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From thrill seekers to social creatures: dimensions of curiosity differentially predict video game preferences and behaviours

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ABSTRACT
Research has shown that curiosity leads to improved performance in formal activities (e.g. school and work). However, there is an underappreciation of the motivating role that curiosity plays in more recreational activities, such as video gaming. Moreover, curiosity has historically been conceptualised in various ways, presenting a challenge when choosing a measure of curiosity. Using an updated curiosity framework (Five-Dimensional Curiosity Scale Revised), this study investigated how six dimensions of curiosity predicted video gaming behaviours, including play time and structural characteristics of video games (i.e. features of games that players enjoy, such as good graphics). The sample comprised 398 self-identified video gamers (50.30% males) from Malaysia and the Philippines, with a mean age of 37.30 ($SD = 12.05$). Confirmatory multiple regression analyses revealed that, of the six dimensions of curiosity, thrill-seeking predicted overall time spent playing video games, while joyous exploration predicted enjoyment of rewarding and punishing features. Overt social curiosity predicted enjoyment of social features in video games, but covert social curiosity did not. Other associations between dimensions of curiosity and structural characteristics of games were observed in exploratory analyses. Our findings offer insights into aspects of games that individuals enjoy based on the dimensions of curiosity.

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Curiosity dimensions; video gaming; structural characteristics

Curiosity plays a fundamental role in many aspects of life. It evokes feelings of interest within individuals, not only about standalone topics that captures their attention, but also the larger world around them. More formally, curiosity is defined as the recognition of novel stimuli, leading to the desire and pursuit to gain new experiences (Kashdan et al. 2018). Being curious comes with a host of benefits, such as improved memory, persistence, and creativity, all of which have been shown to be advantageous in school and job performance (Mussel and Spengler 2015; Von Stumm, Hell, and Chamorro-Premuzic 2011). While curiosity is important and beneficial for formal activities, how it relates to more activities is less studied (Yow et al. 2022) Based on longitudinal data, people spend a comparable amount of time between working and leisure activities (Ortiz-Ospina, Giattino, and Roser 2020), indicating that leisure activities represent a major domain of human activity, and should not be underemphasised compared to their non-leisure counterparts. Iso-Ahola and Baumeister (2023) also reported an underappreciation in how individuals engage in leisure activities, given that it can potentially make up for the lack of meaning in life if one finds work trivial and unimportant. In the context of curiosity, a scoping review (Yow et al. 2022) found that the majority of curiosity research revolves around employment and education, highlighting the need for further research on curiosity and recreational activities. In the paucity of research concerning curiosity in leisure activities, scholars have investigated curiosity in the context of tourism, music, and sports (Jani 2014; Omigie and Ricci 2022; Park, Ha, and Mahony 2014).

One such recreational activity is video gaming. Video gaming is a hugely popular activity; over the last decade, there has been a steady growing interest in video games (Marston and Azadvar 2020). Richter (2022) reported that in 2021, revenue from the video gaming industry added up to an estimated $192.7 billion, and eclipsed other popular media industries such as film entertainment, and music. In the USA, there were an estimated 214 million video gamers in 2020, and this number

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has continued to rise since (Entertainment Software Association 2020; 2022). Besides video games simply being fun and engaging, circumstances such as lockdowns and work from home conditions due to COVID-19 could have contributed to this surge in video gamers, by freeing up time to play games. For example, in Singapore, marketing research firm YouGov reported that almost 60% Singaporean gamers aged 18–24 reported playing more video games post-COVID-19 (Ho 2020). Beyond the pandemic, the number of video game users have continued to rise annually, and this trend is projected to increase by a further 400 million users between 2023 and 2027 (Clement 2023). From a video gaming perspective, video games must be able to pique gamers' curiosity and maintain it. Thus, curiosity is a concept frequently used by game designers because it drives player engagement and keeps people deeply involved with a game (Schaekermann et al. 2017). In the present study, we seek to better understand the motivational antecedents of video gaming by examining the role that curiosity plays.

1. Measuring the psychological construct of curiosity

Curiosity has been defined in numerous ways. For example, personality researchers conceptualised curiosity as part of the openness trait (Costa and McCrae, 2008). Some scholars have also regarded curiosity as a unidimensional construct akin to interest (Marvin and Shohamy 2016). More recently, literature has moved towards curiosity being viewed as multidimensional. A significant portion of curiosity research has conceptualised curiosity as comprising dual facets (e.g. interest vs deprivation; Litman 2008), where a distinction is made in how curiosity is piqued: being curious for the pleasurable experience, or to avoid the anxiety that one experiences from lacking knowledge. Other researchers have also proposed additional dimensions of curiosity (e.g. social curiosity: pertaining to interest in other individuals; Renner 2006). Overall, these conceptualisations were often studied in parallel and remained as isolated strands of research. Current knowledge suggests that curiosity comprises of multiple facets, and thus a more inclusive framework and measure is needed. A scoping review conducted by Yow et al. (2022) found that the most recent and comprehensive measure of curiosity was the Five-Dimensional Curiosity Scale Revised (5DCR; Kashdan et al. 2020). The 5DCR provides a significant improvement over previous conceptualisations by combining existing lines of research and the multifaceted nature of curiosity into a cohesive and comprehensive measure. This allows researchers to further explore the nuances of curiosity, and serves as an ideal framework for further research involving curiosity.

