

Tolerance in Internet gaming disorder: A need for increasing gaming time or something else?

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Background and aims: The criterion of tolerance in DSM-5 Internet gaming disorder (IGD) refers to a need for increasing time spent gaming. However, this focus on “need for gaming time” may overlook some of the broader motivations, outcomes, or effects of gaming that underlie excessive play. This study aimed to explore regular and problematic gamers’ experiences and perceptions of tolerance in IGD. *Methods:* An online survey of 630 adult gamers yielded 1,417 text responses to open-ended questions. A thematic analysis of 23,373 words was conducted to extract dominant themes. *Results:* Participants reported that they increasingly desired game items, status, or story progress as they became more involved or invested in games. As players develop higher standards of play in games, an increasing number of potential reward outcomes may have diminishing mood-modifying effects. None of the participants, including those with self-reported IGD, explicitly referred to a need for increasing time spent gaming. *Discussion and conclusions:* These results suggest that players may be motivated by preferences for specific goals or reinforcers in games rather than wanting an amount of time spent gaming. Thus, problematic gaming may involve a need for completion of increasingly intricate, time-consuming, or difficult goals to achieve satisfaction and/or reduce fears of missing out. Further research is needed to determine whether these cognitive and motivational factors related to gaming stimuli should extend or replace the concept of tolerance in IGD or be considered as separate but related processes in disordered gaming.

Keywords: Internet gaming disorder, tolerance, addiction, gaming, motivation, DSM-5

INTRODUCTION

Problematic video gaming is recognized as a global mental health issue in need of greater understanding of its core symptoms (King & Delfabbro, 2014; Lo, Wang, & Fang, 2005; Mentzoni et al., 2011). In the fifth edition of *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5), Internet gaming disorder (IGD) is a proposed condition (not yet a legitimate diagnosis) that refers to persistent and recurrent gaming associated with clinical impairment or distress (American Psychiatric Association [APA], 2013). IGD has a comparable set of criteria to other behavioral addictions, including gambling disorder in the DSM-5. Tolerance, as the third criterion of IGD, refers to the need for increasing amounts of time spent gaming (APA, 2013, p. 795). The focus on “need for more time” in this criterion contrasts with substance-based disorders that refer to an increasing volume or concentration of a substance to achieve intoxication (Miller, Dackis, & Gold, 1987; Siegel, 1989). Alcohol use disorder, e.g., has separate criteria for the consumption of alcohol and the time invested in alcohol-related activities (APA, 2013, p. 490). Although referring to gaming tolerance as a need for increasing gaming time has some appeal due to its simplicity, it may not necessarily be valid to equate this with the need for an increasing dose, in that this variable alone may fail to capture many other

factors that motivate and maintain excessive behavior (Andrade & Pontes, 2017; James & Tunney, 2017; King & Delfabbro, 2016).

Gaming is a complex activity to consider as an addiction, and the stimulus–response relationships involved in gaming are only just beginning to be understood in neuroimaging studies (Dong, Wang, Du, & Potenza, 2017; Han et al., 2007, 2011; Kim et al., 2011). Accordingly, some researchers have criticized the concept of tolerance in gaming, as well as other behavioral addictions, for being a superficial copy of its counterpart in substance-based addiction (Blaszczynski, 2006; Charlton & Danforth, 2007; Starcevic, 2016). One limitation of the literature on gaming tolerance has been the reliance on survey studies using confirmatory approaches that rarely consider factors other than a need to spend more time playing (King & Delfabbro, 2016). Therefore, the aim of this study was to explore the concept of gaming tolerance (“need for increasing time”) from the perspectives of a diverse group of game-playing individuals, including those with and without self-reported IGD.

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Tolerance: A challenging concept

Tolerance and withdrawal play a central role in maintaining the addictive cycle of behavior (Mendelson, Sholar, Mello, Teoh, & Sholar, 1998). The drive to reduce aversive withdrawal states forms the basis for dependence in negative reinforcement models of addiction (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004). However, as West (2008) highlights, it is debatable how strong a feeling of desire must be to count as craving, just as it might be arbitrary to classify a diminishing feeling or need for an increasing dose as tolerance. The thresholds for tolerance differ across cultures, social settings, and families (APA, 2013). The manifestation of withdrawal symptoms (e.g., nausea, craving, irritability, and other physical signs) also differs across disorders (Hughes, Higgins, & Bickel, 1994). In the field of behavioral addictions, withdrawal and tolerance are considered important features of disorders, but few empirical studies have observed these processes in action.

