Telematics and Informatics 34 (2017) 1802–1813

Contents lists available at ScienceDirect

Telematics and Informatics

journal homepage: www.elsevier.com/locate/tele

Turkish validation of the Game Transfer Phenomena Scale (GTPS): Measuring altered perceptions, automatic mental processes and actions and behaviours associated with playing video games

Muhterem Dindar*, Angelica B. Ortiz de Gortari

Faculty of Education, Learning and Educational Technology Research Unit, University of Oulu, Finland
Faculty of Psychology, Psychology and Neuroscience of Cognition Research Unit, University of Liège, Belgium

A R T I C L E I N F O

Keywords:
Game Transfer Phenomena
Turkish
Video games effects
Involuntary phenomena

A B S T R A C T

Studies on Game Transfer Phenomena (GTP) have demonstrated that experiencing altered sensorial perceptions, automatic thoughts and behaviours after playing video games are relatively common phenomena. The aim of this paper is twofold: (i) to validate the Turkish version of the GTP scale (GTPS), and (ii) to examine the prevalence and the relation between the various dimensions of GTP (e.g., visual perceptions, thoughts, behaviours) and video game players' individual characteristics (e.g., demographics, gaming habits). A total of 954 frequent players were recruited online. Independently of the different samples used in the original validation of the GTPS and the current study, the findings obtained via confirmatory factor analysis showed that the GTPS-Turkish is reliable and valid and proved to be adequate for measuring GTP. A total of 99% of the players in the sample had experienced some type of GTP. Moreover, the correlational, univariate and multivariate analyses showed associations between various video game player characteristics and GTP. The most remarkable finding was that the prevalence of GTP was higher among minors than adults.

1. Introduction

Research on Game Transfer Phenomena (GTP) has been an emerging field of study in recent years to understand how video game experiences are transferred to every day contexts that includes re-experiencing images, sounds, sensations, thoughts, involuntary motoric activations, etc associated with playing video games, and the subsequent psychological, cognitive and social implication of these transfers (Ortiz de Gortari, 2016; Ortiz de Gortari and Griffiths, 2014a; Ortiz de Gortari et al., 2011). Studies into GTP are important to understand gamers' well-being, and the further development of this novel field of study is particularly important due to the advancement in technologies implemented in the modern video games that contain cinematographic graphics, rich sensory cues (e.g., auditory, visual cues), and appealing narratives. Consequently, they cultivate high levels of immersion that can lead to temporal changes in perception and cognitions. For example, studies have shown that exposure to virtual simulators, virtual worlds or video games can provoke physiological symptoms similar to motion sickness (e.g., eye strain, headache, nausea, disorientation) (Chang et al., 2013; Dong et al., 2011; Edward et al., 2014; LaViola, 2000; Treleaven et al., 2015). Moreover, due to the increasing realism in video games, the brain perceives the virtual reality as objective reality in optimal conditions (Blascovich and Bailenson, 2011; Dill, 2009; Turkle, 2011). Scholars have claimed that memories derived from video games are as memorable as real-life memories (Johnson et al., 1993; Ortiz de Gortari, 2007). Hence, individuals' experiences and memories in the virtual world might blend with

* Corresponding author.
E-mail address: muhterem.dindar@oulu.fi (M. Dindar).

http://dx.doi.org/10.1016/j.tele.2017.09.003
Received 25 May 2017; Received in revised form 18 September 2017; Accepted 20 September 2017
Available online 21 September 2017
0736-5853/

their objective reality.

In general, the use of highly realistic cues in video games has led to a plethora of studies investigating the cognitive, affective, and behavioural effects of playing video games (e.g., Boot et al., 2008; Exelmans and Van den Bulck, 2015; Green and Bavelier, 2006; Greitemeyer and Mügge, 2014). However, most of the studies have focused on investigating conscious thoughts or action processes rather than unconscious mental processes, automatic behaviours, perceptual experiences and neural adaptations that occur subsequent to video game playing. This has been the focus of studies on GTP (Ortiz de Gortari, 2016).

1.1. Game Transfer Phenomena

Game Transfer Phenomena (GTP) refers to the spontaneous transfer of video game experiences to real life (Ortiz de Gortari and Griffiths, 2014a). GTP can manifest as altered sensorial perceptions, involuntary thoughts or behaviours (Ortiz de Gortari et al., 2015). GTP mostly happens soon after playing and lasts seconds or minutes (Ortiz de Gortari and Griffiths, 2015). However, in some cases GTP lasts for days or longer (Ortiz de Gortari et al., 2011; Ortiz de Gortari and Griffiths, 2016). Studies have shown that GTP is directly related to the content and the mechanics of the video games. For example, gamers have seen images, heard sounds from the game, and experienced thoughts with the logic of the game, etc. (Ortiz de Gortari and Griffiths, 2014b,c; Ortiz de Gortari et al., 2011).

Three main modalities of GTP have been identified: *altered perceptions*, *automatic mental processes*, and *behaviours and actions* (Ortiz de Gortari et al., 2015). The first modality, altered perceptions, comprises experiences in various sensory channels (e.g., visual, auditory, body) (Ortiz de Gortari et al., 2015). Visual experiences include visualizations of game elements in the mind (e.g., daydreaming about video game activities), visual pseudo-hallucinations (e.g., seeing game elements in real-life contexts), experiencing visual distortions (e.g., perceiving people or things different than their regular size, shape or colour) and misperceptions (e.g., misperceiving real-life objects as game elements) (Ortiz de Gortari et al., 2015; Ortiz de Gortari and Griffiths, 2014b). Body-related experiences include tactile sensations (e.g., sensation of pressing gamepad buttons when not playing), proprioception (e.g., illusion of bodily movements), and distortion of time (e.g., perceiving real-life events in slow motion) (Ortiz de Gortari, 2010; Ortiz de Gortari et al., 2011; Ortiz de Gortari et al., 2015; Ortiz de Gortari and Griffiths, 2014b). Auditory experiences can manifest as involuntary mental alliterations of game-related sounds (e.g., hearing game music or game sounds in the mind), phonic hallucinations (e.g., hearing in-game sounds coming from real-life objects), inner speech (e.g., voicing thoughts in the mind with the game character's voice), or auditory confusions (e.g., misperceiving real-life sounds as in-game sounds) (Ortiz de Gortari et al., 2011; Ortiz de Gortari and Griffiths, 2014c; Ortiz de Gortari and Griffiths, 2015).

The second modality of GTP, automatic mental processes, can occur as persistent thoughts related to the game content (Ortiz de Gortari et al., 2015). Examples include to keep thinking about the game or how to apply game strategies in real life contexts (Ortiz de Gortari and Griffiths, 2014a). Automatic thoughts can also occur as attentional bias towards game-related cues (Decker and Gay, 2011; van Holst et al., 2012). External stimuli can trigger involuntary thoughts about the game or individuals might be biased to interpret external stimuli as in-game cues (Ortiz de Gortari, 2010; Ortiz de Gortari et al., 2011; Ortiz de Gortari and Griffiths, 2014a). Moreover, automatic thoughts can include confusions of in-game conversations with real-life conversations or elicitation of fears or concerns about executing in-game activities in real life (e.g., driving over people with a car) (Ortiz de Gortari and Griffiths, 2014a).

The third and last modality of GTP is behaviours and actions. This modality includes verbal outbursts, motoric actions or body movements and activities (Ortiz de Gortari and Griffiths, 2015). For example, unconsciously avoiding security cameras, or talking or acting like game characters in real life, can be considered as typical of the behaviours and actions modality of GTP (Ortiz de Gortari, 2010; Ortiz de Gortari et al., 2015; Ortiz de Gortari and Griffiths, 2014a).

