The role of personality on disordered gaming and game genre preferences in adolescence: Gender differences and person-environment transactions

El papel de la personalidad en el juego problemático y en las preferencias de géneros de videojuegos en adolescentes

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Abstract

Playing video games is one of the world's most popular leisure activities, especially for teenagers. The main aim of the present study was to examine additive and moderation effects of gender and personality to explain individual differences in problematic gaming and video game genre preferences in adolescence. 776 Spanish high school students (mean age = 14.29 years, *SD* = 1.59, 50.64% girls) completed the questionnaires of the Five-Factor Model of personality, frequency of video gaming, disordered use, and the video games they mostly played. Gender differences were observed for gaming behaviors: boys played more and presented much more disordered gaming than girls. Boys preferred competitive genres; for example, action-*shooters*, sport, fight and strategy games. Girls preferred nonviolent and ocasional game genres; for example, social simulation, and brain and skill games. Gender moderated the association between personality and disordered gaming: disordered gaming was associated with low agreeableness and low conscientiousness in boys, and with low extraversion and low conscientiousness in girls. Low consciousnness moderated the association between gaming frequency and problematic use of video games: playing more video games led to disordered gaming, mainly in irresponsible and impulsive individuals. Though small, significant associations were found among all of the personality domains and video game genre preferences. These findings highlight the relevance of gender and personality for gaming behaviors in adolescence, and suggest paying more attention to gender-dependent differences and person-environment transactional processes when studying gaming-related behaviors.

Keywords: Video games; addiction; game genres; personality; gender.

Resumen

Jugar a videojuegos es una de las actividades de ocio más populares en adolescentes. El principal objetivo de este estudio fue examinar los efectos aditivos y de moderación del género y la personalidad en el juego problemático y en la preferencia en géneros de videojuegos durante la adolescencia. 776 estudiantes españoles (media de edad = 14,29; *DT* = 1,59; 50,64% chicas) cumplimentaron cuestionarios del Modelo de los cinco grandes de personalidad y de conductas relacionadas con videojuegos. Se observaron diferencias de género en conductas relacionadas con videojuegos: los chicos jugaban más y presentaron mucho más uso problemático que las chicas. Ellos prefirieron géneros competitivos; por ejemplo, juegos de acción-*shooters*, deportes, lucha y estrategia. Las chicas prefirieron géneros no violentos y ocasionales; por ejemplo, simulación social, y juegos de habilidad y lógica. El género moderó las asociaciones entre personalidad y juego problemático: el juego problemático se asoció a baja amabilidad y baja responsabilidad en chicos, y a baja extraversión y baja responsabilidad en chicas. La baja responsabilidad moderó las asociaciones entre frecuencia de juego y uso problemático: jugar más a videojuegos conducía a un uso problemático de éstos, principalmente en individuos irresponsables e impulsivos. Se encontraron asociaciones pequeñas pero significativas entre la personalidad y preferencias en géneros de videojuegos. Estos hallazgos destacan la relevancia del género y la personalidad en las conductas relacionadas con videojuegos durante la adolescencia, y animan a prestar más atención a las diferencias dependientes del género y a las transacciones persona-ambiente al estudiar estas conductas.

Palabras clave: Videojuegos; adicción; géneros de videojuegos; personalidad; género.

Playing video games has become one of the world's most popular leisure activities in recent decades (Entertainment Software Association —ESA— 2018). Approximately 47% of the Spanish population regularly plays video games (*Asociación Española de Videojuegos* —AEVI— 2018). For a minority of players, gaming can lead to negative effects that resemble the addiction components of other addictive disorders, including salience, mood modification, tolerance, withdrawal or relapse (Griffiths, 2005). Accordingly, DSM-5 (American Psychiatric Association —APA— 2013) has included Internet Gaming Disorder (IGD) as a potential behavioral addiction that deserves further study. Recently Gaming Disorder diagnosis has been incoporated into ICD-11 (Bobes, Flórez, Seijo & Bobes, 2019; World Health Organization —WHO— 2017).

The prevalence of disordered gaming is estimated between 1-9%, depending on cut-off criteria, age, gender or socio-cultural differences (Gentile, 2009; Gentile et al., 2017; Mihara & Higuchi, 2017; Paulus, Ohmann, Von Gontard & Popow, 2018). Disorder gaming may lead to loneliness and poor academic performance (Gentile et al., 2011; Lemmens, Valkenburg & Peter, 2011), and has shown strong associatons with symptoms of affective, emotional and attention deficit hyperactivity disorders (González-Bueso et al., 2018; Mihara & Higuchi, 2017; Müller et al., 2015). Therefore, a better understanding of the factors that facilitate disordered gaming would help prevent such detrimental effects.

