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An empirical examination of factors associated with Game Transfer Phenomena severity

Abstract

Game Transfer Phenomena (GTP) (i.e. altered perceptions, spontaneous thoughts and behaviors with game content) occur on a continuum from mild to severe. This study examined the differences between mild, moderate and severe levels of GTP. A total of 2,362 gamers' participated in an online survey. The majority of gamers experienced mild levels of GTP. The factors significantly associated with severe levels of GTP were: (i) being students, (ii) being aged 18 to 22, (iii) being professional gamers, (iv) playing videogames every day in sessions of 6 hours or more, (iv) playing to escape from the real world, (v) recalling dreams always or very often, (vi) having a sleep disorder, mental disorder or reported dysfunctional gaming, and (vii) having experienced distress or dysfunction due to GTP. In addition, having used drugs and experiencing flashbacks as side-effects of drug use were significantly less likely to be reported by those with mild levels of GTP. In general, the findings suggest that those with higher levels of GTP share characteristics with profiles of gamers with dysfunctional gaming (e.g., problematic and/or addictive gaming).

Keywords: Game Transfer Phenomena; excessive gaming; dysfunctional gaming; gaming addiction; psychiatric comorbidity; escapism

Introduction

Understanding the effects virtual immersion has on the individual has been at the core of numerous studies concerning the effects of videogame playing. These studies have been conducted to either identify individuals 'at risk' to aversive effects of playing games or to identify which individuals get the most benefits from therapeutic interventions using virtual reality (Ling, Nefs, Brinkman, Qu, & Heynderickx, 2013). Other studies have attempted to distinguish between problematic and non-problematic gamers who invest substantial amounts of time playing (Király, Urbán, Griffiths et al., 2015; Pontes, Király, Demetrovics & Griffiths, 2014). For instance, brain differences such as variations in grey matter volume in the left anterior cingulate gyrus have been reported between pathological gamers and professional gamers. Disrupting functions in the anterior cingulate may affect individuals competence to monitor and inhibit improper behavior (Han, Lyoo, & Renshaw, 2012). It has also been demonstrated that problematic gaming leads to negative outcomes as a consequence of excessive videogame play (e.g., social problems, relationship problems, occupational problems, educational problems, etc.) and sleep disturbances (e.g., daytime sleepiness, insomnia) (Achab et al., 2011; Fossum, Nordnes, Storemark, Bjorvatn, & Pallesen, 2014; Lam, 2014; Van Rooij, Kuss, Shorter, Schoenmakers, & Van de Mheen, 2014). Such players may also have comorbid psychiatric disorders (e.g., anxiety, depression, substance use, ADHD, etc.) (Ferguson, Coulson, & Barnett, 2011; Gentile et al., 2011; Király et al., 2015; Kuss & Griffiths, 2012; Walther, Morgenstern, & Hanewinkel, 2012), and specific personality traits (e.g., neuroticism, schizoid traits, lower self-control, etc.) (Allison, von Wahlde, Shockley, & Gabbard, 2006; Mehroof & Griffiths, 2010).

Additionally, studies have investigated why only certain individuals appear to be affected, at least temporarily, by the playing of violent videogames (Bushman & Gibson, 2011). Such research has found that many of those affected by violent content have pre-existing dispositions and includes individuals with antisocial personality traits, elevated levels of psychoticism, trait aggressiveness, low agreeableness or low conscientiousness, and sensation seeking (Arriaga, Esteves, Carneiro, & Monteiro, 2006; Breuer, Vogelgesang, Quandt, & Festl, 2015; Ferguson, San Miguel, Garza, & Jerabeck, 2012; Giumetti & Markey, 2007; Markey & Scherer, 2009; Sigurdsson, Gudjonsson, Bragason, Kristjansdottir, & Sigfusdottir, 2006). Other factors that can play a role include environmental and socio-cultural factors (e.g., family violence, peer influences, less parental involvement) (Anderson, Gentile, & Buckley, 2007; Ferguson, et al., 2012) and individual responses to arousal

(Krcmar, Farrar, Jalette, & McGloin, 2015). Additionally, it has been argued that children are more susceptible to priming effects than adults, and therefore more susceptible to violent content within videogames (Bushman & Huesmann, 2006).

Levels of immersion, presence, and physiological symptoms of cyber sickness among individuals have also been investigated. The sense of presence is significantly correlated with immersive tendencies and monocular visual ability (Ling, et al., 2013), and high levels of state anxiety (Robillard, Bouchard, Fournier, & Renaud, 2003). Reports of cyber sickness symptoms have been significantly correlated with immersive tendencies independently of the game played (Ling, et al., 2013). Research has also found that emotional responses and game engagement varies according to personality traits (e.g., sensation seeking) (Ravaja et al., 2004).

Research on Game Transfer Phenomena

Game Transfer Phenomena (GTP) refer to involuntary phenomena such as hearing, seeing, thinking and/or doing something as in the videogame after stopping playing (Ortiz de Gortari & Griffiths, 2012). This can includes such things as seeing game tags above peoples' heads, seeing maps in the corner of the eye, hearing music coming from the console when it is turned off, hearing voices in the head or coming from objects associated with the game, perceiving objects as distorted, feeling tactile sensations of gamepads when not playing, confusing memories from the game with those from real life, and saying something from the game without intending to, etc. These are just a few of many examples of the experiences of over 1,200 gamers reported in previous studies concerning Game Transfer Phenomena (GTP) collected through interviews (Ortiz de Gortari, Aronsson, & Griffiths, 2011) and online forums (Ortiz de Gortari & Griffiths, 2014a; Ortiz de Gortari & Griffiths, 2014b; Ortiz de Gortari & Griffiths, 2014c). To date, one of the most interesting observations about gamers' GTP self-reports that have been analyzed are the similarities reported by gamers when playing the same games (Ortiz de Gortari, et al., 2011; Ortiz de Gortari & Griffiths, 2014c).

