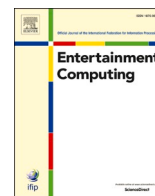




Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



Coping with COVID-19 pandemic stressors: Comparisons between non-players and players, and levels of Game Transfer Phenomena

Angelica B. Ortiz de Gortari

Faculty of Psychology, Centre for the Science of Learning & Technology, University of Bergen, PO Box 7807N, 5020 Bergen, Norway

ARTICLE INFO

Keywords:

COVID-19
Video games
Game Transfer Phenomena
Emotion regulation
Resilience
Fear of contamination

ABSTRACT

During the COVID-19 pandemic, video game playing increased exponentially. The question if playing could offer benefits to cope with the pandemic stressors emerged. This study compares how non-players and players who may or may not have incorporated game content in everyday context [i.e., experienced Game Transfer Phenomena (GTP)] cope with the pandemic stressors, emotion regulation and resilience. It also examines the impact of GTP on the perception of self and the world. A total of 567 completed a survey (59.6 % male, Mean_{Age} = 28.55). The measures include emotional regulation (ERC), resilience to stress (BRCS) and fear of contamination (PI). No differences between players and non-players on ERC, BRCS and PI were found. Players with moderate GTP levels were more likely to report contamination fears and show preventive COVID coping behaviours. The positive impact of GTP was associated with high resilience and cognitive reappraisal as an emotion regulation strategy. The results suggest that attention should be paid to players who experience GTP more frequently and with a negative impact. Maladaptive coping styles can exacerbate distress from GTP and situational stressors. Identifying methods of protecting vulnerable individuals from these psychological burdens can guide interventions and mitigate consequences in similar situations.

1. Introduction

The COVID-19 pandemic brought about unthinkable stressors that were once perceived as figments of science fiction. To avoid contracting and spreading the virus, health authorities encouraged preventive strategies and habits to cope, including decontamination routines, such as handwashing, sanitising surfaces and objects and wearing a face mask. Preventive measures prompted in-home quarantines and social distancing. During the initial months, news outlets continuously reported on the number of deaths worldwide, and sensationalist media reported on the scarcity of supplies.

Many individuals turned to technology to cope and function. Playing video games was the most popular digital activity during the COVID-19 pandemic [6]. Avid players invested more time in playing, and new players quickly emerged [45]. To guide interventions and thus mitigate the consequences in similar extreme situations, factors and activities must be defined to protect individuals from the psychological burden in extreme conditions—such as pandemics—and identify the most vulnerable individuals. This necessity led to the present investigation on whether or not playing video games could offer benefits regarding coping with anxiety, the role of emotion regulation and resilience to

overcome pandemic-related challenges. This study also investigated if experiencing Game Transfer Phenomena (GTP), which imply the incorporation of video game elements in everyday life, could offer benefits during the pandemic.

2. Background

2.1. Transfer of experiences from video games

Throughout the years, academic interest in the effects of playing video games on the real world has grown.

The cultivation theory—initially aimed at the manner in which television viewing cultivates viewers' perceptions—has been applied to video games to argue that continuous exposure to video games can lead players to perceive the real world as the game world [50,51]. Although the cultivation theory poses a shortcoming with its inconsistent results, studies conducted using this theoretical framework have demonstrated that cultivation effects usually occur for first-order measures (i.e., perception of the probability and prevalence of a situation as opposed to judgments indicating peoples' beliefs and attitudes), and the cultivation is directly related to the content of the video games played [51].

E-mail address: Angelica.ortizdegortari@uib.no.

<https://doi.org/10.1016/j.entcom.2022.100530>

Received 7 February 2022; Received in revised form 20 September 2022; Accepted 22 September 2022

Available online 27 September 2022

1875-9521/© 2022 Elsevier B.V. All rights reserved.

Interventions that aim to interfere the consolidation of traumatic memories have used video game playing as a visuo-spatial task. Studies have found that playing video games can, under specific circumstances, hinder the formation of imagery related to traumatic events and cravings ([52,54]).

Research on Game Transfer Phenomena (GTP) has emerged as an area of study that focuses on understanding the effects of exposure to game experiences, and game features on sensory perceptions, cognitions and behaviours [24,53,27,34].

The transfer of experiences from the game world to the real world, including problem-solving strategies, knowledge, and emotional responses, such as anxiety, has been reported in different studies [3,11,26].

Specific examples of GTP include interpreting real-world situations with a game-based logic, experiencing sensory/cognitive intrusions of sounds and images from a game, and engaging in behaviours associated with a game in real-life contexts [23,25,29,30,31]. The most commonly reported experiences are inner intrusions such as thoughts, visual and auditory imagery, including inner-speech from a game [27].

Researchers have acknowledged the potential of using GTP for disrupting or substituting unwanted thoughts and imagery [35], while at the same time raising caution due to the potential distress caused by some GTP experiences [35]. The appraisal of GTP tends to be positive in most cases [27,31]. However, distress has been associated with two conditions: i) when GTP manifest very frequently and in a variety of forms (e.g., visual, auditory), and ii) when GTP manifest as external intrusions (e.g., hearing sounds outside the head) or dissociations and mix-ups (e.g., feeling as if still being in a game, or reacting to real-life objects as one would to those in a game) [27].

Various underlying psychopathological factors have been found to be associated with GTP (e.g., schizotypal personality, neuroticism, depression, anxiety, ADHD, and problematic gaming) [17,20,28,33], but, in most cases, players who reported experiencing GTP have had no clinical diagnosis [27,31,33]. However, research has found that those who experience GTP more frequently and in various forms are significantly more likely to have used drugs, suffer from a mental disorder, and experience distress or dysfunction due to their GTP experiences [32]. Therefore, in this study, it was important to compare how players with different levels of GTP cope with pandemic stressors.

2.2. Benefits of playing video games during the pandemic

Studies have demonstrated the benefits of playing video games during the pandemic, such as cognitive stimulation; opportunities to socialise; social support and reduction in loneliness, anxiety, stress, anger/irritability, boredom; emotional coping; relaxation; and alleviating mental health conditions [2,12,13].