One widely studied risk factor for IGD is personality (Gervasi et al., 2017; Mihara & Higuchi, 2017; Paulus et al., 2018; Şalvarlı & Griffiths, 2019). Personality traits have shown to be relevant in a wide variety of life outcomes (Ozer & Benet-Martínez, 2006), including several addictive-related behaviors (Andreassen et al., 2013; Ibáñez et al., 2010; Mezquita et al., 2015). Nowadays, the most accepted personality framework of personality is the Five-Factor Model (FFM) (John, Naumann & Soto, 2008), which proposes five basic dimensions: extraversion, neuroticism, agreeableness, conscientiousness, and openness to experience (McCrae & Costa, 2008). According to recent systematic reviews, the most consistently FFM personality domains related to IGD are neuroticism, low conscientiousness and low agreeableness (Gervasi et al., 2017; Şalvarlı & Griffiths, 2019).

Most of these studies have been conducted with adults (e.g., Braun, Stopfer, Müller, Beutel & Egloff, 2016; Charlton & Danforth, 2007). Therefore, their relevance in preadolescence and adolescence is still not well-stablished. This is a major gap in IGD research because this lifespan stage is particularly important for the development of psychological problems associated with problematic video gaming (Mihara & Higuchi, 2017; Paulus et al., 2018). As far as we know, very few studies have explored the association of FFM domains and disordered gaming in preadolescents and adolescents. At these ages, problematic video gaming has been consistently associated with low conscientiousness (García-Oliva & Piqueras, 2016; Vollmer, Randler, Horzum & Ayas, 2014; Wang, Ho, Chan & Tse, 2015). However, and with regard to other FFM dimensions, the results are less conclusive: low extraversion has been shown to be associated in two studies (García-Oliva & Piqueras, 2016; Vollmer et al., 2014), whereas low agreeableness, high neuroticism (Vollmer et al., 2014) and low openness (Wang et al., 2015) only in one study. This scarce and somewhat inconsistent finding reveals the necessity for more research in the additive effects of personality on disordered video gaming during adolescence, which is our first study aim.

Another scarcely explored issue in the video games and personality field is *person-environment transactional processes*; i.e., how personality complexly interplays with the environment to influence behavior (Caspi & Roberts, 2001). Such processes have been described in the video games and aggressivity field, with some studies suggesting that exposure to violent video games may promote aggressive behavior, but mainly in individuals with an aggressive personality (e.g., Anderson & Dill, 2000; Markey & Markey, 2010). This data may be indicative of a *reactive transaction,* i.e. different individuals face the same environment but react to it differently according to personality characteristics (Caspi & Roberts, 2001). However, and as far as we know, the role of person-environment transactions in the development of disordered gaming remains uncharted. One environmental risk factor for IGD is the amount of time spent playing video games (Gentile, 2009; Mihara & Higuchi, 2017), although only a minority of enganged players tends to develop problematic gaming (Charlton & Danforth, 2007). This may be suggestive of a *person-environment transactional process,* i.e. higher gaming frequency would impact more negatively to certain gamers but not others because of their personal characteristics. Exploring if personality moderates the association of exposure to video games on gaming disorder is our second study aim.

Personality may also be relevant for genre gaming preferences but, as far as we know, this topic has not yet been explored in adolescents. Studies suggest that low agreeable adults would prefer violent video games (Chory & Goodboy, 2011; Greitemeyer & Sagioglou, 2017), extraverted gamers would prefer action games, and players high in openness would opt for role-playing games –RPGs– (Braun et al., 2016). It has been suggested that some genres may be more potentially addictive than others (Rehbein, Staudt, Hanslmaier & Kliem, 2016). Particularly, it has shown that preference of Role Playing Games (RPGs), shooter and simulation games contributes to elevated gaming time (Rehbein et al., 2016), and that RPGs, specially Massively Multiplayer Online Role-Playing Games (MMORPGs), and shooter games, tend to present the stronger associations with disordered gaming (Lemmens & Hendrix, 2016; Müller et al., 2015). Therefore, exploring the personality characterstics related to genre preferences in adolescence is also a relevant issue, and is our third study aim.

