PE research through the highly constrained use of videogame worlds and specifically the near complete absence of single-player role-playing games, a genre which inherently contains elements that

would likely facilitate the occurrence of the PE, such as avatar customisation (Ducheneaut et al., 2009; Ratan & Sah, 2015).

A further limitation highlighted in the paper by Szolin et al. (2022b) relating to the current PE research base concerns the relatively small number of identified behaviours that occur due to the PE. More specifically, and despite growing interest in this topic, research into precise ways the PE may manifest is scarce. For example, the literature review conducted by Szolin et al. (2022b) identified only two studies that explored avatar gender and the PE in the context of videogames (i.e., Ratan & Sah, 2015; Yee et al., 2011). This small number of studies exploring gender and the PE means only a very narrow range of potential PE consequences have been identified, and highlights a clear need for innovative research to explore new ways this phenomenon may manifest.

In addition, it must be noted that the PE remains a fairly recently discussed phenomenon, with the term first coined in the context of avatar research in 2007 by Yee and Bailenson. Moreover, of the growing studies in this field, a large proportion contain studies involving custom-designed virtual worlds rather than commercially available videogame worlds (Szolin et al., 2022). Although studies based on bespoke virtual worlds designed by researchers purely for the purpose of an experiment do not necessarily exclude themselves from being relevant to the real-world experiences of individuals and their avatars, such as during videogame use, there inevitably remain concerns over ecological validity when applied beyond the custom-made virtual settings in which these studies are conducted. This means that due to the majority of studies relating to the PE being based on bespoke virtual worlds and non-commercially available videogames, combined with the arguably limited research available as a consequence of this field of study still being in its infancy, evidence-based knowledge concerning the ways this phenomenon may manifest specifically during videogame use remains highly limited and highlights another key weakness of this topic area.

The present study

The aims of the present study were to address the aforementioned limitations present in the extant PE literature in the context of videogames, namely the lack of diversity in virtual worlds used in PE studies as well as expanding the identified ways that this phenomenon may manifest. More specifically, the present study was based on the single player action-roleplaying game *Fallout: New Vegas*, a title that has not been utilised in any previous PE research regarding commercially available videogames and belongs to a genre which, despite

potentially lending itself well to the occurrence of the PE, has largely been under-represented in the current literature concerning this phenomenon (Szolin et al., 2022).

In particular, *Fallout: New Vegas* is particularly well suited to research on the PE for a number of key reasons. More specifically, *Fallout: New Vegas* provides players with a large amount of freedom and choice in how to play the game, which means players involved may more easily be influenced by their avatar without being constrained by game-based restrictions that could inhibit occurrence of the PE. For example, many of the quests in *Fallout: New Vegas* are both optional and may be completed in a number of different ways (e.g., violent or pacifist routes). Furthermore, *Fallout: New Vegas* may be seen as archetypal for the genre of single-player action-roleplaying games, with many fundamental components and design choices common across this and similar genres, while still being relatively novel to this field of research.

In addition, the present study explored novel ways in which the PE may manifest during videogame use in the context of gender-conforming behaviours, which refers to changes to attitudes and behaviours that occur as a result of playing as either male or female avatars. There have previously been several PE studies that have investigated gender-conforming behaviours in videogames. For example, Yee et al. (2011) found evidence to suggest that irrespective of their biological gender, individuals controlling male avatars were more likely to engage in hostile interactions with other players while individuals controlling female avatars were more likely to engage in healing behaviours, with each of these game behaviours having previously been linked to their respective genders. In addition, Ratan and Sah (2015) obtained research evidence that linked improved maths performance to the use of male avatars compared to female avatars among female participants. However, it should be noted that these listed gender-conforming behaviours, in particular maths ability, are stereotypes that do not necessarily represent real-world gender-based behaviours or abilities (Georgiou et al., 2007).

The present study expanded on the current documented gender-conforming behaviours by exploring three novel behaviours that have not been present in any previous PE research but which are common across many videogames of this and similar genres, and investigating whether these are more likely to occur due to the gender of the player's avatar. These three behaviours comprised: (i) number of quests completed, (ii) number of locations discovered,

and (iii) number of non-player characters (NPCs) or enemies killed. These precise gameplay variables were chosen for several key reasons.

Firstly, the included variables of the present study encompass a variety of different and varied game behaviours, ranging from exploration to violence/pacifism to chasing objectives and missions. Secondly, these particular variables are not unique to this videogame title, and are in fact common across both this and similar genres of game. This means that the results obtained from this study may have relevance and be appropriately applied to a wide range of videogame environments and contexts. Finally, and as previously discussed, these three variables explored in this study are entirely novel to the field of PE in the context of videogames, and will therefore provide new research data to expand this field of study.

Method

Participants

A total of 537 participants were initially recruited for the present study. However, after reviewing the data collected, 184 were removed due to providing incomplete or erroneous responses (i.e., reporting a number for a variable that would not have been possible to achieve during gameplay) leaving 353 for further analysis. Participants were primarily recruited from online videogame forums as well as students from the researcher's University Research Participation Scheme using opportunity sampling methods. In order to participate in the present study, all participants were required to have played the videogame *Fallout: New Vegas* and have access to a previous save file. In addition, as an ethical requirement of the present study, all participants were asked to confirm they were at least 18 years old before taking part in the study.

The final sample of participants comprised 276 identifying as male and 77 identifying as female, with a total of 107 reporting using a female avatar and 246 reporting using a male avatar (see Table 1). The number of hours participants reported playing *Fallout: New Vegas* ranged from 1 to 500 (M=60.92, SD=56.08). However, as participants were reporting pre-existing archival data from their game files, the period of time over which they amassed their hours playing the game was not recorded.

Table 1. Group information

Group	Number of players	Number of male avatars	Number of female avatars	Time spent playing game (mean)	Time spent playing game (standard deviation)
Male	276	215	61	64.20 hours	58.58 hours
Female	77	31	46	49.16 hours	44.38 hours
Total	353	246	107	60.92 hours	56.08 hours

Materials

The present study was based on experiences playing the videogame *Fallout: New Vegas.* This game is a 2010 action-roleplaying game developed by *Obsidian* and published by *Bethesda Softworks,* and available on a number of game systems including: *PC, PlayStation 3* and later models through backwards compatibility, and *Xbox 360* and later models through backwards compatibility. *Fallout: New Vegas* is an open-world game set in a post-apocalyptic future centred primarily in the US Mojave Desert. Since release, *Fallout: New Vegas* has won a number of awards including the 2011 Golden Joystick Award and was nominated for two BAFTA awards, and is still cited as one of the most popular roleplaying videogames (IGN, 2022).

Fallout: New Vegas was selected as the focus of the present study for a number of key reasons. Firstly, *Fallout: New Vegas* provides players with notable freedom of choice in how they complete quests or missions and how they interact or navigate through the game world. For example, the majority of quests or missions may be completed in a number of ways including either through violence or pacifism. In addition, while there is an intended route to completing this game in terms of order of activities and quests, a player may deviate from this and either skip or avoid missions to pursue other in-game activities, such as completing minor quests, collecting items and equipment, or even spending time gambling for in-game currency. This freedom of choice in how players approach the game means participants are not forced to approach the game in a particular way through the game's systems, and any behaviours occurring as a results of avatar gender and the PE may be appropriately observed. Furthermore, the previously discussed popularity of this videogame title means that a strong

community of gamers continue to play this game, thereby increasing the recruitment rate of participants.

Measures

The dependent variables for the present study comprised three in-game behaviours: (i) number of quests completed; (ii) number of locations discovered; and (iii) number of non-player characters (NPCs) or enemies killed. The frequency of each of these in-game behaviours is automatically recorded by the game and accessible through the game's character information menu. In particular, these three measures were selected because they represent three novel behaviours that have not appeared in any previous PE research based on this type of videogame. Furthermore, these particular three behaviours are common for this genre of videogame, which means the results from the present study may be generalised and applied to other roleplaying videogames. Finally, each of these measures explores a distinct form of gameplay, ranging from violence, quest completion and exploration. This included range of variables provided a novel opportunity to explore the link between gender-conforming behaviours and gameplay behaviours.

Procedure

After initial recruitment, participants were asked to complete an online survey based on their pre-existing save file for the videogame *Fallout: New Vegas*. This survey contained questions relating to the participants' gender identity, their avatar gender, the number of hours spent playing *Fallout: New Vegas,* and the total number of occurrences for each of the three gameplay behaviour variables (i.e., number of quests completed, number of locations discovered, and number of NPCs or enemies killed). The information relating to the frequency of each of these gameplay variables is automatically recorded by the game and accessible through the character menu, and instructions for accessing this information were provided at the start of the survey.

Design

The present study was a quasi-experiment using pre-existing data collected through a survey. An initial analysis of the relationship between the variables was conducted using the Pearson correlation coefficient on the three variables consisting of: (i) number of quests completed; (ii) number of locations discovered; and (iii) number of NPCs or enemies killed. Following this, a multivariate analysis of covariance (MANCOVA) was performed to explore the relationship and interaction effects of gender (i.e., player gender vs. avatar gender) on the

three aforementioned dependent variables while also controlling for the variable of time (i.e., hours spent playing the game). This statistical technique was selected in order to explore the interaction or influence between a player's virtual world avatar gender and their physical world gender identity on specific gameplay behaviours, and thereby observe the potential for gender-conforming behaviours arising as a consequence of the PE. Data were analysed using SPSS 28 statistical software package.

Ethics

Approval for the study was provided by the researcher's university ethics committee. Each participant provided their consent to be involved in the study through the online survey before completing any of the questions, along with being provided other supplementary materials concerning the present study. Included with this information were the aims of the research, how the data would be used, contact information for the researchers, guidance on how to obtain support or help after the survey, and the participants' rights (including their right to withdraw their data and the procedure for doing so).

Results

Firstly, in order to explore whether the dependent variables (i.e., quests completed, locations discovered, and enemies or NPCs killed) were significantly associated with one another, and thereby determine the most appropriate manner of analysing the data for the present study, bivariate Pearson's correlation coefficients were run on these variables. The results indicated that these variables were significantly correlated with each other. More specifically, quest completion was significantly correlated with location discovery (r=0.845, p<.01) and enemies or NPC killed (r=0.627, p<.01) and location discovery was significantly correlated with enemies or NPCs killed (r=0.761, p<.01).

In addition, Levene's test of equality of error variances was examined, which showed that the dependent variables of number of quests completed and number of NPCs or enemies killed had equal variances at an alpha level of .05 (p=.66), and the variable of number of locations discovered at a modestly adjusted alpha level of .01 (p=.01) as recommended by Allen and Bennet (2008). Finally, Box's test of equality covariance matrices was found to be significant (p<0.01), which meant that while a MANCOVA could be conducted, Pillai's Trace criterion was selected as the specific multivariate test for this analysis as it is considered to be robust

enough to counter this violation to the assumptions of a MANCOVA (Olson, 1976; O'Brien & Kaiser, 1985).

Next, a MANCOVA was conducted using the independent variables of player gender (male and female) and avatar gender (male and female) and the three dependent variables of: (i) number of quests completed; (ii) number of locations discovered; and (iii) number of NPCs or enemies killed. In addition, the covariate for the MANCOVA was time (i.e., hours spent playing the game) in order to control for its potential extraneous effects.

The MANCOVA results of the multivariate tests (see Table 2) showed significant interactions between avatar gender and player gender (Pillai's Trace=0.02, F(3, 347)=2.88, p=.04), as well as the factors of avatar gender (Pillai's Trace=0.03, F(3, 347)=3.70, p=.01), and player gender (Pillai's Trace=0.05, F(3, 347)=5.57, p<.01).

Table 2. MANCOVA results of multivariate tests for player/avatar gender when interacting with variables of quest completion, location discovery and number of enemies or NPCs killed

Source	Effect	Value	F	DF	Error DF	p	η^2
Time	Pillai's Trace	0.28	45.38	3	347	<0.01	0.28
Player	Pillai's Trace	0.05	5.57	3	347	<0.01	0.05
Avatar	Pillai's Trace	0.03	3.70	3	347	.01	0.03
Player*avatar	Pillai's Trace	0.02	2.88	3	347	.04	0.02

Following this, the univariate tests of between participants results were explored to provide more details on the effect of player and avatar gender on the three dependent variables (see Table 3). Firstly, the results indicated that there was a significant interaction between player and avatar gender for quest completion (p=.04) (see figure 1), but with a relatively weak effect size (η^2=0.02). In addition, a further significant main effect of player gender was identified (p=.01), with male players (M=74.22) being significantly more likely to complete more quests than female players (M=54.05) but with a relatively weak effect size (η^2=0.02).

Secondly, there was a significant interaction between player and avatar gender for location discovery (p<0.01) (see figure 2), but with a relatively weak effect size (η^2=0.02). In addition,

a significant main effect of player gender was identified (p<.01), with male players (M=156.87) being significantly more likely to discover more locations than female players (M=113.29), but with a relatively weak effect size (η^2=0.03).

Thirdly, there was no significant interaction between player gender and avatar gender on number of NPCs or enemies killed (F(1, 349)=2.63, p=.11). However, there were significant main effects for avatar gender (p<.01) and player gender (p<.01), with female avatars (M=900.34) being significantly more likely to score higher for number of NPCs or enemies killed than male avatars (M=849.68) irrespective of the player's gender, and male players (M=941.4) being more likely to score higher for number of NPCs or enemies killed than female players (M=591.3) but with relatively weak effect sizes (η^2=0.02 and η^2=0.05).

Finally, there was a significant effect of the covariant of time on the three measures of quest completion (F(1, 349)= 84.81, p<.001), location discovery (F(1, 349)= 79.83, p<.001), and number of enemies or NPCs killed (F(1, 349)= 115.97, p<.001). In addition, the effects sizes for each of these variables were all large (η^2=0.2, η^2=0.19, η^2=0.25).

Figure 1. Interaction graph for player/avatar gender on quest completion

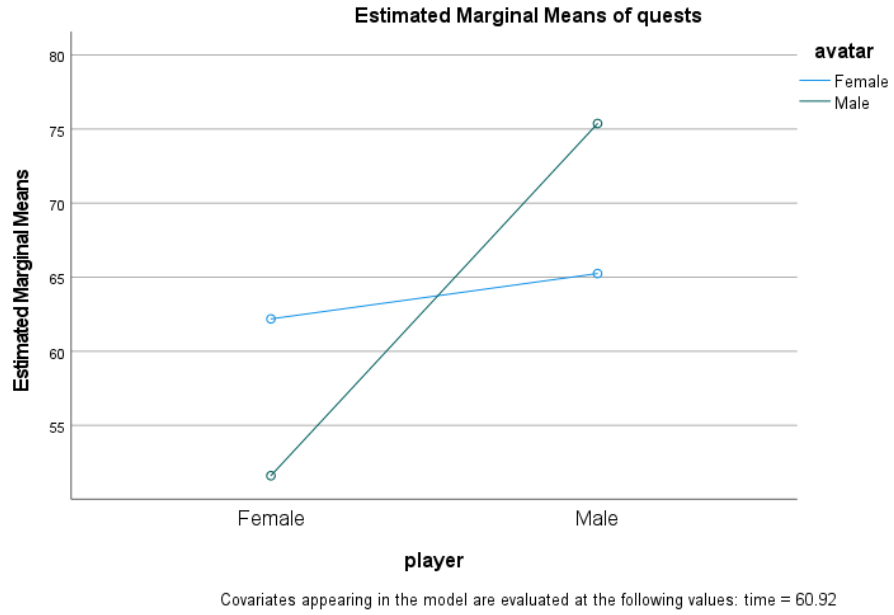

Figure 2. Interaction graph for player/avatar gender on location discovery

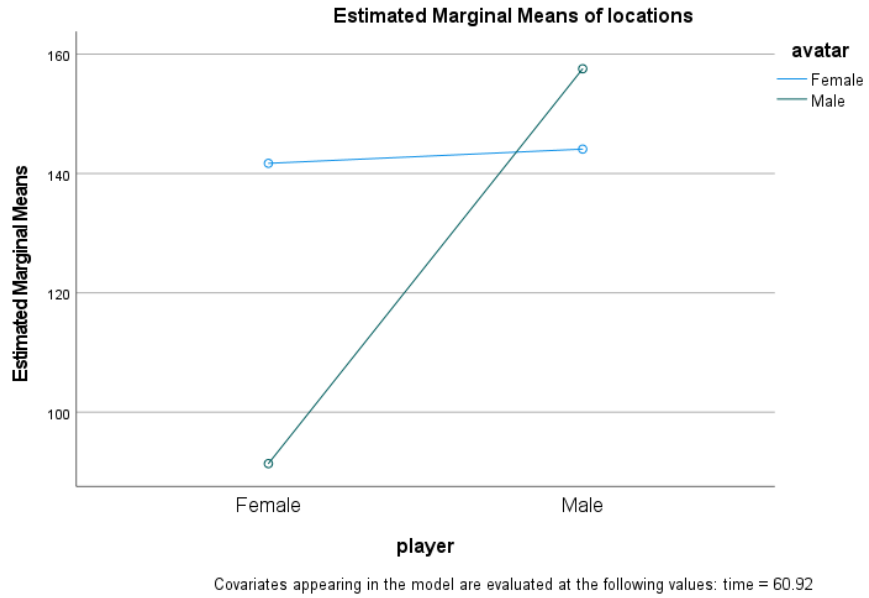

Table 3. MANCOVA results of tests of between-subjects effects for player/avatar gender when interacting with variables of quest completion, location discovery and number of enemies or NPCs killed

Source	Variable	F	DF	*p*	η^2
Time	Quests	84.81	1	<0.01	0.2
	Locations	79.83	1	<0.01	0.19
	Kills	115.97	1	<0.01	0.25
Player	Quests	6.79	1	.01	0.02
	Locations	9.45	1	<0.01	0.03
	Kills	16.37	1	<0.01	0.05
Avatar	Quests	0.00	1	.96	<0.01
	Locations	2.75	1	.1	<0.01
	Kills	7.30	1	<0.01	0.02
Player*avatar	Quests	4.09	1	.04	0.02
	Locations	8.23	1	<0.01	0.02
	Kills	2.63	1	.11	<0.01

In order to further explore the identified significant interaction effects of player and avatar gender on the measures of quest completion and location discovery, follow-up one-way MANCOVA analyses using the Bonferroni correction were conducted which split male and female players to allow the strength and direction of these interactions to be observed (see Table 4). The initial multivariate test results were significant for both male players (Pillai's Trace=0.03, F(3, 271)=3.16, p=.03, η^2 =0.03) and female players (Pillai's Trace=1.38, F(3, 72)=3.8, p=.01, η^2 =0.14).