An important early study of tolerance in gambling (Griffiths, 1993) examined the excitement levels (measured by heart rate) in regular and non-regular gamblers, and reported that regular gamblers experienced a greater reduction in their excitement levels after gambling as compared with non-regular gamblers, indicating this group experienced diminished effects of the activity. However, over the last two decades, research in the behavioral addictions field has generally moved away from examining the physiological correlates of addiction to focus more on behavioral and cognitive determinants of use. This shift is supported, e.g., by a study by Blaszczynski, Walker, Sharpe, and Nower (2008) who reported that pathological gamblers tend to increase their bet size not for excitement or to maintain arousal levels, but because of cognitive factors relating to winning. As the field expands its focus to a wide range of everyday behaviors under the banner of “addiction,” a challenge for scholars will be to clarify the differences between normal motives and tolerance symptoms. As Billieux, Schimmenti, Khazaal, Maurage, and Heeren (2015) stated, “the need to increase the time spent in a specific behavior can be driven by various motives, especially at the early stages of involvement, and these motives are mostly unrelated to tolerance symptoms” (p. 121).

Problems with the concept of tolerance in gaming

The concept of tolerance itself is not easy to define in many cases and the usage of the term, as well as the broader concept of behavioral addiction, has been considered controversial (Billieux et al., 2015). Tolerance is typically viewed as the need for an increasing dose to achieve the same level of response (Poulos, Hinson, & Siegel, 1981); however, it has proven challenging to operationalize this process across many disorders, including gaming disorder. There have also been some inconsistencies, or at least several interpretations, of the meaning of tolerance in disordered gaming, possibly stemming from the broader uncertainty about the defining features of gaming as well as the fact that gaming encompasses many different genres and modes of play. Despite this, numerous instruments continue to include screening items for tolerance in gaming and

Internet use disorders (King, Haagsma, Delfabbro, Gradisar, & Griffiths, 2013; Lemmens, Valkenburg, & Gentile, 2015; Lortie & Guittton, 2013).

Several attempts to define tolerance specifically in relation to gaming have been made. Time spent gaming is often referred to in these definitions. For example, Tao et al. (2010) and Weinstein and Lejoyeux (2010) referred to gaming tolerance as the need for more advanced computer equipment, more software, or more hours of use. In this definition, financial expenditure on gaming equipment is combined with gaming behavior. However, the purchasing of equipment may occur quite infrequently, vary considerably in the types and amounts of purchases, and new hardware may have a very limited influence on actual gaming behavior. Another definition proposed by Petry et al. (2014) referred to tolerance as the need to play “more exciting games.” This wording may convey that the player transitions frequently across games or game modes. However, many high-level players are known to make a significant long-term investment in a single game (e.g., *World of Warcraft*). An ethnographic study by Snodgrass et al. (2017) reported that only 24% of their sample agreed that tolerance described an important and typical negative gaming experience. Finally, there is some neurobiological evidence (Dong et al., 2017) that indicates problem gamers can experience sustained craving for gaming, rather than satiation, following a 30-min session of gaming, which complicates the assumption that gaming time alone is satisfying and reduces aversive withdrawal states.

Applying motives in gaming to tolerance

A large body of literature on the motives for gaming has provided helpful reference points for potential indicators of healthy and problematic gaming (Chin-Sheng & Chiou, 2007; Dauriat et al., 2011; Hoffman & Nadelson, 2010; Jegers, 2007; Puerta-Cortés, Panova, Carbonell, & Chamorro, 2017; Seok & DaCosta, 2014; Wan & Chiou, 2006). Przybylski, Rigby, and Ryan (2010) advanced a model based on self-determination theory that suggested that the appeal and well-being effects of video games were based in their potential to satisfy basic psychological needs for competence, autonomy, and relatedness. The work by Yee (2006) on the motives of massively multiplayer online (MMO) players has similarly outlined many different motivations that sustain gaming. Many of these motivational concepts have proven useful in studies that investigate high engagement and problematic or addictive gaming (Charlton & Danforth, 2007). However, the boundary between normal and maladaptive gaming motivations is not always clearly demarcated. A study by Kuss, Louws, and Wiers (2012), for example, reported that escapism as a motive for play was more often endorsed by problematic gamers than normal gamers. Similarly, a recent study by Laconi, Pirès, and Chabrol (2017) reported that problematic gamers reported higher scores on social, escape, coping, and fantasy motives than normal gamers. There is a consistent finding in these types of studies that normal and problem gamers both endorse many of the same motivations for gaming, with problem users simply tending to score much higher than casual users. This often creates a need for some malleability

in the operational definition of these motives when they are applied to gaming disorder. For example, a high score on “escape” motivation may be termed a “dysfunctional coping mechanism” in the same study that this motive is acknowledged as not inherently problematic (Laconi et al., 2017).