Previous analysis of survey data concerning GTP reported that 97% of gamers had experienced GTP at some point during their playing careers (Ortiz de Gortari & Griffiths, 2016) and those that had experienced GTP in comparison to those that had never experienced GTP were more likely to be students, have a pre-existing medical condition, play sessions of 3 to 6 hours, and play for immersion, exploration, customization, mechanics and escape from the real world, while those that had never experienced GTP were significantly more likely to be aged 33 to 38 years old, play sessions of less than one hour, be a professional player, be

self-employed, and never recall dreams (Ortiz de Gortari & Griffiths, 2015). However, it is not known which factors are more prevalent among those gamers that experience high levels of GTP (i.e., experience GTP many times and/or have experience of two or more types of GTP) and what factors predict the severity levels of GTP.

GTP appear to be experienced by gamers in different ways (e.g., visual, auditory, tactile) and with or without further consequences (Ortiz de Gortari & Griffiths, 2016). While some gamers are indifferent to their GTP experiences, others have engaged in safe-seeking behaviors (e.g., behaving extra vigilant, avoiding the "trigger" of the experience) (Ortiz de Gortari & Griffiths, 2014a; Ortiz de Gortari & Griffiths, 2014c; Ortiz de Gortari & Griffiths, 2016) or tried to stop the unwanted intrusions (e.g., listening to loud music to stop hearing sounds from the game) (Ortiz de Gortari & Griffiths, 2014b). Also, some gamers perceive their GTP as harmless, while others can get highly distressed (Ortiz de Gortari, et al., 2011; Ortiz de Gortari & Griffiths, 2014a; Ortiz de Gortari & Griffiths, 2014b; Ortiz de Gortari & Griffiths, 2014c).

Research into psychosis argues that the interpretation (either individual or cultural) of non-volitional phenomena (e.g., visual hallucinations) is what leads to the distress and disability (Morrison, 2001b). *"The initial interpretation of an intrusion will determine the cognitive and behavioral responses or strategies that will affect the subsequent occurrence of similar intrusion"* (Morrison, 2001a p. 264). Therefore one of the goals of the research into GTP has been to operationally define and explain a variety of non-volitional phenomena associated with playing videogames as non-pathological. At this early stage of understanding GTP, knowing which factors are involved in the different levels of GTP experienced by gamers can substantially contribute in identifying those individuals that may need help, guidance, and/or intervention.

Consequently, the main aim of the present study was to examine if there are differences between those gamers who have experienced mild, moderate or severe levels of GTP. The present study explored the relationship between GTP severity and (i) socio-demographic characteristics, (ii) gaming habits and gamer profile, (iii) appraisal of GTP and impact of GTP on gamers' lives (iv) medical conditions, drug use, flashbacks, and dream recall, (v) motivation for videogame playing, and (vi) specific game genres.

Method

Sample

A convenience (self-selected) sample of 2,362 gamers participated in an online survey and most participants were male (86.0%), In total, 73.1% of the sample were aged between 18 and 27 (with ages ranging from 18 to 54 years or older) and almost half were students (46.1%).

Procedure

The gamers were recruited to complete an online survey via online gaming community forums, *Facebook,* and meetup.com groups during 2014. A pilot survey was carried out prior to the final study to ensure gamers understood questions being asked. Before the gamers started answering the survey they provided informed consent. Anonymity and confidentially of the gamers' responses were ensured and the authors obtained ethical approval for the study by the research team's University Ethics Committee.

Materials in the survey

Individual characteristics. These items assessed socio-demographic factors (i.e., age, gender, occupation and country of residence), in addition to further questions about drug use, having flashbacks as side-effects of drug use, having a medical condition, and frequency of recalling dreams.

Gaming habits and motivations. These items assessed frequency of playing, gaming session length, and type of gamer. A 10-item multiple choice scale was used to assess gaming motivations, and related to such reasons as immersion, achievement and socialization, as well as playing for excitement or liking to finish the game as fast as possible.

Distress and dysfunction due to GTP. A single question ("Have your GTP experiences ever distressed or affected you socially, occupationally or in other areas of functioning?") was used to assess distress or negative consequences in some area of the life due to GTP.

Appraisal of GTP. A six-item multiple-choice format was used to assess whether the experiences had been positive, negative, or neutral.

Medical conditions. These items assessed whether gamers considered themselves having some of the following conditions: visual disorder (excluding short-sightedness/long-sightedness), hearing disorder, sleep disorder (excluding insomnia provoked by the visualization of videogame images), mental disorder, and problematic gaming or gaming addiction.

Game Transfer Phenomena Scale (GTPS; Ortiz de Gortari, Pontes & Griffiths, 2015). The GTPS is a psychometrically validated 20-item scale that assesses five GTP modalities/sub-modalities: altered visual perceptions (e.g., 'I have seen distorted real life environments and/or objects due to my videogame playing'), altered body perceptions ('I have experienced bodily sensations of movement as if I was in a videogame'), altered auditory perceptions (e.g., 'I have heard the music from a game when I was not playing'), automatic mental processes (e.g., 'I have wanted or felt the urge to do something in real life after seeing something that reminded me of the videogame') and actions and behaviors (e.g., 'I have acted out a behavior or performed an activity influenced by a videogame'). A five-item Likert scale was used to assess the frequency of each modality (i.e., 'all the time', 'many times', 'a few times', 'once' and 'never'). In the present study, the GTPS showed high levels of internal consistency (Cronbach's alpha = .929), and Principal Components Factor Analysis identified one overriding factor (i.e., GTP) that accounted for 43% of the variance.