Scrivner et al. [40] tested the hypothesis that consuming horror and dystopian movies and series containing pandemic and apocalyptic themes offered benefits, which included foreseeing the after-effects of a pandemic and being better prepared at the early stages of the pandemic in terms of material resources. They found that those who engaged more frequently with the survival fiction genre (i.e., related to zombies, apocalypse/post-apocalypse, and alien-invasion) were significantly more prepared for the pandemic and experienced fewer harmful disruptions in their life during the pandemic.

Emotional regulation and resilience appear to be key protective factors against the adverse outcomes of high-stress levels. It has been suggested that resilience and emotional regulation skills can be trained or promoted by the use of interactive media, including video games [37,43,44]. Therefore, this study investigated resilience and emotional regulation in the context of playing video games during the pandemic.

Two forms of emotional regulation have been identified. *Cognitive reappraisal* involves changing the way one thinks about potential emotion-eliciting events to alter the meaning and change the emotional impact. *Expressive suppression* is characterised by changing the way one

behaviourally responds to emotion-eliciting events by attempting to hide, inhibit or reduce the emotion [8,15].

Studies have also shown the transfer of emotion regulation strategies from virtual experiences to challenging situations in daily life and regulating mood states through playing [44]. Playing video games has also reduced hostile feelings and improved one's mood [9,18]. Even simple games have reduced treatment-resistant depression symptoms [38], stress [39] and physical pain [14,36].

Lobel et al. [21] found a relationship between in-game interoceptive awareness and tendencies to actively seek a resolution from the negative effects of distressful gameplay; the basis of this relationship is found in regulatory strategies that focus on problem-solving rather than focusing on emotions.

A qualitative study with military veterans under mental health treatment, a population at risk of suffering from post-traumatic stress disorder (PTSD), depression, and anxiety, found that playing video games helped the veterans to manage mood and stress. In this case, playing video games became an adaptive coping strategy, helping them with distraction and symptom substitution and promoting autonomy, confidence, and socialisation, which allowed them to find support and brotherhood (Colder Carras et al., 2018).

Video games developed for therapeutic or educational purposes have been found to be effective in improving resilience skills [22,49].

Resilience is understood as resistance to illness, adaptation to stress, and willingness to thrive [42]. It is considered a protective factor against the adverse outcomes of high stress levels. Two main conceptualisations of resilience have been established. The first conceptualisation finds resilience as a way to move to a superior level of function following a stressful event [5]. The second conceptualisation sees resilience as a way to return to the previous level of functioning (i.e., bouncing back or recovering). The current study examines resilience according to the latter definition.

Researchers have argued that overcoming game obstacles to progress in a game and resolving game challenges share similarities with the skills needed in real life to cope with challenges and "bounce back" from stressful situations. Moreover, role playing with video game characters who overcome adversity can positively influence a player's self-esteem [43].

2.3. Research questions

Based on the review of the literature, the following questions emerged regarding the potential benefits of playing video games in the context of the pandemic:

RQ1. What are the differences between non-players and players regarding coping strategies to deal with the pandemic stressors (i.e., preventive measures, avoidance behaviours and worrying), resilience and emotion regulation?

RQ2. What are the differences between players who did not experience GTP and those who experienced different levels of GTP (mild, moderate, severe) during the pandemic in terms of coping with pandemic stressors, resilience, and healthy strategies for emotion regulation?

RQ3. How are coping behaviours towards pandemic stressors, resilience, and emotion regulation associated with the impact of GTP?

3. Method

3.1. Participants and procedure

A total of 639 participants participated in an online survey, of which 72 were excluded for not completing key variables of the study or providing unreliable responses. The final sample comprised 567 participants [age range 18–65 years; mean age 28.55 years (SD = 9.35)]. More than half (59.6 %) of the participants identified themselves as male, 37 % as females, 2.5 % as queer or non-binary, and 0.9 % preferred

not to say or provide another response. The most common primary occupations of the participants were as follows: ‘employed’ (39 %), ‘student’ (32.8 %) and ‘currently not working’ (12.9 %).

A convenience sample was obtained via different online outlets, including video game discussion groups on the social networks Facebook and Twitter. The survey was also distributed among stakeholders at video game-related organisations and universities providing education relevant to video games. The recruitment goal was to complete it as fast as possible before the conditions of living under lockdown changed. Unfortunately, recruitment took longer than expected. The data was collected between June 2020 and April 2021, during which time many countries in the world were applying national lockdowns. In terms of the participants’ level of lockdown, most of the participants (72.3 %) went outside only for essential chores (e.g., grocery and pharmacy), and 9.2 % were in complete lockdown. Another 16.2 % continued to go out but observed social distance guidelines, while only 2.3 % kept performing activities and went out in a usual fashion. The average time spent outside the household was around 3 h per day (175.47 min, SD = 154.62). The most prevalent countries of residence were the USA, the United Kingdom, Mexico, Italy, Germany and Belgium.

The majority of the participants played video games (74.8 %), and most played at least five times a week (72.8 %). The average playing time per week was 20.95 h (SD = 17.50), with an average session length of 2.77 h (SD = 1.89).

First person shooter games, action adventure games, role-playing games, platform games and simulation games were the most common video game genres played by the sample. Specifically, the contents of the most common games played during the last six months were fantasy environments, combat or role playing, games with narrative, simulation of realistic environments and games that involve competitions. Only 3.6 % were esports players (i.e., those who earn an income by competing in playing video games).

The study was conducted in accordance with the ethical guidelines of the Declaration of Helsinki. Prior to participation in the survey, all participants provided informed consent, and the confidentiality and anonymity of the responses were ensured. At the end of the study, a debriefing was provided. Participants had the option to enter a raffle for a gift card upon survey completion by entering their email addresses in a survey form that was separate from the data.

3.2. Measures

Socio-demographics. Socio-demographics included age, gender, occupation, and country.