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Last, another well-established risk factor for gaming-related behaviors is gender. Males play video games and experience disordered gaming much more than females (Mihara & Higuchi, 2017; Paulus et al., 2018). Males also tend to prefer more competitive and aggressive video games genres, e.g. action-shooters or sports games. Females tend to prefer more casual nonviolent games, e.g., puzzles or platform genres (Lemmens & Hendriks, 2016; Rehbein et al., 2016; Scharkow, Festl, Vogelgesang & Quandt, 2015). Yet despite these clear gender differences, the possibility that risk factors for disordered gaming were different for males and females has scarcely been studied. Regarding personality, as far as we know, only one study has explored the association between personality and adolescents disordered gaming separately for boys and girls (Garcia-Oliva & Piqueras, 2016). It found that low conscientiousness and low extraversion were associated with addiction to video games in boys, but no significant effects of personality were noted for girls. Although this preliminary finding requires replication, it indicates that the possible gender-dependent role of personality on video game-related behaviors deserves more research attention, which is our fourth study aim.

In short, we have reviewed some relevant gaps regarding the role of gender and personality in the field of adolescent video game-related behaviors, and our main aim is to systematically explore them. Specifically, the additive role of gender and FFM personality traits will be examined in disordered gaming and game genres preferences. Additionally, we will explore the moderation role (a) of personality on the association between video game frequency and disordered gaming; and (b) of gender on the association between personality and video game-related behaviors. It was hypothesized that boys would present more problematic video gaming than girls, and that boys would prefer competitive and aggressive genres, whereas girls would opt for puzzle and casual games. Regarding the role of personality, low conscientiousness and low extraversion would be associated with disordered gaming, principally among boys. As studies about personality and genre preferences are scarce, no systematic hypotheses were proposed, but it could be expected low agreeableness to be associated with competitive genres, extraversion with action games, and openness with RPGs. Last, according to previous data on other topics such as violent video games and aggressive behavior, it was hypothetized that those personality risk factors for disordered gaming would interact with gaming frequency in predicting disordered gaming.

Method

Participants and procedure

The participants were recruited from two public high schools in the urban area of Castellón de la Plana, located in the east of Spain. Of the 1106 students invited to participate, 835 returned signed parental written consent. Of these, 59 participants did not attend asssessment sessions or did not complete all the questionnaires. The final sample consisted of 776 adolescents (393 girls), whose ages range was 12-17 years, with a mean age of 14.29 years (SD=1.59).

This *ex post facto* and transversal study (Montero & León, 2005) formed part of broader research about psychosocial risk factors involved in adolescent mental health. Trained research assistants administered a battery of questionnaires in three one-hour sessions separated by one week. Those students previously authorized by their parents/legal guardians voluntarily completed a socio-demographic survey together with the rest of the battery of self-administered and paper-pencil questionnaires. Research assistants gave detailed instructions to the students, highlighted the confidentiality of the data and the importance of the honesty in their responses, and helped the students when necessary (for more details see Moya-Higueras et al., 2020).

Measures

The JS NEO-A60, (Walker, López & Mezquita, 2018) was used to assess the FFM personality dimensions of neuroticism, extraversion, openness, agreeableness and conscientiousness. This scale is a 60-item abridged form of the Junior Spanish version of the NEO-PI-R (Costa & McCrae, 1992), namely the JS NEO (Ortet et al., 2012), which replicated satisfactorily the adult NEO-PI-R factor structure in samples aged from 12 to 17 years and showed adequate scores in reliability (every personality trait showed a coefficient α higher than .82) and construct validity (a joint factor analysis of the test and a Big Five questionnaire focused on children was provided). The Cronbach's alphas for this study were .83 for neuroticism, .83 for extraversion, .75 for openness, .82 for agreeableness, and .89 conscientiousness.

Gaming frequency was reported on a 6-point Likert scale (from 0 = *"never or almost never"* to 5 = *"between 3 to 5 hours a day"*). Furthermore, players reported up to five of their most frequently played video games, which were categorized according to previous studies (e.g., Lemmens & Hendriks, 2016; Rehbein et al., 2016) as: action-shooter (e.g., *Call of Duty*); sports (e.g., *FIFA,* also including driving sports like *MotoGP*); strategy (mainly MOBA games, e.g. *Clash Royale*); brain+skill (including highly intercorrelated genres —Rehbein et al., 2016—: puzzle brain games, e.g. *Candy Crush Saga*; puzzle skills games, e.g. *Piano Tiles*; fitness games, e.g. *Wii Sports*; and skill platform games, e.g. *Super Mario Bros)*; adventure (including adventure games without shooter components, e.g. *Assassins' Creed*); social simulation (e.g., *The Sims*); construction (e.g., *Minecraft*); RPGs (e.g., *Skyrim,* including MMORPGs, e.g. *World of Warcraft*); and fighting (e.g., *Mortal Kombat*).