The 5DCR consists of six factors: (1) joyous exploration, (2) deprivation sensitivity, (3) stress tolerance, (4) overt social curiosity, (5) covert social curiosity, and (6) thrill seeking. Joyous exploration refers to the pleasurable experience that one gains when engaging in behaviour. Kashdan et al. (2009) describes this dimension as a general fascination with new information that leads to positive emotions. Conversely, sensitivity deprivation refers to a type of curiosity that results in anxiety and frustration of not knowing certain information. This suggests that an individual could be curious not due to an interest in acquiring new knowledge, but rather more of a preoccupation to learn what one does not know, or closing an information gap. Next, prior to exhibiting curiosity, a person makes a judgement call if they can adequately manage potential distress that could surface when exploring a situation. This forms the curiosity dimension of stress tolerance. In other words, someone with low stress tolerance may display less curiosity. Another way that an individual can be curious is in relation to another person, thus forming the social curiosity dimension. This dimension can be further split into two components: overt, where individuals are interested in gathering information through socialising, and covert, where knowledge regarding others are obtained indirectly and secretly (e.g. spying). Lastly, besides tolerating stress, some may embrace it, and willingly pursue social, financial, and legal risks to gain unique experiences. This dimension is thus termed thrill seeking, where arousal is sought after, rather than avoided.

2. Curiosity's relationship with video gaming intentions and behaviours

Virtual worlds are great sandboxes for the investigation of human behaviour. How or why people play video games can reveal things about their personal attitudes and motivations. Lazzaro (2004) identified curiosity as one of the main motivational factors of gaming. This sense of curiosity and the 'want' to find out and explore more about a game then leads to immersion in the virtual world, narrative, or even just novel stimuli.

The idea of curiosity being an antecedent to video gaming was introduced approximately four decades ago, where Malone (1981) purported that curiosity formed one of three pillars (the other two being challenge and fantasy) of intrinsic motivation leading to playing video games. At the time, curiosity was viewed as having two components – sensory, and cognitive. Given the shift in perspectives over the years when conceptualising curiosity (the most contemporary one being the 5DCR; Kashdan et al. 2020), there is a need to update the literature in the links between curiosity and gaming, especially if there are specific dimensions of curiosity that can better account for video gaming behaviours.

Using Malone's (1981) three-factor framework, Sedano et al. (2007) identified curiosity as one of the critical elements in prolonged engagement with mobile games, and found that curiosity was the main driving factor behind participants' motivation to complete a game. Simultaneously, Sedano et al. (2007) also reported that curiosity was separate from the other two factors of challenge and fantasy. However, Sedano et al. (2007) did not employ the use of parametric statistical analyses, thus findings should be interpreted with caution. Nonetheless, the results do hint at the importance of curiosity toward gaming tendencies.

More recent research has also sought to further clarify the relationships between curiosity and video gaming behaviours. For example, Dahabiyeh, Najjar, and Agrawal (2021) found that higher levels of curiosity led to lowered perceived risk, such as compromising privacy, in playing an online game, but increased intention to play it. When faced with scenarios that offer enabling conditions for curiosity (e.g. partial information), players tend to not evaluate the risks involved, which covers a wide spectrum, ranging from information risk (e.g. privacy), to financial or even physical risks. Even if individuals engage in risk assessment, they often underplay it, preferring to indulge their curiosity regardless of outcome, highlighting the power of curiosity. Also in the study, curiosity was conceptualised as a unidimensional construct, specifically as an information gap that individuals want to close (i.e. deprivation factor of Litman 2008). However, based on research that paints curiosity as a multidimensional construct (e.g. Kashdan et al. 2020), it is unclear how different dimensions of curiosity relate to video gaming intentions. Additionally, the curiosity scale used by Dahabiyeh, Najjar, and Agrawal (2021) was adapted from the state-trait curiosity inventory (Naylor 1981). This could be problematic as the state-trait curiosity inventory does not strictly measure curiosity arising from an information gap, but rather focuses on the state-trait distinction. As a result, findings should be interpreted with caution. This limitation again highlights the importance of using an appropriate measure to examine the multidimensional structure of curiosity.

In another study, Kim and Lee (2017) investigated how interest and deprivation types of curiosity were related to future play intentions in mobile games. Participants were categorised into different groups, based on their interest and deprivation curiosity scores (dichotomised into high/low scores, resulting in a combination of four groups). Statistically, there was a significant difference between the four groups, but there was no post-hoc test conducted to evaluate where the difference lay. Hence, it is premature to conclude if there is an 'ideal' group that would be more likely to continue playing mobile games. Also, the study used intention to play, as opposed to actual gaming behaviour. Studies have shown that intentions do not necessarily lead to behaviour (Webb and Sheeran 2006), which underscores the advantage of examining exhibited behaviour, or at least retrospective recall of gaming behaviour, as opposed to intentions toward behaviour.

Overall, research has shown that curiosity has a positive relationship with time spent engaging with the subject matter of interest (e.g. playing video games). For instance, when individuals are curious about something, they assign more attention toward, and spend more time engaging in activities surrounding it (Yang, Carlson, and Chen 2020). More importantly, recent research has not only uncovered other dimensions of curiosity (e.g. social curiosity; Renner 2006) but also synthesised them into a single measure (i.e. 5DCR; Kashdan et al. 2020). By examining curiosity more comprehensively using updated scales, more insight can be gained on the relationships between different facets of curiosity and gaming behaviours, which often include the use of game genres. However, there are drawbacks related to genre of games.