Confinement. This consisted of two measures; one on the average time (in hours) spent outside the home per day during the past six months of the pandemic and one was a single-choice question: “Keep doing activities and going out as normal”, “Still going out, but keeping social distance”, “Only going out for essential chores (e.g., groceries, pharmacy) and/or exercise” and “Not going out at all”.

Brief Resilient Coping Scale (BRCS) (4-items) [41]. The BRCS uses a 5-point Likert scale [“does not describe me at all” (1) to “describes me very well” (5)] and captures tendencies to cope with stress adaptively. The scale focuses on effectively using coping strategies in flexible and committed ways to solve problems actively despite stressful circumstances. Scores of 4–13 indicate low resilient coping, scores of 14–16 indicate medium resilient coping and scores of 17–20 indicate high resilient coping. The mean total score in the sample was 13.59 (SD = 3.07), and the maximum score was 20. The Cronbach’s Alpha was 0.650.

Emotion Regulation Questionnaire (ERQ) (10-items) [16]. The ERQ uses a 7-point Likert scale of agreement [“Strongly disagree” (1) to “Strongly agree” (7)]. The questionnaire consists of two scales corresponding to two different emotion regulation strategies: cognitive reappraisal (6 items) and expressive suppression (4 items). The mean total score in the sample was 44.58 (SD = 8.68), and the maximum score was 70. The Cronbach’s Alpha was 0.774.

Revision of the Padua Inventory (PI) (8-items) [4]. The complete PI inventory is composed of 39 items rated on a 5-point Likert scale from 0 (“not at all”) to 4 (“very much”) and measures symptoms of obsessions and compulsions. The current study utilised only the sub-scale on “Contamination obsessions and washing compulsions factors”. The mean total score in the sample was 13.66 (SD = 8.31), and the maximum score was 32. The Cronbach’s Alpha was 0.893.

Coping behaviours during the COVID-19 pandemic (7-items). Items were created using a Likert scale of frequency [“never” (0) to “very frequently” (4)]. The items included the following: i) preventive measures, such as disinfecting packages, consuming over-the-counter medicines/vitamins to avoid contracting an illness, and panic shopping (i.e., buying several products at once for fear of shortage), ii) avoidance behaviours (e.g., avoiding social contact outside the household, such as meeting friends, going out, etc.) and iii) worrying about oneself or people one care about contracting an illness or believing themselves or those they care about to be more vulnerable to the virus in comparison to other people. Exploratory Factor Analysis (EFA) resulted in two factors. Factor 1 (COVID Safety Behaviours, COVID-SB) explained 35.96 % of the variance, and Factor 2 (COVID Preventive Behaviours, COVID-PB) explained 20.06 % of the variance. The factor loadings were between 0.780 and 0.496. The Kaiser-Meyer-Olkin measure verified the sampling adequacy for the analysis (KMO = 0.738). All the KMO values for individual items ranged from 0.793 to 0.682, which is above the acceptable limit of 0.5 [10]. Bartlett’s test of sphericity [$X^2(21) = 711.02$; $p < .001$] indicated that the correlation structure was adequate for factor analyses. The Kaiser’s criterion of eigenvalues was greater than 1, accounting for 56.02 % of the total variance. A minimum of 50–60 % is required for research in social sciences [46]. COVID-SB had a Cronbach’s Alpha of 0.700, and COVID-PB had a Cronbach’s Alpha of 0.598. The total Cronbach’s Alpha for the scale was 0.691 (see Table 1 for details).

Video game habits. Video game habits included the following factors: days of play per week, hours of play per day, session length duration, and video game genres played most often during the last six months.

Video game content. Several items were created to examine the predominant characteristics of the video games that participants had played during the last six months. The video game content included: simulation of realistic environments, fantasy environments, role-playing, narrative, powerful character or hero, competition, socialisation, combat (e.g., fight or shooting), apocalyptic atmosphere, zombies and demons.

Game Transfer Phenomena Scale (GTPS) (20-items) [34] was used to assess GTP during the last six months. The GTPS has a 5-point Likert scale of frequency (“Never” to “All the time”). The scale measures the following factors: (i) altered visual perceptions, (ii) altered auditory perceptions, (iii) altered body perceptions, (iv) automatic mental processes, and (v) actions and behaviours. The scale specified that the

Table 1

Exploratory factor analysis of the items of coping behaviours during the COVID-19 pandemic.

	Factor	
	COVID-SB	COVID-PB
Avoiding meeting friends	0.780	
Avoiding going out	0.709	
Worrying about self or others contracting the virus	0.507	
Disinfecting packages		0.553
Consuming medicines		0.513
Believing oneself as more vulnerable to the virus		0.511
Panic shopping		0.469

Extraction Method: Principal Axis Factoring.

Rotation Method: Varimax with Kaiser Normalization. COVID-SB = COVID Safety Behaviours ($\infty = 0.700$), COVID-PB = COVID Preventive Behaviours ($\infty = 0.598$).

participants should only report experiences when not under the effect of a psychoactive substance (i.e., alcohol, cannabis, ecstasy, etc.) The mean total score in the sample was 12.47 (SD = 11.81), and the maximum score was 52 from the total of 80 points on the scale. The Cronbach's Alpha was 0.918.

Impact of Game Transfer Phenomena (10-items). A questionnaire using a 5-point Likert scale of frequency ["Never" (0) to "Always" (4)] was created to assess the impact of GTP on the perception of the self (e.g., feeling creative or smart, feeling insane, losing control of one's actions, etc.) and the perception of the world (e.g., perceiving trivial activities or chores as fun, worrying that the real world will become like the video game, etc.) during the last six months. The mean total score in the sample was 6.23 (SD = 5.98), and the maximum score in the sample was 30. The EFA revealed two factors. Factor 1 explained 41.68 % of the variance, and Factor 2 explained 20.28 % of the variance. The factor loadings were between 0.811 and 0.528. The Kaiser-Meyer-Olkin measure verified the sampling adequacy for the analysis (KMO = 0.856). All the KMO values for individual items ranged from 0.884 and 0.794, which is above the acceptable limit of 0.5 [10]. Bartlett's test of sphericity ($X^2(45) = 1358.56; p < .001$) indicated that the correlation structure was adequate for factor analyses. The Kaiser's criterion of eigenvalues was greater than 1, accounting for 61.97 % of the total variance [46]. The Cronbach's Alpha for negative items was 0.833 and the Cronbach's Alpha for positive items was 0.818 (see Table 2 for details).