A Spanish adaptation of a disordered gaming scale for youths was employed (Gentile, 2009). The original 11 items was back-translated, which included addiction components such as salience, mood modification, tolerance, withdraw-

al or relapse. Those participants considered pathological gamers by the original scale's study displayed higher spent time on gaming, lower academic performance, and attention problems (Gentile, 2009). For the current study, the participants indicated their frequency of video game-related problems on a 4-point Likert scale (from 0 = "*never or almost never*" to 3 "*almost always or always*") during the last 12 months. According to the parallel analysis run using Monte Carlo PCA (Watkins, 2006), a one-factor structure was obtained with the EFA, where all items presented adequate factor loadings ranging from .49 to .81. Cronbach's alpha in this sample was .88. In order to establish the cut-off point for the categorization of disordered gamer, we followed the procedure of the original study (Gentile, 2009). Specifically, we coded categories "*almost always or always*" and "*many times*" as 1, category "*sometimes*" as .5, and "*never or almost never*" as 0, and those adolescents who exhibited at least 6 of the 11 criteria assessed by the scale were considered pathological gamers.

Statistical analysis

Version 21 of the SPSS statistic package was used to calculate the descriptive statistics, correlations, t-test analyses and multiple linear regression analyses. Those missing values that represented less than 5% in a questionnaire were replaced with the mean score of the items remaining in that scale. In order to depict graphically interactions between personality risk factors and gaming frequency in disordered gaming; it was employed the InterActive software, an open-source analysis and data-visualization application (McCabe, Kim & King, 2018).

Ethics

This research was approved by the Ethical Committee of the Universitat Jaume I, and was authorized by the School Board of the participating high schools and by the Regional Valencian Authorities. Participants and their parents/legal guardians were informed about the study and provided parental informed consent. All the study procedures were followed in accordance with the Declaration of Helsinki.

Results

Regarding the descriptive data, 560 of the 776 participants reported playing video games in the last month, 92.69% for 383 boys and 52.16% for 393 girls. In addition, 38.9% of boys and 8.3% of girls played daily. Moreover, 6.4% of all the participants were labeled as "disordered gamers", 11.1% boys (43 individuals) and 0.8% girls (3). The *t*-test analyses showed that girls presented lower gaming frequency (Cohen's *d* = 1.26, *p* < .001), and higher scores for openness (Cohen's *d* = .54, *p* < .001), neuroticism (Cohen's *d* = .43, *p* < .001), agreeableness (Cohen's *d* = .30, *p* < .001) and conscientiousness (Cohen's *d* = .23, *p* < .001) than boys.

Multiple linear regression analyses were run to explore if personality predicted gaming frequency, but only openness presented a significative association that explained 1.3% of variance (*b* = .08, *p* = .01) after controlling for age and gender (age; *b* = -.05, *p* = .070; gender; *b* = .54, *p* = .000). The additive role of age, gender, personality and gaming frequency was explored on disordered gaming. In addition, it was also examined in a last step: a) if gender moderated the prediction of personality and gaming frequency on disordered gaming; and b) the moderation role of personality in the gaming frequency-disordered gaming association. All the possible relevant interactions were included in the regression model in this last step to control for potential confounders, according to the recommendations by Keller (2014). Interactions between personality and gaming frequency were found (conscientiousness x gaming *b* = -.09; *p* = .007) as well as between gender and personality (agreeableness x gender, *b* = .09; *p* = .008; conscientiousness x gender; *b* = .15; *p* = .000). These two last interactions indicated that the association between some personality domains and disordered gaming differed for boys and girls. Consequently, the regression analyses were performed separately for each gender.

Table 1 presents the regression analyses for the whole sample, and also for boys and girls separately. Low conscientiousness was associated with disordered gaming for both genders. Low agreeableness was related to pathological gaming among males, whereas low extraversion and high openness were associated with disordered gaming in females. Gaming frequency was also related to disordered gaming for both genders. A significant gaming frequency-low conscientiousness interaction was found for both boys and girls.

Table 1. *Multiple Linear Regressions of Disordered Gaming as Dependent Variable.*

		Disordered gaming		
		Total sample (776)	Males (383)	Females (393)
Step 1				
	Gender	-.44***	-	-
	Age	.07*	.09	.05
	ΔR²	.20***	.01	.01
Step 2				
	Neuroticism (N)	.04	.09	.03
	Extraversion (E)	-.06	-.01	-.20***
	Openness (O)	.06	.04	.11*
	Agreeableness (A)	-.13**	-.17**	-.05
	Conscientiousness (C)	-.18***	-.27***	-.12*
	ΔR²	.07***	.15***	.08***
Step 3				
	Gaming frequency	.25***	.24***	.30***
	ΔR²	.04***	.06***	.09***
Step 4				
	NxGaming frequency	.01	.04	.02
	ExGaming frequency	.00	.01	-.03
	OxGaming frequency	.01	.00	.05
	AxGaming frequency	.05	.05	.09
	CxGaming frequency	-.08*	-.11*	-.13*
	ΔR²	.01	.01	.02
	R²	.32	.22	.19