3. Video gaming genre and its limitation

Genre classification is a common framework used to categorise video games, and served a marketing purpose, allowing consumers to easily narrow down the games that interest them (Lee, Clarke, and Perti 2015). In the video gaming industry, a multitude of genres has been used to classify games. Common genres include: Action Adventure, Action Role Playing, Board or Card Games, Casual, Education, Fighting, Flight, Massively Multiplayer Online Role-Playing Games (MMORPG), Music, Party, Platformer, Puzzle, Racing, Real-Time Strategy, Role-Playing (RPG), Shooters, Simulation, Sports, Text Adventure and Turn Based Strategy (Peever, Johnson, and Gardner 2012). These genres can also sometimes be further broken down into sub-genres: a shooter game can be divided into either a first-, or third-person shooter.

Much research has been conducted involving the use of video game genres, such as the relationships between personality and video game genres (Peever, Johnson, and Gardner 2012). For example, Graham and Gosling

(2013) found that extraversion and neuroticism were associated with role-playing gamers in World of Warcraft, an MMORPG. Another study conducted by Lesmana et al. (2021) revealed that first-person shooter players possessed very low extraversion, agreeableness, conscientiousness, and openness, but have high neuroticism. Dewanto and Tiatri (2021) reported that openness was positively related to the genre of sports. However, findings from the above studies could be distorted by the fact that often times, a video game does not fit into a single genre. For instance, a game could simultaneously be an action game, a role-playing game, and a first-person shooter (e.g. Cyberpunk 2077; CD Projekt RED 2020). Indeed, the increasing complexity and scope of modern games where game developers try to incorporate multiple elements and activities make it nigh impossible to clearly categorise games into single genres. As a result, studies involving the use of game genres may suffer from the amalgamation of multiple genres tagged to a game.

In more curiosity-specific research, Gómez-Maureira and Kniestedt (2019) investigated how factors of curiosity were related to video game genres. However, the aforementioned authors acknowledged another challenge in using genres. They explained that the genre of 'action' can be problematic, as a large number of games involve fast-paced sequences but may be based on vastly different game mechanics. This may then confuse participants when considering what an 'action' game is.

4. A potential solution: structural characteristics of a video game

Rather than looking at genres, another approach may be to look at the structural characteristics (or specific features) of a video game that appeal to players. These could range from social features (allowing players to communicate with one another) to exploration features (navigating to new areas; Griffiths, Davies, and Chappell 2004). Early work from Wood et al. (2004) reported that despite growing anecdotal evidence on the importance of structural characteristics, there remained a lack of empirical research on that area. Findings from Wood et al. (2004) revealed that a high degree of realism (realistic sound, graphics, and setting), character development, the ability to customise the game, and multiplayer features were the most essential features that gamers look out for. Building on Wood et al.'s (2004) work, King, Delfabbro, and Griffiths (2010) drew on gaming research, proposing that there could be important features that were previously omitted (e.g. presence of rewards to engage players). This resulted in the five-factor taxonomy of video game structural characteristics (social features, manipulation and control features, narrative and identity features, reward and punishment features, presentation features) that players align with in games (Table 1). Given the limitations of single use video game genres (i.e. a game can comprise of many genres), using structural characteristics can potentially provide more nuanced insights.

Table 1. The video game structural characteristics taxonomy (King, Delfabbro, and Griffiths 2010).

Feature	Definition
Social features	Social aspects of video game playing
Manipulation and control features	Role of user input in influencing in-game outcomes
Narrative and identity features	Role of character creation and interactive storytelling
Reward and punishment features	The ways in which players win and lose in video games
Presentation features	Visual and auditory presentation of video games

5. Multidimensional curiosity, playtime, and video game structural characteristics

Given that contemporary research views curiosity as multidimensional (with the 5DCR being the most comprehensive measure to capture curiosity; Kashdan et al. 2020), there is reason to believe that adopting a multidimensional approach will permit a fuller and more nuanced understanding of the relationship between curiosity and video gaming play-styles and preferences. For example, joyous exploration refers to revelling in new experiences. In a video gaming context, this could be exploring a virtual world and finding joy in what surprises the environment holds. In MMORPGs, gamers explore the dynamic and large open worlds to satisfy their curiosity, and this motivation to make new discoveries keeps them playing (Chou and Ting 2003). The role of exploration for 'fun' and uncovering new things in games has also been highlighted in research (Gómez-Maureira and Kniestedt 2019). The authors reported that games involving exploration are of particular interest to participants, and cited cues such as obstructions (e.g. a rock to block an object of curiosity) or out of place elements (e.g. three identical trees where one stands out by having an extra apple hanging from a branch; Gómez-Maureira and Kniestedt 2019). Such cues usually come with the promise of rewards should gamers explore them further. This notion was also supported in research by Wang and Sun (2011), who reported that gamers who enjoy exploring do so because of a desire to earn unique rewards. Overall, this would suggest a positive relationship between joyous exploration and playtime, as well as a predictive relationship between the joy of exploration and reward features in video games.