Next, in terms of quest completion, the results of the follow-up between participants tests indicated that there was no significant difference between male and female avatars for female players (p=.44), nor was there a significant difference between male and female avatars for

male players although this was approaching significance (p=.07), with pair-wise comparisons indicating that male players controlling a male avatar (M=76.45) scored higher on quest completion than male players controlling a female avatar (M= 66.31). In terms of location discovery, the results of the follow-up between participants tests indicated no significant difference between male and female avatars for male players (p=.26), but there was a significant difference between male and female avatars for female players (p=.01), with pair-wise comparisons indicating females controlling a female avatar (M=129.13) scored significantly higher for location discovery than females controlling a male avatar (M= 89.78).

Table 4. Follow-up MANCOVA results of between-subjects effects for player/avatar gender on the variables of quest completion and location discovery after splitting player gender

Player gender	Source	Variable	F	DF	p	η^2
Male	Avatar gender (male vs. female)	Quests	3.4	1	.07	0.01
	Avatar gender (male vs. female)	Locations	1.25	1	.44	<0.01
Female	Avatar gender (male vs. female)	Quests	0.6	1	.26	<0.01
	Avatar gender (male vs. female)	Locations	6.98	1	.01	0.09

Discussion

The aims of the present study were to (i) explore three forms of in-game behaviours that have not been present in any previous research on the PE and (ii) investigate whether they were more likely to occur due the gender of the player's avatar using a sample of male and female participants who played the videogame *Fallout: New Vegas*. The three behaviours comprised (i) number of quests completed, (ii) number of locations discovered, and (iii) number of non-player characters (NPCs) or enemies killed. The analysis resulted in two main findings regarding gender differences in regard to male and female avatars and players. These were (i) an own-gender avatar/player increase to game performance in terms of quest completion and location discovery, and (ii) a potentially new PE consequence relating to the use of female avatars and the number of NPCs or enemies killed during gameplay.

Firstly, the present study identified a significant interaction between avatar gender and player gender across the measures of both quest completion and location discovery. More specifically, the results indicated that game performance was significantly higher for players who controlled an avatar of the same gender to the player across the measures of quest completion and location discovery (i.e., male players controlling a male avatar, and female players controlling a female avatar), suggesting the potential presence of an own-gender bias in game performance.

This own-gender bias was further confirmed in the post-hoc analysis specifically for female players controlling a female avatar for the measure of location discovery, and male players controlling a male avatar was approaching significance for the measure of quest completion (p=.07). However, the post-hoc analysis did not indicate any further significant results concerning player/avatar gender and the measures of quest completion or location discovery, although it must be noted that these findings do not necessarily disprove the interaction results obtained from the initial MANCOVA and these results should not be dismissed on that basis. Instead, the identified significant results of the post-hoc may be seen as providing additional support for specific individual findings, namely an own-gender bias for females across the measure of location discovery and, to some extent, an own-gender bias for male players across the measure of quest completion which was approaching significance (p=.07).

Taken together, these findings which suggest that game performance or efficacy in this case measured by quest completion and location discovery, may be improved or increased when a player controls an avatar that is seen as visually similar to the self-identified gender of the

player is supported by previous research regarding game performance and avatar similarity. For example, research has previously indicated that game performance may be positively influenced through controlling an avatar that is seen as visually similar to the player (Jang et al., 2010; Rahill & Sebrechts, 2021; Vasalou et al., 2007), although there have also been examples of conflicting studies that have not identified a link between these factors (Paleczna et al., 2022). In the case of the present study, the results from the analysis appear to show that game performance may be improved through controlling an avatar that is seen as similar to the player, although it must be noted that this appearance variable is only measured in terms of the gender of the avatar and that data concerning the precise customisation of each player's avatar (e.g., hairstyle, ethnicity, facial features) were not available in the present study.

The result from the present study suggesting that players who control an avatar of the same gender may experience improved game performance may be explained through avatar identification and the effects this has on gameplay experiences. More specifically, research has previously indicated that player and avatar similarity is positively associated with avatar identification (Trepte & Reinecke, 2010), which in turn is linked with factors such as game enjoyment and sense of presence in a game world (Christy & Fox, 2016; Rahill & Sebrechts, 2021; Szolin et al., 2023). In the present study, it may be the case that players who controlled an avatar of the same gender experienced a greater degree of identification with their character, and this in turn may have led to a greater sense of in-game presence as well as enjoyment and therefore engagement with the game, which resulted in improved game performance in terms of quest completion and location discovery.

However, while an own-gender performance bias is seemingly present for the variables of quest completion and location discovery based on the analysis in the present study, this effect was not present for the variable of number of NPCs or enemies killed. This lack of own-gender bias for the variable of NPCs or enemies killed suggests that the link between avatar identification, in this case the mirroring of player and avatar gender, and game performance may be linked to specific measures of gameplay performance and may help to partially explain the previously stated conflicting results in this area of study (Jang et al., 2010; Paleczna et al., 2022; Rahill & Sebrechts, 2021; Wauck et al., 2018). More specifically, the studies exploring the link between gameplay performance and avatar identification used a range of different videogame contexts and measures of gameplay performance, and the seemingly conflicting results concerning the presence of this phenomenon may be due in part to the different measures of gameplay performance specific to each of these studies and that

avatar identification may potentially only affect specific forms of gameplay behaviours or even only occur in specific videogame contexts. Nevertheless, the present study appears to support the idea that controlling an avatar that is seen as similar to the user in terms of gender identity may have a positive impact on specific aspects of game performance, such as location discovery and quest completion.

Secondly, the results of the present study also identified a potential PE consequence in terms of avatar gender and number of NPCs or enemies killed during gameplay. More specifically, the findings indicated that female avatars were significantly more likely to score higher on the measure of number of NPCs or enemies killed than male avatars, and this occurred irrespective of the gender of the player. In terms of the PE, the indication that female avatars demonstrated higher scores for number of NPCs or enemies killed may mean that players, both males and females, associated or imbued their female avatar with specific characteristics in line with behaviours that would result in a higher number of in-game kills.

These results concerning a potential PE in terms of gender and number of NPCs or enemies killed is both surprising and interesting given that historically stereotypical gender roles place males as being more aggressive than females (Paaßen et al., 2017; Ward & Grower, 2020), and this is also true in regard to videogame representations of gender (Blackburn & Scharrer, 2019). In fact, the results of the present study identified that male players were significantly more likely to score higher on number of kills than female players. Similarly, in a related piece of research, Yee et al. (2011) identified that male players were more likely to engage in PvP (player versus player combat) while playing *World of Warcraft* (a massively multiplayer online game released in 2004). However, the present study and the research conducted by Yee et al. (2011) appear to conflict in terms of the PE, with Yee et al. (2011) identifying that male avatars were more likely to engage in this behaviour irrespective of the gender of the player whereas the present study indicated that female avatars were more likely to score higher on number of NPCs or enemies killed irrespective of the gender of the player.

There are a number of potential explanations for both the finding that female avatars scored higher for the number of NPCs or enemies killed and the seemingly conflicting results with the study by Yee et al. (2011). Firstly, while arguably similar, PvP combat and NPC combat differ in terms of opponent, with PvP based on combat between physical world users controlling an avatar, whereas NPC combat is based on characters controlled by the computer, and this may have affected the results of these studies. More specifically, the

perceived virtual presence of a physical world user may have played a part in shaping the behaviours of the players in the study by Yee et al. (2011), a factor which the authors acknowledged in their paper. As discussed, there is a historical social stereotype for males to be seen as more aggressive than females, and this societal expectation potentially generated by the virtual presence of physical world users may have influenced the results of Yee et al. (2011) in the online videogame context employed in their study. By contrast, the videogame context used in the present study was an entirely offline experience, with no other physical world users present during the gameplay experience beyond the players themselves. This difference in videogame context and presence of other players may in part account for the conflicting results between the present study and the research conducted by Yee et al. (2011).

Secondly, while there is certainly a stereotypical societal view of males as more aggressive than females, media representations of women are not consigned purely to passive and non-combative characterisations. For example, in videogames there is a range of employed portrayals of female characters, including strong and independent protagonists (i.e., Aloy from the *Horizon* series), femme fatale characters (i.e., Anna Williams from the *Tekken* series), as well as the frequently employed trope of the damsel in distress (i.e., Princess Peach from the *Mario* series). Although videogames often portray their female characters and protagonists in a problematic and overtly sexualised manner (Downs & Smith, 2010: Kuss et al., 2022), these characters can sometimes be seen as both powerful and objectified (Tompkins et al., 2020), such as the popular but controversial Lara Croft from the *Tomb Raider* series.

In terms of the present study, the finding that players achieved a higher number of kills while controlling a female avatar irrespective of the gender of the user may be due to a held assumption or belief associating this behaviour with female digital characters, facilitated by the absence of physical world virtual users to reinforce societal expectations of gender and aggression as seen in the study by Yee et al. (2011). This potential PE concerning digital female characters as being more combative or aggressive than male characters may suggest a disparity between physical world and virtual world gendered expectations of behaviour, with female avatars being imbued with these characteristics more so than male avatars.

Finally, and in relation to the previously discussed point concerning female representation in videogames, a further point may be used to explain the present study's conflicting results with Yee et al.'s study (2011) and the finding that female avatars were more likely to score

higher on the measure of number of NPCs or enemies killed compared to male avatars, namely the date these studies were conducted and the subsequent proliferation of media female representation. In particular, research indicates that between the years of 2015 and 2020, the number of female protagonists in videogames doubled from 9% to 18% (Statista, 2022), and this rise in female representation was also true for other forms of media with a 21.6% increase in the number of female lead actors in US films between 2011 and 2021, accounting for a total of 47.2% in 2021 (Statista 2022). This increase in female media presence, particularly in videogames, may have caused a shift in how players perceive female avatars. More specifically, in the twelve years since Yee et al. (2011) conducted their study, there has been a notable rise in female videogame representation, and this may have contributed to a change in how females are perceived, departing from the traditional and passive 'damsel in distress' trope to more aggressive, assertive, and combative characters that seemingly outpace male characters in these attributes in the specific context of the present study.

Limitations and future research

The present study identified a number of different ways that the gender of both the player and their avatar can influence gameplay behaviour and performance in *Fallout: New Vegas*. However, it is important to acknowledge a number of key limitations in the present study which means the interpretation of the results discussed should be viewed with caution, including the limited and unbalanced sample sizes, uncontrolled and potentially confounding variables, the quasi-experimental design of the study, and restricted generalisability.

Firstly, a limitation in the present study relates to the unbalanced and relatively small participant sample sizes across specific groups. In particular, as seen in Table 1, there were substantially more male players (n=276) than female players (n=77), and this was also true for male avatars (n=246) compared to female avatars (n=107). Furthermore, examining the group sizes across the main factors showed a notable difference in size between male players controlling a male avatar (n=215), male players controlling a female avatar (n=61), female players controlling a female avatar (n=46), and female players controlling a male avatar (n=31). These relatively small group sizes combined with the considerable size difference between specific groups may have affected and distorted the analysis and subsequent interpretation of the data, and any conclusions drawn should be viewed with a large degree of caution until further evidence from future related studies are obtained.

In addition, it must also be noted that the effect sizes for the univariate tests were often modest (see Table 3). These small effect sizes mean that while a significant result may have been obtained for specific variables, the strength of these observed differences between groups may be considered to be fairly minimal. Therefore, the discussed results and the strength of the conclusions drawn should be viewed with some caution in respect to these relatively small effect sizes.

Secondly, a further limitation relates to the potential for uncontrolled and confounding variables to have impacted the results. The data for the present study did not distinguish participants in terms of various individual factors that may have affected their gameplay performance beyond their identified gender. For example, experience and familiarity with a videogame have been shown to have a significant impact on a player's gameplay performance (Brown et al., 1997; Ratan et al., 2015). Although this present study did include time spent playing as the selected avatar as a covariant, no data were collected regarding each participants total familiarity or time spent with the videogame or videogames more generally which may have affected the results obtained in this study.

Thirdly, another limitation relates to the quasi-experimental design of the present study. More specifically, this study used pre-existing save file data in order to observe and record an individual's gameplay behaviour, whereas a traditional experimental design would involve randomly placing participants in the various conditions relating to player/avatar gender. Therefore, there may be some difficulty in determining causality of player/avatar gender in respect to differences in gameplay behaviours due to the quasi-experimental design of this study. In particular, the selected design of this study introduces the issue of whether participants selected their character to reflect how they wanted to engage with the game or whether their character influenced their in-game behaviour.

More specifically, and building on the previous point regarding issues establishing causality, there are a number of factors that may have influenced a participant's choice of avatar and subsequent behaviour during this study. For example, in *Fallout: New Vegas* there are specific dialogue choices that are restricted to particular genders, and which arguably provide a more optimised route through the game. For example, there are female dialogue choices during an interaction with Benny (a key antagonist) that progress the game faster than the options available to male characters, and this may explain the apparent PE finding of the present study. In particular, it may be the case that more experienced players selected a

female avatar as a gameplay-optimised build, and the higher NPC/enemy kill count recorded by players controlling a female avatar simply represent the greater game proficiency/experience of the player and not a consequence of the PE. However, it should be noted that alternative explanations for the findings of this present study are speculative, and future research is required to establish whether these results occurred due to a PE occurrence or due to other factors.

In addition, and related to the previous point concerning participant data, the means by which participant responses were collected may have also impacted the quality and reliability of the data and analysis. In particular, participants were primarily recruited from online forums and the researcher's university participation scheme using opportunity sampling methods. Although this method of participant recruited provided notable benefits in terms of ensuring sufficient data for the statistical analysis, it also meant that the data collected were far less reliable compared to more traditional in-person experimental set-ups where participants can be observed and external variables be more tightly controlled.

Finally, another limitation relating to the present study concerns the potentially restricted generalisability of these results. In particular, while the results may appear to indicate specific gender-conforming behaviours relating to players and their avatars, these may be specific to the videogame context of the present study and may not occur to the same degree in other virtual environments. For example, while research relating to virtual world avatars may often seemingly treat videogames homogenously (Szolin et al., 2022), this assumption has increasingly been challenged (Szolin et al., 2023) with some research evidence indicating that different virtual environments can lead to different user experiences relating to factors such as sense of presence, pleasure, and synchrony (Han et al., 2023). In light of this indication of the heterogeneity of virtual worlds, while the results of the present study may potentially suggest specific behaviours relating to gender, any application to other virtual environments should be done with caution.

However, although the inherent differences between game worlds does cause some issues when applying these results to other virtual environments, it should be noted that the present study specifically attempted to reduce these issues and improve generalisability through the particular choice of game behaviours that were measured. More specifically, the behaviour measures used in the present study comprised: number of quests completed; number of locations discovered; and number of NPCs or enemies killed. These variables were selected

because they not only cover a wide range of different forms of gameplay behaviour, but are also common to many videogame genres and titles. This means that the results obtained in this study may potentially be applied, or at least compared, to other videogame environments. Furthermore, it should also be noted that the present study used pre-existing (i.e., actual as opposed to self-report) data from participants' save files from *Fallout: New Vegas*. This use of archival data meant that player's gameplay experiences occurred in a natural, non-laboratory environment and without any possibility of demand characteristics affecting the data, and thereby strengthening the ecological validity of the obtained results.

Finally, there are a number of interesting avenues of future research related to the results identified in the present study. Firstly, and related to the previous point regarding virtual world heterogeneity, future research in this topic may benefit from exploring the extent to which the identified PE consequence and gender-conforming behaviours discussed in the present study occur in other virtual world environments and videogame titles. More specifically, previous research has indicated that the precise nature of a virtual environment can affect a user's experience, including factors such as self-presence (Han et al., 2023) and strength of the user-avatar relationship (Szolin et al., 2023), elements which have been highlighted as key to the occurrence of phenomena such as the PE (Szolin et al., 2022).

Furthermore, and related to the previously discussed point relating to the experimental design of this present study and issues concerning causality, future research may benefit from exploring these identified potential effects of avatar and player gender on gameplay behaviour in experimental settings. In particular, this present study highlighted a number of novel ways that avatar and player gender may affect gameplay behaviour, but the quasi-experimental design of this study means that causality cannot be confidently established. Therefore, to address this highlighted limitation, future research should investigate these discussed effects of avatar/player gender on gameplay behaviour through controlled experimental settings in order to help establish causality.

More specifically, and as previously discussed, there may be various factors that can influence an individual's choice of avatar that result in particular gameplay behaviours occurring that do not represent PE manifestations. To address this, future research should adopt a stronger and more rigorous experimental design including random allocation of participants to avatar groupings to reduce the potential of factors relating to participant choice of avatar characteristic (e.g., gender) determining in-game behaviour/attitudes that may

otherwise me mistakenly observed as manifestations of the PE and more confidently establish causality.

In addition, it should also be acknowledged that the topic of the PE is still relatively new, and there is currently only a relatively small number of identified consequences of this phenomenon particularly within the specific context of commercially available videogames (Szolin et al., 2022). In light of this limited research base, future studies may benefit from exploring not only already known PE consequences in different virtual world environments, but also from investigating new ways this phenomenon may manifest and affect users.