Note. Males were assigned 1 and females were assigned 2.
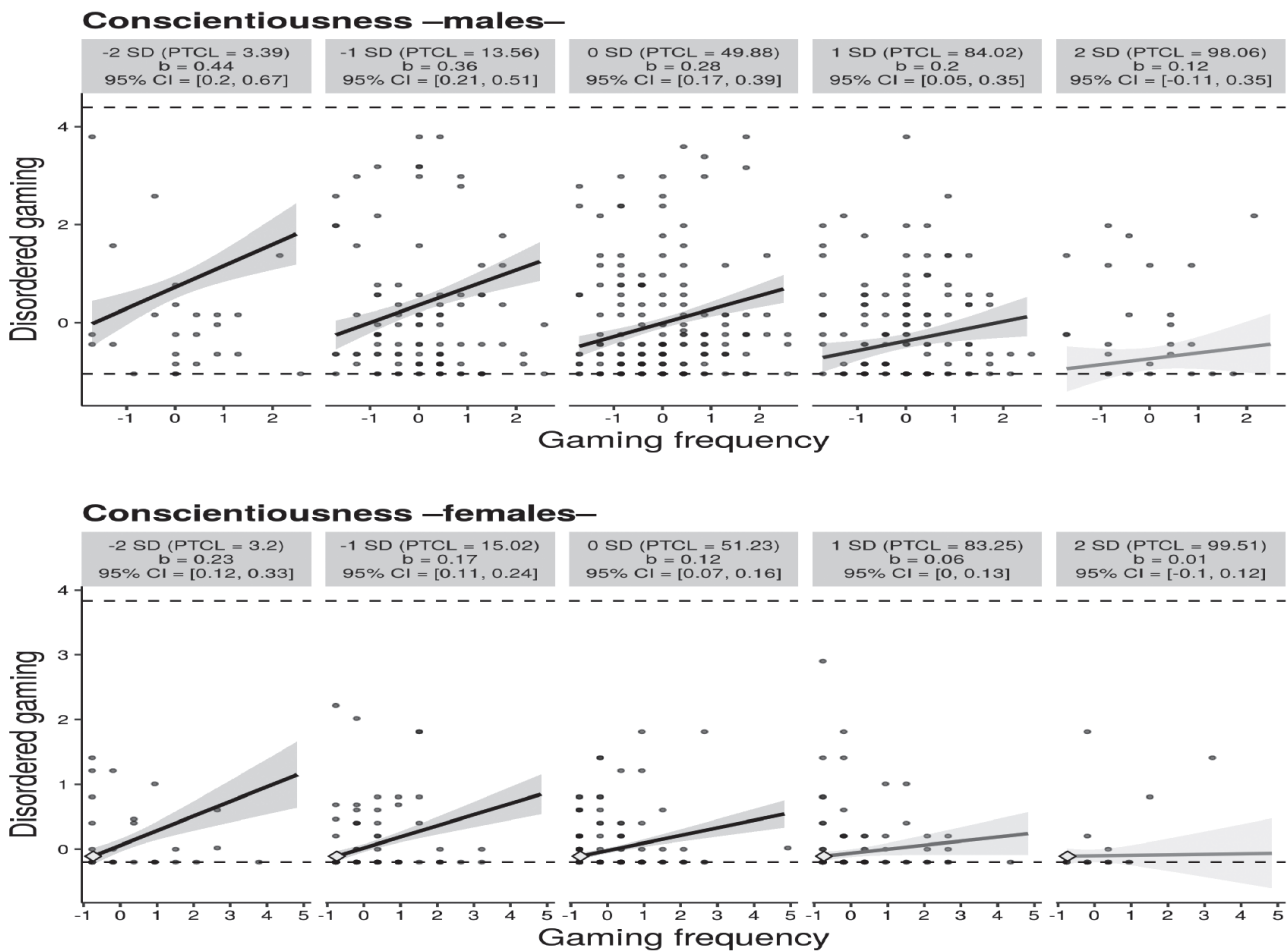* *p* ‹ .05. ** *p* ‹ .01. *** *p* ‹ .001.