4. Statistical analysis

Before conducting the analyses, data were inspected for normality and outliers. Mahalanobis distance was used to explore outliers, which were subsequently removed from the analyses. The distribution of normality was checked visually using Q-Q plots.

Descriptive statistics were computed for GTP, and new variables were created; this allowed grouping of participants who had not experienced GTP during the last six months and those who had experienced different levels of GTP (based on the frequency and number of GTP experienced during the pandemic). The group without GTP (noGTP) had a GTPS score of 0, the group with low GTP (mildGTP) had scores of 1–26, the group with moderate GTP (moderateGTP) had scores of 27–53, and the group with high GTP (severeGTP) had scores of 54–80. The ranks were adopted from a previous study on GTP to allow comparisons (See [32]). None of the participants in the sample scored high enough to be considered as having experienced a severe level of GTP (i.e., experienced GTP many times and/or experienced GTP very frequently) [32]. A series of T-tests were conducted to examine the differences between video game players and non-players regarding the continuous variables of interest. An EFA was conducted to reduce the number of items on coping behaviours during the COVID-19 pandemic

Table 2
Exploratory factor analysis of the items used to measure the impact of GTP.

	Factor	
	Negative	Positive
Feeling insane	0.811	
Losing control over one's actions	0.767	
Feeling confused or disoriented	0.766	
Feeling frustrated, nervous or anxious	0.686	
Worrying that the real world will become like the video game world	0.589	
Feeling capable of overcoming challenges or adversities		0.778
Feeling creative or smart		0.714
Feeling physically powerful or strong		0.703
Perceiving trivial activities or chores as fun		0.672
Wishing the real world was like the video game world		0.528

Extraction Method: Principal Axis Factoring. Rotation Method: Varimax with Kaiser Normalization. Negative impact perceptions ($\alpha = 0.833$), Positive impact perceptions ($\alpha = 0.818$).

as well as the impact of GTP on perceptions. Analysis of variance (ANOVA) was conducted to examine the continuous variables from the scales and the GTP groups.

5. Results

5.1. Descriptives

Game Transfer Phenomena. The GTP scale ranged from 0 to 80 points. In the present study, the maximum number of points was 52. Most players (84.2 %) reported having experienced at least one form of GTP during the last six months. More than two-thirds (69.7 %) had a mild level of GTP, while 14.6 % had moderate GTP. None of the participants in the sample had a severe level of GTP.

Resilience score. Two-fifths of the participants had a low level of resilience (43.7 %), another two-fifths had a medium level of resilience (41.4 %), and only 14.9 % had a high level of resilience.

5.2. Comparison of players and non-players

A series of T-tests were conducted to examine the difference between the groups of video game players and non-video game players in terms of coping behaviours during the COVID-19 pandemic. The continuous variables consisted of PI, ERQ and BRCS. No significant differences emerged between the groups in any of the variables. Further analyses were conducted with chi-square analysis to test the levels of resilience (BRCS) (i.e., high, medium and low resilience) among the video game player and non-video game player groups, but neither group demonstrated any significant difference (see Table 3).

5.3. Comparison of players with different levels of GTP and no GTP

A one-way between-subjects ANOVA was conducted with coping behaviours during the COVID-19 pandemic with regard to avoidance and preventive measures. No significant differences were found with regard to COVID-Safety Behaviours, but COVID-Preventive Behaviours showed significant differences among the GTP groups (i.e., no, mild and moderate GTP) ($F_{2,408} = 12.23; p < 0.001$). According to the Tukey post hoc test, significant differences were observed between the noGTP and the mildGTP groups, and between the noGTP and the moderateGTP groups. The moderateGTP group showed significantly higher mean scores on COVID preventive behaviours than the noGTP and the mildGTP groups.

Symptoms of obsessions and compulsions measured by the PI showed statistically significant differences among the groups ($F_{2,409} = 13.73; p < 0.001$). According to the Tukey post hoc test, significant differences were observed between the noGTP and the moderateGTP groups, but not between the noGTP and mildGTP groups. Additionally, significant differences were found between the mildGTP and the moderateGTP groups. The moderateGTP group had significantly higher mean scores with regard to PI in comparison to the noGTP and the mildGTP groups.

No significant differences were observed among the ERQ (see Table 4).

There were not enough participants in the noGTP group to compute the ANOVA calculations with the BRCS. Chi-square analysis with the levels of resilience did not show significant differences between the mildGTP and the moderateGTP groups [$X^2(2, N = 327) = 1.23; p > .05$].

5.4. Impact of GTP on perceptions

The positive impact of GTP ($M = 4.16, SD = 4.05$) on perception of the self or the real-world perceptions had a higher mean score than the negative impact ($M = 2.07, SD = 3.21$). More than half of the participants perceived trivial activities or chores as fun when experiencing GTP or felt creative and smart when GTP occurred. In terms of the negative

Table 3
T-tests for scales comparing players and non-players.

Scales	Players			Non-players			t (563)	p	95 % CI for Mean Difference	
	n	M	SD	n	M	SD			Lower	Upper
PI	423	13.66	8.43	143	13.64	7.98	0.03	0.980	-1.55	1.61
COVID-SB	422	9.03	2.45	143	8.81	2.77	0.876	0.382	-0.26	0.69
COVID-PB	422	5.15	3.41	143	5.05	3.26	0.293	0.770	-0.55	0.73
BRCS	328	13.61	3.03	143	13.58	3.20	0.09	0.930	-0.58	0.63
ER CR	396	28.23	6.81	141	29.26	6.12	-1.57	0.120	-2.30	0.26
ER ES	396	16.35	5.36	141	15.35	5.22	1.90	0.058	-0.03	2.02

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

Note: PI = Contamination obsessions and compulsive washing factors; COVID-SB = COVID Safety Behaviours; COVID-PB = COVID Preventive Behaviours; BRCS = Resilient coping; ER CR = Emotion Regulation Cognitive Reappraisal strategies; ER ES = Emotion Regulation Expressive Suppression strategies.