The present study

Tolerance is a proposed feature of DSM-5 IGD, but it appears to be a tenuous and challenging concept to apply to gaming (King, Herd, & Delfabbro, 2018). Gaming is arguably a more complex activity than substance use in terms of its use and reward properties. The current description in IGD referring to a “need for increasing time” may be valid in the sense that it refers to an increasing commitment to gaming, but it does not refer to specific reinforcers or reward-seeking behaviors. In support of this view, motivational models of gaming have drawn attention to specific desires and preferences in games, such as a desire for novel or rare rewards, social status and interaction, and immersion and escape (Smyth, 2007; Yee, 2006). Such factors would appear to suggest a wider range of social and psychological reinforcement that extends beyond the satisfaction of physiological cravings or the alleviation of withdrawal. At present, the DSM-5 refers to the “team aspects” and “competition” (APA, 2013, p. 797) in IGD, but these motivational factors have not been explained in connection to tolerance beyond an inference that these aspects of play may have mood-relieving effects. A conceptual dilemma arises: Should researchers seek to refine or extend the concept of tolerance in gaming disorder, or investigate alternative processes that might replace this criterion? This study was designed to contribute to this debate by exploring gamers’ experiences and perceptions of tolerance and reward-seeking behaviors in gaming activities (i.e., to identify the stimuli that gamers may increasingly seek or “crave,” and any diminishing effects from prolonged use or interaction). It was hoped that this approach might help to determine whether increasing gaming time or certain game reinforcers may be considered more salient or relevant to the experience of problematic gaming.

METHODS

Participants

Participants were recruited via advertisements posted on forums of several popular gaming LAN community websites. Advertisements were viewed 2,610 times, with a 24% response rate. Inclusion criteria were: (a) being at least 18 years old, (b) currently gaming on a weekly basis, and (c) English language fluency. A total of 630 participants (480 males) aged 18–56 ($M = 25.8$, $SD = 7.1$) were recruited. After excluding cases with missing data, there were 20 participants (95% male, mean age of 26 years, $SD = 8.1$) who met five or more criteria for DSM-5 IGD and 39 (81% male, mean age of 24 years, $SD = 4.6$) who met three or four criteria (i.e., at risk). It is important to note that the IGD group were self-identified only and not externally verified by a consultant psychiatrist. The IGD risk groups reported to play games, on

average, 34 hr/week ($SD = 20/22$), and the normal group reported to play, on average, 20 hr/week ($SD = 14$).

Design and procedure

The study employed an anonymous online survey primarily comprising psychometric instruments as well as with open-ended questions. This approach was used to attempt to obtain a diverse and large sample of gamers, including those who would not typically respond to invitations for more time-intensive focus group approaches. An anonymous survey was reasoned to be more capable of minimizing demand characteristics because participants might feel less obligated to provide certain information in an online de-identified format. Total participation time required 30–60 min and completed surveys entered a draw to win gift vouchers. The retention rate across all surveys was 79%. Data collection occurred from May to August 2016.

Measures

A questionnaire assessed demographic information (i.e., age, gender, ethnicity, education, and employment status). Internet gaming activity was examined using a tabular week diary format that measured hours of video-gaming in a typical week in the past 3 months, among other questions on gaming context, reward, and genre preferences.

IGD criteria checklist. The IGD checklist is a 9-item self-report measure to assess the DSM-5 IGD classification (APA, 2013). Symptoms include: preoccupation, tolerance, withdrawal, unsuccessful attempts to limit gaming, deception or lies about gaming, loss of interest in other activities, use despite knowledge of harm, use for escape or relief of negative mood, and harm. For example, the item measuring withdrawal symptoms states: “In the past 12 months, did you feel irritable, angry, guilty or sad when attempting to cut down or stop playing or when you were unable to play?” Response options included “no” and “yes.” The internal consistency of the tool was adequate ($\alpha = 0.77$).