1.2. Prevalence of GTP and its relationship with individual characteristics

A study conducted to understand the prevalence and characteristics of GTP (e.g., duration, circumstances of occurrence) found that 96.6% of the gamers in the sample had experienced GTP at some point. GTP was most prevalent with the genres of adventure games, action games, first-person shooter games and massive multiplayer role-playing games. Most of the participants reported having no negative feelings towards their GTP experiences (Ortiz de Gortari and Griffiths, 2015).

A limited number of studies have investigated the relationship between GTP and individual characteristics (Ortiz de Gortari and Griffiths, 2015; Ortiz de Gortari and Griffiths, 2016; Ortiz de Gortari et al., 2016). For example, a study by Ortiz de Gortari and Griffiths (2015) with 2362 video game players showed that players between the ages of 18 and 22 were more likely to experience GTP than older players. Players who were older than 33 years were found to be less susceptible to GTP. The results of the study also revealed that session length, rather than frequency of playing was significantly associated with GTP (Ortiz de Gortari and Griffiths, 2015).

In a more recent study, Ortiz de Gortari et al. (2016) grouped video game players under three categories based on the severity levels (i.e., variety of GTP and frequency of manifestation) of their GTP experiences and compared various characteristics of the groups. Their findings showed that individuals between the ages of 18 and 22 years and students were more likely to belong to the severe GTP group (i.e., experienced GTP frequently and a large variety of GTP) rather than to the mild or moderate GTP group. Moreover, it was found that players in the mild GTP group were less likely to have any pre-existing psychological medical conditions compared with other groups. Also, players in the mild GTP group were more likely to be casual players whereas players in the severe GTP group were more likely to be professional players. Playing every day was more prominent among the severe (53%) and moderate (37%) GTP groups. Those in the severe group were significantly more likely to play sessions of six hours or more. GTP has also been investigated in particular video games such as in the Localization-Based Augmented Reality game Pokémon Go showing a prevalence of 81% ($n = 1085$) (Ortiz de Gortari, 2017).

Table 1
The profile of participants.

Sex	f	%	Education	f	%
Male	925	97	Primary school student (Grade 4–8)	18	1.9
Female	29	3	Only primary school graduate	32	3.4
			High school student	606	63.5
Daily play time at different age groups (h)	M	SD	Only high school graduate	60	6.3
15–17 (n = 590)	5.3	3.9	Undergraduate student	197	20.6
18–22 (n = 302)	5.8	4.0	Only undergraduate degree	28	2.9
23–27 (n = 55)	5.2	3.0	Graduate student	8	0.8
28–35 (n = 7)	3.4	1.9	Graduate degree	5	0.5
Frequency of game play in the last 12 months	f	%	Length of the playing sessions at different age groups (h)	M	SD
Never	4	0.4	15–17 (n = 590)	5.4	2.4
Less than once in a month	13	1.4	18–22 (n = 302)	5.4	2.5
Once in a month	9	0.9	23–27 (n = 55)	4.8	2.4
Few times in a month	46	4.8	28–35 (n = 7)	3.6	1.3
3–4 times in a week	134	14			
5–6 times in a week	138	14.5			
At least once a day	610	63.9			
Proficiency in video game play	f	%	Years of game play experience among different age groups	M	SD
Beginner	7	0.7	15–17 (n = 590)	7.8	3.0
Intermediate	253	26.5	18–22 (n = 302)	10.0	3.5
Advanced	564	59.1	23–27 (n = 55)	11.9	4.1
Professional	130	13.6	28–35 (n = 7)	17.4	5.6

To date, studies on GTP have established a foundation for investigating and understanding involuntary phenomena with video game content. Based on the GTP framework (Ortiz de Gortari, 2015) a scale has been developed for assessing GTP, and the GTP Scale (GTPS) has proven to be reliable and valid (Ortiz de Gortari et al., 2015). However, a previous study showed some cross-cultural differences between an English- and Spanish-speaking sample on the prevalence of GTP in most of the dimensions of GTP (e.g., visual, body) (Ortiz de Gortari, 2015). Therefore, the first aim of this study was to test the GTPS in a different cultural context and validate the GTPS in a Turkish sample. The second aim was to examine the prevalence and the relation between the various dimensions of GTP (rather than examining GTP as unified phenomena) and players' individual characteristics (e.g., demographics, gaming behaviours), since the different types of GTP (altered sensorial perceptions, spontaneous thoughts) may be explained by different underlying mechanisms. This study will not only contribute to understanding GTP in distinct cultural context, but also obtaining deeper insights into how the different forms of GTP manifest (visual, auditory, etc.).

2. Method

2.1. Participants

A total of 954 Turkish video game players participated in an online survey. The mean age of the participants was calculated as 17.6 (Range = 15–35; *SD* = 0.88). The majority of the participants were male (97%), and high school students (63.5%). Most participants (92%) reported playing video games at least 3–4 times per week. The average time played per day was above 5.5 h across all age groups (ages between 18 and 22 reported the highest daily playing time, 5.8 h). Moreover, just over half of the participants identified themselves as advanced level players (59.1%). Overall, the sample comprised of mostly male adolescents and young adults who had extensive experience in playing video games and played video games frequently (See Table 1 for further details on participants' profiles and their video game habits.).

2.2. Procedure

The participants were recruited via an online survey in an open Turkish video game group with over 30,000 members on Facebook with the permission of the group's administrator. Data collection took place in the spring of 2016. The Facebook group did not focus on a specific video game genre or type. Thus, it is possible to assume that the recruited participants had diverse video game playing backgrounds. The online research method was chosen since it offers various advantages including alleviating the social desirability effects, reaching a heterogeneous and a larger sample size in a short period of time, and it is not considered an intrusive method since researchers are not in direct contact with the participants (Griffiths et al., 2013). The present survey did not contain sensitive questions or requested private information, which could compromise participants' confidentiality by making the individuals identifiable, e.g., IP address, name or location. The participants were required to follow three steps to participate in the survey. First they had to click on the announcement link on the Facebook page. As a second step, the participants were presented the consent form page that informed about the aim and the scope of the study and explained their rights as participants. Last, participants had to click on the "Proceed" button to display the survey. No incentive or reward was offered to the participants. Participants were free to quit the survey at any moment. Thus, we can claim that participants had no other motive than voluntary and intentional participation in the study. A debriefing page was included at the end of the survey.

2.3. Measures

2.3.1. Demographics

The first section of the survey included questions about age, gender and educational status.

2.3.2. Player profile

This comprised questions about years of experience of video game playing, and perceived video game playing proficiency. Perceived video game playing proficiency was measured with a four-item Likert Scale question: "Please rate your proficiency level in playing video games" (beginner level, medium level, advanced level and professional level).

2.3.3. Gaming habits

Frequency of game play in the last twelve months was measured through a five-point Likert Scale question: "How often have you been playing video games in the last twelve months?" Answers to this question varied between "Never," "Less than once in a month", "Once in a month", "Few times in a month", "3–4 times in a week", "5–6 times in a week", and "At least once in a day" (Lemmens et al., 2015). The daily playing time on weekdays and weekends was assessed through individual questions. The daily playing time for the participants was calculated with a weighed mean formula: DailyPlayHours = (Average_Daily_Play_in_Weekdays∗5 + Average_Daily_Play_at_the_Weekends∗2)/7 (Rehbein et al., 2016). Lastly, the length of the playing sessions was measured through a one choice question: "At one sitting, how long do you play a video game without any interruption?" Answers to this scale varied as "0–1 h" (1), "1–2 h" (2), "2–3 h" (3), "3–4 h" (4), "4–5 h" (5), "5–6 h" (6), "6–7 h" (7), "7–8 h" (8), "more than 8 h" (9).