Table 4
ANOVA for those with no GTP and those with mild and moderate GTP.

Measure	No GTP			Mild GTP			Moderate GTP			F	Between groups df	Within group df	Post hoc, ≠	η ²
	n	M	SD	n	M	SD	n	M	SD					
PI	65	11.26	9.08	287	13.22	7.86	60	18.52	8.75	13.73***	2	409	T: N ≠ M, L ≠ M	0.595
COVID-SB	65	8.35	2.93	287	9.16	2.23	59	9.15	2.74	3.025	2	408		
COVID-PB	65	3.80	3.26	287	5.05	3.22	59	7.18	3.54	16.88***	2	408	T: N ≠ L ≠ M	0.246
ER CR	65	28.52	8.19	274	28.09	6.46	57	28.58	6.80	0.18	2	393		
ER ES	65	16.95	5.90	274	16.23	5.30	57	16.19	5.04	0.50	2	393		

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

η² = effect size; T = Tukey post hoc test.

Note: PI = Contamination obsessions and compulsive washing factors; COVID-SB = COVID Safety Behaviours; COVID-PB = COVID Preventive Behaviours; ER CR = Emotion Regulation Cognitive Reappraisal strategies; ER ES = Emotion Regulation Expressive Suppression strategies.

impact, more than a quarter (28 %) reported feeling frustrated, nervous, anxious, or insane when GTP happened (see Table 5 for the specific percentages).

Pearson correlation was conducted to further understand the impact of GTP on perceptions and the other variables under investigation, during the pandemic (see Table 6). The analysis showed that COVID-PB, P1, BRCS and ERQ CR were correlated with the positive impact of GTP on perceptions. Only PI and COVID-PB were correlated with the negative impact of GTP on perceptions. The correlated coefficients ranged from 0.280 to 0.110.

Further analyses were conducted with ANOVA to identify whether or not there were any differences in the levels of resilience. The positive impact of GTP on perceptions was statistically significantly different among the levels of resilience ($F_{2,325} = 0.944$; $p < 0.001$). According to the Games-Howell post hoc test, significant differences were observed between the mild, and moderate levels of GTP and high resilience coping. Those with a positive impact of GTP showed higher scores for high resilience coping ($M = 6.08$, $SD = 5.17$) in contrast to moderate resilience coping ($M = 4.46$, $SD = 3.88$) and low resilience coping ($M = 3.31$, $SD = 3.55$). The effect size was 0.124.

No significant differences were found in the negative impact of GTP on perceptions and levels of resilience ($F_{2,325} = 0.326$; $p < .05$).

Table 5
GTP impact on perceptions of the self and/or the real world.

	N	%
Perceived trivial chores as fun	176	53.3
Felt creative or smart	170	51.5
Wished that the real world was like the video game world	158	47.9
Felt like overcoming challenges	142	43.0
Felt confused and disoriented	108	32.7
Felt physically powerful	96	29.1
Felt frustrated, nervous or anxious	92	27.9
Felt insane	91	27.6
Felt like control was lost over actions	73	22.1
Worried that the real world would become like the video game	52	15.8

6. Discussion

This study examined coping strategies to deal with pandemic stressors, emotion regulation strategies and resilience to stress. A comparison was made between people who did not play video games, video game players who experienced different levels of GTP and players who did not experience GTP during the pandemic.

Most participants went outside their homes only for essential chores, and the average time spent outside per day was three hours. Most participants played video games with an average session length of almost three hours.

Evidence suggests that engaging in the fictitious scenarios of video games requires persistence and emotional regulation to master the game [21]. By playing, players can explore dangerous environments with themes of devastation, pain, and death, sometimes with a high level of realism, and this can form a certain level of preparedness in coping with difficult real-life situations in the future [40], such as those experienced during the pandemic. In contrast to what was expected, this study did not find any significant differences between players and non-players regarding the variables investigated.

Additionally, no differences were found between players who did and did not experience GTP regarding resilience to stress. No differences were neither found between the different levels of GTP, including experiencing no GTP, on emotional regulation. This finding is interesting because lower resilience and poor emotional regulation strategies have been found in players identified with gaming disorder [48], and gaming disorder has been recurrently associated with GTP [17,20,28].

Regarding the ability to cope with pandemic stressors, those with a moderate level of GTP showed more anxiety, as reflected in their COVID-19 prevention behaviours and fears of contamination, than those who had not experienced GTP or only had at a mild level.

Preventive activities included disinfecting packages, consuming medicine to avoid infection and engaging in panic shopping. While these results showed that those with GTP and especially those with moderate GTP levels were better at adopting preventive measures to avoid being infected with COVID-19, the findings also suggest higher anxiety regarding contracting COVID-19 and greater fear associated with the

Table 6
Correlations between GTP impact on perceptions and the main measures of the study.

	COVID-SB	COVID-PB	PI	BRCS	ER CR	ER ES
GTP positive impact perceptions	-0.042	0.197**	0.174**	0.241**	0.110*	0.035
GTP negative impact perceptions	-0.045	0.280**	0.261**	-0.012	0.032	-0.004

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Note: COVID-SB = COVID Safety Behaviour, COVID-PB = COVID Preventive Behaviour, PI = Contamination obsessions and compulsive washing factors; BRCS = Resilient coping; ER CR = Emotion Regulation Cognitive Reappraisal strategies, ER ES = ERQ Emotion Regulation Expressive Suppression strategies.

virus. Their contamination fears may be related to their susceptibility to ruminate and fantasise or to psychopathological traits that make them more vulnerable to situational stressors.