In particular, the use of avatars and videogames has become an increasingly popular part of modern culture, with an estimated 3.457 billion players worldwide by 2024 (Statista, 2022). Furthermore, previous research has indicated that the occurrence of the PE can have a notable impact on a user both in-game and outside of the game, with effects ranging from changes to gameplay styles (Yee et al., 2011) to altered perceptions and attitudes of physical world socio-political issues, such as immigration (Peña et al., 2018; Peña & Hernandez Pérez, 2020). However, despite these numbers and powerful influence of videogame avatars, there are still very few identified consequences of the PE in this context. Therefore, future research may benefit from not only exploring existing PE consequences in new virtual world contexts, but from beginning to identify new ways that this phenomenon may occur.

Conclusion

The aims of the present study were to investigate the PE and gender-conforming behaviours in the videogame *Fallout: New Vegas* using three behavioural measures (i.e., quest completion; location discovery, and number of NPCs or enemies killed). The findings in the present study indicated the potential presence of an own-gender bias to gameplay performance across two of the measures (i.e., quest completion and location discovery), suggesting that players who controlled an avatar of the same gender were more likely to gain a higher score on these measures than players controlling an avatar of a different gender to themselves. Furthermore, the present study also found a potential PE consequence relating to gender, with female avatars more likely to score higher on number of NPCs or enemies killed irrespective of the physical world gender of the user. In addition, and based on these results and previous literature, the present study highlights several avenues of future research, including both further exploration of these identified gender-conforming behaviours and PE

consequence in other virtual world contexts and game titles as well as expanding the current research base of known PE consequences.

Chapter 6: Avatars in videogames: Investigating the association between Gaming Disorder and the Proteus effect

Introduction

Virtual player-controlled characters, often referred to as avatars, are a common feature in many videogames. The primary purpose of an avatar is to provide an individual with the means to interact with (and navigate through) a videogame world, and may include acts such as completing in-game quests and objectives or simply to explore the virtual world (Szolin et al., 2022a). However, although avatars are fundamentally designed as a tool to engage with a videogame world, these virtual characters can also be used to perform a number of other functions that relate to the user controlling the avatar.

In the case of online games, such massively multiplayer online (MMO) games which feature a virtual landscape inhabited by large numbers of player-controlled characters, the avatar may be seen as a conduit for overt player-to-player communication (Steinkuehler, 2006) as well as more subtle forms of communication relating to self-presentation and identity expression (Gibson et al., 2023; Nowak & Fox, 2018). For instance, some videogame players may use their avatar to present a realistic version of themselves in the game world through mimicking the physical world appearance of the user, whereas others may use their character to express aspects of their identity that are not present in the physical world (Sibilla & Mancini, 2018). A key example of using an avatar as a means of identity expression can be seen in research relating to transgender and non-binary videogame players. In particular, gender dysphoric individuals may design their avatar to represent their preferred gender identity in game as a precursor to adopting this gender in the physical world (Arcelus et al., 2017; Griffiths et al., 2016).

Clearly, videogame avatars can be a powerful tool for individuals to use in interacting with a game world and expressing aspects of the user's identity. Furthermore, these highlighted functions of the avatar demonstrate how these virtual characters can be moulded and influenced by the player, whether it be through the customised appearance of the avatar or even how they behave in a virtual world. However, the relationship that can develop between a user and their avatar is much more complex than may initially appear, and while the user certainly influences the avatar, it has been empirically shown that the avatar can also

influence the user in a phenomenon referred to as the Proteus effect (PE – Peña et al., 2018; Ratan & Sah, 2015; Song et al., 2014; Yee & Bailenson, 2007; Yee et al., 2011).

The PE (Yee & Bailenson, 2007) refers to the process whereby the user makes specific inferences based on available identity cues of their avatar, such as appearance, and that these player-observed characteristics of the avatar can then influence the attitudes and behaviour of the player themselves both within the game world as well as the physical world (Ratan et al., 2020; Peña et al., 2018). More specifically, it is suggested that when an individual takes control of an avatar, they will often make various assumptions regarding their virtual character based on the information available to them such as visual cues relating to the avatar's appearance and then adapt their behaviour or attitudes to align with their perception of these characteristics. For example, research has indicated that both male and female videogame players controlling a male avatar in an MMO will act more aggressively to other players and perform more player-versus-player actions than if they were playing as a female avatar because this form of behaviour is considered to be stereotypically associated with males (Yee et al., 2011).

Research relating to the PE has identified that this phenomenon is not uncommon, and has been successfully observed in the majority of PE videogame studies (Szolin et al., 2022a). Furthermore, while the PE may occur relatively often across various populations and study designs, a number of specific factors have been identified as potentially affecting the strength and likelihood of the PE. For example, research has indicated that greater levels of avatar attachment, identification, embodiment, as well as gameplay immersion may all contribute towards increasing the likelihood of the PE occurring (Ratan & Dawson, 2016; Li & Lwin, 2016; Song et al., 2014; Szolin et al., 2022a). However, although the extant literature on the PE does not suggest that this phenomenon is specific to any single type of videogame player and may occur across different populations, there is one set of gamers who may be particularly susceptible to the effects of this phenomenon, namely individuals with gaming disorder (GD).

GD is defined by the World Health Organization (WHO) in the 11th Revision of the *International Classification of Diseases* (ICD-11) as impaired control over gaming behaviour that takes precedence over other life activities despite negative consequences, and causes significant impairment to social, occupational, personal, or other areas of functioning (WHO, 2020). For example, research has identified positive relationships between GD and

depression (You et al., 2017), disruption of work and social relationships (Griffiths et al., 2004), and low self-esteem and body dissatisfaction (Leménager et al., 2013).

In terms of prevalence, identifying the precise number of individuals who experience disordered gaming can be often be difficult (Darvesh et al., 2020) due to factors such as the use of different conceptualisations for this disorder (Kuss & Griffiths, 2012; Pontes & Griffiths, 2014) and cultural differences between countries that can impact reported global prevalence rates (Király et al., 2023). Nevertheless, research has indicated that GD appears to affect large numbers of gamers, with some evidence suggesting a global prevalence rate of 1.96% when using the highest quality data (Stevens et al., 2020). However, while the number of individuals who experience GD is high, clearly not all videogame players experience this disorder and that this represents only a relatively small percentage of individuals who play videogames. To investigate these differences, researchers have found a number of factors which separate individuals with GD from 'healthy' populations, and prominently includes factors such as higher avatar identification and stronger user-avatar relationships (Szolin et al., 2022b).

Avatar identification refers to the extent to which an online gamer identifies with or sees themselves as similar to their virtual world avatar, and research has consistently shown that this and other components indicative of stronger bonds between a user and their avatar is highly prevalent and pronounced amongst GD populations (Burleigh et al., 2017; Dieter et al., 2014; Leménager et al., 2016; Green et al., 2021; Liew et al., 2018; Lopez-Ferndandez et al., 2019; Mancini et al., 2019; Müller & Bonnaire, 2021; Sioni et al., 2017; Smahel et al., 2008; You et al., 2017; Zhong & Yao, 2013). When combined with research relating to the PE, this high avatar identification and user-avatar relationship facets found among gamers presenting with GD suggests that this population may have a particularly high susceptibility to the PE.

However, the link between GD and PE is still largely unexplored with sparse direct research and contradictory evidence. For example, one notable study conducted by Stavropoulos et al. (2020a) suggested that GD severity was positively associated with the PE, and that individuals who score highly on GD measures are more likely to experience some forms of PE consequences from gaming. This research, combined with the discussed link between aspects relating to the occurrence of the PE and GD, such as avatar identification, suggests

that there may be a link between PE and GD, and that individuals suffering from this disorder may be more likely to experiences the consequences of the PE.

Further research conducted by Byrne et al. (2022) indicated that the PE impacted not only a player's behaviour but also their cognitive process and desires relating to videogame use, and that this in turn appeared to increase GD symptoms. However, Byrne et al. (2022) also found that there was a significant negative relationship between GD and the PE, suggesting that higher manifestations of the PE resulted in lower GD symptom occurrence and severity. Clearly, there is some contention concerning the relationship between GD and the PE, and combined with the limited number of studies examining this topic highlights the need for further research.

The present study

The aims of the present study were to address and expand on the current research evidence concerning the potential link between GD and the PE in the context of videogames. More specifically, the present study aimed to provide direct evidence indicating whether an association exists and how GD severity may affect the PE. As discussed, specific factors, such as heightened avatar identification, appear to be relevant to both GD and the occurrence of the PE that may be indicative of a link between these phenomena, although this assertion is primarily based on indirect associational research evidence. Research by Stavropoulos et al. (2020a) provided a clearer and more refined indication that GD severity is associated with the PE, although research by Byrne et al. (2022) appear to signal that while the PE can impact cognitive process that in turn affect GD, there may be a negative association between GD and the PE when these are compared directly.

The present study addresses the dearth of research directly investigating the PE in the context of GD by exploring how and to what extent the PE and GD are associated. In addition, the present study also explored the degree to which an individual's sense of self-presence within a virtual world potentially mediates the association between GD severity and the PE. More specifically, self-presence in the context of videogames has been defined as the extent to which an online gamer experiences their virtual self as their physical self, and can include elements relating to physical body schema, emotional state, and identity (Ratan & Hasler, 2009). As discussed, the occurrence of the PE is based on the integration of a user's physical self with their virtual character, and this can lead to the gamer adopting and displaying specific behaviours or attitudes that are associated with their controlled character, and sense

of presence and identification with an avatar are key elements to this process (Stavropoulos et al., 2020b; Szolin et al., 2023). It is therefore hypothesised that: higher GD severity scores will predict higher PE behaviours (H_1), and (ii) sense of self-presence in a videogame will mediate the relationship between GD severity and PE behaviours (H_2).

Method

Participants

A total of 485 participants were initially recruited for the present study. However, after reviewing the data collected, 107 were removed due to providing incomplete responses, leaving 378 for final analysis. The final sample of 378 participants comprised 230 identifying as female, 136 identifying as male, 11 identifying as non-binary/third gender, and one person preferring not to say. The ages of participants ranged from 18 to 56 years old (*M*=21.38, *SD*=4.49). The preferred gaming system of participants included: 37.3% computer (e.g., PC, Mac); 43.9% console (e.g., *Xbox, PlayStation, Nintendo* gaming consoles); and 18.8% mobile devices (e.g., smartphone, tablet). Participants reported a wide range of preferred videogame titles, with a selection including: *Grand Theft Auto V*; *Animal Crossing: New Horizons*; *Star Wars: The Old Republic*; *League of Legends*; *Red Dead Redemption 2*; *and Fortnite*. The number of hours participants reported playing videogames ranged from 0 to 60 per weekday (*M*=7.72, *SD*=7.47), and 0 to 25 per weekend (*M*=6.75, *SD*=4.85), see Table 1 for further details.

Table 1: Descriptive information of participants

		Gender			
		Female	Non-binary/third gender/not disclosed	Male	Total
Total number		230	12	136	378
Age	Mean	21	21.9	22.75	21.38
	Range	38	22	33	38
	SD	4.27	4.24	9.0	4.49
Time*	Mean	12.97	18.87	16.08	14.47
	Range	83	65.5	37	83.5
	SD	9.99	13.2	12.65	11.46
Platform	Console	82	79	5	166
	PC	90	46	5	141
	Mobile	58	11	2	71

*Combined hours per weekday and weekend

Measures

The survey collected various demographic and gaming preference information from participants, including: age; gender identity; number of hours spent playing videogames; which videogame title they have played the most during the past 12 months; and preferred gaming system or platform. In addition, three psychometric measures were used in the study comprising the Proteus Effect Scale (PES), the Self-Presence Questionnaire (SPQ) and the Internet Gaming Disorder Short-Form (IGDS-SF9).

Firstly, the PES (Van Looy et al., 2012) is a six-item scale that is used to assess the extent to which individual's behaviour is affected or influenced by videogames (e.g., *"I feel differently when I play with another character"*). Responses are rated on a 1-5 Likert scale providing a

final score ranging from 6-30, with higher scores representing higher PE influence on behaviour. The PES has demonstrated good construct validity (Van Looy et al., 2012; Stavropoulos et al., 2020a), and the internal consistency of the PES in the present study was found to be excellent (Cronbach's alpha = .91).

Secondly, the SPQ (Ratan & Hasler, 2009) was used to assess participants' sense of self-presence within the virtual world. The SPQ is a 13-item scale that includes three dimensions of self-presence: proto self-presence, which refers to the extent to which an individual experiences their virtual body as an extension of their physical body (e.g., *"When playing the game, how much do you feel your avatar is a part of your body?"*); core self-presence, which refers to the degree to which virtual world events and interactions elicit emotional reactions from the user (e.g., *"When sad events happen to your avatar, do you also feel sad?"*); and extended self-presence, which refers to how much the avatar represents the identity of the user (e.g., *"To what extent is your avatar's appearance related to some aspect of your personal identity?"*) (Ratan & Hasler, 2009). Responses are rated on a 1-5 Likert scale providing a final score ranging from 13-65, with higher scores representing a higher sense of self-presence within the virtual world and greater identification/connection to an avatar. The SPQ has been shown to be a useful measure of self-presence with evidence of construct validity (Ratan & Hasler, 2009; Burleigh et al., 2018), and the internal consistency of the SPQ in the present study was found to be very good (Cronbach's alpha = .85).

Finally, the IGDS-SF9 (Pontes & Griffiths, 2015) was used to assess IGD. The scale comprises nine items based on DSM-5 criteria for diagnosing IGD severity (e.g., *"Do you feel the need to spend increasing amount of time engaged gaming in order to achieve satisfaction or pleasure?"*). Responses are rated on a 1-5 Likert scale providing a final score ranging from 9-45, with higher scores representing higher severity of IGD. The IGDS-SF9 has been widely assessed and has been found to demonstrate strong criterion and construct validity, and has been translated and used across the globe (Pontes & Griffiths, 2015; Poon et al., 2021). The internal consistency of the IGDS-SF9 in the present study was very good (Cronbach's alpha = .86).

Procedure

Participants were primarily recruited from online videogame forums and social media as well as students from the researcher's university using opportunity sampling methods. In addition, a recruitment poster advertising the study was shared through social media and a

YouTube/Twitch streamer also promoted the study through their various channels. In order to participate in the present study, all participants were required to have played online videogames. In addition, as an ethical requirement of the present study, all participants were asked to confirm they were at least 18 years old before taking part in the study.

Data analysis

The present study used data collected from an online survey comprising basic demographic information and responses to the three scales (PES, SPQ, and IGDS-SF9). The data were primarily analysed using mediation analysis with accumulated scores from the PES (*y*), SPQ (*m*) and IGDS-SF9 (*x*) providing the variables for analysis. Mediation analysis was selected as the statistical technique for the present study in order to explore the relationship between IGD and occurrence of the PE, as well as the extent to which an individual's sense of presence and connection to their avatar mediated or affected this connection. Data were analysed using SPSS 28 statistical software package with the Hayes PROCESS (version 4.2) macro installed.

Ethics

Approval for the study was provided by the researcher's university ethics committee. Each participant provided their consent to be involved in the study through the online survey before completing any of the questions, along with other supplementary materials concerning the present study. Included with this information were the aims of the research, how the data would be used, contact information for the researchers, guidance on how to obtain support or help after the survey, and the participants' rights (including their right to withdraw their data and the procedure for doing so).

Results

Correlation analysis

To examine the relationships between the scores on the three scales (i.e., IGDS-SF9, PES, and SPQ), initial bivariate Pearson's correlational analyses were conducted. The results indicated that each of the three variables were significantly correlated with each other. More specifically, IGDS-SF9 scores were significantly correlated with SPQ scores (r=.43, p<0.001) and PES scores (r=.49, p<0.001), and SPQ scores were significantly correlated with PES scores (r=.52, p<0.001).

Multiple mediation analysis

In order to explore the association between IGD and the PE and the potential mediating effect of the three domains measured by the SPQ (i.e., proto self-presence, core self-presence, and extended self-presence), the Hayes (2013) Macro PROCESS method (Model 4) was used with a bootstrapped bias correction at a level of 5000 and 95% confidence intervals (see Figure 1).