The ubiquitous nature of the internet has led to people commonly interacting with others through online mediums. In gaming, being able to socialise with others was reported to be the most important feature of online games (Griffiths, Davies, and Chappell 2004). Of special note is the genre of MMORPGs, which functions as an omnipresent space for social interactions (Stavropoulos et al. 2017). Ducheneaut and Morre (2004) also found that competitive and cooperative experiences with other players led to increased enjoyment in video gaming. Accordingly, this indicates that curiosity in other players can be what draws gamers to the social aspects in video games. Regarding covert social curiosity behaviours such as gossip, research has also linked gossiping to aggressive behaviour, and aggression has been found to be associated with the playing of more violent video games (Möller and Krahé 2009). The dimension of social curiosity could be further exacerbated by COVID-19. Since the outbreak, research has also found that individuals reported playing more multiplayer games to make up for the lack of in-person communication (Barr and Copeland-Stewart 2022). Even before COVID-19, interpersonal communication via the use of information technology has been rising (Palvia et al. 2018), thus this upward trend may not be directly caused by the pandemic, but simply accelerated. Nonetheless, it appears that social curiosity plays an even more important role now in increasing gaming playtime (i.e. both overt and covert social curiosity predicting playtime) and influencing behaviour, especially pertaining to the social features in video games that allow players to connect with others (i.e. both overt and covert social curiosity predicting enjoyment of social features).

In deprivation sensitivity, an individual may feel curious about a disparity between what one knows, and what one wants to know. Such elements are common in puzzle games such as Portal (Valve 2007), where players manipulate space using a portal gun to reach the end of the level. There may only be one solution, and the gap in knowledge arises between the player's attempted solution and the right solution, which is closed as the player develops strategies to complete the level (Costikyan 2013). Deprivation sensitivity in games can also be seen in in-game scenarios where stimuli are purposefully complex and ambiguous, which then creates an information gap, and results in the manifestation of curiosity (To et al. 2016). The need to close these gaps in knowledge could then lead to prolonged gaming sessions, hence we expected that deprivation sensitivity could predict playtime.

The ability to tolerate stress (i.e. stress tolerance) that arises when facing complex and ambiguous stimuli affects the degree to which one demonstrates curiosity. In the gaming literature, Canale et al. (2019) found that vulnerability to stress was positively correlated with weekly gameplay time. Similarly, Yu, Mao, and Wu (2018) pointed out that individuals who are intolerant of negative affective states tend to cope with problems using activities that provide means of escape. Following this logic, it stands to reason that individuals with low stress tolerance should engage more in video gaming, underpinned by a predictive relationship between them.

Lastly, thrill seeking is a facet of curiosity where arousal is coveted. For example, Petrova, Gross, and Insights (2017) reported that the reason why an individual watches gaming videos on YouTube is to get a thrill out of activities that one would not experience in the actual world, such as skydiving or bungee jumping. In research conducted by Gómez-Maureira and Kniestedt (2019), participants commonly mentioned Grand Theft Auto (Rockstar North 2015) when thinking of games that invoke thrill seeking curiosity. Grand Theft Auto is an action-adventure game series, where players play the role of a criminal who often partakes in larger-than-life activities, such as robbing banks and hijacking planes. It appears that playing games provides an avenue for individuals to satisfy their thrill-seeking curiosity by allowing them to partake in experiences that cannot be easily realised in the real world. It is also worth noting that some of the most popular gaming franchises with the highest number of hours played such as Call of Duty (Treyarch 2015) and Battlefield (DICE 2021) revolve around violence and combat – a dangerous yet thrilling endeavour that people do not usually participate in in real-life. Thus, it is possible that thrill seeking would be associated with gaming hours.

6. The present study

While the construct of curiosity in gaming has been investigated, it is sometimes conceptualised as a unidimensional construct. This view does not align with a more comprehensive and multidimensional view of the nature of curiosity. At present, it is unclear if there are specific aspects of curiosity in the 5DCR that lead to different gaming behaviours, above and beyond intentions. Given the multifaceted nature of curiosity and acknowledging its importance in why individuals play games, our knowledge and understanding can be expanded by utilising a comprehensive and holistic framework of curiosity to uncover the links between the dimensions of curiosity and gaming related behaviours. Moreover, given the potential concerns over using game genres as a framework, we instead took a different approach and examined the structural characteristics of games.

Research has shown that curiosity has a positive relationship with time spent engaging with the subject matter of interest. We therefore hypothesised that all the facets of curiosity would predict video gaming playtime. Other than time spent, we can also gain knowledge into the characteristics of games that players enjoy. Accordingly, we hypothesised that joyous exploration would predict enjoyment of rewarding features in a video game. Lastly, we also hypothesised that both covert and overt social curiosity factors would predict enjoyment of social aspects in a video game. The other associations between the dimensions of curiosity and structural characteristics of video games were examined in a more exploratory fashion.

7. Method

7.1. Participants

We targeted participants who were from Southeast Asia, at least 18 years of age, proficient in the English language, and played video games for at least 1 hour per week (to be considered a video gamer). The '10-times rule' method was used (sample size greater than 10 times the number of relationships pointing to latent variables; Hair, Ringle, and Sarstedt 2011), which resulted in a recommended sample of 300. After data cleaning, a final sample size of 398 was obtained, with 50.30% males, and 49.70% females. Participants' age ranged from 18 to 75 years, with $M = 37.30$, $SD = 12.05$. Participants were either from the Philippines (50.80%), or Malaysia (49.20%). Average years of education was 14.22 ($SD = 3.16$, range = 2–26 years; 4 nonsensical values were omitted). With regards to relationship status, 53.50% were married, 42.00% were single, and 4.50% reported as 'others'. Among the participants, 1.51% of the participants' information on occupation were missing or uninterpretable, 83.92% were working full time, 4.27% were unemployed, 4.52% were homemakers, 4.02% were students, 0.75% retirees, and 1.00% were employed part-time.