2.3.4. Game Transfer Phenomena Scale (GTPS)

The GTPS (Ortiz de Gortari et al., 2015) includes 20 items (four items at each dimension) to capture the frequency of GTP experiences in three modalities: (i) altered sensorial perceptions, (ii) automatic mental processes (AMP) and (iii) actions and behaviours (AAB). The altered sensorial perceptions cover experiences in three sensorial channels: altered visual perception (AVP), altered body perceptions (ABP) and altered auditory perceptions (AAP). The items were developed to investigate GTP (Ortiz de Gortari, 2015) and then validated by Ortiz de Gortari et al. (2015). The GTPS uses a Likert-scale of frequency which range between "Never" (1), "Once" (2), "A few times" (3), "Many times" (4) and "All the time" (5). The scale was translated into Turkish using a forward translation design (Hambleton and Kanjee, 1993). First, two language experts translated the scale into Turkish, and then these translations were combined into a single set by an expert panel. Participants of this panel were two experts from Linguistics studies, one expert from video gaming studies, and one expert from the Psychometrics field. Eight frequent video game players in a focus group meeting evaluated the provisional translation created by the expert panel. The final version was created after fine-tuning the scale items based on the suggestions of the video game players. As a last step, the GTPS-Turkish was piloted on 18 video game players and no issue of misunderstanding was observed.

2.4. Statistical analysis

The statistical analysis involved descriptive statistics about the participants, psychometric properties of the GTP scale, univariate, multivariate and correlational analyses between the participants' profile, demographics, gaming variables and the GTP dimensions. A confirmatory factor analysis (CFA) with maximum likelihood estimation method was conducted to test the fit of the GTP scale to the current sample using the LISREL software. Further statistical analysis was performed with the IBM SPSS22 software. Chi-square (χ^2), the ratio of chi-square to the degree of freedom (χ^2/df), Root Mean Square Error of Approximation (RMSEA); Normed Fit Index (NFI); Non-normed Fit Index (NNFI); Comparative Fit Index (CFI); Standardized Root Mean Square Residual (SRMR); Goodness of Fit Index (GFI); Adjusted Goodness of Fit Index (AGFI) indices were used to evaluate the fitness of scale on the current sample. χ^2 shows the difference between hypothesized covariance matrix and the observed covariance matrix (Tavakol et al., 2011). RMSEA shows to what extent a model's fit is within the reasonable limits in the population (Brown, 2014). NFI compares the χ^2 value of the null and the hypothesized model (Bentler and Bonett, 1980). However, NFI is inclined towards negative bias in small sample sizes (Bentler, 1990). Thus, NNFI adjusts the negativity bias in NFI (Bentler and Bonett, 1980). CFI compares the fit of the proposed model and the null model while adjusting for the sample size base that is inherent in χ^2 (Tavakol et al., 2011). SRMR is the average discrepancy between the correlations in the hypothesized model and the correlations in the data matrix (Brown, 2014). The GFI is the measure of the variance and covariance explained by the model (Tavakol et al., 2011). AGFI on the other hand, takes the parsimony into account while showing the variance explained by the model (Joreskog and Sorbom, 1986).

3. Results

In the first section, we present the statistical results related to the validity and reliability of GTPS-Turkish. This will be followed by the presentation of correlations, univariate and multivariate statistics regarding the relationships between GTP dimensions and individual characteristics of video players.

3.1. Reliability and validity of the Turkish GTP scale (GTPS-Turkish)

The overall Cronbach's alpha score of the scale was 0.923 and it varied between 0.741 and 0.825 across the dimensions, meaning that the scale showed a good internal consistency. Factor loadings of the scale items were all above 0.40 limit (Field, 2009). The convergent validity of the scale was assessed through calculation of Average Variance Explained (AVE) and Composite Reliability (CR) scores. The AVE for the AAP (0.56) dimension was above the suggested threshold of 0.50 whereas for the AVP (0.431), ABP (0.432), AMP (0.419) and AAB (0.432) dimensions, it was slightly below 0.50 (Hair et al., 2006). CR scores were above 0.70 across all the dimensions. It has been suggested that when the AVE scores are above 0.40 and CR scores are above 0.70 the convergent validity of a scale is considered adequate (Fornell and Larcker, 1981; Huang et al., 2013).

Furthermore, to check the response stability of the participants, the standard error of measurement (SE*m*) was calculated (Wuang et al., 2012) for each GTP dimension. The SE*m* is calculated by multiplication of standard deviation with square root of one minus reliability coefficient (e.g., Cronbach's alpha) (Morrow et al., 2015). According to literature when the SE*m*/SD ratio is equal to "2 or less" it is considered a good precision (Wuang et al., 2012; Wyrwich et al., 1999). In the current sample, the SEm/SD ratio was 0.51 for the AVP, 0.50 for the ABP, 0.42 for the AAP, 0.50 for the AMP, and 0.50 for the AAB dimension. These values indicated that the precision of scores was good across all the dimensions.

The distribution of the GTP dimension scores was also examined for floor effects (i.e., a scale cannot differentiate an increased performance from the minimum score until a certain point (Wuang et al., 2012)) and ceiling effects (i.e., a scale being incapable of measuring a performance beyond a certain level (Pontes and Griffiths, 2015)). It has been suggested that the number of participants with the highest or lowest possible scores should not exceed 20% (Lim et al., 2008). In the current study, the lowest possible score was 20 and the highest possible score was 100. Only 0.9% (n = 9) of the participants had the minimum score whereas none had the highest score. Thus, we can conclude that floor and ceiling effects were not substantial on the current sample (see Table 2 for scale descriptive statistics).

A CFA was conducted to check the construct validity of the GTPS-Turkish (see Table 3 for the fit indices of the measurement model). The NFI, NNFI, CFI, GFI and AGFI scores were all above the 0.90 threshold for a good fit (Bentler, 1990). The RMSEA value was also considerably below the threshold of 0.1 limit for a good fit (Browne and Cudeck, 1993). Furthermore, the SRMR index was below the 0.05 limit and indicated a perfect fit (Hu and Bentler, 1999; Kline, 2005). The chi square/df ratio of the scale was above the suggested limit of 3 (Kline, 2005). It is known that chi-square/df ratio surpasses the limit of 3 in large sample sizes (Jöreskog and Sörbom, 1993). In order to test whether the high chi-square/df ratio was caused by the sample size, 295 cases were randomly chosen from the data set and a second CFA was conducted. As seen in Table 3, chi-square/df ratio was below 3 in the smaller sample. Therefore, we can conclude that the construct validity of the GTPS-Turkish was good. In addition, the similar CFA results between the whole sample and the randomly chosen sub-sample demonstrated that population-cross validity of the GTPS-Turkish scale was sufficient.

Regarding criterion validity, positive correlations were found between the original GTPS dimensions and video game play session length (Ortiz de Gortari et al., 2016). Parallel to these findings, all dimensions in the GTPS-Turkish dimensions were positively correlated with video game play session length in the current study (see Table 4). On the other hand, concurrent validity of the GTPS-Turkish could not be tested because GTP is an emerging field of study and there are no similar measures that could be used for the validation (Ortiz de Gortari et al., 2015).

Table 2
Scale descriptive statistics.