Statistical analysis

The aim of the statistical analysis was to examine differences among the levels of GTP and associated variables. The data were analyzed in different steps. First, the gamers were categorized into one of three different groups. The groups were classified according to GTP severity based on an 80-point GTPS scale. No previous research had been conducted differentiating the severity levels of GTP. The maximum of 80 points were obtained based on the frequency responses to the 20 GTPS items ("Always", "Many times", "A few times", "Once", excluding "None"). The scale was divided into three levels since no previous study has established the difference between levels of GTP (low = 1 to 26, moderate = 27 to 53, and severe = 54 to 80). These were calculated based upon ranges within the GTPS. Whilst there is the potential for overlap for classifications near the upper/lower boundaries for each classification, the ranges of values within the classifications minimized any confounding influence this could have had. Secondly, differences between the groups were examined via chi-square tests. The variables examined were: (i) individual characteristics: socio-demographics, medical conditions, drug use, flashbacks and recalling dreams, (ii) gaming habits: frequent playing, gaming session length, type of gamer, (iii) motivations for playing and, (iv) distress and appraisal of GTP. Finally, a multinomial logistic regression was conducted to examine which factors predicted higher levels of GTP in the sample.

Results

More than half of the gamers showed mild GTP levels (57.8%), more than one-third showed moderate GTP levels (35.6%), and the remainder showed severe GTP levels (6.6%).

Socio-demographic variables in the different levels of GTP

Gender

The majority of the gamers in all three groups were male. Gender was not significantly different among the groups (see Table 1).

Age

Independently of the GTP severity group, the majority of gamers were 18 to 22 years old (46.5%). In total, 73.1% of gamers were aged between 18 and 27 years. Overall there was a statistically significant association between age and GTP severity ($\chi^2[14] = 67.814$, $p < 0.001$). Those in the severe GTP group were more likely to be 18 to 22 years old (64.8%) with a standardized residual (SR) = 3 compared to 52.2% with medium GTP (SR = 2.3) and 40.7% for low GTP (SR = -2.8). For gamers aged 28 to 32 years there were significant differences for low severity GTP (SR = 2.5) and high severity GTP (SR = -3.4). This trend was also reflected in the 33 to 38 year age category. No significant differences were found for those gamers over the age of 39 years (see Table 1).

Occupation

Most of the gamers in all three GTP groups were students (46.6%) and they were the most prevalent group for severe GTP (63%) with those in full-time and part-time employment being the second most prevalent for severe GTP (both on 13.3%). Overall there was a statistically significant interaction between occupation and GTP severity (χ^2 [16] = 67.814, $p < 0.01$). Those with severe levels of GTP were more likely to be students (SR = 2.8). No other occupational interactions were significant (see Table 1).

Table 1.
Socio-demographics according to the GTP severity level

	Mild %	**Moderate %**	**Severe %**	***X²***	***d.f***	***p* value**
Gender	n=1,125	n=751	n=135			

Male	86.9	85.0	83.7	2.1	2	0.353
Female	13.1	15.0	16.3			
Age	n=1,094	n=718	n=122	67.8	14	0.001
18-22 years old	40.7	52.2	64.8			
23-27 years old	27.0	26.5	24.6			
28-32 years old	18.0	12.5	3.3			
33-38 years old	8.8	5.3	2.5			
39-43 years old	2.5	1.8	3.3			
44-48 years old	1.7	0.7	0.0			
49-53 years old	0.8	0.0	0.8			
54 years old or older	0.5	1.0	0.8			
Occupation	n=1,136	n=760	n=135	67.814	16	0.001
Full-time employed	30.7	27.5	13.3			
Part-time employed	9.2	8.3	13.3			
Self-employed	7.2	6.2	3.0			
Unemployed	6.5	5.3	3.7			
Homemaker	1.1	1.6	0.7			
Student	43.3	48.6	63.0			
Retired	0.2	0.1	0.0			
Disabled to work	0.1	0.3	0.0			
Other	1.8	2.2	3.0			

Underlying reasons explaining levels of GTP

Medical conditions

The majority of the gamers in all three GTP groups did not have any pre-existing medical condition. There was a statistically significant interaction between having a medical condition and GTP severity ($\chi^2[2] = 29.792$, $p < 0.001$). Those in the mild GTP severity group (16.8%) were significantly less likely to have a medical condition compared to those in the other groups. To understand the interactions between GTP severity and medical conditions better a new dichotomous variable was created to examine the prevalence of

physical and psychological medical conditions. Only having a psychological medical condition was significant different among the groups ($\chi^2[2] = 30.420$, $p < 0.001$). Those in the mild GTP severity group (8.4%) were less likely to have a psychological condition compared to those in the other groups (see Table 2). It was also found that those who were in the severe GTP group were significantly more likely to have a sleep disorder ($\chi^2[2] = 19.774$, $p < 0.001$), mental disorder ($\chi^2[2] = 16.441$, $p < 0.001$) and problematic gaming/gaming addiction than the other groups ($\chi^2[2] = 12.602$, $p < 0.01$) (see Table 3).

Table 2.
Medical conditions according to GTP severity level

	Mild %	**Moderate %**	**Severe %**	***X²***	***d.f***	**p value**
	n=1,095	**n=734**	**n=127**			
Medical condition	16.8	26.0	30.7	29.8***	2	0.001
Physical medical condition	6.6	7.9	5.5	1.7	2	0.438
Psychological Medical condition	8.4	15.4	20.5	30.4***	2	0.001

*p < 0.05 **p < 0.01 ***p < 0.001

Table 3.
Variety of medical conditions according to GTP severity level

	Mild %	**Moderate %**	**Severe %**	***X²***	***d.f***	**p value**
	n=1,095	**n=734**	**n=127**			
Visual disorder	4.2	6.7	4.7	5.6	2	0.062
Hearing disorder	1.4	1.4	3.9	5.2	2	0.074
Sleep disorder	4.7	8.6	13.4	19.8***	2	0.001
Mental disorder	2.9	5.7	9.4	16.4***	2	0.001
Problematic gaming/gaming addiction	2.7	4.5	8.7	12.6**	2	0.002

*p < 0.05 **p < 0.01 ***p < 0.001

Drug consumption and flashbacks as side-effects of drug consumption

The majority of the gamers in all three GTP groups had never consumed psychoactive drugs or experienced flashbacks of drug use. However, there was a statistically significant interaction between drug use ($\chi^2[2] = 21.531$, $p < 0.001$), having experienced flashbacks as a side-effect of drug use ($\chi^2[2] = 15.775$, $p < 0.001$) and GTP severity. Those in the mild GTP group were significantly less likely to have used drugs (9.6%) and to have experienced flashbacks as a side-effect of drug use (15.8%) compared to those in the others groups (see Table 4).