Open-ended questions. Six open-ended questions explored aspects of tolerance and related processes. A range of questions were asked to gather as much information as possible in relation to salient features of the player’s increasing use of, and changing psychological relationship to, games. Questions including: (a) *increasing time* (i.e., “Q1. Have you ever had the experience of wanting to play a game for longer? If so, do you remember why?”), (b) *phenomenology* (i.e., “Q2. What do you notice happens for you when you get more involved in a game?”), (c) *maintaining play* (i.e., “Q3. What usually keeps you playing a game, or playing a game for longer than intended?”), (d) *reward salience, positive frame* (i.e., “Q4. Is there anything you’ve done in a game that you are particularly proud of?”), and (e) *reward salience, craving* (i.e., “Q5. When you’re unable to play your game, do you feel like you are missing out? If so, what do you feel you are missing out on?”). Questions were designed by a clinical psychologist and did not use pathology-related terms to avoid leading or priming (Judd, Ryan, & Park, 1991). Responses had no word limit.

Data analysis

A total of 1,417 written responses were obtained, with an average of 236 responses per question. The total length of obtained material was 23,373 words. The data were analyzed using thematic analysis (Braun & Clarke, 2006). First, data for each question were read multiple times to develop familiarity with the responses. Second, patterns in responses were identified (e.g., evidenced by commonly used terms such as “friends,” “immersion,” and “boredom”) and assigned initial labels of classification (e.g., “social aspects,” “escape reality,” and “mood change”) to refer to the overarching meaning of each set of responses. A list of all identified labels was generated, along with relevant extracts. Two of the researchers discussed and agreed on the definitions of these labels, which led to the development of themes that fit with the theoretical perspectives on tolerance (i.e., a need for more of something to achieve the same effect) and models of motivation and game structural characteristics (Westwood & Griffiths, 2010; Wood, Griffiths, Chappell, & Davies, 2004). All material was then reread by the authors to ensure a good fit with extracted themes, and to ensure that themes were internally coherent, consistent, and distinctive. After all themes were extracted, the responses belonging to IGD participants were highlighted for comparison with non-IGD participants. This occurred at this final stage to blind the researchers to avoid potential bias toward these responses. A copy of all participants’ responses is freely available by request.

Ethics

The study procedures were carried out in accordance with the Declaration of Helsinki. Ethics approval for this research was provided by the University of Adelaide’s Human Research Ethics Subcommittee. Participants were informed that the study was voluntary and that they were free to withdraw at any time. All responses were anonymous. Participants gave informed consent by clicking through the survey after reading the participant information sheet.

RESULTS

This section presents a summary of the thematic analysis. A selection of quotes are provided for each theme, with accompanying qualifiers to signify the gender (M: male and F: female) and age (years), and group [IGD and normal (N)]. For example, [M, 21, IGD] refers to a 21-year-old male who endorsed five or more IGD criteria.

Theme 1: Needing more of “something”

Participants were first asked to reflect on what they sought from games when they became more committed to gaming. The responses were diverse and participants often cited more than one reason. IGD and non-IGD participants reporting seeking similar rewards in games, but notably only IGD participants ($N=3$) referred to rewards as “intense.” Participants did not refer specifically to needing “more time” in games. This observation was confirmed by a

keyword search (i.e., for checking purposes) for the terms “time” ($n = 57$) and “need” ($N = 51$), which identified only a need to “complete,” “finish,” play one more “level”/“turn”/“game,” or “to be better.” The notion of “needing more time” was challenged by one IGD participant [M, 32] who stated, “I feel like every gamer ever has felt the desire to play games for longer.” Time investment was considered necessary to achieve specific goals, as another IGD participant [M, 18] explained: “I had to kill about 15 Bosses in WOW and we got what we wanted after 8–10 hr trying.”