	Internal reliability							Convergent validity	
Dimension (alpha) (0.923)	Item	Mean	SD	Item total r	Factor loading	t-value	Error variance	CR	AVE
Altered visual perceptions (AVP) (0.741)	AVP1	2.71	1161	0.533	0.59	18.54	0.65	0.751	0.431
	AVP2	1.59	1016	0.576	0.69	25.53	0.52		
	AVP3	1.59	1.028	0.612	0.70	23.11	0.50		
	AVP4	2.01	1.166	0.586	0.64	20.39	0.59		
Altered body perceptions (ABP) (0.752)	ABP1	2.03	1.236	0.611	0.67	21.65	0.55	0.753	0.432
	ABP2	1.95	1.238	0.582	0.65	20.84	0.58		
	ABP3	2.36	1.396	0.576	0.66	21.26	0.57		
	ABP4	1.85	1.221	0.571	0.65	21.12	0.57		
Altered auditory perceptions (AAP) (0.825)	AAP1	2.59	1.272	0.581	0.72	24.50	0.48	0.831	0.555
	AAP2	2.11	1.257	0.637	0.84	30.31	0.29		
	AAP3	2.08	1.265	0.608	0.79	27.81	0.37		
	AAP4	2.06	1.185	0.607	0.61	19.82	0.62		
Automatic mental processes (AMP) (0.745)	AMP1	2.53	1.423	0.617	0.70	23.09	0.51	0.741	0.419
	AMP2	3.71	1.098	0.507	0.56	17.53	0.68		
	AMP3	2.96	1.400	0.546	0.64	20.51	0.59		
	AMP4	1.86	1.254	0.624	0.68	22.29	0.53		
Actions and behaviours (AAB) (0.748)	AAB1	2.60	1.298	0.601	0.64	20.90	0.59	0.753	0.432
	AAB2	1.73	1.167	0.615	0.66	21.51	0.57		
	AAB3	2.08	1.238	0.592	0.66	21.46	0.57		
	AAB4	1.65	1.068	0.606	0.67	22.08	0.55		

CR: Composite reliability; AVE: Average variance explained.

Table 3
CFA Results.

	All data	Randomly chosen 295 cases
χ^2	797.55	342.38
df	160	160
χ^2/df	4.98	2.14
p-value	< 0.001	< 0.001
RMSEA	0.065	0.062
NFI	0.97	0.96
NNFI	0.97	0.98
CFI	0.98	0.98
SRMR	0.046	0.050
GFI	0.92	0.90
AGFI	0.90	0.86

RMSEA: Root Mean Square Error of Approximation; NFI: Normed Fit Index; NNFI: Non-normed Fit Index; CFI: Comparative Fit Index; SRMR: Standardized Root Mean Square Residual; GFI: Goodness of Fit Index; AGFI: Adjusted Goodness of Fit Index.

3.2. Correlational analysis between GTP and various variables

Correlational analysis using Pearson's correlation coefficients was performed to examine the relationships between the GTP dimensions (e.g., altered perceptions, mental processes) and age, daily play time, frequency of game play in the last twelve months, game play session length, proficiency in video game play, and years of video game play (see Table 4 for results on Pearson's correlation coefficients).

The results showed that age was negatively correlated with all GTP dimensions ($r = -0.120$ to -0.095) except with AVP and AAP. No significant correlation was observed between age and AVP and AAP dimensions. The relatively small correlations indicated that ABP, AMP and AAB were experienced less frequently among the older players. Daily playing time ($r = 0.120$–0.154), and game session length ($r = 0.139$–0.203) were positively correlated with all the GTP dimensions at a small magnitude. The current results suggested that an increase in playing hours, or playing session length are associated with experiencing GTP more often. Players with higher proficiency in video gaming reported higher frequency of GTP at the AVP, ABP, AMP and AAB dimensions. No relationship was observed between proficiency in gaming and AAP dimension. Frequency of playing video games in the last twelve months was positively correlated only with AVP, AAP, AMP, and AAB dimensions at small levels. On the other hand, years of game play experience was only correlated with AAB dimension. Finally, all GTP dimensions were positively correlated with each other at medium levels (see Table 4 for correlation analysis between GTP dimensions and various variables).

3.3. Prevalence of GTP

Overall, the prevalence of GTP (i.e., frequency of participants who experienced a type of GTP at least once) was 99.1% and the prevalence in the dimensions of GTP was as follows: AVP (83.2%), ABP (76.8%), AAP (82.5%), AMP (95.8%), AAB (81.5%). More specifically, the prevalence of GTP across the items of the AVP dimension varied from 29.4% to 65.5%. For the ABP dimension items, the percentage of participants who experienced GTP ranged from 38.2% to 55.7%. For the AAP dimension, the prevalence of GTP across its items was between 49.1% and 70.7%. Furthermore, the prevalence of GTP was between 37.8% and 93.7% for the AMP dimension items and between 32.5% and 69% for the AAB dimension items (see Table 5 for full data on the prevalence on GTP).

Table 4
Correlations between GTP factors and video game player characteristics.

	1	2	3	4	5	6	7	8	9	10	11
Age (1)		0.034	0.036	0.055	0.119**	0.438**	−0.040	−0.120**	−0.057	−0.099**	−0.095**
Daily play time (2)			0.470**	0.391**	0.197**	0.135**	0.142**	0.135**	0.120**	0.154**	0.131**
Frequency of game play in the last 12 months (3)				0.192**	0.148**	0.176**	0.069*	0.053	0.116**	0.111**	0.100**
Game play session length (4)					0.176**	0.136**	0.139**	0.201**	0.106**	0.181**	0.203**
Proficiency in video game play (5)						0.280**	0.094**	0.089**	0.055	0.104**	0.095*
Years of game play experience (6)							0.031	0.026	0.055	0.063	0.083*
AVP (7)								0.636**	0.609**	0.611**	0.637**
ABP (8)									0.587**	0.618**	0.655**
AAP (9)										0.545**	0.613**
AMP (10)											0.691**
AAB (11)											

AVP: Altered visual perceptions; ABP: Altered body perceptions; AAP: Altered auditory perceptions; AMP: Automatic mental processes; AAB: Actions and behaviours.
** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 5
Response frequencies for each item.

Item	Never (%)	Once (%)	Sometimes (%)	Usually (%)	Always (%)	Total have GTP* (%)
Visualized /seen images with closed eyes	24.5	7.5	45.8	17	5.1	65.5
Seen images with eyes open	70.6	7.5	15.8	4.1	1.9	29.4
Seen distorted real-life environments and/or objects	70.5	8.4	14.6	4.2	2.3	29.5
Misperceived a real-life object	51	10.1	28	8.3	2.6	49.0
Altered Visual Perceptions overall						83.2
Bodily sensations of movement	52.8	9.2	23.7	10.4	3.9	47.2
Tactile touch sensation	57.1	8.6	20.1	10.3	3.9	42.9
Perceived time and/or body differently	44.3	7.8	23.6	15.8	8.5	55.7
Felt as mind has disconnected from body	61.8	8.7	16.7	8.5	4.3	38.2
Altered Body Perceptions overall						76.8
Heard the music from a VG	30.3	11.8	33.8	17	7.1	70.7
Heard a sound from a VG	48.6	12.2	24.1	9.9	5.2	51.5
Heard a character's voice from a VG	50.9	9.7	24.3	9.9	5.1	49.1
Misinterpreted a sound IRL	48.2	13.2	25.9	9.5	3.1	52.8
Altered Auditory Perceptions overall						82.5
Wanted/felt the urge to do something IRL triggered by a game-related cue	38.7	9	24.1	17.3	19.9	61.3
Still being in the mind-set of a VG	6.3	4.6	27.7	35.1	26.3	93.7
Thinking about using a VG element IRL	25.4	8.4	26.7	23.9	15.5	74.6
Mixed up VG events with IRL events	62.2	8.3	16.6	7.3	5.7	37.8
Automatic Mental Processes overall						95.8
Sang, shouted or said something with VG content unintentionally	31	10.9	34.2	15.3	8.6	69
Reflex body reaction associated with VG	66.6	8.6	13.8	7.2	3.8	33.4
Acted out a behavior/ performed an activity influenced by a VG	48.7	14.2	22.2	10.3	4.6	51.3
Acted differently IRL situations unintentionally based on VG experience	67.5	9.7	15.7	4.1	2.9	32.5
Automatic Actions and Behaviors overall						81.5

AVP: Altered visual perceptions; ABP: Altered body perceptions; AAP: Altered auditory perceptions; AMP: Automatic mental processes; AAB: Actions and behaviours. VG = Video games; IRL = In real life.
* GTP experienced at least once.