Figure 1. Illustrations of moderating effects between conscientiousness with gaming frequency on disordered gaming. Simple slopes are provided for levels of the moderator 2 SD and 1 SD below the mean, at the mean, and 1 SD and 2 SD above the mean. Each graphic shows the computed 95% confidence region (shaded area), the observed data (gray circles), the maximum and minimum values of the outcome (dashed horizontal lines), and the crossover point (diamond). The x-axes represent the full range of the focal predictor. CI = confidence interval; PTCL = percentile.

Figure 1 graphically presents the interactions found in the regression analyses. It depicts the negative impact of gaming frequency on problematic gaming according to different levels of conscientiousness as a moderator. The results showed that gaming frequency was highly associated with disordered gaming at low conscientiousness levels, whereas no associations appeared at high conscientiousness levels.

Multiple linear regressions were peformed for each game genre with 547 participants (375 males, 172 females) who indicated the name of at least one played video game. The role of age, gender, personality and gender-personality interactions was explored. It was found no moderation effects of gender on most genres, except for action-shooter (extraversion x gender; b = -.09; p = .032) and social simulation (openness x gender; b = .10; p = .03) games. The regression analyses for the whole sample are presented in Table 2.

Regarding gender and genre preferences, the regression coefficients indicated that boys prefered playing more competitive games, (action shooter, sports games, strategy and fighting games), and girls reported using more social simulation and brain+skill games. For personality, all the dimensions presented minor associations with genre preferences. The most played genres (action-shooter, sports) presented a similar pattern of associations, with less openness and more extraverted teenagers preferring these games (in action-shooter, this pattern was found only for boys; for extraversion, b = .15; p = .006; for openness, b = -.10; p = .069). Strategy games were asociated with low aggreableness. Brain+skill category was associated with openness and conscientiousness. Social simulation and adventure games presented a similar pattern of relationships, with open to experience and introverted youngsters preferring these genres (in social simulation games, these effects were more evident in females; for extraversion, b = -.15; p = .073; for openness, b = .14; p = .085). Construction games were predicted by neuroticism. Fighting games were associated with low aggreeableness, low consciousness and openness. Openness, low conscientiousness and introverson predicted preferences for RPGs games.

Table 2. *Multiple Linear Regressions of the Videogame Genres as Dependent Variables.*

	Game Genre (n of players)	Action -shooter (292)	Sport (251)	Strategy (175)	Brain +Skill (152)	Adventure (65)	Social simulation (47)	Construction (40)	Fighting (32)	RPG (31)
Step 1	Gender	-.40***	-.26***	-.20***	.41***	-.06	.35***	-.09	-.16***	-.06
	Age	-.05	-.01	-.02	-.07	-.03	-.12**	-.14**	.01	.02
	ΔR²	.15***	.06***	.04***	.17***	.01	.15***	.03**	.02**	.00
Step 2	Neuroticism	.03	-.05	-.04	.03	.02	-.02	.17***	-.08	.05
	Extraversion	.10*	.09*	-.05	.05	-.09*	-.09*	.01	.00	-.10*
	Openness	-.11*	-.10**	.04	.12**	.10*	.09*	.06	.10*	.19***
	Agreeableness	.04	.03	-.14**	.05	-.03	-.03	.04	-.16**	-.02
	Conscientiousness	.06	-.03	-.01	.11*	-.03	.01	.00	-.11*	-.11*
	ΔR²	.02*	02*	.02	.04*	.02	.01	.03**	.04**	.05***
	R²	.17	.10	.06	.21	.01	.16	.06	.05	.05

Note. RPG = Role-playing Game; b = standardized beta; ΔR² = change in variance; R² = total R². Males were assigned 1 and females were assigned 2.
* $p < .05$. ** $p < .01$, *** $p < .001$.

Discussion

The present study shows the relevance of personality and gender for disordered gaming and game genre preferences in adolescents. As it was hypothetized, boys showed much more disordered gaming and preferred different game genres than girls. Furthermore, specific profiles of personality seemed to modestly guide the preference for certain genres. Personality also showed rellevance for disordered gaming, with low conscientiousness to be related in both boys and girls, and other FFM dimensions showing gender-dependent associations: low agreeablennes in boys, and introversion and high openness in girls. Last, we also found person-environment transactional process in disordered gaming: a higher frequency of video gaming appeared to impact more negatively in some players than others, partially because of its personality characteristics; thus low conscioncious adolescents who played more frequenly tended to present higher disordered gaming levels than other youngsters.