Deficits related to inhibitory dysregulation are involved in the underpinnings of both involuntary phenomena (i.e., auditory hallucinations that resemble some forms of GTP) and obsessive-compulsive disorders (i.e., where fear of contamination and compulsive washing to avoid contracting or spreading diseases are the most common symptoms) [1]. This may explain the relationship between GTP and fear of contamination, as seen in the current study.

Similar to the findings of a previous study [27], the impact of GTP on one's perception of the self or the world was mainly positive during the pandemic. Perceiving trivial chores as fun and feeling creative or smart were the most common positive impacts of GTP, while feeling frustrated, nervous, anxious, or insane were the most common negative impacts of GTP.

Moreover, the positive impact of GTP was associated with healthier strategies for regulating emotions. This includes cognitive reappraisal [8], which is the most efficient way to cope with stress; it entails looking at stressful life events from different perspectives and trying to avoid the vicious circle of negative emotions [47].

Furthermore, resilience—or bouncing back from stress—was also associated with the positive impact of GTP. Interestingly, while most participants had low or medium resilience to stress, regardless of whether or not they were video game players, the group of highly resilient players reflected a significantly higher positive impact of GTP. This result suggests that individuals with high levels of resilience tend to cope in a positive way with GTP, and they may also be able to take advantage of their GTP experiences.

No significant differences were found in terms of resilience and the negative impact of GTP on perceptions of the self and/or the world during the pandemic. The negative impact of GTP on perceptions was only positively associated with COVID preventive behaviours and fear of contamination; this may reflect psychopathological traits associated with anxiety and tendencies concerning the negative interpretation of involuntary phenomena, such as hallucinations [7].

7. Limitations

Important limitations of the current research must be noted. First, the study participants comprised a convenience sample known to be subject to response biases. Additionally, the sample was gender unbalanced, as most participants were male.

Second, the anxiety and stress levels in the sample were unknown, as no specific measures on this construct were included. Instead, the current study used a validated scale on fear of contamination (i.e., PI) and items examined via EFA in order to assess anxiety associated with COVID-19 pandemic-related behaviours.

Third, a limitation can be found in comparison with other studies using different measures on COVID coping behaviours; this study created a new scale on coping behaviours during the COVID-19 pandemic because there were no relevant scales when the study was conducted.

Fourth, the time assigned for the recruiting was longer than expected

(10 months). The COVID behaviours assessed may have changed in that time period, as the pandemic lockdown restriction measures were changed and adjusted.

8. Conclusions and Future directions

This study did not find significant differences between players and non-players in terms of the variables investigated. Future studies should pay close attention to the specific content of the video games when investigating whether the games can enhance the players' emotional regulation and resilience.

It is possible that the heightened fear of contamination and engaging in preventive behaviours provided players—particularly those with moderate levels of GTP—with a significant level of protection against contracting the contagious virus. Future studies may consider investigating whether this group was indeed better protected against contracting the virus.

While patterns of behaviours and worries about COVID-19 are normal mechanisms of defence to avoid harm, persistent thoughts and behaviours related to COVID-19 have been found to be associated with clinical anxiety, substance use to cope (i.e., drugs and alcohol) and suicidal thoughts [19]. Future studies may also attempt to further investigate the relationship established between GTP and OCD tendencies in the current study; OCD underpinnings could possibly explain associations between gaming disorders and GTP, as has been recurrently reported in previous studies.

A previous study suggested that it may be important to consider the level of GTP, since those with severe level of GTP were found to be more likely to have a mental disorder or to have used drugs [32]. Even though none of the participants in the present study have a severe level of GTP, the findings corroborate the importance of assessing its levels, as differences were found between those with mild and moderate levels of GTP in terms of responding to the stressors of the pandemic. However, no differences were found regarding emotion regulation strategies.

The findings in this study suggest that attention should be paid to players who experience GTP more frequently and in various forms. Particularly to individuals whose GTP has a negative impact on their perception of the self or the world because these individuals may be more prone to experiencing distress and dysfunction because of GTP.

It is essential to keep in mind that GTP experiences are not necessarily positive or negative; importance should be placed on how the individual appraises their experiences [7,32]. It is crucial to provide information about GTP and support players in making sense of their experiences. If players interpret GTP positively, they may be able to benefit from these spontaneous phenomena through various means, including modifying pessimistic perceptions of the world and themselves. On the contrary, if GTP are interpreted negatively, maladaptive coping styles can exacerbate distress and, in extreme cases, provoke impairment (e.g., cause one to avoid stimuli that resemble the game, question their own mental stability, etc.).

Declaration of Competing Interest

The authors declare that they have no known competing financial

interests or personal relationships that could have appeared to influence the work reported in this paper.