3.4. Comparisons between the GTP and noGTP groups

A dichotomous variable was created and participants were classified as "GTP" (i.e., participants who had experienced GTP at least once) and "noGTP" (i.e., participants who had never experienced GTP) for each GTPS-Turkish dimension. Several independent sample *t*-tests were performed to compare the GTP and noGTP groups in the five dimensions of GTP investigated (visual, auditory, body-related perceptions, mental processes, and actions and behaviours) in relation to i) daily playing hours, ii) game play session length, and iii) years of game play experience (see Table 6 for full results).

3.5. GTP and gaming habits

In terms of daily playing hours, in general those in the GTP group tended to spend more hours per day playing video games than those in the noGTP group but no significant difference was observed across the GTP dimensions. Regarding the length of the playing

Table 6
t-Test comparisons between GTP and noGTP groups across years of game play experience, daily play time and length of the playing sessions.

Dimension		Years of game play experience		Daily play time (h)		Length of the playing sessions (h)	
		M (SD)	t (Cohen's d)	M (SD)	t (Cohen's d)	M (SD)	t (Cohen's d)
AVP	GTP (n = 794)	8.77 (3.63)	0.039 (0.002)	5.51 (3.89)	0.789 (0.078)	5.41 (2.44)	1.828 (0.157)
	noGTP (n = 160)	8.76 (3.39)		5.21 (3.78)		5.02 (2.53)	
ABP	GTP (n = 733)	8.65 (3.52)	-1.955 (0.148)	5.41 (3.73)	−0.566 (0.064)	5.45 (2.46)	2.40* (0.183)
	noGTP (221)	9.19 (3.76)		5.64 (3.42)		5.00 (2.45)	
AAP	GTP (n = 787)	8.86 (3.58)	1.712 (0.144)	5.50 (3.88)	0.986 (0.061)	5.38 (2.44)	0.978 (0.084)
	noGTP (n = 167)	8.34 (3.60)		5.26 (3.90)		5.17(2.54)	
AMP	GTP (n = 914)	8.80 (3.59)	1.302 (0.209)	5.51 (3.92)	1.715 (0.342)	5.36 (2.50)	0.900 (0.138)
	noGTP (40)	8.05 (3.57)		4.26 (3.35)		5.00 (2.70)	
AAB	GTP (n = 768)	8.79 (3.65)	0.357 (0.028)	5.58 (3.96)	0.708 (0.164)	5.44 (2.46)	2.557* (0.208)
	noGTP (n = 186)	8.69 (3.31)		4.97 (3.48)		4.93 (2.44)	

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. AVP: Altered visual perceptions; ABP: Altered body perceptions; AAP: Altered auditory perceptions; AMP: Automatic mental processes; AAB: Actions and behaviours.

Table 7
Chi square tests for GTP - noGTP by proficiency in video game play.

Dimension	Source	Beginner (f)*	Intermediate (f)	Advanced (f)	Professional (f)	χ^2	p	Cramer's V
AVP	GTP (n = 794)	0	216	469	102	2.92	0.232	0.056
	noGTP (n = 160)	7	37	95	28			
ABP	GTP (n = 733)	6	185	442	100	2.697	0.260	0.053
	noGTP (n = 221)	1	68	122	30			
AAP	GTP (n = 787)	6	207	465	109	0.245	0.885	0.016
	noGTP (n = 167)	1	46	99	21			
AMP	GTP (n = 914)	7	238	547	122	5.05	0.08	0.073
	noGTP (n = 50)	0	15	17	8			
AAB	GTP (n = 768)	5	203	460	100	1.476	0.478	0.039
	noGTP (n = 186)	2	50	104	30			

AVP: Altered visual perceptions; ABP: Altered body perceptions; AAP: Altered auditory perceptions; AMP: Automatic mental processes; AAB: Actions and behaviours.
* Due to insufficients sample size, beginner category was not included in any of the chi-square analyses at the table.

session, those in the GTP group played longer sessions than those in the noGTP group across all the dimensions, although not significant in most of the GTP dimensions. Only ABP ($M_{GTP} = 5.45$, $SD_{GTP} = 2.46$; $M_{noGTP} = 5.00$; $SD_{noGTP} = 2.45$ $t_{(1,952)} = 2.40$, $p < 0.05$), and AAB ($M_{GTP} = 5.44$, $SD_{GTP} = 2.46$; $M_{noGTP} = 4.93$; $SD_{noGTP} = 2.44$; $t_{(1,952)} = 2.557$, $p = < 0.01$) showed significant differences. Regarding the total years of video game play experience, no difference was observed between the GTP and noGTP groups across the dimensions.

3.6. GTP, proficiency in video game play and gender

A chi-square test of independence was conducted to examine the differences between GTP experiences (GTP vs. noGTP) according to the players' level of proficiency and gender. No significant deviation was observed between the GTP and noGTP groups in terms of gaming proficiency across any of the GTP dimensions (see Table 7 for chi-square test of independence results).

Regarding gender, no significant differences were found between males and females in terms of the GTP dimensions (see Table 8).

3.7. Age and GTP

To investigate the prevalence of GTP dimensions across the different age groups, the participants were further distributed into two groups: Group 1 (15–17 years old) and Group 2 (18 years old or older). Descriptive statistics showed that the percentage for those in Group 2 who had experienced GTP was lower than in the younger age groups across all GTP dimensions except in the AVP (see Table 9).

3.8. Severity of GTP

Further analysis was conducted to understand if there were differences in terms of the severity of GTP (i.e., frequency of GTP manifestation) among the different age groups. In the current study, the severity of each GTP dimension was calculated by averaging the item scores belonging to the dimension. A 2 (age groups) × 5 (GTP dimensions) Multivariate Analysis of Variance (MANOVA) was conducted to examine whether the age groups differed from each other at the dimensions of GTP. Preliminary assumption testing for normality, linearity, univariate and multivariate outliers, homogeneity of variance–covariance matrices and multi-collinearity was conducted to check whether the dataset met the assumptions of Multivariate Analysis of Variance (MANOVA) (Pallant, 2007). Based on their Mahalanobis distance, six outlier cases were excluded from the analysis to meet the multivariate normality assumption. No significant violation was found for the other assumptions. The results of the analysis showed a significant difference between the age groups for the dimensions of GTP ($F_{(4,942)} = 4.301$; $p = 0.001$; $\eta_p^2 = 0.022$). The effect size of the difference can be considered as small (Tabachnick and Fidell, 2007, p.55). To investigate the source of difference observed in MANOVA, independent

Table 8
Chi-square results for GTP-noGTP by gender.

Dimension (n = 1265)		Female (%)	Male (%)	χ^2	p	Cramer's V
ABP	GTP (n = 794)	22	711	0.016	0.900	0.004
	noGTP (n = 160)	7	214			
AAP	GTP (n = 787)	23	764	0.210	0.647	0.015
	noGTP (n = 161)	6	161			

The frequency of females who did not experience AVP (n = 1), AMP (n = 3) and AAB (n = 4) were below the minimum cell size (n = 5) suggested in the literature (Bewick et al., 2003). Therefore, AVP and AMP was not included in the analysis. ABP: Altered body perceptions; AAP: Altered auditory perceptions; AMP: Automatic mental processes; AAB: Actions and behaviours.

Table 9
Prevalence of GTP at different age groups.