The following reward themes were identified: (a) *social aspects* (e.g., “playing with friends” [M, 40, N], “meeting people online” [M, 33, N], “bonding over games” [M, 23, N], “presence of familiar company” [M, 25, N]); (b) *mood change* (e.g., “the excitement is real” [M, 34, N], “avoid feeling unsatisfied” [M, 32, IGD], “relaxing” [M, 22, IGD], “fun and intense” [M, 35, IGD], “significant emotion” [M, 26, N]); (c) *immersion* (e.g., “immerse myself completely” [M, 34, N], “completely immerse myself” [M, 29, IGD], “zoning out” [M, 39, N], “love being immersed” [F, 18, N], “escape from reality ... put off having to rejoin reality” [F, 26, N], “hard to keep track of time ... brought down to earth [when stopped]” [F, 18, N]); (d) *achievement* (e.g., “in game progression” [M, 28, IGD], “win more” [M, 22, N], “wanting to accomplish more” [M, 23, N], “complete a level” [M, 24, N], “more to achieve” [M, 28, N], “achieve an objective” [M, 24, N]); (e) *narrative* (e.g., “can’t put down the story” [F, 51, N], “see more of the storyline” [M, 27, N], “discover the plot and develop characters further” [F, 19, N], “more of the story” [F, 19, N]); and (f) *exploration* (e.g., “want to explore” [M, 18, N], “explore everything” [F, 23, N], “explore the world” [M, 38, N]).

Theme 2: Changing perceptions of goals and rewards

Participants referred to having perceptions of goals and rewards in games that changed over time, encompassed by the theme of *gaming standards*, which referred to having increasingly specific goals or narrow requirements to feel satisfied by the game (e.g., “The more I play the higher my expectation of myself becomes” [M, 19, N], “I had to get better” [M, 21, IGD], “I play for a sense of completeness, a standard set personally by me” [F, 19, N], “prove to myself I am in the top 5%” [M, 29, N], “complete whatever goal I’ve set for myself” [M, 20, N]). Several additional themes related to meeting these higher standards: (a) *greater challenges*, such as difficult or improbable feats of skill, beating difficult enemies or bosses, or fulfilling rare or esoteric goals (e.g., “achieving something of high difficulty” [M, 21, N], “performing a really good play that requires skill” [M, 34, N], “defeating hard bosses” [M, 21, N], “beating both half-life games” [M, 32, IGD], “difficult mechanical combos” [M, 18, N]); (b) *higher social ranking*, or obtaining a certain rank based on time played or skill level relative to the player population (e.g., “top 100 World of Warcraft PVE achievements in 2010” [M, 28, IGD], “top 1% for players in Oceania in LoL” [F, 24, N], “played 2,500 hr of DoTA 2” [M, 19, N], “won MLG 2011-2014, WoW 2v2 and 3v3 arenas, world first achievements since 2008” [M, 19, IGD], “11 world record speed runs in a game” [M, 26, N],

“prestige level 10 in Call of Duty” [M, 20, N]); and (c) *total completion*, referring to satisfying a personal or game-defined standard for completion (e.g., “finishing it 100%” [M, 22, IGD], “100% finishing a tough game” [M, 52, IGD]).

Theme 3: Time loss while gaming

Participants were asked to report on any internal (i.e., mental or affective) changes as they became more involved in a game. The dominant theme, as indicated by the majority of responses ($N = 82$), was *losing track of time* (e.g., “I lose track of time” [F, 22, N], “losing track of time” [M, 22, IGD], “time passes very quickly” [F, 24, N], “time can seem to run away” [M, 24, N], “time passes quickly” [M, 32, IGD], “time disappears” [F, 35, N]). A related theme was *disconnection from reality*, referring to the dissociative-like experience of becoming immersed in the game (e.g., “disconnection with reality” [M, 29, N], “everything around me fades away” [M, 32, IGD], “lose touch with real life” [M, 35, IGD], “I don’t notice what is going on around me” [M, 30, N], “feel stronger connection to the game than life” [M, 23, N], “feel as though the game is happening to me” [F, 21, N], “lose track of my surroundings” [M, 50, N], “when I stop it becomes difficult to adjust to the real world” [M, 23, N]). These responses suggested players often could not make reliable estimates or judgments about time spent playing. There were no apparent differences between IGD and non-IGD participants on these themes, aside from IGD participants also highlighting how time loss contributed to being less social and neglecting life responsibilities (e.g., “start to neglect others” [M, 22, IGD], “antisocial behavior increases” [M, 28, IGD], “lose interest in real life” [M, 35, IGD]). Another IGD participant [M, 32] explained that time loss in gaming enabled an escape from real-world problems (specifically, depression and anxiety).