In our sample, 72.16% played video games in the last month, which is a very similar percentage of gamers reported in Spain (Buiza-Aguado, Alonso-Canovas, Conde-Mateos, Buiza-Navarrete & Gentile, 2018). Nevertheless, the percentage of daily gamers was much lower (22.7%), another comparable result found among Spanish adolescents (Gonzálvez, Espada & Tejeiro, 2016). In addition, 6.4% of the total sample was categorized as disordered gamers, which is similar to the original study estimated prevalence of 7.5% (Gentile, 2009), to the estimates of 7.7%-8.3% of the pathological gaming prevalences in Spanish adolescents (Buiza-Aguado et al., 2018; Lopez-Fernandez, Honrubia-Serrano, Baguley & Griffiths, 2014), and to the 5.1% estimate of IGD risk in a representative European adolescent sample (Müller et al., 2015).

Regarding the role of gender, boys were much more likely to play video games and to show disordered gaming than girls, as previously found (Mihara & Higuchi, 2017; Paulus et al., 2018). Genre preferences were also affected by gender, with girls preferring social simulation and mental/skill puzzle games; while boys choose competitive and aggressive video games, e.g. action-shooter, sports, strategy and fighting games, which fall in line with previous research (e.g., Lemmens & Hendriks, 2016; Rehbein et al., 2016; Scharkow et al., 2015). Gender differences on personality may partially explain these findings. Girls tend to show higher scores in openness whereas boys tend to present lower levels of agreeableness (e.g., Ortet et al., 2012; Costa & McCrae, 1992), what may led girls to prefer more intellectual video games whereas led boys to play more competitive and violent ones. These gender-based differences on genre preferences may help to explain why males, who prefer games featuring more time-consuming and engagement characteristics, get more involved in gaming and are more hard-core players than females (Rehbein et al., 2016; Scharkow et al., 2015).

In relation to personality, our results replicated the role of low conscientiousness observed in adults (Gervasi et al., 2017; Şalvarlı & Griffiths, 2019) and in the few studies done with adolescents (García-Oliva & Piqueras, 2016; Vollmer et al., 2014; Wang et al., 2015). The other relevant personality domain for video game addiction in adulthood is neuroticism (Gervasi et al., 2017; Şalvarlı & Griffiths, 2019). Nevertheless, no effect of this dimension was found in adolescent disordered gaming, which agrees with other studies in youngsters (García-Oliva & Piqueras, 2016; Wang et al., 2015). Collectively, these results suggest that negative emotionality is less important for disordered gaming in adolescence than in later life stages.

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Other personality factors that have also been associated with adolescent disordered gaming are introversion (Garcia-Oliva & Piqueras, 2016; Vollmer et al., 2014) and low agreeableness (Vollmer et al., 2014). Our data support the relevance of these personality characteristics, but suggest a differential role according to gender: introversion was related to disordered gaming in females while low agreeableness presented a significant relation for males. This latter association may imply that competitive and aggressive motives seem more relevant for boys and lead to greater gaming perseverance despite their negative consequences (Vollmer et al., 2014). The role of introversion in disordered gaming exclusively for girls can be explained by the gender differences associated with game genre preferences. Girls preferred social simulation and brain/skill games with fewer social and exciting components than other genres like action-shooter or sport games, which are mainly preferred by boys. Playing these games constitutes a solitary leisure activity, and girls with few social skills (Gentile et al., 2011; Kowert, Vogelgesang, Festl & Quandt, 2015) and introverted characteristics (Garcia-Oliva & Piqueras, 2016; Vollmer et al., 2014) would be at increased risk of disordered gaming. Although these suggestive findings require replication, they imply that future research should pay more attention to gender-dependent differences in risk and protective variables involved in gaming-related behaviors.

Another risk factor for IGD is gaming frequency (Gentile, 2009; Mihara & Higuchi, 2017; Vollmer et al., 2014). In our study, gaming frequency was related to disordered gaming, but the magnitude of this association was between low and moderate. This effect size may suggest that the detrimental effects of longer video gaming would affect some adolescents but not others. Accordingly, it was found that the amount of time playing video games would more negatively impact those adolescents who are less responsible and more impulsive. The effects of this interaction have been found for both genders, and remained robust when controlling for other interaction confounders (Keller, 2014). Similar moderation effects have been described in video gaming-related behaviors. It has been shown that exposure to violent video games adversely affects mainly those individuals with aggressive-related personality dispositions, which make them susceptible to such violent media (e.g., Anderson & Dill, 2000; Markey & Markey, 2010). Similar effects have been observed in other addictive behaviors, such as alcohol use, where environmental risk factors (i.e. poor parental monitoring and high alcohol availability) seem to exert detrimental effects on drinking behavior mainly in disinhibited youngsters (Pedersen & McCarthy, 2008). Altogether, these findings would reflect person-environment transactional processes (Caspi & Roberts, 2001), which suggest that low conscientiousness and impulsive trais would exacerbate the harmful effects of environmental risk factors on addictive behaviors.