Age group	AVP		ABP		AAP		AMP		AAB	
	GTP %	noGTP %	GTP %	noGTP %	GTP %	noGTP %	GTP %	noGTP %	GTP %	noGTP %
15–17 (n = 160)	82.9	17.1	80.8	19.2	83.7	16.3	96.8	3.2	81.9	18.1
18 and above (n = 364)	83.8	16.2	70.3	29.7	80.5	19.5	94.2	5.8	78.3	21.7

AVP: Altered visual perceptions; ABP: Altered body perceptions; AAP: Altered auditory perceptions; AMP: Automatic mental processes; AAB: Actions and behaviours.

samples *t*-tests were conducted for each GTP dimension. The significance limit in *t*-tests tests was set as 0.010 (0.05/5 comparisons) in accordance with the Bonferroni correction. Results are displayed in Table 10.

As Table 10 shows, in all GTP dimensions, minors had higher GTP scores. However, the only significant differences were observed in ABP ($t_{(1, 946)} = 3.73$; $p < 0.001$) and AMP ($t_{(1, 946)} = 2.901$; $p < 0.001$) dimensions. In general, *t*-test results showed that GTP was more prominent among the minors than the young adults.

4. Discussion

The first objective of this study was to assess the validity and reliability of the GTP Scale in a Turkish sample. Our second objective was to investigate the prevalence of GTP and its relationship with several video player characteristics. These characteristics included gender, daily play time, game play session length, years of video game experience, proficiency in video game play, and frequency of video game play. The GTP Scale originally assessed five dimensions of GTP: altered visual perceptions, altered body perceptions, altered auditory perceptions, automatic mental processes and automatic actions and behaviours associated with video game playing. Overall the internal consistency of the GTPS-Turkish across its dimensions was satisfactory. The validity of the scale was further investigated through analysis of its convergent validity, factorial structure, response stability, and floor and ceiling effects. The analyses showed good convergent validity and response stability and no floor and ceiling effects. Furthermore, CFA results indicated that the factorial structure of the scale was good. Thus, we can conclude that the GTPS-Turkish is a reliable and valid instrument to measure GTP experiences in the Turkish context. The current findings suggest that the GTP Scale (Ortiz de Gortari and Griffiths, 2015) is suitable to measure GTP experiences in cross-cultural settings. However, measurement invariance of the scale should be tested across cultures to see whether the GTPS is appropriate to compare GTP experiences in different cultures.

In terms of the prevalence of GTP, in the current sample the majority of the participants (99.1%) reported having experienced at least one type of GTP at least once. In a previous study with an international sample, Ortiz de Gortari and Griffiths (2016) utilized the same instrument (i.e., the GTP scale) and found similar results. A total of 96.6% of video game players reported having experienced GTP at least once. In the same study, dimensions of GTP were sorted according to their prevalence as automatic mental processes (87.4%), altered auditory perceptions (85.2%), altered visual perceptions (84.8%), actions and behaviours (77.7%), and altered body perceptions (72.7%). In the current study, the most prevalent GTP dimension was reported as automatic mental processes (95.8%), followed by altered visual perceptions (83.2%), altered auditory perceptions (82.5%), actions and behaviours (81.5%), and altered body perceptions (76.8%). The order of the GTP dimensions in terms of their prevalence was almost the same in both the current study and Ortiz de Gortari and Griffiths' study (2016). The only difference was that the altered visual perceptions in the current study was the second most prevalent GTP dimension, whereas it was the third in Ortiz de Gortari and Griffiths' study (2016). In addition, the prevalence of automatic mental processes, actions and behaviours, and altered body perceptions was higher whereas the prevalence of altered auditory perceptions, and altered visual perceptions was lower in the current study compared with Ortiz de Gortari and Griffiths' study (2016). These results indicate that some types of GTP might be more prominent than others regardless of the cultural context although the frequency of GTP experiences across the dimensions might differ.

Table 10
t-Test results about the severity of GTP at different age groups.

Dimension		M (SD)	t	p	Cohen's d
AVP	15–17 (n = 585)	1.98 (0.81)	0.742	0.458	0.049
	18 and above (n = 363)	1.94 (0.80			
ABP	15–17 (n = 585)	2.13 (0.98)	3.73	< 0.001	0.253
	18 and above (n = 363)	1.89 (0.91)			
AAP	15–17 (n = 585)	2.26 (1.02)	2.037	0.042	0.13
	18 and above (n = 363)	2.13 (0.97)			
AMP	15–17 (n = 585)	2.84 (0.99)	2.901	0.004	0.205
	18 and above (n = 363)	2.64 (0.96)			
AAP	15–17 (n = 585)	2.06 (0.91)	2.462	0.014	0.170
	18 and above (n = 363)	1.91 (0.85)			

AVP: Altered visual perceptions; ABP: Altered body perceptions; AAP: Altered auditory perceptions; AMP: Automatic mental processes; AAB: Actions and behaviours.

The correlational analyses in the current study showed that daily playing time and session length was positively correlated with all dimensions of GTP. Particularly, session length rather than frequent playing time has been found to be relevant for GTP to occur (Ortiz de Gortari and Griffiths, 2016). Similarly, in the current sample the correlations between playing session length and the dimensions of GTP were higher than the correlations between daily play time and the dimensions of GTP except for altered visual perceptions and altered auditory perceptions. Altered visual perceptions and altered auditory perceptions correlated at a higher magnitude with the daily playing time than the playing session length.

Further analysis into playing frequency and session length comparing those who have experienced GTP with those who have never experienced GTP and GTP modalities showed that frequency of video game play was significantly correlated with all GTP dimensions except than the altered body perceptions. Session length did not show significant differences between GTP and noGTP across most of the dimensions, with exception of automatic mental process and actions and behaviours. Thus, the current findings suggest that frequency of video game playing and session length might facilitate particular types of GTP rather than all types.

Previous studies have shown associations between video game proficiency and GTP. For instance, professional players have been found to be significantly less likely to experience GTP (Ortiz de Gortari and Griffiths, 2015). However, a closer examination of severity levels of GTP (i.e., experiencing GTP frequently and in a variety of forms) suggested that while professional players appear to be less susceptible to GTP, if they experience GTP they tend to experience GTP severely (Ortiz de Gortari et al., 2016). In the current study the proficiency of the video game player (i.e., beginner, medium, advanced, professional) was positively correlated with all dimensions of GTP except than the altered body perceptions. However, considering the large sample size and low correlations (below 0.1) between proficiency and GTP dimensions, it is questionable whether the current findings carry any practical significance. Thus, we have conducted chi-square tests to investigate the prevalence of GTP and noGTP across different proficiency levels. No significant difference was observed in the any of the GTP dimensions. The current findings do not support previous studies who argued that GTP might fade off after players are repeatedly exposed to the same game features, as is the case with professional gamers who play the same or similar games (Ortiz de Gortari and Griffiths, 2015; Ortiz de Gortari et al., 2016). Although, our sample only included a small number of professional gamers. Future studies should be conducted to investigate GTP in a sample of professional gamers.

In terms of age, a previous qualitative study on GTP included minors (Ortiz de Gortari et al., 2011), but our study is the first to examine GTP in a large sample of minors (i.e., players under the age of 18). Previous studies could not provide any information about the prevalence of GTP among minors. The current study showed that age was negatively correlated with all dimensions of GTP except altered visual perceptions. Further, compared with the players aged 18 or above, those younger than 18 had higher frequency of GTP manifestation at all dimensions. However, only significant differences were observed in the altered body perceptions, and automatic mental processes dimensions. This suggests that minors might be more susceptible to certain types of GTP. Our findings are on a similar line to studies that argue that video games have larger effects on adolescents than adults. Smahel et al. (2008) reported that the tendency to identify oneself with the video game avatars was more prominent among young people. Furthermore, Yee (2006) found that compared with adults, adolescents are more attached to video games and reported that their most annoying recent experiences were related to playing video games rather than real life issues.