References

- [1] J.C. Badcock, F.A. Waters, M. Maybery, On keeping (intrusive) thoughts to one's self: testing a cognitive model of auditory hallucinations, *Cogn. Neuropsychol* 12 (1) (2007) 78–89.
- [2] M. Barr, A. Copeland-Stewart, Playing Video Games During the COVID-19 Pandemic and Effects on Players' Well-Being, *Games Culture* 17 (1) (2022) 122–139.
- [3] B. Bigl, If the game goes on. Perceived transfer effects from virtual game worlds into everyday life, in: B. Bigl, S. Stoppe (Eds.), *Playing with Virtuality, Theories and Methods of Computer Game Studies*, Peter Lang, Frankfurt, 2013, pp. 135–146.
- [4] G.L. Burns, S.G. Keortge, G.M. Fornea, L.G. Sternberger, Revision of the Padua Inventory of obsessive compulsive disorder symptoms: Distinctions between worry, obsessions, and compulsions, *Behav. Res. Ther.* 34 (2) (1996) 163–173.
- [5] C.S. Carver, Resilience and thriving: Issues, models, and linkages, *Journal of Social Issues* 54 (2) (1998) 245–266.
- [6] J. Clement, COVID-19 impact on the gaming industry worldwide - statistics & facts, 2021. Retrieved from <https://www.statista.com/topics/8016/covid-19-impact-on-the-gaming-industry-worldwide/>.
- [7] M. Connell, J.G. Scott, J.J. McGrath, F. Waters, F. Larøi, R. Alati, K. Betts, A comparison of hallucinatory experiences and their appraisals in those with and without mental illness, *Psychiatry Res.* 274 (2019) 294–300.
- [8] D. Cutuli, Cognitive reappraisal and expressive suppression strategies role in the emotion regulation: an overview on their modulatory effects and neural correlates, *Front. Syst. Neurosci.* 8 (2014) 175.
- [9] C.J. Ferguson, S.M. Rueda, The hitman study, *Eur. Psychol.* 15 (2) (2010) 99–108.
- [10] A. Field, *Discovering statistics using SPSS*, Sage publications, London, 2009.
- [11] J. Fritz, How Virtual Worlds Affect Us: On the Structure of Transfers from the Media World to the Real World, in: G. Buurman (Ed.), *Total Interaction*, Birkhäuser Basel, Basel, 2005, pp. 95–121.
- [12] A. Gabbadini, C. Baldissarri, F. Durante, R.R. Valtorta, M. De Rosa, M. Gallucci, Together Apart: The Mitigating Role of Digital Communication Technologies on Negative Affect During the COVID-19 Outbreak in Italy, *Front. Psychol.* 11 (2763) (2020).
- [13] A. Giardina, M. Di Blasi, A. Schimmenti, D.L. King, V. Starcevic, J. Billieux, Online gaming and prolonged self-isolation: Evidence from Italian gamers during the COVID-19 outbreak, *Clin. Neuropsychol.* 18 (1) (2021).
- [14] M.D. Griffiths, D.J. Kuss, A.B. Ortiz de Gortari, Videogames as Therapy: An Updated Selective Review of the Medical and Psychological Literature, *Int. J. Privacy Health Inform. Manage.* 5 (2) (2017) 71–96.
- [15] J.J. Gross, Emotion regulation: Conceptual and empirical foundations, *J. Cogn. Neurosci.* (2013) 16.
- [16] J.J. Gross, O.P. John, Individual differences in two emotion regulation processes: implications for affect, relationships, and well-being, *J. Pers. Soc. Psychol.* 85 (2) (2003) 348.
- [17] A. Jones-Rincon, A.B. Ortiz de Gortari, M.I. Gallegos, J.H. Bray, *Comparing Gaming Disorder with Game Transfer Phenomena: demographics, psychosocial, gambling and gaming factors*. Paper presented at the Cyberpsychology Section Annual Conference 2021, Virtual conference, 2021, 6-7 July 2021.
- [18] M. Kowal, E. Conroy, N. Ramsbottom, T. Smithies, A. Toth, M. Campbell, Gaming Your Mental Health: A Narrative Review on Mitigating Symptoms of Depression and Anxiety Using Commercial Video Games, *JMIR Serious Games* 9 (2) (2021) e26575.
- [19] S.A. Lee, How much "Thinking" about COVID-19 is clinically dysfunctional? *Brain Behav. Immun.* 87 (2020) 97.
- [20] J. Llamas-Alonso, G. Georgiou, L. Kvilashvili, A.B. Ortiz de Gortari, The role of spontaneous cognition, positive schizotypal traits and internet gaming addiction in the frequency of Game Transfer Phenomena. Paper presented at the BPS Cyberpsychology Virtual Conference, 2021.
- [21] A. Lobel, I. Granic, R.C. Engels, Stressful gaming, interoceptive awareness, and emotion regulation tendencies: A novel approach, *Cyberpsychol., Behav., Social Network.* 17 (4) (2014) 222–227.
- [22] R. Menendez-Ferreira, J. Torregrosa, D. López-Fernández, J. Mayor, Design of a serious games to improve resilience skills in youngsters, *Entertain. Comput.* 40 (2022) 100462.
- [23] A.B. Ortiz de Gortari, M.D. Griffiths, Altered visual perception in Game Transfer Phenomena: An empirical self-report study, *Int. J. Hum.-Comput. Int.* 30 (2) (2014) 95–105.
- [24] A.B. Ortiz de Gortari, The Game Transfer Phenomena framework: Investigating altered perceptions, automatic mental processes and behaviors induced by virtual immersion, *Ann. Rev. Cyberther. Telemed.* 14 (2016) 9–15.
- [25] A.B. Ortiz de Gortari, Game Transfer Phenomena: Origin, development and contributions to the videogame research field, in: A. Attrill-Smith, C. Fullwood, D. Kuss, M. Keep (Eds.), *Oxford Handbook of Cyberpsychology*, Oxford University Press, Oxford, 2019.
- [26] A.B. Ortiz de Gortari, K. Aronsson, M.D. Griffiths, Game Transfer Phenomena in video game playing: A qualitative interview study, *Int. J. Cyber Behav., Psychol. Learn.* 1 (3) (2011) 15–33.
- [27] A.B. Ortiz de Gortari, Å. Diseth, Multidimensional assessment of Game Transfer Phenomena: Intrusive cognitions, perceptual distortions, hallucinations and dissociations, *Frontiers in Psychology*, 2022, p. 13.
- [28] A.B. Ortiz de Gortari, J. Gackenbach, Game Transfer Phenomena and Problematic Interactive Media Use: Dispositional and Media Habit Factors, *Front. Psychol.* 12 (1144) (2021).