Tendency to recall dreams

Overall the majority of the sample (76.8%) 'usually remembered' dreams irrespective of their GTP level. None of the individual comparisons between GTP severity and remembering dreams were statistically significant (SR < 2). Overall there was a statistically significant interaction between the tendency to recall dreams and levels of GTP ($\chi^2[2] = 21.382$, $p < 0.001$), but the only statistically significant interactions were found between mild and moderate levels of GTP and not usually recalling dreams. Those with mild levels of GTP were more likely to not recall dreams (SR = 2.6) and those with moderate levels were less likely to not recall dreams (SR = -2.7) (see Table 4).

Table 4.
Drug use, flashbacks and dreams according to GTP severity level

	Mild %	**Moderate %**	**Severe %**	***X²***	***d.f***	***p* value**
Drugs	n=1,015	n=723	n=135			
Have used drugs	9.6	16.3	18.5	21.5***	2	0.001
Flashbacks	n=335	n=257	n=34			
Have experienced flashbacks	15.8	28.4	32.4	15.8***	2	0.001
Tendency to recall dreams	n=1,317	n=812	n=150			
Remember dreams	73.3	81.4	82.7	21.4***	2	0.000

*p < 0.05 **p < 0.01 ***p < 0.001

Gaming habits and gamers' self-concept in terms of severity of GTP

Type of gamer

The majority of the gamers in all three GTP groups were hard-core gamers. Those with mild GTP levels had the most newbies (72.4%) and casual gamers (63.6%), while severe GTP had proportionately more hard-core gamers (70.7%). Overall there was a significant interaction between type of gamer and GTP severity ($\chi^2[8] = 31.922$, $p < 0.001$). Those in the mild GTP group were significantly more likely to be casual gamers (SR = 2.1), while those in the severe GTP group were significantly more likely to be professional gamers (SR = 2.0) and significantly less likely to be casual gamers (SR = - 3.2). None of the other comparisons showed a significant effect (see Table 5).

Frequency of playing

Playing every day was the most common in the severe and moderate GTP groups (52.0%, 37.4%) but not in the mild GTP group (30.5%). Overall there was a significant interaction between frequency of playing and GTP severity ($\chi^2[8] = 55.590$, $p < 0.001$). Playing every day, 2-4 times per week, less than once a week, or playing once a week were significantly different among the groups. Those in the mild GTP group were more likely to play less than once per week (SR = 2.5) and less likely to play every day (SR = -2.4), while those in the moderate group were less likely to play less than once a week (SR = -2.5). Lastly, those with severe levels of GTP were more likely to play every day (SR=3.7) and less likely to play once a week (SR=-2.7) or 2 to 4 times per week (SR=-2.2).

Gaming session length

The most common session length in the severe and moderate GTP groups was 3 to 5 hours 59 minutes (53.0% and 46.0% respectively) while it was 1 to 2 hours 59 minutes in the mild GTP group (48.7%). This interaction showed that there was a significant effect between session length and GTP severity ($\chi^2[6] = 107.697$, $p < 0.001$). All of the comparisons were significant. Gamers with severe GTP were the most likely to play for over 6 hours in a gaming session (SR = 5.3). Gamers with mild GTP were more likely to be gamers that played for less than 3 hours in a gaming session (see Table 5).

Table 5.
Gaming habits according to the GTP severity level

	Mild	**Moderate**	**Severe**	***X²***	***d.f***	***p* value**

	%	%	%			
Frequent playing	n=1,318	n=812	n=150	55.590	8	0.000
Less than once a week	4.6	1.7	0.7			
Once a week	5.3	5.2	0.0			
2-4 times a week	38.2	32.4	24.7			
5-6 times a week	21.5	23.3	22.7			
Every day	30.5	37.4	52.0			
Session length	n=1,318	n=811	n=151	107.697	6	0.000
Less than 1 hour	4.9	2.1	0.0			
1 hr. to 2 hrs. 59 minutes	48.7	37.7	20.5			
3 hr. to 5 hrs. 59 minutes	37.9	46.0	53.0			
Over 6 hrs	8.4	14.3	26.5			
Gamer profile	n=1,314	n=812	n=150	31.922	6	0.000
Newbie gamer	1.6	0.7	1.3			
Casual gamer	35.2	29.4	17.3			
Hard-core gamer	56.4	64.3	70.2			
Professional gamer	6.5	5.5	10.7			

*p < 0.05 **p < 0.01 ***p < 0.001

Motivations and in-game behaviors

Playing for exploration and immersion were the most prevalent motivations for playing independently of GTP severity level. Similarly, playing for reasons such as immersion, excitement, and escape from the real world were significantly different among the GTP groups. Those in the severe GTP group were significantly more likely to play for escape from the real world (61.6%) in comparison to the other GTP groups ($\chi^2[2] = 59.970$, $p < 0.001$). Those in the moderate group were more likely to play for excitement (50.2%) ($\chi^2[2] = 40.536$, $p < 0.001$). Those in the mild GTP group were significantly less likely to play to

compete or improve scores (41.7%) (χ^2[2] =6.227, $p < 0.05$), exploration (62.5%) (χ^2[2] =10.672, $p < 0.05$) or immersion (67.7%) in comparison to the other GTP groups (χ^2[2] =19.834, $p < 0.001$) (see Table 6).