Years of video game playing experience was positively correlated with only actions and behaviours. This suggests that having a long background in playing video games might not facilitate most types of GTP. Similarly, as with findings in previous studies on GTP (Ortiz de Gortari and Griffiths, 2015), we did not find any differences between males and females in terms of GTP. However, only a small minority of females participated in the existing study (n = 29; f = 3%). Further studies with a larger female sample are necessary to better understand the prevalence of GTP across gender.

5. Limitations and future studies

The current research relies on self-report data that was collected through non-probability sampling. Thus, the current findings might not represent the whole population of gamers in Turkey. The study has several limitations inherent to survey studies such as social desirability, biased recalls and lack of depth. Moreover, it provides limited insights about the temporal evolution of GTP experiences. In this regard, future studies could use experience-sampling methods to unearth the antecedents, facets of GTP and its subsequent effects on individuals. In addition, our findings do not address specific game genres associated with GTP. There is still limited knowledge on how certain game design features like narrative, interactions, speed of actions, colours and level of realism are related to GTP. Thus, future studies can apply purposeful sampling to recruit players of different game genres and investigate the interplay of game elements and GTP experiences. Furthermore, the correlational results in the current study do not show direction of causality. Also, the correlations between the dimensions of GTP, demographics and gaming habits (i.e., age, frequency of game play, session length, daily play time, years of video game playing experience, and proficiency in playing video games) appear to be small in the current study. Therefore, future studies should focus on other variables that might explain GTP experiences with higher variances.

While previous research has found significant associations between session length and overall scores of the GTPS (Ortiz de Gortari et al., 2016), playing a long session is not a prerequisite to experience GTP. This has been demonstrated previously (Ortiz de Gortari and Griffiths, 2015) and corroborated in this study. In the current study, by analysing GTP per dimension rather than, suggests that using gaming habits (i.e., playing hours, video game play session length) to examine the criterion-related validity of the GTPS scale can be inadequate. More research is necessary to better identify the variables that might help to assess criterion-validity of GTPS scale dimensions.

The current study shows that minors can be more susceptible to GTP compared with adults particularly to experiencing altered body perceptions, and automatic mental processes dimensions. However, it is still unknown what psychological/perceptual constructs cause the differences between different age groups. Therefore, future studies might investigate potential cognitive and perceptual factors in different age groups that lead to GTP. For instance, studies have found that players showed attention bias towards game-related cues (van Holst et al., 2012) and other studies have found that failures in cognitive control and experience in playing video games are related (Bailey et al., 2010; Kronenberger et al., 2005). Future studies should investigate how cognitive control at different ages (e.g., minors vs. adults) is related to the dimensions of GTP.

Finally, the participation of minors in our study was incidental. We believe that participants provided accurate information about their age and gender, but this information were not verified as usually occurs when conducting online research and therefore the results in this matter should be take it with caution. Future studies should verify this information.

6. Conclusions

In summary, the current study confirmed that the GTPS-Turkish is a reliable instrument for measuring GTP experiences among Turkish video game players. Furthermore, the current study characterized GTP dimensions as follows: i) altered visual perceptions were related to daily play time, frequency of video game play, video game play session length, and proficiency of video game playing at a small degree; ii) altered body perceptions were correlated with age, daily play time, video game play session length, and proficiency in video game play at small levels. Minors were found to be more prone to altered body perceptions than adults; iii) altered auditory perceptions were modestly associated with daily play time, frequency of video game play, and game play session length.; iv) automatic mental processes were related to age, daily play time, frequency of video game play, game play session length, and proficiency in video game play at small magnitudes. The current findings also revealed that minors had higher automatic mental processes than adults; v) the actions and behaviours dimension was mildly correlated with age, daily play time, frequency of video game play, game play session length, proficiency in video game play, and years of video game playing experience.

GTP has been conceptualized for investigating the transfer of video game effects, manifesting as altered perceptions, cognitions and behaviours, rather than focusing on examining particular video game contents (e.g., violence) or dysfunctional gaming (gaming addiction) (Ortiz de Gortari, 2016). Our study strengthens the conceptualization of GTP, since the items of the original GTP scale (Ortiz de Gortari et al., 2016) were reliable to assess GTP, even in a population with a different cultural background (i.e., a Turkish sample that included minors). However, our study also has shown that there are differences among the GTP modalities and dimensions (e.g., automatic mental processes, altered sensorial perceptions) in terms of gaming habits such as daily play time, frequency of video game play and video game play session length. This highlights the challenges of examining the transfer of effects from video games as a unified phenomenon. More studies on GTP should be conducted to understand the influence of video game playing on cognitive, perceptual and behavioural mechanisms.

References

Bailey, K., West, R., Anderson, C.A., 2010. A negative association between video game experience and proactive cognitive control. Psychophysiology 47 (1), 34–42.
Bentler, P.M., 1990. Comparative fit indexes in structural models. Psychol. Bull. 107 (2), 238.
Bentler, P.M., Bonett, D.G., 1980. Significance tests and goodness of fit in the analysis of covariance structures. Psychol. Bull. 88 (3), 588.
Bewick, V., Cheek, L., Ball, J., 2003. Statistics review 8: qualitative data–tests of association. Crit. Care 8 (1), 1.
Blascovich, J., Bailenson, J., 2011. Infinite Reality. Avatars, Eternal Life, New Worlds, and the Dawn of the Virtual Revolution. Harper Collins, New York.
Boot, W.R., Kramer, A.F., Simons, D.J., Fabiani, M., Gratton, G., 2008. The effects of video game playing on attention, memory, and executive control. Acta Psychol. 129 (3), 387–398.
Brown, T.A., 2014. Confirmatory Factor Analysis for Applied Research. Guilford Publications, New York.
Browne, M.W., Cudeck, R., 1993. Alternative ways of assessing model fit. In: Bollen, K.A., Long, J.S. (Eds.), Testing Structural Equation Models. Sage, Newbury Park, CA, pp. 136–162.
Chang, C.H., Pan, W.W., Chen, F.C., Stoffregen, T.A., 2013. Console video games, postural activity, and motion sickness during passive restraint. Exp. Brain Res. 229 (2), 235–242.
Decker, S.A., Gay, J.N., 2011. Cognitive-bias toward gaming-related words and disinhibition in World of Warcraft gamers. Comput. Hum. Behav. 27 (2), 798–810.
Dill, K.E., 2009. How Fantasy Becomes Reality: Seeing Through Media Influence. Oxford University Press, New York.
Dong, X., Yoshida, K., Stoffregen, T.A., 2011. Control of a virtual vehicle influences postural activity and motion sickness. J. Exp. Psychol. Appl. 17 (2), 128.
Edward, M., Russell, B., Hoffman, B., Stromberg, S., Carlson, C.R., 2014. Use of controlled diaphragmatic breathing for the management of motion sickness in a virtual reality environment. Appl. Psychophysiol. Biofeedback 39 (3–4), 269.
Exelmans, L., Van den Bulck, J., 2015. Sleep quality is negatively related to video gaming volume in adults. J. Sleep Res. 24 (2), 189–196.
Field, A., 2009. Discovering Statistics Using SPSS. Sage, London.
Fornell, C., Larcker, D.F., 1981. Evaluating structural equation models with unobservable variables and measurement error. J. Mark. Res. 18, 39–50.
Green, C.S., Bavelier, D., 2006. Effect of action video games on the spatial distribution of visuospatial attention. J. Exp. Psychol. Hum. Percept. Perform. 32 (6), 1465.
Greitemeyer, T., Mügge, D.O., 2014. Video games do affect social outcomes a meta-analytic review of the effects of violent and prosocial video game play. Personality and Social Psychology Bulletin 0146167213520459.
Griffiths, M.D., Lewis, A., Ortiz de Gortari, A.B., Kuss, D.J., 2013. Online forums and blogs: a new and innovative methodology for data collection [forthcoming]. Stud. Psychol. 14 (3), 5–24.
Hair, J.F., Tatham, R.L., Anderson, R.E., Black, W., 2006. Multivariate Data Analysis, 6th ed. Pearson Prentice Hall, Upper Saddle River, NJ.
Hambleton, R.K., Kanjee, A., 1993. Enhancing the validity of cross-cultural studies: Improvements in instrument translation methods. Paper presented at the Annual Meetings of the American Educational Research Association. Atlanta, GA.
Hu, L.T., Bentler, P.M., 1999. Cut-off criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. Struct. Equ. Model. Multi. J. 6 (1), 1–55.
Huang, C.C., Wang, Y.M., Wu, T.W., Wang, P.A., 2013. An empirical analysis of the antecedents and performance consequences of using the moodle platform. Int. J. Inf. Educ. Technol. 3 (2), 217.
Johnson, M.K., Hashtroudi, S., Lindsay, D.S., 1993. Source monitoring. Psychol. Bull. 114 (1), 3–28.
Joreskog, K.G., Sorbom, D., 1986. LISREL User Guide Version VI. Scientific Software International, Mooresville, IL.
Jöreskog, K.G., Sörbom, D., 1993. LISREL 8: Structural Equation Modelling with the SIMPLIS Command Language. Scientific Software International, IL.
Kline, R.B., 2005. Principles and Practice of Structural Equation Modelling, 2nd ed. The Guilford Press, New York.
Kronenberger, W.G., Mathews, V.P., Dunn, D.W., Wang, Y., Wood, E.A., Giauque, A.L., Ellipsis Li, T.Q., 2005. Media violence exposure and executive functioning in