Regarding gaming genre preferences, the present study found a minor, but significant, role of personality. Openness was related to playing RPGs, brain+skills, adventure, fighting, and social simulation games. RPGs, adventure, and fighting games involve fantastic and unrealistic elements, so those youngsters with a fertile imagination can be more attracted by them (Braun et al., 2016). Open-to-experience individuals, especially girls, would also prefer less conventional and mentally challenging game genres, such as brain+skill and social simulation games, whereas low-open adolescents would prefer more conventional and realistic games like sports and action-shooter games. Extraversion also plays a significant role when choosing games. Action-shooters and sports genres were associated with extraversion, probably because these games contain a more social component (e.g., multiplayer online features) and tend to be more exciting and arousing (Braun et al., 2016; Chory & Goodboy, 2011). In contrast, introverted adolescents tend to prefer RPG, adventure, and social simulation games. These data suggest that introverted players would prefer to spend their time playing more solitary games, some of them to cope with their social necessities by simulating social interactions in a virtual world (Kowert et al., 2015). Low agreeable players tend to choose fighting and strategy games (mainly MOBA), probably because of their competitive tendencies and the violent gratification of in-game fighting (Chory & Goodboy, 2011; Greitemeyer & Sagioglou, 2017). Consciousness was also relevant for game preferences, with high scores for choosing "positive" and "responsible" games like training games for cognitive and psychomotor abilities. Conversely, low consciousness predicted fighting and RPGs preferences, genres that usually involve a lot of time on gaming (Rehbein et al., 2016) and have been associated with an increased IGD risk (Lemmens & Hendrix, 2016). Finally, neuroticism was associated with construction games (e.g., *Minecraft*). Neuroticism has been related to obsessive-compulsive symptoms (e.g., Samuels et al., 2000), which could explain why high players in neuroticism prefer playing them where the performed activity is repetitive.

This study presented some limitations. First, the study consisted of a convenience sample since the high schools were not randomly chosen. Second, the data were collected via self-report questionnaires, so data may be affected by biases such as social desirability. Third, the assignation of a given game to a specific genre was artificial to some extent because games usually include mixed features from different genres. Furthermore, there was a significant range restriction for the game genres variable (participants were allowed to mention up to five games, but of the nine genres, only one, presented a range from 0 to 5). This range restriction, together with the relative heterogeneity of the games included in each genre, may explain partially the small effect sizes found in the genres-personality as-

sociation. Fourth, the 'disordered gamers' categorization should be better understood as an index of problematic video game use instead of a clinical IGD diagnosis. In addition, the original scale (Gentile, 2009) was developed before the inclusion of the IGD in the DSM-5. Therefore, the study's prevalence could be underestimated due to the fact that the DSM-5 establishes 5 criteria for IGD diagnosis instead of the 6 that our study scale uses. Furthermore, the cut-off point could vary due to cultural differences and gamer profiles (Bernaldo-de-Quirós, Labrador-Méndez, Sánchez-Iglesias & Labrador, 2020). Last, causal inferences should not be made because of this study's cross-sectional design. Personality traits may predispose to gaming behaviors, but video games have been shown to also influence certain personality characteristics (e.g., Greitemeyer & Sagioglou, 2017). Further research should examine the longitudinal relationships between personality and gaming to establish the direction that underlies the associations of the examined variables. Despite these limitations, this study also presents some remarkable strengths. It deals with the relatively unexplored topic of the role of gender and personality on the use and abuse of video games in adeolescence. To this end, instruments with sound psychometric qualities were administered in a relatively wide sample of preadolescents and adolescents, and followed a novel approach by examining the moderator role of gender and personality in disordered gaming.

The present study highlights the importance of gender and personality in explaining gaming behavior. Boys prefer more competitive aggressive video games, whereas females opt for more nonviolent and occasional games. Distinct personality characteristics appeared to be differentially involved in disordered gaming for boys and girls: low conscientious and introverted girls and low conscientious and disagreeable boys presented higher disordered gaming levels. Personality moderated the negative impact of gaming frequency on problematic gaming: regular video game use was related to disordered gaming mainly in low conscientious adolescents. Last, different personality profiles would partly guide the choice of specific video games. These findings may help us to better understand the adolescent gaming field, and might be useful for developing personalized treatment programs and prevention strategies for problematic video game use based on gender and/or personality characteristics, in line with personality-targeted prevention and intervention programs developed for other addiction-related behaviors (Conrod, 2016).

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Conflict of interests

The authors declare no conflict of interests.

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