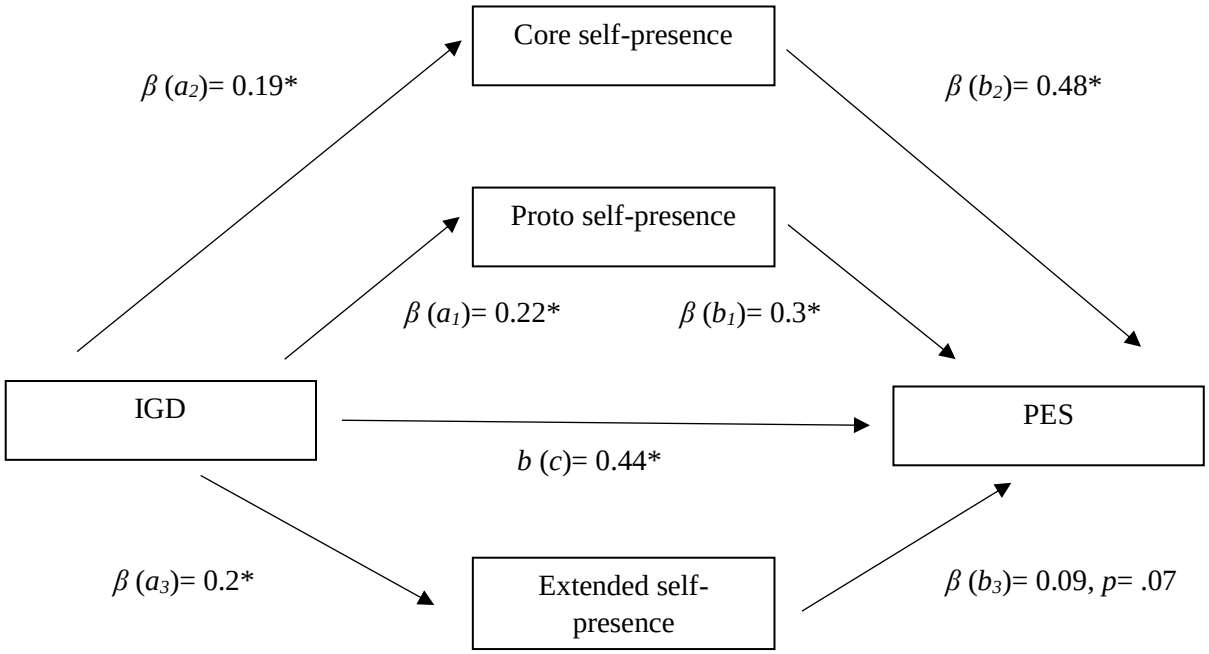

Figure 1: Pathway model and effects of IGD and SPQ domains (proto, core and extended self-presence) on PES

*Significant at $p< 0.001$

Firstly, in terms of proto self-presence, analysis of the data indicated that the overall model for path a_1 was significant ($F[1,376]= 49.35$, $p<.001$, $R^2=.12$), with IGD scores being significantly associated with SPQ proto self-presence scores ($\beta=.22$, $p<0.001$, 95% CI [0.16, 0.28]). Secondly, in terms of core self-presence, analysis of the data indicated that the overall model for path a_2 was significant ($F[1,376]= 77.91$, $p<.001$, $R^2=.17$), with IGDS-SF9 scores being significantly associated with SPQ core self-presence scores ($\beta=.19$, $p<0.001$, 95% CI [0.14, 0.23]). Finally, in terms of extended self-presence, analysis of the data indicated that

the overall model for path a_3 was also significant (F[1,376]= 24.74, p<.001, R^2=.06), with IGDS-SF9 scores being significantly associated with SPQ extended self-presence scores (β=.2, p<0.001, 95% CI [0.12, 0.28]).

Analysis of the data also indicated that the overall model for the mediation pathway was found to be significant (F[4,373]= 58.35, p<.001, R^2=.38). In addition, proto self-presence scores (b_1) were significantly associated with PES scores (b=.3, p<0.001, 95% CI [0.17, 0.42]) and core self-presence scores (b_2) were significantly associated with PES scores (β=.48, p<0.001, 95% CI [0.3, 0.67]). However, extended self-presence scores (b_3) were not significantly associated with PES scores at a standard alpha level of .05 (β=.09, p= .07, 95% CI [-0.1, 0.19]). The total effect model for path c was significant (F[1,376]=123.57, p<.001, R^2=.25), with IGDS-SF9 scores being significantly associated with PES scores (β=.44, p<0.001, 95% CI [0.36, 0.52]).

Finally, the total effect of IGDS-SF9 on PES scores was .44, with a significant direct effect of .27 (p<0.001) and an indirect partial mediation effect of .17. The unstandardized indirect effect of proto self-presence was .06 (bootSE= 0.02, 95% CI [0.03, 0.11]), indicating a significant partial mediating effect of this variable. In addition, the unstandardized indirect effect of core self-presence was .09 (bootSE= 0.02, 95% CI [0.05, 0.13]), also indicating a significant partial mediating effect of this variable. Finally, the unstandardized indirect effect of extended self-presence was .02 (bootSE= 0.01, 95% CI [0, 0.05]). However, it should be noted that the 95% confidence intervals were rounded to two decimal places, and that the lower limit confidence intervals for extended self-presence were in fact below 0 (-.0019), indicating that this variable was not significant in terms of acting as a mediator between the IGD and PES scores.

Discussion

The aims of the present study were to explore the association between gaming disorder (GD) and the Proteus effect (PE), and whether sense of self-presence in a videogame, as assessed using the SPQ, mediated this relationship. The analysis resulted in two key findings regarding the associations between these variables, namely: (i) there was a significant overall association between IGDS-SF9 scores and PES scores, with higher IGD severity predicting greater occurrence of the PE; and (ii) self-presence acted as an overall partial mediator between IGD and the PE, with higher sense of self-presence within a videogame positively

affecting the association between IGD and the PE. More specifically, the results of the present study indicated that individuals with greater GD symptoms were more likely to exhibit consequences relating to the PE. Furthermore, the analysis also suggested that the extent to which an individual feels present in a videogame and connected to their avatar acts as an important factor in the relationship between GD and likelihood of PE consequences occurring.

The results of the present study appear to support the previous, albeit limited, research conducted on the association between the PE and GD. For example, research conducted by Szolin et al. (2022b) argued that specific key elements necessary for the occurrence of the PE, such as avatar identification and connection (Ratan & Dawson, 2016; Li & Lwin, 2016; Song et al., 2014; Szolin et al., 2022a), were also highly prevalent among those with GD, and that it was therefore likely that those with GD were more susceptible and likely to exhibit consequences relating to the occurrence of the PE. In addition, Stavropoulos et al. (2020a) also found evidence suggesting that as GD severity increased there was an increased likelihood for individuals to be influenced and affected by the PE. The results of the present study, combined with the existing literature on this topic, appear to support the assertion that there is a positive association between GD severity and occurrence of the PE.

Moreover, while Stavropoulos et al. (2020a) used a sample of participants consisting solely of those who played *World of Warcraft* (i.e., a massively multiplayer online role-playing game), the results of the present study were based on a more general sample of videogame players with no specific criteria relating to game preference or virtual world environment and a wide range of videogame titles reported by participants. Research has indicated that virtual world environments should not be treated homogenously in terms of the development of user-avatar relationships, and that different environments may elicit different responses from individuals in terms of factors such as self-presence (Han et al., 2023). Consequently, the findings of Stavropoulos et al. (2020a) and those discussed in the present study concerning the association between the PE and GD across different virtual world environments suggests that this relationship is not specific to a single videogame context (i.e., *World of Warcraft*), and indicates that the PE may be a common and important component of the user-avatar relationship for a large number of the GD population.

However, it must also be acknowledged that while the results of the present study appear to support the research conducted by Stavropoulos et al. (2020a) as well as the proposed

theoretical link regarding GD and the PE posited by Szolin et al. (2022b), the findings also appear to conflict with other's research on this topic. In particular, in their study of meta-cognition and desire thinking, Byrne et al. (2022) found evidence to suggest a significant negative relationship between the PE and GD, with a decrease to GD severity as the PE increased. In contrast to the results by Byrne et al. (2022), the results of the present study and those of Stavropoulos et al. (2020a) both identified a significant positive relationship between GD and the PE, and that higher GD severity appears to be associated with higher scores on PE measures. However, Byrne et al. (2022) acknowledged these results as contentious and argue that they may in fact be explained through greater activation of the PE. More specifically, Byrne et al. (2022) suggested that users may have aligned their self-concept to that of the avatar and incorporated aspects of their character's personality to their own, such as resilience and autonomy, and this may reduce the player's perception of the impact of GD symptoms and severity. Therefore, while initially seeming to conflict with past research on this topic, the research conducted by Byrne et al. (2022) may potentially support the positive association between GD and the PE demonstrated in the present study, as well as highlighting some of the issues that may arise when using self-report measures to explore GD and the PE.

In addition, analysis in the present study indicated that two domains of the SPQ (proto self-presence and core self-presence) were found to act as individual significant partial mediators between GD and PE scores. Furthermore, the domain of extended self-presence was found to be approaching significance, and only modestly higher than the standard alpha level of .05 (p= .07). The SPQ assesses several key domains relating to the user-avatar relationship, including emotional connection with an avatar (i.e., core self-presence), avatar identification (i.e., extended self-presence), and extension of one's body through an avatar (i.e., proto self-presence), and the results of the present study indicate that two of these areas of the user-avatar relationship acts as a relevant factor in the association between GD and the PE, along with a further third domain (i.e., extended self-presence) using a modestly adjusted alpha level of .07.

Previous research on the user-avatar relationship for those with GD has primarily focused on avatar identification and self-concept clarity (Leménager et al., 2020; Szolin et al., 2022b). The analysis discussed in the present study appears to highlight that factors such as emotional connection and extension of one's body through a virtual character also appear to be important elements to the user-avatar relationship for those with GD, and that these each represent a partial mediating pathway to the occurrence of the PE. Furthermore, based the

results of the present study, identification with an avatar as demonstrated by the domain of extended self-presence may also be an key factor in the association between GD and the PE, although this claim is somewhat more tenuous compared to the other two domains of the SPQ given the marginally higher reported significance level.

The somewhat questionable role that extended self-presence may play in the association between GD and the PE is particularly surprising given the previous literature relating to the PE (Sibilla & Mancini, 2018; Szolin et al., 2022a) and GD (Leménager et al., 2020; Szolin et al., 2022b) which suggests that strong avatar identification is common for those with GD and an important contributing factor to the occurrence of the PE. However, it should also be noted that specific factors relating to the present study, such as ordering of questions in the survey, may have negatively impacted the results relating to extended self-presence, and that the extent to which the results for extended self-presence ($p = .07$) exceeded the typical significance alpha level of .05 was arguably trivial. Nevertheless, while these non-significant results relating to extended self-presence are close to being statistically significant, this does potentially suggest that this aspect of the user-avatar relationship is perhaps less important in the association between GD and the PE than other factors such as core presence and proto self-presence.

While the existing literature on GD and the PE combined with the findings of the present study highlight that factors such as identification, emotional connection, and potentially sense of presence are likely key components of the user-avatar relationship for those with GD, the described association between GD and the PE also provides a novel insight into the experiences of individuals with GD and the bi-directional nature of this user-avatar relationship dynamic. More specifically, the results of the present study as well as Stavropoulos et al. (2020a) appear to indicate that the occurrence and strength of the PE increases alongside GD severity, which may be interpreted as showing that this is a key part of the user-avatar experience for individuals with GD. This suggests that for individuals with GD, the avatar is more than a mere tool to navigate and interact with a virtual world in control by the user, but becomes a force of influence over the user in terms of their behaviour and attitudes. In particular, the research on the PE and GD indicates that the relationship between a user and their avatar occurs bi-directionally, and although the user exerts their influence over their character through gameplay, the character itself has a degree of influence over the user in return. Furthermore, this relationship dynamic potentially increasingly shifts power into the hands of the avatar as GD severity increases.

Previous research into the user-avatar relationship for GD populations has indicated that these virtual characters hold an important and often significant place in the lives of the user, especially compared to non-gaming disordered ('healthy') populations (Leménager et al., 2020; Szolin et al., 2022b). For example, the significance of the avatar for GD populations is particularly noteworthy in the context of fMRI studies, which report higher left-angular gyrus brain activity among those with GD during reflection of their avatar compared to their self (Dieter et al., 2015; Leménager et al., 2016). More specifically, the left-angular gyrus brain region is associated with self-identification, processing, and distinguishing individuals from others (Decety & Chaminade, 2003; Decety & Grezes, 2006). The higher activation of this brain region during avatar reflection compared to self-reflection demonstrated in the study by Dieter et al. (2015) suggests that those with GD may identify more strongly with their virtual world character than their physical world self, highlighting the significance of the avatar for these individuals which occurs even at a neurobiological level.

When this relationship is considered in light of the existing PE research relating to those with GD, the extent of this complex and multifaceted bond between user and avatar becomes apparent. Although the PE occurs across populations (Szolin et al, 2022a), differences in the user-avatar relationship between gaming disordered and 'healthy' populations suggest that not all populations are equally susceptible to this phenomenon. In the case of 'healthy' populations, the avatar is considered a separate entity to the user that may exert a degree of influence in terms of behaviour and changes to attitudes through the occurrence of the PE and the user's relatively transient identification with their character. However, for those with GD, the avatar can sometimes be identified with more strongly than the user's actual self (Dieter et al., 2015; Szolin et al., 2022b), thereby becoming amalgamated and merged into the personal identity of the user.

As a consequence of this fusion of the identities of user and avatar, the occurrence of the PE becomes a far more complex and powerful phenomenon, and signals a likely loss of autonomy through the influential effects of an avatar that is more pronounced than in 'healthy' populations. More specifically, while 'healthy' populations may identify with an avatar, those with GD may in essence 'become' their avatar in terms of their sense of self, which means that the occurrence of the PE arguably occurs at an internal level as a consequence of this assimilation of user and avatar identities. Due to this process, the avatar may be seen as the dominant force of control over behaviour and personality compared to the user, and to which the user becomes increasingly subservient in terms of the relationship

dynamic. This integration (or perhaps absorption) of avatar and user personalities may account for the results in the present study concerning association between the PE and GD, and highlights the powerful grip and influence that an avatar may wield on the attitudes and behaviour of individuals with GD.

Limitations and future research

The present study found evidence supporting the association between IGD severity and PES scores, as well as the mediating role relating to aspects of the user-avatar relationship, contributing to the limited research on this topic. However, it is necessary to acknowledge several key limitations in the present study, including direction of causality, videogame environment, and the use of the PES and self-report measures.

Firstly, the direction of causality relating to GD, the user-avatar relationship components and the effects this had on the PE strength and likelihood of occurrence cannot be confidently established through the methods presented in the present study. In particular, while there is a strong theoretical basis that links GD with stronger user-avatar relationships and in turn greater susceptibility to the PE (Stavropoulos et al., 2020a; Szolin et al., 2022b), there remains a degree of uncertainty concerning the direction of causation relating to these variables based on the results presented here.

Secondly, a further limitation of the present study relates to the potentially limited generalisability of the identified results in relation to the wider gaming community. More specifically, the data collected in the study were based solely on online videogame experiences and players. However, it must be acknowledged that online videogames represent only a small proportion of available videogames, with many players choosing to avoid this genre. Furthermore, research indicates that different virtual worlds may elicit varied responses from individuals in relation to factors such sense of presence, pleasure, and synchrony (Han et al., 2023) as well as affecting the strength of user-avatar relationships (Szolin et al., 2023). This means that the results in the present study and the conclusions drawn relating to the relationship between GD, the PE and aspects of the user-avatar relationship may only be applicable to a select proportion of gamers and may not necessarily be representative of the wider videogame community. However, although the present study was based on a relatively limited section of the gaming community, there were no criteria regarding player's preference for online videogame world. Therefore, while of arguably

limited generalisability to the full gaming community, the results in the present study may be applied to a much larger sub-section of this population.

In addition, a key element to this study involved the use of the PES (Van Looy et al., 2012), a scale designed to observe the occurrence of the PE with questions such as *"I feel differently when I play with another character"*. However, the use of the PE scale is problematic for two key reasons, namely: the validity of the scale in assessing PE occurrence; and the use of self-report scales in PE research more generally. Firstly, the extent to which the questions of the PES scale in assessing the PE is arguably questionable. For example, while *"I feel differently when I play with another character"* may potentially imply the occurrence of a PE, it is far too vague in its specific wording to reliably or confidently indicate an individual is experiencing the PE. The PES was selected to be used in this present in order to align with the existing research on the potential association between GD and the PE (Stavropoulos et al., 2020a; Byrne et al., 2022), and future research would benefit from using more accurate and sophisticated methods of assessing occurrence of the PE.

Furthermore, it must also be acknowledged that the present study relied on self-report measures in order to obtain data, and that this introduced important limitations relating to GD and the PE. In particular, it may be the case that players under-reported the severity of GD as assessed by the IGDS-SF9 due to self-report bias and a desire for gamers to present themselves in a more socially desirable manner (Williams et al., 2009; Jeong et al., 2018). Similarly, research conducted by Szolin et al. (2023) suggests that individuals may not always be consciously aware of the occurrence of the PE, and that self-report studies which examine this phenomenon may be particularly susceptible to inaccurate participant responses concerning the extent to which the PE has affected their attitudes or behaviours. As a consequence of potential under-reporting of both GD symptoms and the occurrence of the PE, the data and subsequent analysis in the present study may not accurately represent the strength of the relationship between these variables. However, it should be noted that the present study found evidence to support the association between GD and the PE, which means that any under-reporting of either GD severity or PE consequences would imply a potentially even stronger relationship between these variables.

Finally, in terms of future research, it is recommended that further work be conducted on the association between GD and the PE. More specifically, although the present study obtained evidence to support the association between GD and the PE, the combined existing literature

on this topic remains fairly limited with some conflicting results. In particular, although there is a strong theoretical basis to explain how higher GD severity may be associated with greater PE consequences (Szolin et al., 2022b), as well as some previous research evidence to support this claim (Stavropoulos et al., 2020a), research conducted by Byrne et al. (2022) appears to conflict with this and suggests that a negative association between GD severity is associated with lower scores on a PE measure.

However, as previously discussed, these contradictory results by Byrne et al. (2022) may be explained through stronger activation of the PE, to the extent that identification and assimilation of the avatar's identity resulted in a reduced perception of GD symptoms and severity. Therefore, future research would benefit from expanding the research base on this topic by providing further evidence relating to the potential link between GD and the PE to help establish how and to what extent these factors are related.

In addition, the current limited research base on this topic has exclusively relied on self-report measures regarding to the occurrence of the PE, which may be particularly susceptible to bias relating under-reporting of participants (Szolin et al., 2023). Future research would also benefit from exploring the potential link between GD and the PE using different research methods that involved direct observation or experimental manipulation rather than self-report measures in order to reduce the potential for participant bias in reporting the PE.