7.2. Measures

The current study was part of a larger scale project. Only measures relevant to the aims of the present study are presented here. In the current study, a total of three scales were administered, along with a short demographic section asking for age, gender, nationality, number of years of education, occupational status, and relationship status.

7.2.1. Five-dimensional curiosity scale revised (5DCR)

The 5DCR (Kashdan et al. 2020) is a 24-item measure consisting of six subscales: joyous exploration, deprivation sensitivity, stress tolerance, thrill seeking, overt social curiosity, and covert social curiosity (Refer to Table 2 for example items). Each subscale has four items, which are rated on a 7-point Likert scale, ranging from 1 (*does not describe me at all*) to 7 (*completely describes me*). All items in the stress tolerance subscale are reverse scored. Scores are averaged across each of the six subscales, with higher scores representing higher levels of curiosity on the respective dimension. The six-factor structure was confirmed in both a German, and UK sample (Grüning and Lechner 2023). The 5DCR was shown to be internally reliable (Cronbach's alpha for each subscale at least .80; Grüning and Lechner 2023; Kashdan et al. 2020). Cronbach's alphas for the current study ranged from .82 to .90.

Table 2. Measures, subscales, and example items of the five-dimensional curiosity scale revised (Kashdan et al. 2020) and video game structural characteristics survey (King, Delfabbro, and Griffiths 2010).

Scale/subscale Name	Example Item
Five-Dimensional Curiosity Scale Revised	
Joyous exploration	I enjoy learning about subjects that are unfamiliar to me
Deprivation sensitivity	I can spend hours in a single problem because I just can't rest without knowing the answer
Stress tolerance	I cannot handle the stress that comes from entering uncertain situations
Thrill seeking	When I have free time, I want to do things that are a little scary
Overt social curiosity	I ask a lot of questions to figure out what interests other people
Covert social curiosity	When people quarrel, I like to know what's going on
Video Game Structural Characteristics Survey	
Social features	Making friends with other players in the game
Manipulation and control features	Needing good reflexes to advance in the game
Narrative and identity features	Taking on a new identity in the game
Reward and punishment features	Doing the same thing over and over, order to get a large reward
Presentation features	Sound, including music and audio effects

7.2.2. Gaming behaviour survey

The gaming behaviour survey consists of five author-generated items that measures several gaming behaviours, including (1) average time spent per day playing video games during the weekdays and (2) weekends, (3) rating themselves on a 'very casual' to 'very hardcore' video gamer continuum on a 5-point Likert scale, (4) gaming systems used to play video games on, and (5) most common gaming system used to play video games on. The terms casual and hardcore are commonly used within the video gaming space, and refer to persistence towards gaming and duration of gaming sessions (Poels et al. 2012).

7.2.3. Video game structural characteristics survey (VGSC)

The VGSC (King, Delfabbro, and Griffiths 2010) comprises 37 items across five features of video gaming characteristics: social (seven items), manipulation and control (eight items), narrative and identity (seven items), reward and punishment (10 items), and presentation (five items). Table 2 presents an example item for each of the features. Each item is rated on a 5-point Likert scale, ranging from 1 *(not enjoyable at all)* to 5 *(very enjoyable).* Scores are averaged for each of the five subscales; higher scores indicate higher levels of enjoyment. Cronbach's alpha ranged from .75 to .91 across the five subscales in the present study.

7.3. Procedure

Approval for the conduct of the study was obtained from the Human Research Ethics Committee of James Cook University (approval number: H8712) prior to commencement. Taking part in the study was voluntary and participants could withdraw at any point in time without any consequences. Participants were recruited via a panel provider company, where they were remunerated with approximately USD$3 each. The study was administered online via Qualtrics (2020), where participants were first presented with an information sheet explaining the background and purpose of the study, before being asked whether they consented to participate. Participants who gave consent then completed the demographics questionnaire, followed by the 5DCR, gaming behaviour survey, and finally the VGSC. The study took approximately 20 minutes to complete.

7.4. Design and analysis

The design was correlational in nature. A multiple linear regression analysis using the stepwise method was used to examine if dimensions of curiosity could predict play times. A multivariate multiple regression analysis was used to identify associations between the six dimensions of curiosity, and five structural characteristics of video games.

8. Results

8.1. Descriptive statistics

Regarding gaming platforms used, 18 nonsensical responses were omitted. Of the remainder, 71.13% ($n = 271$) used one device to play video games, while the remaining 27.39% ($n = 109$) gamed on multiple platforms. For single-platform gamers, 73.06% ($n = 198$) gamed exclusively on mobile phones, 16.24% ($n = 44$) played on a computer/laptop/tablet, and 10.70% ($n = 29$) on a gaming console. The mean of how the participants rated themselves on the casual to hardcore (i.e. in terms of persistence towards gaming and duration of gaming sessions) gamer continuum was 2.36 ($SD = 0.96$, range = 1 - 5). Participants reported that they played games for an average of 3.34 hours a day ($SD = 2.67$, range = 0.2–19.71[1]).