Table 6.
Motivations according to GTP severity level

	Mild % n=1,317	**Moderate %** n=811	**Severe %** n=151	***X²***	***d.f***	**p value**
Finish the game as fast as possible	18.1	19.1	17.2	0.5	2	0.775
Mechanics	47.0	48.0	50.3	0.7	2	0.696
Improve scores and/or compete with others	41.7	46.4	49.0	6.2*	2	0.044
Socialize	34.6	36.2	39.7	1.8	2	0.404
Explore	62.5	68.2	72.0	10.7**	2	0.005
Immersion	67.7	76.2	76.2	19.8***	2	0.001
Customize	54.2	56.0	60.3	2.3	2	0.321
Excitement	36.6	50.2	48.3	40.5	2	0.001
Escape	34.9	47.3	61.6	60.0	2	0.001

*p < 0.05 **p < 0.01 ***p < 0.001. This was a multiple answer question hence percentage sum can be larger than 100%.

Videogame genres

Differences were observed among the majority of the videogame genres according to GTP severity level. Those in the severe GTP group were significantly more likely to have experienced GTP when playing fighting (χ^2[2] =68.730, $p < 0.001$), MMORPG (χ^2[2] =93.979, $p < 0.001$), simulation (χ^2[2] =74.920, $p < 0.001$) and strategy (χ^2[2] =91.400, $p < 0.001$) games, while those in the mild GTP group were significantly less likely to have experienced GTP when playing adventure (χ^2[2] =146.089, $p < 0.001$), first person shooter (χ^2[2] =92.618, $p < 0.001$), puzzle (χ^2[2] =21.716, $p < 0.001$), musical and dance (χ^2[2] =27.680, $p < 0.001$), and role playing (χ^2[2] =108.231, $p < 0.001$) games. Those in the moderate GTP group were more likely to have experienced GTP when playing action (χ^2[2] =109.005, $p < 0.001$) and racing (χ^2[2] =29.739, $p < 0.001$) games (see Table 7).

Table 7.
Video game genres played when GTP happened according to GTP severity level

	Mild	Moderate %	Severe %	X^2	*d.f*	p value
Action	39.5	62.3	62.3	109.0***	2	0.001
Adventure	43.4	67.5	77.5	146.1***	2	0.001
FPSVG	38.7	57.4	67.5	92.6***	2	0.001
Racing VG	15.6	25.2	24.5	29.7***	2	0.001
Fighting VG	11.3	22.6	31.8	68.7***	2	0.001
Puzzle VG	18.1	25.9	28.5	21.7***	2	0.001
Music/Dance VG	13.1	20.5	25.2	27.7***	2	0.001
Educational VG	2.5	4.6	5.3	7.6*	2	0.022
MMORPG VG	19.6	33.4	51.0	94.0***	2	0.001
RPG VG	44.1	64.7	74.2	108.2***	2	0.001
Simulation VG	13.8	26.1	37.1	74.9***	2	0.001
Strategy VG	24.1	40.8	52.3	94.0***	2	0.001
Sport VG	8.5	10.9	13.2	108.2	2	0.071

*p < 0.05 **p < 0.01 ***p < 0.001. This was a multiple answer question hence percentage sum can be larger than 100%.

Appraisal and distress

In terms of appraisal of GTP, the majority of the gamers in the severe GTP group (55.6%) and two-fifths in the moderate GTP group (39.4%) had experienced GTP as pleasant and the majority in the mild GTP group had no special feelings about GTP (55.9%). Those in the mild GTP group were significantly less likely to have experienced GTP as pleasant (13.9%) and wanted GTP to re-occur (13.3%) ($\chi^2[2] = 234.027$, $p < 0.001$) compared to other GTP groups. Those in the severe GTP group wanted GTP to re-occur (44.4%) ($\chi^2[2] = 125.370$, $p < 0.001$) and had longer-lasting GTP experiences (15.2%) when compared those in the other GTP groups ($\chi^2[2] = 88.346$, $p < 0.001$). Those in the severe GTP group were less likely to have no special feelings about GTP (21.9%) ($\chi^2[2] = 95.163$, $p < 0.001$), and those in

the moderate GTP group were significantly more likely to have felt confused due to GTP (18.5%) ($\chi^2[2] = 26.002$, $p < 0.001$).

More than half in the severe GTP group (58.0%) had experienced distress or been affected in some area of their life due to GTP while only a minority in the mild (8.9%) and moderate GTP group (27.5%) had had some negative consequence. Those in the severe GTP group (58.0%) were significantly more likely to have experienced distress or been affected in some area of their life due to GTP ($\chi^2[2] = 232.442$, $p < 0.001$) than the other groups (see Table 8).

Table 8.
Appraisal and distress of GTP according to GTP severity level

	Mild %	**Moderate %**	**Severe %**	***X²***	***d.f***	**p value**
Appraisal of GTP	n=1,217	n=779	n=151			
No special feelings	55.9	39.3	21.9	95.2***	2	0.001
Unpleasant	5.0	5.6	7.3	1.5	2	0.472
Pleasant	13.9	39.4	55.6	234.0***	2	0.001
Lasting effects	1.1	6.3	15.2	88.3***	2	0.001
Felt confused	10.7	18.5	17.9	26.0***	2	0.001
Want that it happens again	13.3	29.5	44.4	125.4***	2	0.001
Distress or detrimental in some area of life	n=1,032	n=731	n=138			
	8.9	27.5	58.0	232.4***	2	0.001

*p < .05. **p < .01. ***p < .001. Impact was a multiple answer question hence the percentages are sometimes larger than 100%.

Predictive factors for levels of GTP

A multinomial logistic regression was conducted to examine which factors best predicted levels of GTP experienced in the sample. The model fit for this analysis was good ($p < .001$) and the independent variables provide a better model than the intercept. The analysis indicated that several of the independent variables were statistically significant predictors of the level of GTP experienced. The significant factors were: length of time spent

playing, distress and dysfunction due to GTP, and pleasantness of GTP experience, frequency playing, and tendency to recall dreams (see Table 9).