Finally, and related to the previous point regarding self-report measures in PE studies, future research should also attempt to explore the internal validity of scales such as the PES (Van Looy et al., 2012). In particular, research would benefit from investigating to what extent individuals are aware of the PE occurring or whether this is an entirely subliminal and subconscious process. Establishing individual's awareness of the PE is critical in this field of research, and would determine whether any explicit self-report scales, such as the PES (Van Looy et al., 2012), have any value in this field of research as a method of exploring occurrences of the PE or whether the phenomenon may only be assessed and observed through indirect means which do not rely on an individual's awareness of this process taking place.

Conclusion

The aims of the present study were to investigate the association between GD and the PE, and the mediating effect of different facets of the user-avatar relationships including proto, core, and extended self-presence. The findings indicated that there was a significant overall

positive relationship between gaming disorder and the Proteus effect, and this was mediated by the strength of the user-avatar relationship as assessed using the Self-Presence Questionnaire. In addition, in addition, the three unique domains of the SPQ identified that both core presence and proto self-presence acted as significant mediators in the relationship between GD and the PE, and the third domain of extended self-presence was close to significance. These results suggest that higher GD severity is associated with a greater likelihood of occurrence of the PE, and that factors including avatar identification, emotional connection, and feeling of presence in a virtual world through an avatar act as important contributing elements to this relationship. In addition, and based on these results and previous literature, the present study highlights the importance of future research expanding the currently limited research based on the topic of GD and the PE.

Chapter 7: General Discussion

Introduction and thesis aims

Videogame avatars are a key and often fundamental element of an individual's gaming experience. Beyond the frequent necessary role these characters have in allowing the gamer to navigate and interact with a virtual world, videogame avatars can also become part of a more personal and intimate relationship with the user. For example, many videogame players will design their avatar to represent some aspect of their self (Sibilla & Mancini, 2018), and this can create a greater sense of attachment between a gamer and their character as well as increase their sense of presence within a virtual world (Gorisse et al., 2019; Szolin et al., 2023). However, although videogame players can exert a substantial degree of influence over their avatar in terms of visual appearance, personality, and behaviour, avatars may also influence the user in a process referred to as the Proteus effect (PE) (Yee & Bailenson, 2007).

The PE occurs when a user observes specific characteristics related to their avatar and alters their attitudes or behaviour to align with these characteristics based on pre-existing schema. For example, Yee et al. (2011) found evidence to suggest that videogame players would engage in more player versus player actions when controlling a male avatar compared to a female avatar, and this occurred irrespective of the physical world gender of the participant. Yee et al. (2011) argued that the apparent behavioural influence to engage in more hostile actions when controlling a male avatar occurred due to participants holding a pre-existing belief that links this behaviour with males. Furthermore, the PE may not be restricted to influencing attitudes and behaviours in virtual worlds, with some research evidence suggesting PE experiences in a game may also extend to the physical world (Peña et al., 2018; Peña & Hernandez Perez, 2020). However, although the PE has the potential to lead to notable changes to an individual's attitudes and behaviour both in a virtual and physical world setting, the relatively limited previous research pertaining to this topic means that key elements concerning this phenomenon have remained largely unexplored.

The first chapter of this thesis systematically reviewed the available literature relating to the PE in order to identify and explore the consequences this phenomenon may have on the attitudes and behaviours of videogame players. In particular, whereas previous attempts to synthesis and review the extant literature on the PE combined all forms of virtual environment including both bespoke virtual environments as well as commercially available

videogame worlds (Praetorius & Görlich., 2020; Ratan et al., 2020), the systematic literature review presented in Chapter 1 focused solely on commercially available videogames. The findings from the systematic literature review presented in Chapter 1 identified a number of important and novel findings pertaining to the consequences of the PE as well as the current state of this field of research. More specifically, the study highlighted how the PE can lead to notable changes to an individual's behaviours and attitudes, including socio-political views, gender conforming behaviours and self-perceptions. Moreover, these changes that manifest due to the PE may occur both during gameplay as well as post-game.

In addition, Chapter 1 identified several key components that contribute to the likelihood of the PE occurring, such as immersion, options for avatar customisation, avatar embodiment, and avatar self-relevance. The findings presented in Chapter 1 provided key insights into how the PE may manifest in the context of commercially available videogames as well as providing an account of important contributing factors that may influence the strength and likelihood of the PE occurring.

Moreover, the systematic literature review presented in Chapter 1 also explored the current state of the field of research relating to the PE. In particular, and as discussed in Chapter 1, the current knowledge base for the PE in the specific context of commercially available videogames suffers from a number of key limitations. For example, there are a relatively small number of studies focused on the PE using commercially available videogames, and the limited examples of research that do exist are typically based on a small number of videogame titles. This narrow and restricted array of PE research means that only a small number of virtual worlds and PE consequences have been explored, and that generalising these results across other videogame genres and titles may not be appropriate given the often substantial differences in gameplay, design, gamer experiences, and user-avatar relationship dynamics that occur between videogames (Szolin et al., 2023).

Furthermore, specific aspects of the user-avatar relationship that seemingly affect the strength and likelihood of the PE occurring as discussed in Chapter 1 appear to align with occurrence and severity of gaming disorder (GD), which formed the basis for the second systematic literature review of this thesis presented in Chapter 2. More specifically, the aims of Chapter 2 were to systematically review the available literature regarding user-avatar relationships in the context of GD. GD is defined by the World Health Organization (WHO) in the 11th revision of the *International Classification of Diseases* (ICD-11) as impaired control over

gaming behaviour that takes precedence over other life activities and continues or escalates despite occurrence of negative consequences, and causes significant impairment to social, occupational, personal or other area of functioning (World Health Organisation, 2020).

The results of the systematic literature review presented in Chapter 2 identified a number of key factors relating to the development and maintenance of strong user-avatar relationships for individuals with GD. In particular, it highlighted how individuals with GD will often design their virtual world character to resemble the player's vision of their ideal self, and through this, potentially compensate for and negate their perceived physical world inadequacies. In addition, the results of Chapter 2 indicated how an avatar can become an important and even central component of an individual with GD's life, and may even be identified with more deeply and meaningfully than their physical world identity at a neurophysiological level. Moreover, Chapter 2 also provided some indication that gamers may also incorporate elements of fantasy into their sense of self through interaction with virtual world environments and avatars.

In addition to finding evidence for a number of interesting user-avatar relationship subtleties and dynamics, a critical finding from Chapter 2 related to the seemingly considerable overlap between GD and the PE. In particular, when the results of Chapters 1 and 2 are combined, it becomes apparent that key elements that contribute to the occurrence of the PE, such as strong avatar identification and embodiment, are not only common amongst individuals with GD but far more pronounced among this population than 'healthy' gamers. Furthermore, and as highlighted in Chapter 2, specific aspects of the user-avatar relationship that seemingly affect the strength and likelihood of the PE occurring appear to align with occurrence and severity of gaming disorder (GD). GD is defined by the World Health Organization (WHO) in the 11th revision of the *International Classification of Diseases* (ICD-11) as impaired control over gaming behaviour that takes precedence over other life activities and continues or escalates despite occurrence of negative consequences, and causes significant impairment to social, occupational, personal or other area of functioning (World Health Organisation, 2020). However, despite the strong theoretical link between GD and the PE, there have been only two studies that have explored this potential relationship (i.e., Byrne et al., 2022; Stavropoulos et al., 2020a), and with conflicting results.

Based on the results discussed in Chapters 1 and 2, the purpose of this thesis was to build on and expand the topic area relating to the PE as well as the user-avatar relationship in the

specific context of commercially available videogames through exploration of novel virtual worlds, game genres, and PE consequences. In addition, this thesis aimed to investigate and provide empirical evidence to establish the presence and direction of the theoretical link between GD and the PE that was hypothesised in Chapter 2. In more detail, the aims of this thesis were to:

- Examine the user-avatar relationship in videogames
- Explore the relationship between GD and the PE
- Investigate how the Proteus effect may manifest in videogames.

Major findings

The first empirical study of this thesis presented in Chapter 4 was a qualitative interview study. Building on the research explored in Chapter 1 of this thesis relating to factors that contribute to the development of strong-user avatar relationships and activation of the PE, Chapter 4 was conducted to explore how gamers subjectively experience the user-avatar relationship in videogame playing using qualitative data, with a particular focus on factors related to the occurrence of the PE.

Semi-structured interviews were conducted with 12 participants between the ages of 18 and 27 years. In regard to the demographic information of these participants, this study included: place of residence (six based in the UK, and six based in the US); gender (seven males, one female, four transgender females, and one non-binary); GD status (three currently undergoing treatment and nine not seeking/requiring treatment); and employment status (eight students, one employed and three unemployed). The qualitative interview data collected for the study in Chapter 4 were analysed using thematic analysis, with five major themes and several sub-themes identified including: (i) 'heterogeneity of game worlds': (ii) 'avatar attachment'; (iii) 'game experiences affecting physical world behaviour and attitudes'; (iv) 'types of self in a virtual world' (with the sub-themes of 'actual self', 'idealised self', and 'utopian self'); and (v) 'game difficulty affecting user-avatar relationship'.

Each of the discussed themes presented in Chapter 4 provide a window of insight into the relationship between a user and their avatar in the context of videogames. For example, in the case of the theme of 'heterogeneity of game worlds', participants discussed how different videogame environments elicited different reactions from the player which could either facilitate or inhibit the development of a user-avatar relationship. Furthermore, participants

detailed how even largely similar videogame environments, sometimes from the same game franchise and developer, could offer very gameplay different experiences that could affect the development and strength of the relationship between a user and their avatar. Similarly to this, in the theme of 'game difficulty affecting user-avatar relationship', participants also indicated that increased game difficulty could positively impact the strength of user-avatar relationships, which further evidences the notion that not all videogames and virtual environments elicit the same response from participants in the development of the bond they have with their character. Currently, there is a notable absence of variety in videogame titles in PE research in the context of commercially available videogames, with virtual environments often treated homogenously (Szolin et al., 2022b). However, the themes of 'heterogeneity of game worlds' and 'game difficulty affecting user-avatar relationship' appear to indicate that individual videogame worlds can elicit substantially different relationship dynamics between a user and avatar, and these novel findings suggest that research relating to user-avatar relationships, including the PE, require both careful consideration of the game world used in a study as well as highlighting the need for a greater variety of virtual environments to be used in the field of research.

The next theme identified in Chapter 4 which highlighted an important aspect of user-avatar relationships was 'types of self in a virtual world'. More specifically, participants detailed that avatar customisation in a videogame could be used for a number of key reasons, depending on how the character is designed. For example, participants discussed how avatars based on the physical world appearance of the user (actual-self avatars) facilitated a greater sense of presence in the game world for these users. Alternatively, participants who designed their avatar to resemble how the participants would ideally like to appear as in the physical world (ideal-self avatars) suggested this was a means of closing the distance between their actual and ideal selves and gaining physical attributes or characteristics that would be difficult to achieve in the physical world. Finally, several participants discussed the creation of avatars that contain appearance attributes that are impossible to achieve in the physical world (utopian avatars), such as elf ears or other characteristics derived from fantasy worlds. However, as detailed in Chapter 4, these fantastical physical properties are not necessarily confined to fictional worlds, and that advances in medical science and cosmetic surgery means specific changes to one's body, such as the case of elf ears, are increasingly achievable in the physical world (Szolin et al., 2023). The theme of 'types of self in a virtual world' highlighted how customisation of an avatar in a videogame can be used for a number of key

reasons, including increasing sense of presence in a videogame as well as a form of identity modelling. Furthermore, these detailed ideal and utopian avatars can be used as a form of testing ground to try out new looks or even identities before implementing this in the physical world. Similarly, the theme of 'avatar attachment' also indicated the important role of avatar customisation in user-avatar relationships. In particular, participants involved in the study detailed how being given the opportunity to customise and design their virtual world characters provided players with a greater sense of attachment, ownership, and emotional connection to their avatar, which in turn strengthened user-avatar relationships.

Finally, the theme of 'game experiences affecting physical world behaviour and attitudes' provided an account of how videogame avatars can influence a user outside of the videogame itself. More specifically, in Chapter 4, participants discuss how they would attempt to mimic or replicate specific visual characteristics of their avatar in the physical world, such as hairstyles or purchasing similar clothes as to those worn by the game character. These described experiences with an avatar suggest that virtual characters can be used as either a form of self-template to explore new styles that a user may then recreate in the physical world, or that the avatar may subtly influence the user into mimicking this appearance of a virtual character in the physical world.

Furthermore, in addition to appearance changes, several participants also detailed how they were drawn into new behaviours because of their avatar, such as pursuing botany or astrology due to their character's interest in these topics. Finally, a small number of participants also described how in-game experiences could also permeate to and affect their physical world perceptions in a process known as Game Transfer Phenomenon (GTP- Ortiz de Gortari et al., 2011). Taken together, these components of the theme 'game experiences affecting physical world behaviour and attitudes' highlight how the relationship between a user and their avatar is bi-directional, with avatars having the potential to influence the behaviour and attitudes of users which can extend outside of the game and enter into the physical world.

In addition to the themes identified in Chapter 4 that demonstrate a number of key elements of the user-avatar relationship, the study also presented an interesting and previously largely unexplored aspect of the PE, namely the potentially subliminal nature of this phenomenon. In particular, despite the study being specifically designed to explore user's experiences of the PE, it did not identify any themes explicitly relating to this phenomenon. Previous research on the topic of the PE in the context of commercially available videogames indicates that this

phenomenon appears to occur frequently in the majority of previously published studies on this topic (Bian et al., 2015; Li & Lwin, 2016; Peña et al., 2018; Ratan & Dawson, 2016; Sah et al., 2017: Song et al., 2014; Szolin et al., 2022a; Yee et al., 2011). However, and as discussed in Chapter 4, this absence of explicit user accounts of the PE may indicate that occurrence of the PE may occur in a largely subliminal manner unknown and hidden to the participants, and potentially may even rely on a participant being unaware of the influencing effect of their avatar. While this is a somewhat tenuous conclusion to be drawn based on the absence of data, it does nevertheless potentially have important implications in terms of PE research. In particular, the potentially subliminal nature of the PE means that self-report methods measuring occurrence and strength of the PE may be susceptible to false negative results due to any involved participants being unaware that such a process is occurring, even if that is the case.

The next empirical study presented in Chapter 5 was a pseudo-experimental study which investigated the PE and gender-conforming behaviours in a virtual world. The purpose of the study was to explore three previously unexplored gameplay behaviours in a novel virtual world (*Fallout: New Vegas*), and whether these behaviours were impacted by the gender of an avatar through the PE. The three gameplay behaviours that were examined comprised: (i) number of quests completed, (ii) number of locations discovered, and (iii) number of non-player characters (NPCs) or enemies killed.

This chapter built on the work and recommendations presented in Chapter 1 of this thesis, which identified and highlighted the very limited PE research in terms of manifestations of this phenomenon and specific virtual worlds on which this research is based. In order to build on the recommendations presented in Chapter 1, Chapter 5 of this thesis specifically used a virtual world (*Fallout: New Vegas*) that was unique in PE research in terms of the videogame title as well as rare in terms of being a single player videogame. Furthermore, and again based on the work presented in Chapter 1, the research presented in Chapter 5 utilised several videogame behaviours that have not previously been explored in any previous PE study.

A total of 353 participants were recruited primarily from online forums, with 276 identifying as male and 77 identifying as female and with a total of 107 reporting using a female avatar and 246 reporting using a male avatar. The data that were analysed for the study were obtained from pre-existing save file data which participants were asked to provide in an online survey. The data were analysed using a two-way MANCOVA design, with the

independent variables of avatar gender (male vs. female) and participant gender (male vs. female) and time spent playing the game as a controlled covariate.

The results of the study presented in Chapter 5 indicated two key conclusions relating to the PE and user-avatar relationships in general. Firstly, the results of the study indicated a potential own-gender bias in gameplay performance across the variables of quest completion and location discovery. More specifically, analysis of the data indicated that individuals scored higher on the variables of quest completion and location discovery when in control of an avatar that matched or aligned with the player's physical world gender. However, this own-gender bias relating to gameplay performance was not observed in the third variable of number of enemies or NPCs killed, and suggests that this process may only occur across specific gameplay behaviours rather than affecting all aspects of gameplay. As discussed in Chapter 5, this highlights an important and previously unexplored aspect of the user-avatar relationship in terms of gameplay experiences, and that performance in a videogame under specific conditions may be affected by the gender of a user's avatar.

In addition, the analysis presented in Chapter 5 also indicated a potential new PE consequence in relation to the number of enemies or NPCs killed by a player. More specifically, the results found evidence to suggest that female avatars scored significantly higher on number of enemies or NPCs killed than male avatars irrespective of the physical world gender of the player. This novel finding suggests that participants involved in this study imbued or associated their female videogame avatar with particular characteristics that aligned with behaviours that resulted in a greater number of NPC or enemies killed than male avatars has important implications that notably expand both PE and user-avatar research.

More specifically, the PE findings presented in Chapter 5 suggest that, contrary to previous historical stereotypical societal expectations (Ward & Grower, 2020), aggression and violence were seemingly more strongly associated with controlling a female avatar than a male avatar. This appears to conflict with similar research conducted by Yee et al. (2011) which found that male avatars scored significantly higher on a measure of violence and aggression compared to females and irrespective of the physical world gender of the player. Several explanations for the differences between this study and the work by Yee et al. (2011) are explored in Chapter 5, including influencing presence of other players and changing media representations of women. However, and in particular reference to the latter of these explanations, the PE findings presented in Chapter 5 provide compelling indication that the

PE is not a static phenomenon, but in fact shifts and fluctuates to align with changes to society's views and expectations of particular groups.