8.2. Hypothesis testing

8.2.1. Association between curiosity and gaming hours

A multiple regression via the forward stepwise method was used to examine the dimensions of curiosity as predictors of time spent playing video games. The model was significant, $R^2 = .02$, $F(1, 396) = 8.38$, $p = .004$. Thrill seeking was a significant positive predictor of hours spent video gaming, $B = 2.11$, $SE = 0.73$, $t(396) = 2.89$, $p = .004$, but the other five predictors were non-significant, thus we concluded that our hypothesis was only weakly supported. Table 3 shows the summary of the regression analysis.

8.2.2. Association between curiosity and gaming behaviours

A multivariate multiple regression was conducted to examine the relationships between the dimensions of curiosity and the structural characteristics of video games. The overall model was significant, $F(30, 1955) = 6.38$, $p < .001$. Joyous exploration was significantly associated with reward and punishment features ($B = 0.08$, $SE = 0.04$, $p = .034$), which supported our hypothesis. The hypothesis that both aspects of social curiosity would predict social features was partially supported: overt social curiosity was linked with social features ($B = 0.10$, $SE = 0.04$, $p = .019$), but covert social curiosity was not significantly related to social features ($B = 0.02$, $SE = 0.03$, $p = .439$). Table 4 shows the parameter estimates of relationships between the structural characteristics and dimensions of curiosity.

Table 3. Summary of curiosity dimensions predicting hours spent video gaming.

Curiosity Dimension	*B*	*SE*	*β*	*t*	*p*
Joyous exploration	-	-	−0.04	−0.69	.491
Deprivation sensitivity	-	-	−0.01	−0.21	.833
Stress tolerance	-	-	−0.08	−1.61	.103
Thrill seeking	2.11	0.73	0.14	2.89	.004*
Overt social curiosity	-	-	0.02	2.07	.675
Covert social curiosity	-	-	0.07	1.31	.189

*$p < .05$.

Table 4. Parameter estimates of associations between structural characteristics and dimensions of curiosity.

Structural Characteristic	Dimension of curiosity	*B*	*SE*	*t*	*Sig*
Social Features	Joyous exploration	0.13	0.04	2.99	.003*
	Deprivation sensitivity	0.03	0.04	0.90	.370
	Stress tolerance	0.11	0.03	4.20	<.001*
	Thrill seeking	0.10	0.04	2.61	.009*
	Overt social curiosity	0.10	0.04	2.36	.019*
	Covert social curiosity	0.02	0.03	0.78	.439
Manipulation and control features	Joyous exploration	0.08	0.04	2.14	.033*
	Deprivation sensitivity	0.03	0.03	0.87	.384
	Stress tolerance	0.04	0.02	1.50	.134
	Thrill seeking	0.07	0.03	2.22	.027*
	Overt social curiosity	0.04	0.04	1.15	.252
	Covert social curiosity	0.04	0.03	1.56	.120
Narrative and identity features	Joyous exploration	−0.01	0.04	−0.20	.984
	Deprivation sensitivity	−0.05	0.04	−1.32	.188
	Stress tolerance	−0.03	0.03	−1.07	.286
	Thrill seeking	0.11	0.04	2.77	.006*
	Overt social curiosity	0.06	0.04	1.51	.132
	Covert social curiosity	0.09	0.03	3.17	.002*
Reward and punishment features	Joyous exploration	0.08	0.04	2.12	.034*
	Deprivation sensitivity	0.06	0.03	1.78	.076
	Stress tolerance	0.06	0.02	2.58	.010*
	Thrill seeking	0.06	0.03	1.81	.071
	Overt social curiosity	0.07	0.04	1.88	.060
	Covert social curiosity	0.02	0.03	0.72	.475
Presentation features	Joyous exploration	0.09	0.04	2.09	.037*
	Deprivation sensitivity	0.03	0.04	0.70	.487
	Stress tolerance	0.03	0.03	1.14	.253
	Thrill seeking	0.09	0.04	2.44	.015*
	Overt social curiosity	0.07	0.04	1.83	.068
	Covert social curiosity	0.01	0.03	0.48	.629

*$p < .05$.

On a more exploratory note, thrill seeking significantly predicted social features ($B = 0.10$, $SE = 0.04$, $p = .009$), manipulation and control features ($B = 0.07$, $SE = 0.03$, $p = .027$), narrative and identity features ($B = 0.11$, $SE = 0.04$, $p = .006$), and presentation features ($B = 0.09$, $SE = 0.04$, $p = .015$). Joyous exploration predicted social features ($B = 0.13$, $SE = 0.04$, $p = .003$), manipulation and control features ($B = 0.09$, $SE = 0.04$, $p = .033$), and presentation features ($B = 0.09$, $SE = 0.04$, $p = .037$). Stress tolerance was associated with reward and punishment features ($B = 0.06$, $SE = 0.24$, $p = .009$). Covert social curiosity was associated with narrative and identity features ($B = 0.09$, $SE = 0.03$, $p = .034$). All other associations were non-significant. Of note, deprivation sensitivity was not related to any of the structural characteristics.

9. Discussion

The present study investigated if dimensions of curiosity significantly predicted time spent playing video games, and also examined the links between dimensions of curiosity and structural characteristics of video games. Specifically, we hypothesised that all dimensions of curiosity would predict playtime. We also hypothesised that joyous exploration would be related to reward and punishment features, and that covert and overt social curiosity would be associated with social features. An exploratory investigation of the other associations was also conducted.