Table 9.
The multinomial regression of predictors for levels of GTP

	Model Fitting Criteria	**Likelihood Ratio Tests**		
	-2 Log Likelihood of Reduced Model	***X²***	***d.f***	**p value**
Intercept	397.429	0.000	0	.
Gender	399.121	1.693	2	0.429
Age	397.814	0.386	2	0.825
Employment Status	401.449	4.021	2	0.134
Illness	397.646	0.218	2	0.897
Drug Use	398.871	1.442	2	0.486
Flashbacks	398.283	0.855	2	0.652
Type of Gamer	397.764	0.335	2	0.846
Duration of Play	410.152	12.724**	2	0.002
Frequency of Play	408.993	11.565**	2	0.003
Distress	415.820	18.392***	2	0.000
Pleasantness of Experience	421.419	23.990***	2	0.000
Recall of Dreams	405.616	8.187*	2	0.017

*p < .05. **p < .01. ***p < .001.

Discussion

The aim of the present study was to examine which factors are most associated with gamers who experienced different levels of GTP and the impact of GTP in their lives. The majority of the gamers in the study had the lowest levels of GTP. Clear differences were observed between gamers who were classified in the mild and the severe GTP groups. Differences were found in terms of socio-demographics, gaming habits, type of gamer, motivations for playing, and underlying reasons behind GTP. Also, differences were found in terms of how GTP were appraised and in relation to the distress experienced because of GTP. Further analysis was conducted to examine if demographic variables, consumption of drugs, underlying medical conditions, video game habits, type of gamer, distress, appraisal of GTP experiences and recall the dreams were predictors of the severity groups of GTP. The results show that only video game habits, experience distress due to GTP, pleasantness of GTP experience and tendency to recall dreams were predictors of the severity levels of GTP.

Socio-demographics, gaming habits and type of gamer

In terms of socio-demographics and gaming profile, gender was not significantly different according to GTP severity level. The majority of the gamers were male, although there were more females among those in the severe GTP group. Those in the severe GTP group were significantly more likely to be students and significantly less likely to be full-time employed and being youngest in the sample (18 to 22 years). The severe level of GTP was much less prominent in the older age categories. Particularly, significant differences were found in gamers aged 28 to 32 and 33 to 38 that tended to be in low or severe GTP level. Moreover, those in the severe GTP group were the ones that typically played videogames more frequently and longer sessions than those in the other GTP groups. More than half of those in the severe GTP group were significantly more likely to play every day and significantly less likely to play 2 to 4 times or once a week, while those in the mild GTP group were more likely to play less than once per week and less likely to play every day.

In terms of session length, the most common session length in the severe and in the moderate GTP levels were play sessions of 3 to 6 hours. Those in the severe level were significantly more likely to play session of 6 hours our more, while those in the mild group were significantly more likely to play for less than 3 hours in a gaming session. Interestingly, playing frequently and duration of video game session were even predictors of severe levels of GTP which confirm the relevance of video game habits in the reoccurrence of GTP.

Previous studies have suggested differences in the way adolescents and adults engage in playing videogames, which may be related to GTP severity level. For instance, Griffiths, Davies and Chappell (2014) compared adolescents (19 years or younger) and adults (20 years and over) and found that the younger the player the more they invested in playing and younger gamers also tended to neglect work or education for playing more than adults.

Smahel, Blinka and Ledabyl (2008) found that gamers under 27 years were more likely to identify themselves with their avatar, tended to play more intensively, and showed higher levels of addiction. Yee (2006) found that younger gamers (between 12 and 22 years of age) in comparison to older groups considered their online experiences more rewarding and satisfying than their offline experiences, and that the most annoying experiences reported during the previous days (7 or 30 days) was related to something that happened online. Moreover, those in the youngest groups considered themselves more addicted to gaming.

In terms of type of gamer, there were proportionately more hard-core and professional gamers in the severe group. It is worth noting that professional gamers accounted for less than 7% of the sample and less than 11% of gamers with severe GTP were professional

gamers. Nevertheless, only those who were professional gamers were significantly more likely to be in the severe GTP group. Previous findings comparing those who have experienced GTP versus those that have never experienced GTP showed that professional gamers were significantly more likely to not have experienced GTP (Ortiz de Gortari & Griffiths, 2015). This suggest that while professional gamers are not more susceptible to experience GTP, those professional gamers that actually experienced GTP may be more at risk to experience severe levels of GTP. Individual susceptibility and other confounding factors may be more important for GTP since type of gamer (which in the present study was a subjective self-classification) was not a predictor for severe levels of GTP.

Medical conditions

The majority of the gamers did not have any medical condition and demonstrates that most GTP cannot be explained by pre-existent illnesses, particularly mild levels of GTP. However, there were more gamers in the moderate and particularly the severe group with some medical condition. When looking in depth into medical conditions, those in the mild group were also significantly less likely to have a pre-existing psychological condition.

Further examination of the physical and psychological medical conditions showed that those in the severe GTP group were significantly more likely to include individuals that suffered from sleep disorders. Sleep disturbances have been found among previous self-report studies examining GTP (e.g., sleep paralysis, limbs moving as in the game when being in bed, seeing images from the game) (Ortiz de Gortari & Griffiths, 2014a; Ortiz de Gortari & Griffiths, 2014c). Also, mental disorders were more likely to be found in the severe GTP group. Non-volitional GTP experiences share important commonalities with symptoms of psychopathology (Ortiz de Gortari & Griffiths, 2014a; Ortiz de Gortari & Griffiths, 2014b) and it is important to distinguish between them. Individuals with specific mental disorders may be more susceptible to being influenced by videogame content (e.g., not being able to distinguish between videogame events and real life, developing irrational thoughts, etc.). Moreover, those in the severe GTP group were significantly more likely to report problematic gaming and/or gaming addiction. In an interview study with gamers who reported GTP, problems related to the game were found. These included the neglecting of school obligations, problems with parents, and neglect of self-care (Ortiz de Gortari, 2010).