More specifically, previous researchers have theorised that a key element in the occurrence of the PE is the reliance on schema, and that individuals will observe identity cues from their avatar and connect these with pre-existing thoughts or expectations that will guide the user's behaviour or attitudes. For example, an individual may associate greater body mass with slower speed, and therefore playing as a larger bodied avatar may impact their performance on an exercise game (Peña et al., 2016). However, the results of the study presented in Chapter 5, combined with Yee et al. (2011) are the first examples of evidence to suggest that over time, stereotypical expectations of specific groups can change, which directly impacts the PE. This means that while the PE may occur routinely across different points in time, the precise consequences will not be the same and will constantly shift to align with societal changes in regard to expectations of particular groups. Therefore, while the occurrence of the PE may be constant, the precise manifestation of this phenomenon is an artefact of time and place. Furthermore, not all societies view specific groups in the same light, which means identity expectations and subsequent PE consequences may vary substantially between different cultures. In this way, the PE can be seen as both a powerful process whereby the seemingly passive avatar may in fact wield substantial power of influence over the behaviour and attitudes of the user, but also a form of mirror that reflects the opinions, values, and attitudes of a society or group.

The final empirical study presented in Chapter 6 was a correlational study using data from an online survey that assessed levels of GD, the occurrence of the PE, and strength of user-avatar relationships. The purpose of this study was to explore the strength and direction of the association between GD severity and the PE, and to what extent facets of the user-avatar relationship affected this association. In particular, this final empirical study was based on the combined findings presented in Chapters 1 and 2 of this thesis relating to the PE and GD. More specifically, a key conclusion drawn from the results of the first two chapters argues that there may be an association between GD and the PE, with individuals suffering from GD more likely to experience activation of the PE. This argument relating to the hypothesised greater susceptibility to the PE by individuals with GD was based on the findings from Chapters 1 and 2 which highlighted how GD and activation of the PE both appear to involve and rely on many similar processes and mechanisms, such as avatar customisation (Ratan & Sah, 2015), immersion (Stavropoulos et al., 2020a), emotional connection (Ratan & Dawson,

2016), and avatar identification (Ash, 2016; Li & Lwin, 2016; Ratan & Sah, 2015). In order to explore this hypothesised link between GD and the PE, this study used three measures, including: the IGDS-SF9 (Pontes & Griffiths, 2015) to assess GD severity; the PES (Van Looy et al., 2012) to assess PE strength and occurrence; and the SPQ (Ratan & Hasler, 2009) to assess sense of self-presence in a virtual world, which comprised three distinct domains (i.e., proto self-presence; core self-presence; and extended self-presence).

A total of 378 participants were recruited for this study, with a broad range of ages, gender identities, and gaming preferences included. The data for this study were obtained from an online survey and analysed using multiple mediation analysis, with PES as the dependant variable (*y*), SPQ (divided into the three domains of proto self-presence; core self-presence; and extended self-presence) as the mediating variables (*m*), and IGDS-SF9 and the independent variable (*x*).

The results of the study indicated two key conclusions regarding the association between GD and the PE. Firstly, the study demonstrated a significant positive association between GD and the PE, and that PE strength and occurrence appeared to increase alongside GD severity. These results suggest that the PE may occur with greater frequency and intensity for individuals experiencing GD, and also may be indicative of stronger user-avatar relationships for these gamers compared to 'healthy' populations. Furthermore, these results provide research evidence to support the theoretical link between GD and the PE proposed in Chapter 2, as well as providing further evidence for the extremely limited number of studies on this topic using new participant samples and original research techniques.

In addition, the results from Chapter 6 also indicated that overall self-presence as assessed by the SPQ acted as a significant partial mediator in the association between GD and the PE. More specifically, the results suggested that the extent to which an individual feels present in a videogame appeared to influence or affect the previously highlighted association between GD and the PE, with experiences of greater or more pronounced sense of presence in a virtual environment increasing the association between GD and the PE. Furthermore, the results presented in Chapter 6 also indicated that the individual domains of proto self-presence (i.e., extent to which an individual experiences their virtual body as an extension of their physical body) and core self-presence (i.e., degree to which virtual world events and interactions elicit emotional reactions from the user both acted as significant individual partial mediators. In addition, the third domain of extended self-presence (i.e., how much the avatar represents the

identity of the user) was also significant at a modestly adjusted alpha level (p=.07). These novel results suggested that aspects of the user-avatar relationship such as emotional connection, extension of one's body through a virtual character, as well as personal identification with an avatar appeared to be key components of the user-avatar relationship for individuals experiencing GD, and impacts the likelihood and strength of occurrence of the PE. Furthermore, the combined results of this study highlighted the bi-directional nature of the relationship between a user and their avatar. In particular, the study presented in Chapter 6 indicates that there was a complex and multi-faceted relationship dynamic between a user and their avatar, with both members of this union having the power to influence and affect the other's behaviour and attitudes. In addition, individuals with GD appeared to be particularly susceptible to the influence of their avatar in the form of the PE, and that the balance of power in terms of influence and control appeared to shift ever more into the hands of the virtual character as the severity of GD symptoms increased.

Originality

The results of the two systematic literature reviews and three empirical studies included in this thesis provide a number of key and original contributions to the literature relating to the PE, GD and user-avatar relationships in the context of commercially available videogames. In particular, each of these chapters provided unique insight into these subjects by utilising new and original methods of investigation.

Firstly, and as previously discussed, the two initial systematic literature reviews presented in Chapters 1 and 2 of this thesis each provided an original contribution to the literature by building on and refining existing literature reviews in order to provide unique and illuminating insight into the topics of the PE and GD. More specifically, Chapter 1 explored the consequences of the PE in the specific context of commercially available videogames. While there are two previous systematic literature reviews broadly exploring the topic area of the PE (Praetorius & Görlich, 2020; Ratan et al., 2020), these studies combined research relating to all forms of virtual environment. Due to this broad combination of all available PE research, the reviews conducted by Praetorius and Görlich (2020) and Ratan et al. (2020) were not able to distinguish between commercially available and custom made bespoke virtual environments in terms of the PE and arguably suffered from lower ecological validity. The research presented in Chapter 1 therefore provided an original exploration of the PE through its singular focus on collecting and reviewing research based on commercially available videogame environments.

Similarly, Chapter 2 built on and refined existing literature reviews to provide a unique and original contribution the available literature. In particular, Chapter 2 explored the user-avatar relationship in the context of GD. While there are examples of three systematic literature reviews with some overlapping research aims and methods (Green et al., 2020; Leménager et al., 2020; Sibillia & Mancini, 2019), none of these studies specifically explored the bond that develops between a user and their avatar with a sole focus on GD populations. The research that is presented in Chapter 2 expanded on the existing literature on the topic of GD and user-avatar relationships through an original and unique exploration of these topics that presents new understanding of these subjects.

Secondly, the thematic analysis study presented in Chapter 4 is the first qualitative study to explore the PE in the context of commercially available videogames, and provides illuminating insight regarding the potentially subliminal component required for activation of this phenomenon. Although this claim regarding the potentially hidden process of avatar influence in this context is arguably tenuous based on this research alone, the study provides a necessary starting point for future research to build on this concept and explore it in greater detail. Critically, if the subliminal nature of the PE is confidently established in future research, the implications that this will have on current and future PE empirical findings and research techniques cannot be overstated.

In addition, and as previously discussed, the thematic analysis study presented in Chapter 4 also indicated a number of key and often novel aspects of the user-avatar relationship in videogames, including key elements in videogames that can notably affect the strength of user-avatar bonds and relationship dynamics. Furthermore, this study is also unique in the range and array and contributing participants relating to gender identity, diagnoses of GD, nationality, and employment status. Additionally, Chapter 4 of this thesis is also the first empirical study to question the distinction between types of self-concept in the context of videogames. In particular, the study posited that utopian avatars may functionally be the equivalent to ideal self avatars, and that self-representation through an avatar should be seen as a fluid process rather than fixed and distinct.

Thirdly, the pseudo-experiment study presented in Chapter 5 of this thesis provided both unique data and insight into the PE and user-avatar relationship in the context of gender-conforming behaviours as well as utilising original and pioneering research techniques for data collection. In particular, the novel results indicated the potential presence of an own-

gender bias in videogame performance as well as a previously unreported PE consequence relating to number of enemies or NPCs killed while in control of a female avatar. These results expand the literature relating to both the PE and user-avatar relationships and provide new and original insight into these areas of study.

The pseudo-experiment presented in Chapter 5 is also the first PE study to explore and analyse occurrences of this phenomenon using pre-existing data. While this novel method of data collection introduced specific issues relating to establishing causality, it also meant that demand characteristics were completely removed from this study which would have severely affected the results as well as substantially improving ecological validity compared to a traditional experiment. Furthermore, and based on the findings from Chapter 4 relating to the potentially subliminal nature of the PE, this study's use of participant's objective pre-existing gameplay data meant the method employed in this study may have been more accurate and effective in measuring the PE than a study using self-report methods. Based on these advantages, and notwithstanding a degree of refinement, the original method of data collection presented in Chapter 5 may influence and inspire future research based on the PE.

Finally, the multiple mediation correlational study presented in Chapter 6 of this thesis both contributed to the limited existing literature regarding the association between GD and the PE as well as providing entirely new insight on this topic. More specifically, to date, there have been only two studies that have empirically investigated the association between GD and the PE (i.e., Byrne et al., 2022: Stavropoulos et al., 2020a), and with conflicting results regarding the direction of the association between these factors. The study presented in Chapter 6 provides new supporting evidence to indicate the direction of this association to supplement this notably limited existing research using an expanded participant sample and greater range of videogame titles, thereby providing crucial supporting evidence as well as expanding the topic area to cover a wider range of virtual environments. Furthermore, the study presented in Chapter 6 provided the first empirical evidence relating to the mediating effect of self-presence in the association between GD and the PE, with further evidence relating to the three specific domains of core self-presence, proto self-presence, and extended self-presence. These previously unexplored results provided new insight into how GD may impact the PE and the critical role self-presence and components of the user-avatar relationship have in this process.

Synthesis and advancement of theory

The three empirical studies presented in Chapters 4, 5, and 6 alongside the two systematic literature reviews presented in Chapters 1 and 2 of this thesis each make a notable contribution to the literature relating to GD, the PE and user-avatar relationships in the context of commercially available videogames. However, while individually each of these studies advances one or more of these research areas, the synthesised and combined results from these chapters provide even greater insight into important facets and mechanisms relating to the PE, GD and user-avatar relationships and provide notable advances to the literature and theory concerning these research areas.

Firstly, a notable topic that is present across multiple chapters of this thesis relates to types of self (i.e., ideal, actual and utopian self) that often form the basis of avatar customisation. In particular, existing research based on user-avatar relationships has identified that in videogames where avatar customisation is available, individuals will often design their virtual world character to reflect a version of their self (Leménager et al., 2020; Sah et al., 2017, Smahel et al., 2008: Sibilla & Mancini, 2018; Szolin et al., 2022b). Creating an avatar based on a version of one's self is rooted in self-discrepancy theory (Higgins, 1987), which describes the actual self as how an individual realistically sees themselves and the ideal self as how an individual would ideally like to be.

In addition, and more recently, a third category to the types of self has been applied to avatar research, namely the utopian self (Mancini et al., 2019) which refers to avatars having characteristics that are impossible to attain the physical world (e.g., appearing as a fantasy race such as an Elf). However, prior to this thesis, there had been very little advancement in research in terms of understanding how these different types of self interact with each other and affect an individual's videogame experience. Furthermore, and despite presenting a key new development in avatar theory, the specific topic of utopian avatars has only previous been discussed in one study (Mancini et al., 2019) outside of the research presented in this thesis.

In regard to the subjects of types of self used in avatar customisation, the combined research presented in this thesis provides new important advancement to this topic area that notably expand the current knowledge and understanding of this topic area. In particular, Chapter 2 of this thesis discusses how there may be an element of overlap between utopian and ideal self avatars in the context of videogame avatars. More specifically, Chapter 2 argues that due to

the greater freedom provided by videogames in terms of avatar design, it is limiting to consider one's ideal self as restricted to what is achievable in the physical world alone, especially given that research has previously identified that some individual may consider their avatar as more 'real' than their physical world self (Szolin et al., 2022b). This argument concerning utopian and idealised self avatars was supported by the research presented in Chapter 4, which indicates that some videogame players will design their avatar that is both a utopian and idealised version of their self (Szolin et al., 2023).

This combined research indicates that, contrary to the previously stated assertion that utopian avatars are distinct and separate to idealised self avatars (Mancini et al., 2019), these two categories of self may in fact be functionally the same in the context of videogames and that one's ideal self in a virtual world may include elements of fantasy while still fulfilling role of representing how an individual would ideally like to appear as. Furthermore, and as discussed in Chapter 4, the limitations of what is achievable in the physical world are decreasing in terms of individuals obtaining physical characteristics that would previously have been described as impossible (i.e., elf ears acquired through cosmetic surgery), thereby further blurring the lines between the ideal and utopian self.

In addition, the results presented in Chapter 4, which build on the work initially discussed in Chapters 1 and 2, also indicate that individuals may not necessarily be restricted in one type of avatar or, more accurately, that a single avatar can fulfil the role of multiple types of self. Previous research regarding avatar use has frequently explored and identified the important role of avatar customisation and types of self (ideal, actual, utopian) in user-avatar relationships (Dieter et al., 2015; Leménager et al., 2016; Morcos et al., 2021; Sah et al., 2017; Smahel et al., 2008). However, existing research on types of self in the context of videogames have routinely assumed these categories of self are separate, and that an avatar may at any one time only be representative of one type of self.

In contradiction to this previously held belief regarding avatars and types of self, the research presented in Chapter 4, and advancing initial theories posited in Chapters 1 and 2, suggest that an individual's avatar may simultaneously fulfil the roles of the actual, ideal and/or utopian self representation. More specifically, a single avatar can contain elements of more than one type of self, and that a more appropriate manner of viewing avatars in this sense may be on a permeating spectrum rather than uniquely distinct categories (Szolin et al., 2023). The combined research presented in this thesis regarding types of self and avatar use,

and specifically the apparent overlap between these categories, highlights a new way of understanding how individuals design and use their videogame avatars that notably expands the current knowledge base on this topic.

Secondly, a further research area that is explored across multiple chapters relates to the components that increase the strength of user-avatar relationships in videogames and affect the likelihood of activation of the PE. In particular, previous research has identified a number of factors that contribute to the bond that develops between a user and their avatar, and includes avatar customisation (Ratan & Sah, 2015), immersion (Stavropoulos et al., 2020a), emotional connection (Ratan & Dawson, 2016), and avatar identification (Ash, 2016; Li & Lwin, 2016; Ratan & Sah, 2015). Furthermore, and as discussed in Chapters 1 and 2, many of these factors that contribute to user-avatar relationship strength are also key elements in the occurrence of the PE (Szolin et al., 2022a; 2022b). However, in addition to these previously detailed components that contribute to the bond between a user and their avatar, the research presented in this thesis identified and explored a number of new and important factors that affect both user-avatar relationships and the occurrence of the PE

More specifically, the research presented in Chapter 4 indicates a number of important factors that contribute to user-avatar relationship strength that have not been previously explored in existing literature on this topic. In particular, Chapter 4 highlights the key role of higher game difficulty for increasing user-avatar bonds and emotional connection as well as the differences in between virtual worlds in terms of gameplay mechanics that are instrumental in how one connects to their avatar. Furthermore, Chapter 4 also provided support for and expands on existing research concerning factors such as avatar identification and customisation and their role in user-avatar relationships. In addition, the analysis presented in Chapter 6 provided new evidence using novel methods for several existing key elements that appear to contribute to the occurrence of the PE, including viewing the avatar as an extension of one's body (proto self-presence), identification with an avatar (extended self-presence) and emotional connection to an avatar (core self-presence).

Finally, and in connection to Chapters 4 and 6, the research presented in Chapter 5 should also be briefly discussed here to highlight the comprehensive advancement to existing theory and research concerning user-avatar relationships that this thesis provides. In particular, and as discussed, Chapters 4 and 6 provide evidence for a number of important and previously unexplored factors that contribute to the strength of the user-avatar relationship as well as

providing new evidence for several existing components. In addition, these chapters also provide evidence for both direct and indirect factors that contribute to the occurrence of the PE. Building on this, and as already discussed, Chapter 5 provides empirical evidence for a previously undiscovered PE manifestation using novel methods of investigation. Combined, these three empirical chapters, alongside the initial formulation of theory and synthesis of existing literature provided by Chapters 1 and 2, provide a full account of the PE. More specifically, the combined chapters provide evidence for factors that contribute to user-avatar relationships (Chapter 4), components of the user-avatar relationship which affect the strength and likelihood of the PE occurring (Chapter 6) and a new manifestation of the PE (Chapter 5). In particular, the results from Chapters 4, 5 and 6 can together be seen as detailing subjective experience of user-avatar relationships, factors that contribute to the bond between gamer and avatar, the role of user-avatar relationships in occurrence of the PE, and specific manifestations of the PE. These combined chapters therefore provide a comprehensive explanation of the PE and the role of user-avatar relationships through all stages of this phenomenon, and together advance the existing theory relating to these topics by providing both novel and original insight as well as offering new supplementary evidence for existing research.

Finally, the combined results from these empirical studies also provide new insight into important aspects of user-avatar relationships relating to the association between GD and the PE. More specifically, the study presented in Chapter 6 identified a statistically significant positive association between GD severity and occurrence of the PE, and this was partially mediated through three different facets of self-presence (i.e., core, proto, and extended self-presence). While Chapter 6 provided statistical evidence demonstrating the association between GD, the PE, and the role of different forms of self-presence, these results are greatly expanded upon when this study is considered alongside the thematic analysis results presented in Chapter 4. In particular, the results from Chapter 4 outline and explore individual's subjective experiences of facets of the user-avatar relationships, with many of these themes seemingly overlapping and mirroring self-presence domains discussed in Chapter 6.