aggressive and control adolescents. J. Clin. Psychol. 61 (6), 725–737.
LaViola Jr, J.J., 2000. A discussion of cybersickness in virtual environments. ACM SIGCHI Bull. 32 (1), 47–56.
Lemmens, J.S., Valkenburg, P.M., Gentile, D.A., 2015. The Internet Gaming Disorder Scale. Psychol. Assess. 27 (2), 567.
Lim, L.L., Seubsman, S.A., Sleigh, A., 2008. Thai SF-36 health survey: tests of data quality, scaling assumptions, reliability and validity in healthy men and women. Health Qual. Life Outcomes 6 (1), 1.
Morrow Jr, J.R., Mood, D., Disch, J., Kang, M., 2015. Measurement and Evaluation in Human Performance. Human Kinetics, Champaign, IL.
Ortiz de Gortari, A.B., 2007. Psychosocial implications of online video games. In: Paper presented at the Game in Action Conference, Gothenburg, Sweden.
Ortiz de Gortari, A.B., 2010. Targeting the real life impact of virtual interactions: The game transfer phenomenon: 42 video games players' experiences. Unpublished Master Thesis. Stockholm University, Stockholm.
Ortiz de Gortari, A.B., 2015. Exploring Game Transfer Phenomena: a multimodal research approach for investigating video games' effects. Unpublished PhD Thesis. Nottingham Trent University, Nottingham.
Ortiz de Gortari, A.B., 2016. The Game Transfer Phenomena framework: investigating altered perceptions, automatic mental processes and behaviors induced by virtual immersion. Ann. Rev. Cyberther. Telemed. 9.
Ortiz de Gortari, A.B,. 2017. Game Transfer Phenomena and the Augmented Reality Game Pokémon Go: The prevalence and the relation with benefits, risks, immersion and motivations. Paper presented at the 22nd Annual Cyber Psychology, Cyber Therapy & Social Networking, Wolverhampton, UK.
Ortiz de Gortari, A.B., Aronsson, K., Griffiths, M., 2011. Game Transfer Phenomena in video game playing: a qualitative interview study. Int. J. Cyber Behav. Psychol. Learn. 1 (3), 15–33.
Ortiz de Gortari, A.B., Griffiths, M.D., 2014a. Automatic mental processes, automatic actions and behaviours in game transfer phenomena: an empirical self-report study using online forum data. Int. J. Ment. Health Addict. 12 (4), 432–452.
Ortiz de Gortari, A.B., Griffiths, M.D., 2014b. Altered visual perception in Game Transfer Phenomena: An empirical self-report study. Int. J. Hum-Comput. Int. 30 (2), 95–105.
Ortiz de Gortari, A.B., Griffiths, M.D., 2014c. Auditory experiences in Game Transfer Phenomena: An empirical self-report study. Int. J. Cyber Behav. Psychol. Learn. 4 (1), 59–75.
Ortiz de Gortari, A.B., Griffiths, M.D., 2015. Game Transfer Phenomena and its associated factors: an exploratory empirical online survey study. Comput. Hum. Behav. 51, 195–202.
Ortiz de Gortari, A.B., Griffiths, M.D., 2016. Prevalence and characteristics of game transfer phenomena: a descriptive survey study. Int. J. Hum. Comput. Interact. 32 (6), 470–480.
Ortiz de Gortari, A.B., Oldfield, B., Griffiths, M.D., 2016. An empirical examination of factors associated with Game Transfer Phenomena severity. Comput. Hum. Behav. 64, 274–284.
Ortiz de Gortari, A.B., Pontes, H.M., Griffiths, M.D., 2015. The Game Transfer Phenomena scale: An instrument for investigating the non-volitional effects of video game playing. Cyber Psychol. Behav. Soc. Netw. 18 (10), 588–594.
Pallant, J., 2007. SPSS Survival Manual: A Step-by-Step Guide to Data Analysis Using SPSS for Windows. McGraw Hill, Nova Iorque.
Pontes, H.M., Griffiths, M.D., 2015. Measuring DSM-5 internet gaming disorder: development and validation of a short psychometric scale. Comput. Hum. Behav. 45, 137–143.
Rehbein, F., Staudt, A., Hanslmaier, M., Kliem, S., 2016. Video game playing in the general adult population of Germany: can higher gaming time of males be explained by gender specific genre preferences? Comput. Hum. Behav. 55, 729–735.
Smahel, D., Blinka, L., Ledabyl, O., 2008. Playing MMORPGs: connections between addiction and identifying with a character. Cyber Psychol. Behav. 11 (6), 715–718.
Tabachnick, B.G., Fidell, L.S., 2007. Experimental designs using ANOVA. Thomson/Brooks/Cole.
Tavakol, S., Dennick, R., Tavakol, M., 2011. Psychometric properties and confirmatory factor analysis of the Jefferson scale of physician empathy. BMC Med. Educ. 11 (1), 54.
Treleaven, J., Battershill, J., Cole, D., Fadelli, C., Freestone, S., Lang, K., Sarig-Bahat, H., 2015. Simulator sickness incidence and susceptibility during neck motion-controlled virtual reality tasks. Virtual Reality 19 (3–4), 267–275.
Turkle, S., 2011. Alone Together. Why We Expect More from Technology and Less from Each Other. Basic Books, New York.
Van Holst, R.J., Lemmens, J.S., Valkenburg, P.M., Peter, J., Veltman, D.J., Goudriaan, A.E., 2012. Attentional bias and disinhibition toward gaming cues are related to problem gaming in male adolescents. J. Adolesc. Health 50 (6), 541–546.
Wuang, Y.P., Su, C.Y., Huang, M.H., 2012. Psychometric comparisons of three measures for assessing motor functions in pre-schoolers with intellectual disabilities. J. Intellect. Disabil. Res. 56 (6), 567–578.
Wyrwich, K.W., Nienaber, N.A., Tierney, W.M., Wolinsky, F.D., 1999. Linking clinical relevance and statistical significance in evaluating intra-individual changes in health-related quality of life. Med. Care 37 (5), 469–478.
Yee, N., 2006. The demographics, motivations, and derived experiences of users of massively multi-user online graphical environments. Presence: Teleoperators Virtual Environ. 15 (3), 309–329.