In general, gaming habits appear to be relevant in experiencing GTP (Ortiz de Gortari & Griffiths, 2015), particularly for those in the severe GTP group as shown in the present study. Problematic gamers or those identified with gaming addiction typically play

videogames excessively. Moreover, some GTP experiences appear to be explained by failures in cognitive control and control inhibition (Ortiz de Gortari & Griffiths, 2014c), and pathological gamers (in comparison with non-pathological gamers) have shown increased impulsiveness and perseverative errors in cognitive tasks (Han, et al., 2012). These findings suggest that the association between problematic/addictive gaming and GTP should be further investigated.

Dream recall

Another relationship that was investigated was between dream recall and GTP severity. In general, incorporation of videogame elements in dreams about videogames are often reported by gamers (Gackenbach, Rosie, Bown, & Sample, 2011; Murzyn, 2012; Poels, Ijsselsteijn, & de Kort, 2014), gamers that have experienced GTP have reported similar content in their dreams (Ortiz de Gortari, et al., 2011; Ortiz de Gortari & Griffiths, 2014a). In the present study, there were slightly more gamers in the severe group that tended to recall dreams but the differences in terms of tendency to recall dreams were not significant among the groups. However, the tendency not to recall dreams was more likely in the mild and moderate groups. Although though the associations between those with severe GTP and tendency to recall dreams appear not to be straightforward, the analysis of the predictors showed that tendency to recall dreams was a predictor of severe GTP. This is interesting particularly because previous research has found differences between individuals that tend to recall dreams and those that not tend to. For instance, high recall of dream has been associated with sleep disorders (Schredl, Schäfer, Weber, & Heuser, 1998). As mentioned above, those in the severe GTP group were significantly more likely to report some type of sleep disorder. Irregular sleep patterns may result in higher reports of GTP in circumstances related to sleep. According to one experiment where the visualization of videogame images in sleep onset was induced by playing a ski game simulator showed that waking up gamers early in the night resulted in more reports with direct content of the game played (e.g., "flashes in my head, virtual reality skiing game", "saw the game") while more indirect content remained stable independently of what sleep phase the gamers were woken up from ("stacking wood… at a ski resort that I have been before") (Wamsley, Perry, Djonlagic, Reaven, & Stickgold, 2010).

In another study, Eichenlaub et al., (2014) compared brain activity on those that recalled dreams more frequently (more than three times a week) with those that recalled dreams less frequently. The results showed that those that recalled dreams more frequently

tended to be more reactive to external stimuli both during wakefulness and sleep. The attention toward external stimuli may facilitate intrasleep wakefulness resulting in encoding dreams into memory, which explain the dream recall frequency. This suggests that during sleep, those that tend to recall dreams more frequently (in the present study those in the severe and mild GTP group), may have more restless sleep, and while awake they may be more reactive to external stimuli. Moreover, absorption and fantasy proneness has been associated with high recall of dreams (Beaulieu-PrÉVost & Zadra, 2007; Giesbrecht & Merckelbach, 2006). These overall findings suggest that it is opportune to investigate sleep disruptions, working memory, attention abilities, and fantasy proneness variables in future studies of GTP.

Drug use and visual disturbances

Results showed that the majority of the gamers were not under the influence of a psychoactive substance when GTP was experienced and that the majority had never used drugs. Those in the mild GTP group were significantly less likely to have used drugs than the other two groups. Altered visual perceptions identified in GTP resemble the characteristics of those experienced as side-effects of substances (e.g., seeing moving images in the back of the eyelids, perceiving environments distorted, seeing objects in movement or seeing environments more colorful) (Ortiz de Gortari & Griffiths, 2014a). Therefore, having experienced flashbacks as side-effects of drug use was investigated. Those in the mild GTP group were significantly less likely to have experienced flashbacks. Perhaps, individuals who experienced moderate or higher levels of GTP and had used drugs may be equally susceptible to re-experience images from the videogame as experiencing visual side effects (Ortiz de Gortari, 2015).

Motivations for playing

Differences in motivations for playing may reflect the relevance of engagement in specific activities in the videogame (e.g., focusing on specific game elements, feeling immersed in the videogame). Significant differences were found in reasons for playing videogames including exploring, excitement, immersion, improving scores and/or competing with others and escaping from the real world. High percentages were observed for exploring and immersion in all the GTP groups. However, the most noticeable difference between the groups was that more than half of those in the severe GTP group were significantly more likely to play for escape from the real world in comparison to the other two GTP groups,

while less than half of the mild and moderate GTP groups played for escapism. Playing the game for escape may denote the individual enjoyment of getting immersed in the game, but can also indicate playing the videogame as a compensatory mechanism for escaping from day-to-day life stressors (Kardefelt-Winther, 2014), which has been associated with excessive play and gaming addiction (Kuss, Louws, & Wiers, 2012; Wan & Chiou, 2006). Moreover, it is interesting to note that playing for competition, and willingness to get immersed in the virtual world (which typically denote high engagement in the game) were less relevant for those that have experienced lower levels of GTP.

Videogame genres

Gamers have reported GTP across a large variety of games, in fact more than 400 unique titles (Ortiz de Gortari, 2015). In the present study, differences were found among the videogame genres played in relation to GTP severity. However, it is important to note that the prevalence in each group may simply indicate a preference for specific genres in each group. For better understanding the differences between the GTP groups, it is necessary to compare with a population of gamers who play a particular genre. The most noticeable difference in percentages between the severe GTP group and those in the mild and moderate GTP groups was found in MMORPGs. For instance, more than half of those in the severe GTP group had experienced GTP when playing MMORPGs while only one in five did so in the mild GTP group. For instance, Poels and colleagues (2014) investigated game-biased perceptions such as gaming memories about the videogame and found they were triggered by objects, sounds, and music in MMORPGs. This game genre requires significant investment of playing time since they are permanent virtual communities where meaningful social relationships are established and the game goes on indefinitely. This genre of game has been consistently associated with problematic gaming and gaming addiction (Elliott, Golub, Ream, & Dunlap, 2012; Kuss, et al., 2012).