For example, the specific domain of proto self-presence concerns the extent to which an individual feels that their avatar is an extension of their own body (Ratan & Hasler, 2009). Related to this, a theme explored in Chapter 4 concerns how gameplay difficulty and challenge can increase an individual's sense of presence within a videogame. More

specifically, participants in Chapter 4 detailed how greater game difficulty and mechanics caused them to concentrate more on the videogame and controlling their avatar, which in turn led to a more pronounced sense of connection to their avatar and a feeling of virtual presence in the game world via their character. Similarly, the domain of extended self-presence, which refers to the extent to which an avatar reflects aspects of the user's identity, is also seemingly discussed by participants in Chapter 4 through the themes of '*types of self in a virtual world'* and '*avatar attachment'*. In particular, these two themes in Chapter 4 appear to highlight how, through intentional customisation or later alignment of user and avatar characteristics, greater identification with an avatar appear to be an important factor in the development of strong user-avatar bonds.

While individually each of these studies provided unique and important insight into user-avatar relationships, the combination and synthesis of results from Chapters 4 and 6 provided new levels of depth to the topic of GD and the PE. More specifically, Chapter 6 provided statistical analysis implicating the three types of self-presence (i.e., core, proto, and extended self-presence) as being positively associated with the PE and mediating the association between GD and the PE. The themes explored in Chapter 4 compliment the results of Chapter 6 by providing first-hand accounts of how individuals subjectively experienced these types of self-presence in a virtual world and explored the factors that contribute to the strength and likelihood of these domains of self-presence occurring, and thereby provided substantial new depth in understanding these precise mechanisms related to GD and the PE.

In summary, these studies together highlighted the vital role that strong user-avatar bonds play in the occurrence of the PE, as well as the specific mechanisms that are necessary for the development of these relationships and which contribute to the strength and likelihood of occurrence of the PE. Furthermore, the studies demonstrated that the PE is a highly complex phenomenon which relies on an individual's susceptibility and vulnerability to influence, but the precise manifestation of this phenomenon in turn may be seen as a reflection of the values and ideals held by the individual themselves. In this respect, the combined research of this thesis presents the avatar in the context of the PE as a powerful, and seemingly at times almost independent, agent with the potential to deliver substantial changes to an individual's attitudes and behaviour, whose control appears largely based on how much a gamer connects with them. However, even when the avatar is at its most influential in terms of the occurrence of the PE, it nevertheless remains an object that merely mirrors the pre-existing identity values held by the individual experiencing this phenomenon.

Practical applications

The findings presented in the two initial systematic literature reviews (Chapters 1 and 2) as well as the three empirical studies (Chapters 4, 5, and 6) identified and explored a number of key and original aspects of user-avatar relationships, GD, and the PE in the context of commercially available videogames. While these various chapters provide key insight and advance the current research base relating to these topic areas of GD, the PE and user-avatar relationships, there are also several important ways these findings may be applied to practical and commercial settings, including: improving user enjoyment and engagement with videogame titles; aiding in videogame design and gameplay curation; and utilisation as a behaviour change technique.

Firstly, and as discussed, this thesis explores and provided evidence for a number of new and original factors that influence user-avatar relationships as well as providing supplementary support for several previously implicated elements that contribute to this bond. For example, this thesis highlighted how advanced videogame difficulty, fluidity of game controls, observable consequences to in-game decisions, and greater avatar customisation can all contribute to users feeling a stronger attachment and bond to their virtual world character. Related to this, this thesis also indicated that stronger user-avatar relationships appear to help develop a greater sense of immersion and self-presence in a videogame, which in turn may lead to greater emotional connection and sense of enjoyment of the videogame world. Based on the accumulated findings presented, it is recommended that videogame companies and designers focus on implementing or facilitating the activation of these factors that create a strong bond between user and avatar as this can clearly affect a user's sense of immersion, enjoyment and overall satisfaction with a videogame title, and subsequently benefit ratings and sales of a videogame title.

Secondly, the findings relating to the PE may also be applied to practical game design and commercial settings. In particular, and as highlighted in Chapter 1, the PE has been consistently shown to have to the power to affect a user's behaviour and attitudes in a virtual world (Bian et al., 2015; Li & Lwin, 2016; Peña et al., 2018; Ratan & Dawson, 2016; Sah et al., 2017: Song et al., 2014; Szolin et al., 2022a; Yee et al., 2011). Building on this, and utilising the findings relating to factors that appear to contribute to activation of the PE, such as greater sense of self-presence, videogame designers and companies may use this phenomenon in order to create more curated and designer-led videogame experiences.

For example, while many videogames seemingly pride themselves on providing vast open worlds that allow users to be or do whatever they choose, or at least within the confines of the game system, other game titles seek to provide a more curated experience. A popular example of this form of videogame may be seen in the title '*The Last of Us'*, which involves a strong narrative and character driven focus on-rails experience where players are given little to no freedom in how they complete tasks and play as a character that has already been designed in a particular manner in terms of appearance and personality by the development team. Titles such as *'The Last of Us'* provide a narrow and curated experience that is in some ways reminiscent of a film or book in terms of character and story, but with clear gameplay elements, which may benefit from utilisation and application of the PE.

In particular, highly curated experience games work most effectively when the user and avatar are aligned in terms of attitudes and desired behaviour as this effectively hides the imposed barriers of the game in terms of player choice. More specifically, in cases where a videogame requires a player to behave in a particular manner, the user will find this more agreeable and perceive as less restrictive if they are influenced into wanting to perform this behaviour through alignment with their avatar via the PE. For example, and using the same example of '*The Last of Us'*, a key theme of this game is the protective and paternal behaviour of the protagonist towards the deuteragonist. Calculated utilisation of the PE through key player-observable characteristics of the protagonist (i.e., appearance and other visual cues) may help synchronise the attitudes of player with the avatar and direct user's gameplay behaviour in-line with what the developers intended.

This described strategic use of the PE in order to facilitate users behaving in the desired or expected manner of the game design and development team may aid in creating videogame cohesion, narrative structure, and overall user enjoyment of the videogame title. Furthermore, in these narrative curated games, a user-avatar emotional attachment, and indeed alignment, which appears to be implicated in the development of the PE (as highlighted in Chapters 1, 4 and 6) may also lead to a greater sense of connection and enjoyment of a videogame title, which again may be beneficial in terms of commercial sales and user ratings of a title.

Moreover, and separate to the previous point regarding the PE and videogame design, the PE may also have potential application in much wider settings. In particular, if effectively utilised, the PE may be used a means of behaviour change in a variety of settings within and beyond videogames. For example, it may be argued that social media involves a form of

avatar that, while certainly distinct from videogame avatars, may share some similarities in terms of activation and manifestations of the PE. Furthermore, as technology advances, particularly in regard to virtual reality applications, controlling virtual characters may become increasingly present and commonplace in everyday lives.

Additionally, and building on the previous point regarding advancements in technology, there is an increasing likelihood of avatars becoming far more commonplace beyond videogame use due to developments such as the Metaverse. The Metaverse is a virtual reality environment comprising connected virtual worlds, and may eventually be used as a form of hub for social, professional and leisure activities (Taylor et al., 2024). In this context, the avatar will become particularly significant in terms of how individuals navigate through these virtual worlds as well as interact with other users.

Furthermore, the greater sense of avatar embodiment that virtual reality devices provide may greatly increase user-avatar relationships as well as the likelihood of the PE occurring (Mal et al., 2023). This means that research conducted in regard to the PE and its consequences may begin to be of increasing value at a societal level, in line with widespread adoption of VR technology and the use of avatars becoming more commonplace across a greater number of settings beyond videogames extending to professional, leisure, social, and other contexts. However, it should also be noted that despite noteworthy advancements in the field of virtual reality and applications such as the Metaverse, there is currently relatively limited consumer engagement with this technology and services, but that this may increase as technology advances and becomes more affordable and sophisticated.

In addition, a further potential application of the PE may exist in the context of GD treatment. In particular, a key finding of this thesis relates to the seemingly greater susceptibility to the PE by individuals with GD (as discussed in Chapters 1, 2 and 6). This greater susceptibility to the PE combined with the clear deep connection between a GD user and their avatar (Leménager et al., 2020, Szolin et al., 2022b) may mean that targeted utilisation and exploitation of this user-avatar bond may be used to help treat or inhibit GD. More specifically, it is possible that, based on the discussed use of the PE, avatars that are carefully designed to contain specific identity elements that promote characteristics such as greater self-control or interest in activities outside of videogames may be used to influence the GD user into adopting these characteristics and carrying this forward outside of the game world. To this end, the avatar, which may ordinarily be seen as a possible contributing factor to the

development and maintenance of GD (Leménager et al., 2020, Szolin et al., 2022b), may instead be tactically used as a form of behaviour change technique that encourages and promotes activities and personality characteristics that inhibit GD occurrence and symptom severity.

However, and of particular importance to the previous point, it must be noted that PE research remains limited particularly in regard to manifestation occurring outside of a virtual world and the persistence/permanence of this phenomenon. For example, a study focusing on exploring post-game PE consequences was conducted by Peña et al. (2018) who found evidence to suggest PE manifestations may persist after gameplay, but there are very few examples of similar research with even fewer exploring to what extent these PE occurrences persist. As such, although PE research may have the potential to see extensive application as a behaviour change technique across a number of settings, this will require a greater amount of research focused on the short-and long-term effects of this phenomenon before any recommendations may be made in terms of practical applications in the context of videogame design, GD treatment, or behaviour change.

Limitations and future research

The research presented in this thesis identified and elucidated a number of original and key components relating to the PE, GD, and user-avatar relationships in the context of commercially available videogames. Nevertheless, it must also be acknowledged that there are a number of limitations present in the studies, which have been discussed at length in each of the study's respective chapters. However, in addition to weaknesses found in the individual studies, there are a number of key limitations that may be identified across the research contained within this thesis, and include issues establishing causality, and problems relating to generalising results and conclusions.

Firstly, it must be acknowledged that none of the studies included in this thesis directly established a cause-and-effect relationship between any of the topics under investigation. More specifically, while the three studies included in this thesis and their methods of analysis (i.e., thematic analysis, correlational analysis, pseudo-experiment using pre-existing data) may hint at associations and links between factors such as GD and the PE or specific manifestations of the PE occurring due to an identity variable, it was not possible to confirm causality using these described approaches. However, it must also be noted that the absence of measurement of cause-and-effect relationships is expected in some types of study (i.e.,

qualitative research), and arguably the consequences of using the approaches discussed in the quantitative research of this thesis which prohibit establishing cause and effect, such as improved ecological validity and generalisability, provide valuable benefits to the research and conclusions presented in this thesis. Nevertheless, although there are clear benefits to the research design choices made throughout this thesis, the fact that causality between assessed variables cannot be reliably established in any of the included studies but merely hinted at means that there remains a degree of uncertainty regarding the conclusions presented in this thesis relating most notably to GD, the PE, and manifestations of this phenomenon.

Secondly, a further limitation that exists across all the research studies included in this thesis related to the relatively limited population samples included in each of the studies and the effects this has on generalisability of the findings. In particular, and as discussed earlier in this chapter, the PE is a phenomenon that appears to rely heavily on an individual's pre-existing schema relating to identity cues, perceived stereotypical behaviour patterns, and value systems, which are likely to vary between cultures and groups. However, the participant groups that contributed to the research presented in this thesis were overwhelmingly from the UK and US, which means the results and conclusions may only be applicable to a fairly narrow and restricted example of the gaming population. In particular, research has shown that there are almost three billion videogame players worldwide in 2023 (Statista 2023), which accounts for approximately one-third of the total global population and clearly includes vast numbers of players outside of the UK and US. Due to this narrow range of participants included in the research presented in this thesis, any conclusions drawn relating to the PE, GD, and user-avatar relationships may only be generalisable to UK and US populations and may not be representative of the experiences of gamers outside of these two countries.

Finally, and building on the research presented, there are a number of avenues of future research that may benefit the topics of GD, the PE, and user-avatar relationships. Firstly, and as previously discussed, the precise manifestations of the PE are likely to be culture- and group- specific, although there is (to date) no research that has explored this topic. Future research may therefore benefit from both exploring a wider range of cultures and countries in PE research as well as directly comparing the experiences relating to videogaming and user-avatar relationships in this context between these potentially different and unique populations.

Secondly, a recommendation for future research that has been consistently presented throughout this thesis relates to the limited array of virtual worlds that have been included in PE and user-avatar relationship research. In particular, and as demonstrated in Chapter 1, the majority of research on these topics has focused on a very limited range of virtual environments in terms genre, platform, and title. This is particularly problematic given that research has indicated that videogame players experience individual virtual environments differently (Han et al., 2023). Furthermore, this suggestion that virtual environments are unique and should not be treated homogenously is highlighted in Chapter 4, with participants describing how even videogame titles from the same franchise can create vastly different experiences and subsequent user-avatar relationships. It is therefore recommended that future research both explores a greater and more varied selection of videogame environments as well as further investigation of the differences found between virtual worlds in terms of user-avatar relationships and the PE.

Finally, one of the key aims of this thesis was to explore the association between GD and the PE, and which formed the basis for Chapter 6. In particular, there appears to be substantial overlap between factors that facilitate the occurrence of the PE and common user-avatar relationship dynamics for individuals with GD (i.e., high avatar identification and stronger user-avatar relationships), and this theoretical link was highlighted in Chapter 2. In addition to this theoretical link, there are only two previously research studies that have explored the association between GD and the PE (Byrne et al., 2022; Stavropoulos et al., 2020a) as well as the research presented in Chapter 6 of this thesis. The combined results from these few studies on GD and the PE appears to largely point to a positive association between these variables, with higher GD severity predicting higher PE susceptibility. However, despite the promising results that appear to support the association between GD and the PE, it must be acknowledged that this, to date, remains a fairly limited number of studies on this topic, and future research would benefit from exploring the association between these areas in greater depth.

Furthermore, and once a stronger research base is developed (hopefully) supporting the positive link between GD and the PE, future studies may benefit from focusing PE research on samples of individuals with GD. In particular, using samples of individuals with GD in PE research means that, given this group's seemingly greater susceptibility to the PE, any manifestation of the PE may be more readily and easily observed with this population before later exploration and confirmation with wider 'healthy' gaming populations. Furthermore,

and again given individuals with GD's greater susceptibility to the PE, PE research focused on this group will likely yield data and results that will both shed light on the unique experiences of this group of gamers as well as potentially providing meaningful benefits to treatment and assessment through deeper understanding of the relationship dynamic that occurs between individuals with GD and their videogame avatar.

Final remarks

The aims of this thesis were to (i) examine the user-avatar relationship in videogames, (ii) explore the relationship between GD and the PE, and (iii) investigate how the Proteus effect may manifest in videogames. To achieve these research aims, two systematic literature reviews and three empirical studies were conducted, and included: a thematic analysis interview study; a correlational online survey study; and a pseudo-experiment study. The results of these three empirical studies provide a number of unique insights and original contributions to the topics of GD, the PE and user-avatar relationships in videogames. For example, the results of the thematic analysis study indicated several important components to both user-avatar relationships and mechanisms or features present in videogames that may facilitate or hinder the development of these bonds. Moreover, and in addition to exploring original data highlighting the bi-directional nature of user-avatar relationships in videogames, the thematic analysis study included also indicated the potentially subliminal nature of the occurrence of the PE, which is likely to have significant implications in shaping future research approaches in this subject area.

The pseudo-experimental study also provided new and original insight into the growing area of the PE as well as user-avatar relationships in general. More specifically, the results of the study appeared to indicate that gamers performed better across several key variables when in control of an avatar that is visually similar to themselves in terms of gender identity, as well as presenting a potentially new PE manifestation in terms of female avatars and number of NPCs or enemies killed. Building on these results, this thesis also discussed the implications these results have on PE research, in particular the likely disparity in PE consequences between different groups, cultures, and points in time. In addition, the unique method of data collection used in this pseudo-experimental study for exploration of the PE may be suitably adapted and used to guide future research on this topic area.

The final study of this thesis was a correlational study using multiple mediation analysis to explore the association between GD and the PE. While the purpose of this study was to

confirm the strength and direction of this potential link that has been hinted at in the extremely limited array of previous research, the study built on this by exploring this topic with new participant populations and is the first study to investigate the mediating effect of sense of self-presence in a virtual world in the relationship between GD and the PE. The results of the multiple mediation analysis study provide key evidence supporting the possible link between GD and the PE as well as highlighting the importance of sense of self-presence in this relationship. The results of this study have important research implications, and provided unique and compelling evidence to guide future studies on GD and the PE.

Taken together, the results of these three empirical studies provide original insight into user-avatar relationships in the context of videogames, offer new and complimentary evidence that support the association between GD and the PE, and greatly expand current understanding and knowledge of the PE phenomenon using innovative and pioneering research methods. Furthermore, and despite some limitations including limited generalisability of results due to the included participant populations and issues concerning establishing cause and effect relationships, the empirical studies presented pave the way for future studies and provide recommendations for new research to further advance these fields of study.

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Appendix A: Declaration of collaborative work

Literature reviews

Contribution of the first author (Kim Szolin):

- Conceptualisation
- Design
- Collection of literature
- Organisation of literature
- Analysis of literature
- Write-up
- Implementation of co-authors' feedback

Empirical chapters

Contribution of the first author (Kim Szolin):

- Conceptualisation
- Design
- Participant recruitment
- Data collection
- Data organisation
- Data analysis
- Write-up
- Implementation of co-authors' feedback

Appendix B: Materials for thematic analysis study (Chapter 4)

Interview schedule

1. Can you tell me a bit about yourself?

2. Can you tell me about your personal history with videogames and gaming?

3. Why do you play videogames?

4. What videogames do you play?

-In the past/current

-Why these videogames?

5. How do you customise your videogame avatar?

-Why?

6. How would you describe your relationship with your avatar?

7. In what ways does your avatar reflect who you are?

-Physically, behaviourally, attitudinally.