9.1. Predicting time spent video gaming

The hypothesis that dimensions of curiosity were significant predictors of playtime was weakly supported. Results revealed that thrill seeking was the only significant predictor of video game time, while the other five dimensions were not. Further examination of simple bivariate correlations showed that thrill seeking, stress tolerance, and both overt and covert social curiosity were significantly correlated with playtime. The weak support for our hypothesis could have stemmed from overall playtime being an overly broad measure. Chen, Wilhelm, and Joeckel (2020) collected data on video game playtimes during different times of day, and found that hours spent gaming in the morning and afternoon affected school performance, but hours spent playing games in the evening had no effect on performance. This could be due to the displacement hypothesis, where playing games displaces time that would otherwise have been spent in school (Chen, Wilhelm, and Joeckel 2020). Likewise in the present study, full-time workers and students would naturally have less time to spend on video games during the day given their ‘primary’ commitments, and using overall playtime as a measure could have failed to capture certain nuances, leading to the non-significant results.

There could also be other factors that were not related to curiosity that affected video game playtime. For example, gaming to compensate for low self-esteem (King and Delfabbro 2016) and experiences of competence, autonomy, and relatedness during gameplay (Johnson, Gardner, and Sweetser 2016) have been shown to increase playtime. Subsequent research might look into whether other psychological or trait variables play a role in the relationship between curiosity and video game playtime. Nevertheless, when examining the regression model in the present study, findings show that thrill seeking appear to overshadow the other predictors when asking for retrospective recall of playtime.

We found that the more interested an individual was in satisfying their craving for thrills, the more time they spent playing video games. It appeared that the immersive and interactive qualities of video games serve as an ideal medium to stimulate engagement with thrill seekers. Studies have found that this need for arousal draws thrill seekers toward video games (Jensen et al. 2011). In particular, individuals with high levels of sensation seeking tend to prefer playing video games that contain acts of violence (Bonnaire and Conan 2024), which could also explain why some of the most famous video game franchises are violent in nature (e.g. Call of Duty; Treyarch 2015). However, continued consumption of such games further reinforces the relationship between violence and thrill seeking, and could result in a cycle of violence, leading to maladaptive behaviour such as increased aggression and decreased empathy (Greitemeyer and Mügge 2014). Game developers can potentially focus on integrating or improving aspects that involve violence in their games that would pique and sustain a player's thrill seeking tendencies, but should also be cognisant of the potential negative consequences.

9.2. Joyous exploration and reward/punishment

The hypothesis that joyous exploration would be linked to reward and punishment was supported. This finding was in line with that in past research from Gómez-Maureira and Kniestedt (2019). These authors found that exploration games commonly ranked high in eliciting curiosity within gamers, and went on to suggest that the pleasant experience of exploring a game world was underscored by the promise of rewards. We provide empirical evidence that this is the case. It appears that gamers who identify with the joy of exploring may be doing so because of a reward that awaits them. Interestingly, it is unclear if gamers with high levels of joyous exploration would be aligned with only the punishing, but not rewarding aspect. Perhaps the allure of exploring is not specifically about the promise of rewards per se, but about making progress and discovery within the game, regardless of whether an outcome is rewarding or punishing. Likewise, Gómez-Maureira and Kniestedt (2019) reported that players expect their exploratory behaviour to not only be rewarding, but instrumental in game progression. More research would be needed to shed light on these potential differences – if rewards and punishments function similarly, and if rewards and progress are mutually exclusive.

9.3. Covert and overt social curiosity, and social features

The hypothesis that both aspects of social curiosity would be linked to social features was partially supported. Overt, but not covert, social curiosity was positively associated with social features of video games. Overt social curiosity, which emphasises interaction with others to gather information, would intuitively be linked to features that bring gamers together in a virtual space (e.g. joining a guild, working together to defeat a strong enemy). For example, in World of Warcraft, players band together to defeat increasingly difficult enemy encounters, where interaction between members (i.e. communication and synergy) is key for overcoming these challenges (Williams et al. 2006). Alternatively, the significant link between overt social curiosity and a video game's social features could also be due to more circumstantial factors. Williams et al. (2006) found that playing online games allowed for geographically distant friends and relatives to keep in touch. This would be even more apparent during COVID-19 lockdowns, allowing individuals to connect virtually in lieu of physical meetings.

On the other hand, covert social curiosity was not associated with social features of video games. This could be due to a mismatch in the mechanism in which overt or covert social curiosity are elicited. In overt social curiosity, an individual is usually more upfront and direct in social interactions. Conversely, in covert social curiosity, individuals acquire information through more secretive and indirect ways (e.g. snooping; Kashdan et al. 2020). Based on the items under social features in the VGSC, they appear to be more aligned toward overt social curiosity (e.g. 'sharing tips and strategies about the video game with others'; King, Delfabbro, and Griffiths 2010), compared to covert social curiosity, which could potentially explain the non-significant association.

However, it is plausible that covert social curiosity could be significantly linked to social features, but in a more competitive, rather than cooperative environment. In competitive play, if the goal is to win against other players, then gamers might be more inclined toward covert behaviours. For instance, the term 'stream sniping' refers to secretly acquiring information about another player's avatar by watching their live broadcast (such as on streaming platforms like YouTube, or Twitch), while simultaneously being in the same video game space (Felczak, 2023). Knowing another player's in-game whereabouts can provide a huge advantage, especially in player-vs-player scenarios. To test the claim that covert social curiosity is associated with social features, albeit in a competitive context, more research should be conducted.