Theme 4: Craving experiences

Several themes related to the concept of craving: (a) *fear of missing out*, the fear of failing to reach or maintain the requisite skill or gear level required to retain a place in the group (e.g., “missing out on guild experiences” [M, 27, IGD], “fear of getting left behind as my friends get better gear” [F, 21, N], “withdrawals when my friends are playing” [M, 18, N], “I feel like I am missing out on playing with friends and also falling behind them if there is a leveling system” [M, 21, N], “I may be falling behind while others get better” [M, 19, N], and “only when my friends are playing” [M, 22, N]); (b) *novelty*, or a desire for new content and experiences (e.g., “new update, stuff to do” [M, 19, N], “missing out on a mentally stimulating new experience” [M, 32, IGD], “missing out on new experiences” [M, 22, N], “new update comes out” [M, 26, N], “new experiences” [M, 29, N]); (c) *avoiding spoilers*, the desire to urgently complete a game before the narrative is compromised by unsolicited details (e.g., “worry about getting a spoiler” [M, 32, N], “missing out on the story” [F, 23, N], “hoping that story elements will not be spoiled” [M, 18, N]); and (d) *relaxation*, the importance of gaming for relaxation (e.g., “playing games is my way of relaxing” [F, 20, N],

“missing out on relaxation” [M, 21, N], “relaxation is important to me” [M, 27, N], “main opportunity to relax” [M, 25, N]). There were limited differences in theme content between IGD and non-IGD participants. The “missing out” experience was referred to as “missing out on my second life” by one IGD participant [M, 29] but was not conveyed in similarly strong terms (i.e., “life” or other all-encompassing term) by non-IGD participants.

Theme 5: More play leads to more planning

Another indicator of increasing involvement in gaming was *planning*, referring to the non-gaming time spent consulting strategy guides, walk-throughs, and video demonstrations to prepare for challenges or to complete goals more efficiently (e.g., “I research it more” [M, 26, N], “watching others playing it on YouTube and search online for more information about the game” [M, 32, N], “I start to look into the mechanics of a game and in-depth strategies, and watch tournaments with pro-players playing for money” [M, 21, N], “I’ll seek more knowledge about it” [M, 18, N], “more outside effort (research)” [M, 22, N], “look up more info on Reddit” [F, 20, N], “I plan more to play more often” [M, 25, N]). Some participants also reported to spend increasing amounts of money (e.g., “I tend to want to invest more money into the game” [M, 18, N], “spend more money within the game” [M, 28, IGD]). These experiences were common to both IGD and non-IGD participants.

Theme 6: Rewards do not always matter

Some participants stated that game rewards had value insofar as offering “fun” but were otherwise artificial and worthless (e.g., “they’re just games to me, nothing to be proud over” [M, 30, N], “not really, it’s just a game” [M, 23, N], “not really, it’s just a waste of time” [M, 42, N], “they are not a worthwhile endeavor” [M, 25, N], “would never be proud of my video game achievements” [M, 25, N], “game proud and real-world proud are two different things. Real-world proud takes precedence so nothing comes to mind” [M, 30, N], “nothing, it’s not really that important” [M, 28, N]). This was mainly reported by non-IGD participants, but also, to a lesser extent, by some IGD participants, who stated “Not really, why would you show girls that stuff?” and “the whole nothingness that is gaming.” This suggested that the desirability and salience of game rewards may be fragile or vulnerable to perceived negative evaluation. Relatedly, there was some evidence of existential tension associated with valuing a virtual experience (e.g., “mentally and physically I am drained because of the commitment I made to a video game. I’m conflicted about the meaning of life and whether it’s worth spending my life in a world that isn’t even real” [M, 20, N]).

Synthesis of themes

The extracted themes yielded a series of observations that were proposed to be connected in the following ways: (a) players may be motivated by specific goals or reinforcers in games (Theme 1), which may lead to changes in their perceptions of these reinforcers (Theme 2); (b) players often

experience time loss in the course of a fulfilling gaming session (Theme 3), or have “cravings” for rewards or “fears of missing out” when goals are unfulfilled or they are unable to play (Theme 4); (c) persistent gaming leads to a higher standard of play and narrower reward preferences (Theme 2) which influences craving experiences because the player needs to do more in the game or achieve very specific goals to feel satisfied (Theme 4), which necessitates more planning when not playing to play more optimally (Theme 5); and (d) players seek out the reinforcing effects of games rather than just needing more time in the game (Theme 1) but, for some players, gaming rewards may be viewed with ambivalence or with little regard for their value (Theme 6).