8. Do you feel an emotional connection to your avatar? In what ways?

9. Does your avatar ever affect your behaviour or attitudes inside/outside of the game? In what ways?

10. Does your avatar affect your relationships with other people inside/outside of the game? In what ways?

11. During gameplay, to what extent do you feel your avatar is an extension of your own body?

12. How do you feel when something happens to your avatar?

-Happy, sad, scared.

-Does this ever extend to the physical world outside of the game?

13. Can you tell me any stories that occurred to you that relates to your avatar that you remember particularly well?

14. Is there anything else you would like to add before the interview closes?

Participant information sheet

Participant Information Sheet

Information about this study

My name is Kim Szolin, and I am conducting this study as part of my PhD thesis. The aim of this study is to investigate the relationship videogame players have with their virtual world avatar both in-game and outside of the game.

You are being asked to take part in an interview via Microsoft Teams that will last for approximately 1 hour. I will ask a series of questions relating to both the relationship you have had with your avatar as well as more general questions about the role videogames have had in your life.

With your permission, this interview will be audio recorded and then transcribed. Due to the nature of this research, certain extracts from your interview will be used in the final report. During the interview, please let me know if you would rather not answer any questions or would like to stop the interview at any point. Your participation in this study is entirely voluntary, and you have the right to withdraw at any point during the interview or afterwards up to four weeks after the interview has taken place. You do not need to provide a reason for withdrawing from this study, and any data collected up to that point will be destroyed.

In order to protect your anonymity, the interview transcript will be completely anonymised with all identifiable information including names and places appropriately changed. All data will be securely stored and password protected. Your name will not appear anywhere in the final report, nor will it be known to anyone other than myself and the members of my supervisory team, including: Dr Mark Griffiths, Dr Daria Kuss, and Dr Filip Nuyens. Although your data and personal details will be kept fully anonymised at all times to ensure neither you nor anyone associated with you can be identified, due to the nature of this study extracts from these interviews may be used in the final report.

Details of how to seek help and a list of support services will be made available to you if you feel you have been affected by any of the topics discussed during the interview.

If you have any questions regarding this study or your involvement, I can be contacted via email at: kim.szolin2016@my.ntu.ac.uk, and my Director of Studies, Dr Mark Griffiths, can be contacted at: mark.griffiths@ntu.ac.uk

Thank you for your interest in this study.

Participant consent forms

Participant Consent Form

Investigator

Kim Szolin kim.szolin2016@my.ntu.ac.uk

A *participant information sheet* outlining the purpose of this research accompanies this form.

Please tick all that apply:

I have had the opportunity to ask questions about my participation.	☐
I have been informed and understand the purpose of this research study.	☐
I understand my research is voluntary and I am under no obligation to participate in this study.	☐
I understand I have the right to withdraw from this study without reason during the interview or within four weeks after the interview, and that any data collected will be removed and destroyed by the lead investigator.	☐
I agree to have my interview audio recorded and transcribed for this research study.	☐
I have read and understood the participant information sheet and the consent form.	☐
I confirm I am 18 years old or over.	☐

Participant electronic signature	Date

Name of Investigator	Date
Kim Szolin	

Debrief sheet

Debrief sheet

Purpose of this study

This study is designed to explore the relationship videogame players have with their virtual world avatar. In particular, we are interested in exploring how the avatar can affect the behaviour and attitudes of the videogame player and the relationship dynamic that occurs between user and avatar as a result of this. We hope this information will provide important insight into this phenomenon and allow us to better understand the user-avatar relationship in videogames.

What if I change my mind after taking part?

Your participation in this study is entirely voluntary, and you have the right to withdraw within four weeks after the interview has taken place. You do not need to provide a reason for withdrawing from this study, and any data collected up to that point will be destroyed. If you would like your data to be removed and deleted after you have taken part, you can contact Kim Szolin or Dr Mark Griffiths via email (contact details below).

If I have some questions, who can I contact?

Principal investigator: Kim Szolin. Email: kim.szolin2016@my.ntu.ac.uk

Director of Studies: Dr Mark Griffiths; Email: mark.griffiths@ntu.ac.uk

Psychology Department, Nottingham Trent University

50 Shakespeare Street, Nottingham, NG1 4FQ

Direct Telephone Line: 0115-8482401

If I feel upset, where can I go?

Samaritans: Call 116 123 (or use their email service jo@samaritans.org)

Thank you for your interest in this study.

Appendix C: Materials for experiment study (Chapter 5)

Complete survey for experiment

Start of Block: Information

Information

My name is Kim Szolin, and I am conducting this study as part of my PhD thesis. The aim of this research is to investigate the relationship between gaming behaviour, gender and avatars.

For the purpose of this study, I am asking if you would be willing to complete a short survey that will take approximately 10-15 minutes to finish. All responses are confidential. Responses to these questions will be pooled together before being analysed and used in the final report. All data will be securely stored and password protected.

In order to take part in this study, you will need to own the videogame Fallout: New Vegas and have access to a previous save file. This study will require you to open this save file and provide details of various in-game metrics and statistics, and will include: length of play time for that particular save file; and a number of in-game metrics which can be located in the Pip-Boy menu. Detailed instructions on how to locate this information will be provided in the survey.

Your participation in this study is entirely voluntary, and you may withdraw from the study either during the survey or up to four weeks after submitting your answers. If you choose to withdraw your data after having submitted your answers, please send an email to either myself or Dr Mark Griffiths indicating you wish to withdraw (contact details can be found below). Please note that in order to remove your data aspects of your identity such as email address will become known to myself or Dr Mark Griffiths. However, all data and information related to you will be removed from the study and deleted immediately upon request.

If you have any questions regarding this study or your involvement, I can be contacted via email at: kim.szolin2016@my.ntu.ac.uk, and my lead supervisor, Dr Mark Griffiths, can be contacted at: mark.griffiths@ntu.ac.uk

Finally, contact details for support if you feel upset during the survey can be found below.

Samaritans: Call 116 123 (or use their email service jo@samaritans.org)

End of Block: Information

Start of Block: Consent

Q1 If you are 18 years of age or older, understand the statements above, and freely consent to participate in the study, click on the "I agree" button to begin the survey.

- ○ I Consent

End of Block: Consent

Start of Block: Identifier

Q2 Please provide a six digit identifier. This can be created by using the first two letters of your surname followed by the last two digits of your phone number and the month your were born.

For example, John Smith, 07xxxxxxx89, 01/02/1980 would be SM8902.

_____

End of Block: Identifier

Start of Block: Player Gender

Q3 Please indicate the gender you identify as.

- ○ Male
- ○ Female
- ○ Non-binary/third gender

End of Block: Player Gender

Start of Block: Length of time playing

Q4 Please select a single save file for the videogame Fallout: New Vegas and detail the precise number in hours and minutes spent playing the game in the box below. If possible,

please select the save file in which you have played the longest. This information can be found on the Load Game screen next to each of your save files.

_____

End of Block: Length of time playing

Start of Block: Avatar gender

Q5 Please indicate the gender of your avatar/character based on the save file you reported in the previous question.

- ○ Male
- ○ Female

End of Block: Avatar gender

Start of Block: General stats

Information Based on the same save file as the previous questions, please indicate the number for the following gameplay stats. This information can be found in the Pip-Boy menu under Stats in the General section.

Q7 Gameplay stats.

- ○ Number of quests completed _____
- ○ Number of locations discovered _____
- ○ Total number of things killed _____

End of Block: General stats

Start of Block: Debrief

Information

Purpose of this study
This study is designed to explore the relationship between gaming and avatars. We hope this information will provide important insight and allow us to better understand the link between gaming, gender and the user-avatar relationship.

What if I change my mind after taking part?
Your participation in this study is entirely voluntary, and you have the right to withdraw your data for up to four weeks after you have submitted your answers. You do not need to provide a reason for withdrawing from this study, and any data collected will be destroyed. If you would like your data to be removed and deleted after you have taken part, you can contact Kim Szolin or Dr Mark Griffiths via email (contact details below).

If I have some questions, who can I contact?
Principal investigator: Kim Szolin. Email: kim.szolin2016@my.ntu.ac.uk
Director of Studies: Dr Mark Griffiths. Email: mark.griffiths@ntu.ac.uk Psychology Department, Nottingham Trent University 50 Shakespeare Street, Nottingham, NG1 4FQ Direct Telephone Line: 0115-8482401

If I feel upset, where can I go?
Samaritans: Call 116 123 (or use their email service jo@samaritans.org)

End of Block: Debrief

Appendix D: Materials for survey study (chapter 6)

Complete online survey

Start of Block: Study information

Part 1

Information about this study

My name is Kim Szolin, and I am conducting this study as part of my PhD thesis. The aim of this research is to investigate the relationship between gaming and avatars.

For the purpose of this study, I am asking if you would be willing to complete a short survey that will take approximately 5 to 10 minutes to finish. All responses are confidential. Responses to these questions will be pooled together before being analysed and used in the final report. All data will be securely stored and password protected.

Your participation in this study is entirely voluntary, and you may withdraw from the study either during the survey or up to four weeks after submitting your answers. If you choose to withdraw your data after having submitted your answers, please send an email to either myself or Dr Mark Griffiths indicating you wish to withdraw (contact details can be found below). Please note that in order to remove your data aspects of your identity such as email address will become known to myself or Dr Mark Griffiths. However, all data and information related to you will be removed from the study and deleted immediately upon request.

If you have any questions regarding this study or your involvement, I can be contacted via email at: kim.szolin2016@my.ntu.ac.uk, and my lead supervisor, Dr Mark Griffiths, can be contacted at: mark.griffiths@ntu.ac.uk

End of Block: Study information

Start of Block: Consent

Part 1.1 If you are 18 years of age or older, understand the statements above, and freely consent to participate in the study, click on the "I agree" button to begin the survey.

○ I agree

End of Block: Consent

Start of Block: Identifier

Part 1.2 Please provide a six digit identifier. This can be created by using the first two letters of your surname followed by the last two digits of your phone number and the month your were born.

For example, John Smith, 07xxxxxxx89, 01/02/1980 would be SM8902.

_____

End of Block: Identifier

Start of Block: Videogame use

Part 1.3 Do you play online videogames?

- ○ No
- ○ Yes

End of Block: Videogame use

Start of Block: Time spent playing videogames

Part 1.4 How many hours a week do you play online videogames on weekdays?

_____

End of Block: Time spent playing videogames

Start of Block: Time spent playing videogames

Part 1.5 How many hours a week do you play online videogames at the weekend?

_____

End of Block: Time spent playing videogames

Start of Block: Demographic

Part 2.1 Gender

- ○ Male
- ○ Female
- ○ Non-binary / third gender
- ○ Prefer not to say

End of Block: Demographic

Start of Block: Demographic

Part 2.2 Age (in years)

_____

End of Block: Demographic

Start of Block: Demographic

Part 2.3 Please select the type of system you have used the most for playing online games in the past 12 months

- ○ Console (e.g. Xbox, PlayStation, Nintendo)
- ○ Computer (e.g. PC, MAC, laptop)
- ○ Mobile device (e.g. smartphone, tablet)

End of Block: Demographic

Start of Block: Demographic

Part 2.4 Employment status

- ○ Full-time employed
- ○ Full-time student
- ○ Unemployed
- ○ Part-time employed
- ○ Part-time student/part-time employed
- ○ Other
- ○ Prefer not to say

End of Block: Demographic

Start of Block: Demographic

Part 2.5 In which country do you currently live?

▼

End of Block: Demographic

Start of Block: Demographic

Part 2.6 Relationship status

- ○ Married
- ○ In a relationship (not married)
- ○ Single
- ○ Other
- ○ Prefer not to say

End of Block: Demographic

Start of Block: Videogame preference

Part 3.1 Please write the name of the online videogame you played the most in the past 12 months

_____

End of Block: Videogame preference

Start of Block: Videogame preference

Part 3.2 Please indicate your favourite genres of videogame. You may select more than one option.

- ☐ Real-time strategy games
- ☐ First-person shooter games
- ☐ Role-playing games
- ☐ Multiplayer online battle arena games
- ☐ Racing games
- ☐ Sports games
- ☐ Roguelike games
- ☐ Simulation games
- ☐ Massively multiplayer online game
- ☐ Other

3.2 If you answered other, please provide details here.

_____

End of Block: Videogame preference

Start of Block: SPQ 1. Proto-self presence

Part 4 Please select the response that you feel most accurately describes your experiences for each of the questions. If possible, please base your answers on your experiences in games that allow avatar customisation.

7	Not at all	Somewhat	Moderately	Very much	Absolutely
When playing the game, how much do you feel like your avatar is an extension of your body within the game?	○	○	○	○	○
When playing the game, how much do you feel your avatar is a part of your body?	○	○	○	○	○
When using your avatar, to what extent do you feel like you can reach into the game through your avatar?	○	○	○	○	○
When using your avatar, to what extent do you feel like your arm is elongated (changed to) “stretched” into the game through your avatar?	○	○	○	○	○
When playing the game, to what extent do you feel like your hand is inside of the game?	○	○	○	○	○

End of Block: SPQ 1. Proto-self presence

Start of Block: SPQ 2. Core self-presence

Part 4.1 Please select the response that you feel most accurately describes your experiences for each of the questions. If possible, please base your answers on your experiences in games that allow avatar customisation.

	Not at all	Somewhat	Moderately	Very much	Absolutely
When sad events happen to your avatar, do you also feel sad?	○	○	○	○	○
When scary things happen to your avatar, do you feel afraid?	○	○	○	○	○
When arousing events happen to your avatar, do you also feel aroused?	○	○	○	○	○

End of Block: SPQ 2. Core self-presence

Start of Block: SPQ 3. Extended Self-Presence

Part 4.2 Please select the response that you feel most accurately describes your experiences for each of the questions. If possible, please base your answers on your experiences in games that allow avatar customisation.

	Not at all	Somewhat	Moderately	Very much	Absolutely
To what extent is your avatar's appearance related to some aspect of your personal identity?	○	○	○	○	○
To what extent does your avatar's name represent some aspect of your personal identity?	○	○	○	○	○
To what extent does your avatar's race relate to some aspect of your personal identity	○	○	○	○	○
To what extent is your avatar's gear (clothing) related to some aspect of your personal identity?	○	○	○	○	○
To what extent did your avatar's skin colour represent some aspect of your personal identity?	○	○	○	○	○

End of Block: SPQ 3. Extended Self-Presence

Start of Block: PES

Part 5 Please select the response that you feel most accurately describes your experiences for each of the statements

	Strongly disagree	disagree	Neither agree or disagree	Agree	Strongly agree
When I play with a different character, I feel different in real life	○	○	○	○	○
I behave differently when I play with another character in real life	○	○	○	○	○
When I play with another character, I feel involved in a different way in real life	○	○	○	○	○
The choice of game character determines how I experience things in real life	○	○	○	○	○
I have different game characters so that I can act in different ways in real life	○	○	○	○	○
I see things differently in real life when I play with another character	○	○	○	○	○

End of Block: PES

Start of Block: IGDS9-S

Part 6 Please select the response that you feel most accurately describes your experiences for each of the questions

	Never	Rarely	Sometimes	Often	Very Often
Do you feel preoccupied with your gaming behaviour?	○	○	○	○	○
Do you feel more irritability, anxiety or even sadness when you try to either reduce or stop your gaming activity?	○	○	○	○	○
Do you feel the need to spend increasing amount of time engaged gaming in order to achieve satisfaction or pleasure?	○	○	○	○	○
Do you systematically fail when trying to control or cease your gaming activity?	○	○	○	○	○
Have you lost interests in previous hobbies and other entertainment activities as a result of your engagement with the game?	○	○	○	○	○
Have you continued your gaming activity despite knowing it was causing problems between you and other people?	○	○	○	○	○
Have you deceived any of your family members, therapists or others because the amount of your gaming activity?	○	○	○	○	○
Do you play in order to temporarily escape or relieve a negative mood (e.g., helplessness, guilt, anxiety)?	○	○	○	○	○
Have you jeopardised or lost an important relationship, job or an educational or career opportunity because of your gaming activity?	○	○	○	○	○

End of Block: IGDS9-SF

Start of Block: Debrief

Part 7

Purpose of this study

This study is designed to explore the relationship between gaming and avatars.. We hope this information will provide important insight and allow us to better understand the link between gaming and the user-avatar relationship.

What if I change my mind after taking part?

Your participation in this study is entirely voluntary, and you have the right to withdraw your data for up to four weeks after you have submitted your answers. You do not need to provide a reason for withdrawing from this study, and any data collected will be destroyed. If you would like your data to be removed and deleted after you have taken part, you can contact Kim Szolin or Dr Mark Griffiths via email (contact details below).

If I have some questions, who can I contact?

Principle investigator: Kim Szolin. Email: kim.szolin2016@my.ntu.ac.uk
Director of Studies: Dr Mark Griffiths. Email: mark.griffiths@ntu.ac.uk Psychology Department, Nottingham Trent University 50 Shakespeare Street, Nottingham, NG1 4FQ Direct Telephone Line: 0115-8482401

If I feel upset, where can I go?

Samaritans: Call 116 123 (or use their email service jo@samaritans.org)

End of Block: Debrief

Recruitment poster

DO YOU PLAY ONLINE VIDEOGAMES?

ELIGIBILITY:

PLAY ONLINE VIDEOGAMES

AGED 18 YEARS OLD OR OVER

STUDY ENDS ON 01/05/2023

We are currently looking for participants aged 18 or over to complete our 10 minute survey looking at the relationship between users and their avatars in online games. If you are interested in taking part, please scan the QR code or follow this link:

https://ntupsychology.eu.qualtrics.com/jfe/form/SV_4OQ7xHracRDRBm6

All responses will be anonymized and confidential. If you have any questions, please contact the lead researcher at: kim.szolin2016@my.ntu.ac.uk. This study has been approved by the Nottingham Trent University Research Ethics Committee.

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