9.4. Supplementary findings

Findings showed that thrill seeking predicted four of the five structural characteristics, including preference for narrative and identity features, presentation features, social features, and manipulation and control features. However, thrill seeking was not a significant predictor of preference for reward and punishment features. The non-significant links between thrill seeking and rewards and punishment could be due to how those with high levels of thrill seeking respond to rewards and punishments. Research has found that thrill seeking and risking taking traits play a role in how an individual is enticed by rewards, but are not sensitive towards punishments (Lauriola et al. 2014). Based on reinforcement sensitivity theory, the behavioural activation system (BAS) regulates sensitivity to rewards, while the opposing system – the behavioural inhibition system (BIS) affects responses to punishments (Scott-Parker and Weston 2017). Both systems work in tandem to mediate a person's response to an event. In the present study, the reward and punishment items in the VGSC were collapsed into a single subscale, thus their scores could have been underinflated (i.e. cancelling out one another), resulting in a non-significant link with thrill seeking. Another way to further the literature is to possibly examine indirect relationships. Research has investigated how rewards and punishments act as mediators or moderators (e.g. Sauer, Drummond, and Nova 2015). Future studies should further investigate if rewards/punishments can indirectly impact the association between curiosity and the preferences for narrative and identity features, presentation features, social features, and manipulation/control features.

Results showed that deprivation sensitivity was not a significant predictor of any structural characteristics in a video game. This could be because of an incongruent valence of deprivation sensitivity. In the 5DCR, deprivation sensitivity takes an avoidant approach towards eliciting curiosity (i.e. displaying curiosity to reduce anxiety from not knowing an answer). Conversely, in the VGCS, the items were querying about a person's enjoyment towards the structural characteristics. This perceived mismatch could have distorted the results, and possibly even be further amplified when accounting for context. The main purpose of video games is to provide an enjoyable time for players (i.e. intrinsically motivating), thus avoidant motives are perhaps less pronounced. As a result, the notion of a pleasurable experience may not fully complement the seemingly negatively worded items in deprivation sensitivity.

9.5. Limitations and future research

Several limitations should be considered. Firstly, our data originated from two Southeast Asian countries (i.e. Malaysia and the Philippines), thus the ability to generalise our findings beyond these two countries may be limited. Future studies may choose to focus on other populations, such as China or the USA. These two countries generated the most video game revenue globally (Statista 2023), and research there would provide additional insight if players from these countries prefer certain video game characteristics that involves microtransactions, such as loot boxes, over other countries. Also, the present study screened out participants who were not proficient in the English language, which also limited generalisation. Prospective research might look into language-validating the 5DCR and VGSC within the respective countries of interest to provide more robust findings.

Secondly, we did not examine the impact of the platforms that individuals gamed on as there was an imbalance which was skewed toward number of mobile phone gamers (about 75% of participants reported mobile phones as a gaming platform they used, with a further approximate 75% of these individuals gaming exclusively on phones), which impeded further investigation. While the structural characteristics would be largely consistent between a game on a mobile phone compared to a computer, the magnitude or intensity may differ. For example, gamers who enjoy presentation features such as detailed graphics and good sound quality may have different experiences depending on whether they play on a gaming computer, or a mobile phone, where visual and audio fidelity of lower quality. Future research might specifically target PC or console gamers.

Based on the finding that overt social curiosity predicted playtime in video games, one possible avenue for future research would be to delve deeper into the meaning of 'social'. Our definition leaned towards being interested in interacting with other individuals (or in this case, other players within a game). However, the term 'social' could also refer to social simulation games and actions (Gómez-Maureira and Kniestedt 2019), where players carry out everyday tasks of a virtual character, and interact with other non-playable characters (NPCs). From this perspective, players do not come into contact with real players directly. Future research can examine if there are differences in how both definitions of 'social' affect playtime. Should no differences exist, then video gamers can potentially reap similar benefits akin to gaming with other people, while actually playing solo.

10. Conclusion

The prevalence of video gaming has been rapidly rising. People are turning to video games not only for entertainment, but also to keep in touch with friends and family. Simultaneously, curiosity has been shown to be associated with different aspects of video gaming. In the present study, we sought to examine how the different dimensions of curiosity predicted time spent on video gaming, and also if the aspects of curiosity were associated with structural characteristics of games. We found that only overt social curiosity predicted playtime. Additionally, joyous exploration predicted rewards and punishment within a game, and overt social curiosity (but not covert) predicted social features of a game. This provides insight into which aspects of games individuals enjoy based on the dimensions of curiosity, which game developers can also tap on to create more engaging video games, ultimately allowing the gaming industry to further flourish.

11. Ethics

Approval for the conduct of the study was obtained from the Human Research Ethics Committee of James Cook University (approval number: H8712).

Note

1. Values of ≥24 were removed at the data cleaning stage. Applying a more stringent cutoff (i.e., 12 h of gaming) did not affect findings regarding time spent video gaming, hence the existing dataset was kept.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Disclosure of interest

The authors report there are no competing interests to declare.

Data availability statement

Data can be found at: https://osf.io/edxwv/?view_only=d0f59f85e9ed48c3850dbf92563e8f4b.

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