Appraisal and Distress

According to analysis of self-reports in previous GTP studies, gamers considered their GTP experiences as positive or negative (Ortiz de Gortari & Griffiths, 2014a; Ortiz de Gortari & Griffiths, 2014c). In the present study, differences among the GTP groups were found in terms of how they had appraised their GTP experiences, and if they experienced distress or dysfunction. No difference between the groups was found in terms of having experienced GTP as unpleasant. Interestingly, while those in the mild GTP group were significantly less likely to have experienced GTP as pleasant and less likely to want to GTP

to re-occur, those in the severe GTP group were significantly more likely to want the GTP to re-occur, and were less likely to have had no special feelings concerning GTP. These findings suggest that the recurrence of GTP is related to a specific attitude toward GTP similar to the tendency to recall dreams or experience involuntary auditory imagery (Beaulieu-PrÉVost & Zadra, 2007). Unexpectedly, those in the moderate GTP group rather than those in the severe GTP group were significantly more likely to have felt confused due to GTP. Perhaps the randomness of GTP make the experiences more bizarre to this particular group but at this stage it is difficult to be certain.

In terms of negative consequences due to GTP, more than half of those in the severe GTP group reported distress or dysfunction in some area of their life at some point. However, the negative consequences of GTP may better related to the prevalence, the type of the content, and the circumstances where they manifest than to the frequency and the number of GTP.

Interestingly, both pleasantness of experience and distress or dysfunction in some area of the individual life due to GTP were predictors of severe GTP. More than half of gamers with severe GTP have experienced distress due to GTP. This suggests that although some GTP are experienced as pleasurable with some wanting them to re-occur, this does not mean that GTP have not caused distress or detriment at some point, particularly for those that have experienced GTP more frequently and in different ways (i.e., those with severe GTP). In general, involuntary phenomena range from normal every day phenomena to dysfunctional intrusions that are core of mental disorders (Ohayon, 2000). For instance, re-experiencing perceptual distortions such as those during intoxication with hallucinogen drugs tend to be appraised as ‘bad trips’ (Lerner, Rudinski, & Bleich, 2011). These findings suggest that the appraisal of GTP should be investigated further because if gamers experience GTP as something pleasurable they may want to induce them by playing excessively (e.g., prolonging video game sessions) as some gamers expressed in previous qualitative studies on GTP (Ortiz de Gortari & Griffiths, 2014a). Also, it may be interesting to investigate social factors involved in GTP (e.g., influence of friends) that may promote playing excessively for sharing GTP experiences to feel ‘in fashion’, as a ‘real hardcore gamer’ or part of the game community, since gamers also report experiencing GTP together with friends and joking about them (Ortiz de Gortari & Griffiths, 2014c).

Limitations

One important limitation of this study is that the temporal dimension of GTP was not taken into consideration. Therefore, it is not known if the gamers' retrospective self-reports were about the GTP they had experienced during the course of their life or just at a specific point in time. Future studies should address the temporal dimension of GTP since this will beneficial to understand the actual prevalence of GTP and can contribute to a better understanding of the impact of GTP on gamers' psychological health. Another limitation of the study is how the strength of GTP was assessed. The GTP severity level was based on the frequency and numbers of GTP experiences. However, a better understanding of these experiences as phenomena and their implications on gamers' health could be addressed if GTP are analyzed in terms of the type of experience (e.g., comparing nocturnal experiences vs. those experienced in social context, internal vs. externalized experiences such as inner speech vs. verbal hallucinations). The data were also self-report and self-selected and therefore suffer from the limitations of such data (non-representative, recall bias, social desirability bias, etc.).

Conclusions and future research

Culture delimits meanings, beliefs, values and rules about the understanding of phenomena (Dill, 2009). Typically, non-volitional phenomena such as hallucinations are considered anomalous and exclusively of pathology. However, they are relatively common transitory phenomena and non-malignant in non-clinical populations (Johns & van Os, 2001). Game Transfer Phenomena appear to be temporal and indicate changes in cognitive, perceptual, and physiological functions without further adverse effects in most cases. However, those that have experienced more GTP (more frequently and different types) experienced more distress at least at some point. This suggests that it is important to understand when GTP can be psychologically overwhelming and when they can be beneficial, and being able to assist those in need and learning how to take advantage of GTP for educational and therapeutic means.

In general, GTP appear to be related to game engagement (e.g., escaping in the videogame, investing considerable time playing), those who have experienced high levels of GTP appear to share similarities with profiles of gamers with dysfunctional gaming (i.e., gaming addiction, problematic gaming).

In sum, those in the severe GTP group were significantly more likely to (i) be 18 to 22 years old, (ii) be students, (iii) be professional gamers, (iv) play every day, (v) play for 3 to 6

hours and 6 hours to 8 hours, (vi) have sleep disorder, mental disorder and problematic gaming or gaming addiction, (vi) play to escape from the real world,(viii) want GTP to happen again and that their GTP experiences had lasting effects, (ix) have experienced distress and dysfunction due to GTP and, (x) have experienced GTP with fighting, MMORPG, simulation, and strategy games. Those in the severe GTP group were significantly less likely to (i) be 28 to 32 years old, (ii) be full time employed, (iii) be casual gamers, (iv) play once per week or 2 to 4 times per week, (v) engage in gaming sessions of less than 1 hour and 1 to 3 hours and, (vi) have no special feelings about GTP.

This study also confirmed previous findings about the relevance of video game habits for GTP to occur (Ortiz de Gortari & Griffiths, 2015), and shed light on the relevance of distress and disability provoked by GTP, and appraisal of GTP as predictors of GTP. Future studies should examine what types of GTP experiences are the ones capable of provoking distress and dysfunction and under what circumstances, as well as identify which GTP experiences are pleasurable and wanted, and which individuals enjoy their GTP experiences and what provokes distress. Moreover, future studies should investigate the temporal stability of GTP and the relationship between GTP, gaming disorders, and sleep disruption.

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