DISCUSSION

Tolerance is described in IGD as the need to spend increasing amounts of time engaged in games. This study explored some of the broader motivations underlying the need to play games to identify other variables that might relate to tolerance. The main finding was players tended to have complex goal motivations, including the pursuit of various rewards, such as items, status, exploration, and story outcomes. None of the participants, including those with self-identified IGD, explicitly referred to a need for increasing time spent gaming. Instead, participants reported that they developed more refined and/or specific reward preferences as they become more committed to a game. Over time, a player’s need to increase their time investment in gaming appeared to be a consequence of playing to fulfill higher standards of play in order to feel satisfied or immersed. Participants reported that time loss was common while gaming (see Wood & Griffiths, 2007), which suggests that gaming intentions may not always be mentally formulated by players in discrete units of time (e.g., a gamer may think “I need to keep playing to achieve a certain goal” rather than “I need to play for another hour”). These findings suggest that it may be worthwhile to consider reward-seeking motivations in formulating the concept of tolerance in IGD.

This study suggests that problematic gaming may involve the need for completion of increasingly more intricate, time-consuming, or difficult goals to fulfill psychological needs. This process would eschew the current reference to “increasing time” that does not appear in other definitions of tolerance in other addictive disorders. An emphasis on specific gaming-related needs would also align with the needs described in motivational models (Przybylski et al., 2010; Yee, 2006), such as social belonging, escape, fantasy, and coping motives. Player “satisfaction” was reportedly driven by positive reinforcement associated with obtaining certain rewards (e.g., game items and status) and achieving a sense of immersion, as well as negative reinforcement associated with reducing fears of missing out. The extent to which certain outcomes in games may be reinforcing to players appears to depend, to some extent, on the players’ standards and expectations (see Corr, 2002). Conceptualizing game reinforcers as a kind of “dose” (as opposed to the less intuitive approach of viewing “time” as dose) would depend on whether these rewards have become conditioned stimuli. In other words, not all game rewards

are reinforcing for all types of players (Bartle, 1996). Given the complexity of game design and the many structural characteristics of games (Karlsen, 2011; Wood et al., 2004), it may be more parsimonious to consider “dose” in terms of the game meeting the player’s personal requirements of the activity. Accordingly, tolerance in gaming may refer to the diminishing effect of an increasingly greater set of game reward outcomes, due to a corresponding higher standard of play applied to the game by the player. This means that problematic gamers may spend a lot of time playing feeling bored or frustrated by the lack of a desired reward “dropping” in a game (see Amsel, 1962). They may continue playing in this situation due to the anticipation of an imminent reward. This would be consistent with Kaptsis, King, Delfabbro, and Gradisar’s (2016a) assertion that problem gamers can experience “withdrawal” symptoms even while playing games if certain requirements of the activity are not met.

A major psychological component of craving appears to be the fear of missing out on certain gaming experiences (see Przybylski, Murayama, DeHaan, & Gladwell, 2013). This study highlighted gamers’ fears of missing out on social play, novel gaming experiences, and gaming for relaxation. IGD in the DSM-5 makes specific reference to the “team aspects” of gaming as motivation for prolonged gaming. These findings suggest that “team aspects” may also explain some symptoms of craving (e.g., boredom, irritability, and anxiety; King, Kaptsis, Delfabbro, & Gradisar, 2016), given that the demand for certain rewards may be related to their socially constructed value (i.e., rewards are valuable to the player because they are considered valuable by a wider group of people). Craving for games may therefore be driven by a desire to stay competitive alongside and/or within groups of gaming peers, rather than a desire for any of the intrinsic qualities of the game reward itself. This social motivation aspect of craving may relate to a goal-oriented formulation of tolerance in that players come to adhere to an increasingly inflexible, socially driven schedule of play. Less consistent schedules of play (or skipping gaming sessions) become perceived as less able to relieve fears of missing out. This view of craving may explain why players engage in repetitive or tedious gaming activities, such as “grinding,” or playing games perceived to be of mediocre quality (i.e., not “fun”). Such behaviors fulfill certain high standards of play or inflexible rules governing behavior deemed necessary to be a part of a social group.