- [29] A.B. Ortiz de Gortari, M.D. Griffiths, Auditory experiences in Game Transfer Phenomena: An empirical self-report study, *Int. J. Cyber Behav., Psychol. Learn.* 4 (1) (2014) 59–75.
- [30] A.B. Ortiz de Gortari, M.D. Griffiths, Automatic Mental Processes, Automatic Actions and Behaviours in Game Transfer Phenomena: An Empirical Self-Report Study Using Online Forum Data, *International Journal of Mental Health and Addiction* 12 (4) (2014) 432–452.
- [31] A.B. Ortiz de Gortari, M.D. Griffiths, Prevalence and characteristics of Game Transfer Phenomena: A descriptive survey study, *Int. J. Hum.-Comput. Interact.* 32 (6) (2016) 470–480.
- [32] A.B. Ortiz de Gortari, B. Oldfield, M.D. Griffiths, An empirical examination of factors associated with Game Transfer Phenomena severity, *Comput. Hum. Behav.* 64 (2016) 274–284.
- [33] A.B. Ortiz de Gortari, M. Panagiotidi, The interplay between executive function deficits, psychopathological traits and dysfunctional gaming habits in the context of Game Transfer Phenomena, *Comput. Hum. Behav.* 138 (2023) 107469.
- [34] A.B. Ortiz de Gortari, H. Pontes, M.D. Griffiths, The Game Transfer Phenomena Scale: An instrument for investigating the non-volitional effects of video game playing, *Cyberpsychol., Behav., Soc. Network.* 18 (10) (2015) 588–594.
- [35] A.B.O. Ortiz de Gortari, M.D. Griffiths, Commentary: Playing the computer game tetris prior to viewing traumatic film material and subsequent intrusive memories: examining proactive interference, *Front. Psychol.* 7 (2016) 260.
- [36] F. Pallavicini, S. Bouchard, Assessing the therapeutic uses and effectiveness of virtual reality, augmented reality and video games for emotion regulation and stress management, *Front. Psychol.* 10 (2019) 2763.
- [37] M. Pusey, K.W. Wong, N.A. Rappa, Resilience interventions using interactive technology: a scoping review, *Interact. Learn. Environ.* (2020) 1–16.
- [38] C.V. Russoniello, M.T. Fish, K. O'Brien, The efficacy of playing videogames compared with antidepressants in reducing treatment-resistant symptoms of depression, *Games Health J.* 8 (5) (2019) 332–338.
- [39] C.V. Russoniello, K. O'Brien, J.M. Parks, The effectiveness of casual video games in improving mood and decreasing stress, *J. CyberTherapy Rehabil.* 2 (1) (2009) 53–66.
- [40] C. Scrivner, J.A. Johnson, J. Kjeldgaard-Christiansen, M. Clasen, Pandemic practice: Horror fans and morbidly curious individuals are more psychologically resilient during the COVID-19 pandemic, *Personality Individ. Differ.* 168 (2021) 110397.
- [41] V.G. Sinclair, K.A. Wallston, The development and psychometric evaluation of the Brief Resilient Coping Scale, *Assessment* 11 (1) (2004) 94–101.
- [42] B.W. Smith, J. Dalen, K. Wiggins, E. Tooley, P. Christopher, J. Bernard, The brief resilience scale: assessing the ability to bounce back, *Int. J. Behav. Med.* 15 (3) (2008) 194–200.
- [43] J.G. Tichon, D. Tornqvist, Video games: developing resilience, competence, and mastery, in: *Integrating technology in positive psychology practice*, IGI Global, 2016, pp. 247–265.
- [44] D. Villani, C. Carisoli, S. Triberti, A. Marchetti, G. Gilli, G. Riva, Videogames for emotion regulation: a systematic review, *Games Health J.* 7 (2) (2018) 85–99.
- [45] M. Vuorre, D. Zende, E. Petrovskaya, N. Ballou, A.K. Przybylski, A large-scale study of changes to the quantity, quality, and distribution of video game play during the COVID-19 pandemic, *Technology, Mind, and Behavior* 2 (4) (2021).
- [46] B. Watson, Making sense of factor analysis: The use of factory analysis for instrument development in health care research, *Nurse Researcher* 11 (3) (2004) 91–93.
- [47] C. Xu, Y. Xu, S. Xu, Q. Zhang, X. Liu, Y. Shao, M. Li, Cognitive reappraisal and the association between perceived stress and anxiety symptoms in COVID-19 isolated people, *Front. Psychiatry* 11 (2020).
- [48] J.-Y. Yen, H.-C. Lin, W.-P. Chou, T.-L. Liu, C.-H. Ko, Associations among resilience, stress, depression, and internet gaming disorder in young adults, *Int. J. Environ. Res. Public Health* 16 (17) (2019) 3181.
- [49] F. Zurita-Ortega, R. Chacón-Cuberos, M. Castro-Sánchez, F.L. Gutiérrez-Vela, G. González-Valero, Effect of an intervention program based on active video games and motor games on health indicators in university students: A pilot study, *Int. J. Environ. Res. Public Health* 15 (7) (2018) 1329.
- [50] K. Beullens, K. Roe, J. Van den Bulck, Excellent gamer, excellent driver? The impact of adolescents' video game playing on driving behavior: a two-wave panel study, *Accid. Anal. Prev.* 43 (1) (2011) 58–65.
- [51] Y.M.G. Chong, K.Z.S. Teng, S.C.A. Siew, M.M. Skoric, Cultivation effects of video games: a longer-term experimental test of first- and second-order effects, *J. Soc. Clin. Psychol.* 31 (9) (2012) 952–971.
- [52] J. Skorka-Brown, J. Andrade, J. May, Playing 'Tetris' reduces the strength, frequency and vividness of naturally occurring cravings, *Appetite* (76) (2014) 161–165, <https://doi.org/10.1016/j.appet.2014.01.073>.
- [53] A.B. Ortiz de Gortari, Game Transfer Phenomena: Origin, development and contributions to the videogame research field, in: A. Attrill-Smith, C. Fullwood, D. Kuss, M. Keep (Eds.), *Oxford Handbook of Cyberpsychology*, Oxford University Press, UK, 2019, pp. 532–556.
- [54] E.L. James, A.L. Zhu, H. Tickle, A. Horsch, E.A. Holmes, Playing the computer game Tetris prior to viewing traumatic film material and subsequent intrusive memories: Examining proactive interference, *J. Behav. Ther. Exp. Psychiatry* (2015).