These findings may be useful for informing interventions for problems associated with online gaming, particularly MMO games (Ng & Wiemer-Hastings, 2005; Puerta-Cortés et al., 2017). MMO games feature large, persistent online worlds that support social cooperative play and intricate reward systems wherein players aim to accomplish various goals (Cole & Griffiths, 2007). The MMO end-game often involves playing within time-consuming variable ratio reinforcement schedules to obtain very rare rewards (Beranuy, Carbonell, & Griffiths, 2013). Items with low “drop rates” are particularly desirable among players, who employ optimizing strategies and play in groups (e.g., clans and guilds) to maximize their chances of obtaining them. Players may adhere to an increasingly demanding, rigid or complex, and/or socially dependant schedule of play in pursuit of

end-game rewards. Understanding that longer durations of play may reflect specific motivations to play (i.e., the player's inflexible standards and expectations of play), rather than a "need for gaming time," may improve the design of tasks in cognitive-behavioral therapies, including thought-challenging, behavioral experiments, and graded exposure. Similarly, knowledge of the psychological processes of gaming disorder may inform more relevant psychoeducation (e.g., recognizing how tolerance develops) and educational campaigns to promote awareness of the early signs of problematic gaming. Individuals with gaming problems may be more likely to seek treatment and feel comfortable sharing their experiences, if practitioners are knowledgeable of gaming psychology.

Limitations

The strengths of the study included: (a) open-ended questions that enabled an exploratory rather than confirmatory approach; (b) a high response rate that yielded a large sample of diverse player types and levels of IGD risk; and (c) detailed responses with evidence of critical reflection. However, this study had several limitations. First, all survey responses were obtained anonymously online, which may have led to honest self-disclosure but was unable to capture nonverbal information. Second, while gaming was not considered to be inherently harmful, the interpretation of findings may have been biased by an assumption that cases of normal and disordered gaming exist along a continuum, and by the overarching interest in the concept of tolerance. Third, the analysis of open-ended question responses can be limited by the dominant terms and reference points used by participants. The concepts of "immersion" and "disconnection from reality" require further study to clarify their objective markers (e.g., changes in attention, physiological arousal, and neural activity). Similarly, this work was intended as exploratory and to generate new perspectives on the criterion of tolerance for further investigation, and should not be interpreted as evidence for or against the IGD category in the DSM-5. Fourth, this study employed a diverse population that reported a range of gaming experiences, but did not account for differences across gaming genres. The obtained sample was predominantly male in the gaming risk groups, but this was consistent with prevalence studies. Finally, the study was not able to prompt participants for further details; therefore, follow-up interviews may be a helpful next step for this research agenda.

CONCLUSIONS

IGD in the DSM-5 includes contentious criteria such as tolerance and withdrawal (Kaptsis, King, Delfabbro, & Gradisar, 2016b; Starcevic, 2016). Within broader debates on whether gaming is an addictive behavior (Aarseth et al., 2017; Billieux et al., 2017; Saunders et al., 2017), the controversy concerning the IGD tolerance criterion relates in part to its equivalence of time with dose. Pinpointing a "dose" in gaming is not straightforward. While the DSM-5 states that substance use results in intoxication, and that a problem user seeks increasing amounts of a substance to achieve this effect, a similar dose-response relationship had

not yet been proposed in gaming disorder. This study provides preliminary results that suggest that persistent gaming may be associated with the need to complete increasingly more intricate, time-consuming, or difficult goals to reduce fears of missing out and achieve desired mood-relieving effects, including a state of immersion. Whether this process should be considered a form of "tolerance" that might helpfully extend or replace the current concept of tolerance in IGD remains up for debate.

Proposing new interpretations or modifications to concepts like tolerance in gaming raises valid concerns about whether the initial concept is preserved and still meaningful. A simpler alternative may be to discard tolerance in IGD altogether (Starcevic, 2016). Nevertheless, this study suggests there may be some advantages to acknowledging the interactive nature of gaming activities (i.e., that players actively engage with games) to understand problematic gaming. It is hoped that these observations may encourage researchers to consider whether the study of IGD is best served by confirmatory approaches to the study of its criteria, including the acceptance of gaming tolerance as a time-based concept, or investigating alternative processes that might extend or replace certain criteria. Further research studies on the fundamental nature of disordered gaming are needed to support its case for becoming an official diagnosis and guide future prevention and intervention measures.

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