



Research Article

The Role of Game Genres and the Development of Internet Gaming Disorder in School-Aged Children

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Abstract

Background and Objectives: Internet Gaming Disorder (IGD) is characterized by a pattern of video game playing that results in significant issues with daily life (e.g. problems with inter-personal relationships or poor academic/job performance), and where the gaming persists despite these negative outcomes. Here we tested the hypothesis that the prevalence of IGD depends on the types of games a child plays.

Methods: A sample of 2,982 children from Singaporean primary and secondary schools were recruited for the current study. They filled out questionnaires related to IGD symptoms, general video game play habits, as well as other measures of daily life function. Games were categorized into five genres (Role-playing, Strategy, Action, Puzzle, Music) and the prevalence of IGD was examined as a function of each individual's favorite genre of game.

Results: Not all genres were equally associated with IGD. The highest rates of IGD were associated with players of Role-playing games followed by players of Action, Music, Strategy, and Puzzle games, respectively. However, this pattern was only found in secondary school-age children with primary school-aged children showing no differentiation by genre.

Conclusion: Consistent with previous work, respondents' favorite game genres predicted differential probabilities of IGD. However, this was only true in older children, not in younger children. Future work is needed to determine if this is because young children are not susceptible to the differential influence of various genres or because the games that young children play within these genres lack the critical ingredients that exist in these game types played by older children and adults.

Keywords

Internet gaming disorder; Addiction; Video games; Genre; Children; Adolescence; Internet

Introduction

Internet Gaming Disorder (IGD) was recently included in Section 3 ("Conditions for Further Study") of the newest version of

the Diagnostic and Statistical Manual of Mental Disorders (DSM-5). Although many prospective behavioral addictions were considered by the Substance-Related Disorders workgroup to be inserted into the new DSM-5 alongside Pathological Gambling (which was already recognized in previous versions of the DSM), only IGD was selected for inclusion. The decision to consider this putative disorder was based at least partially on the strength of the existing literature outlining effective methods of measurement [1-11], prevalence rates [12-21], individual-level predictors [13], and the negative consequences of IGD [14-24]. Indeed, it is critical to note that IGD is not defined based upon the number of hours an individual plays video games (i.e., the fact that someone plays a large amount of video games is not in and of itself indicative of IGD). Instead, IGD involves a pattern of video game use that results in significant dysfunction in daily life (e.g., reductions in academic and occupational performance, sleep issues, problems in personal relationships, damage to overall psychological well-being, etc. [25]) and where those playing habits persist despite the presence of the negative life outcomes. Although the field has grown substantially, starting with seminal work examining similarities between video games and slot machines in the early 1990s [26,27], there nonetheless remain many key unexplored questions related to this condition [23,28].

One such question is whether different types of games are differentially associated with IGD symptoms. While it is a well-known fact in the domain of substance abuse that not all "substances" are equally associated with abuse, much less is known with respect to IGD and specific types of games. Examining this issue is of critical importance - both with respect to our theoretical understanding of IGD and in terms of practical advice that can be offered to the public. On the theoretical end, understanding the relationship between the types of games played and the probability of IGD is a necessary precursor for the development of evidence-based theories related to the core mechanics underlying the disorder. On the practical end, while there are well-defined guidelines for the labeling of content associated with negative changes in social behavior (e.g., certain types of violent content that have been related to increases in aggressive affect, cognitions, and behavior [29-30]) that can be utilized by parents when monitoring their child's game play, no such guidelines exist for IGD (i.e., that would provide guidance for parents when steering their child toward/away certain games). Although the vast majority of studies in the field to date have assessed how often individuals play video games in general, few have differentiated between game-types [12,13,31-35], and those few that have examined the relationship between sub-types of games and IGD are consistent with the idea that not all game-types are equally associated with problematic gaming. In particular, players of Role-playing games have disproportionately high levels of problematic gaming [5,36-38], with players of Strategy and Action games also showing higher than average risk [39].

Our goal is to build on this base by examining the relation between the types of games played and symptoms of IGD. In particular, we do so in a large cohort of children in both primary and secondary schools. No work, to our knowledge, has examined the relationship between being a player of certain genres of games and symptoms of IGD in younger populations; all of the published work on genres has examined adult populations. This distinction may be highly relevant

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because children – in particular younger children – do not tend to play the same types of games as adults and thus the relation between game genres played and symptoms of IGD may be quite different in children than in adults. Moreover, the typical reward structures inherent to each genre may differentially affect the player given their age. Many Role-playing games require the player to maintain numerous complex long-term goals so as to progress within the game world. While older players may easily manage such tasks, the same requirements may be too demanding for children, who instead focus on other elements of the game (e.g. exploring the environment). On the other hand, popular Action games task the player to overcome a multitude of short-term, fast-paced goals (e.g. destroy as many robots as possible within one minute). While the typically violent content of the game may prevent children from playing it, such a reward structure could be more tuned for the capabilities of a younger demographic. It is therefore vital to probe whether children are playing similar games as adults, and whether the potential for pathological play is consistent across age ranges, or whether pathological play manifests as a result of children playing games of different genres whose demands are more easily met by a younger audience.

Methods

Participants

A total sample of 2,982 children (817 female) from Singaporean primary (394 girls, 1032 boys) and secondary schools (423 girls, 1133 boys) were recruited for the current study. Primary school respondents (age: $M = 10.1$; $SD = 0.7$ years) correspond to US elementary/middle school students (i.e. grades 3-6), and secondary school respondents (age: $M = 14.0$; $SD = 0.8$ years) to US early high school students (i.e. roughly grades 9-12). Respondents first assessed in grades 3 and 4 (i.e. primary school), remained in primary school throughout the data collection period, such that no respondents transitioned from primary to secondary school during the study. The data were collected between 2007 and 2009 and data from this study were previously reported in Gentile et al., however, this report did not examine the genres of games played by the children or the association between genre and symptoms of IGD). Furthermore, for detailed subject characteristics of the entire sample, please refer to Gentile et al. [12]. All the data reported in this work (i.e., gaming time and IGD symptoms) refer to estimates that were derived from either one, two, or three measurements with the same participants. The repeated measurements were separated by one year each. As the effects on IGD did not differ between waves (see Results), the data reported in this paper were collapsed across waves. The research was approved by the Ministry of Education and participating schools, and parental consent was gathered by schools.

Measures

Children filled out the Pathological Video Game Use and General Media Habits questionnaires. The Pathological Video Game Use questionnaire was a 10-item survey which served as a predecessor to Gentile's [12] scale. This scale was based on the DSM-IV criteria for pathological gambling, as well as Brown's [40] core facets of addiction. Respondents were to answer either "Yes", "No", or "Sometimes" to all 10 questions. As a measure of pathological gaming behavior, IGD scores were computed for each participant as the sum of "yes" responses coded as 1, "sometimes" responses coded as 0.5, and "no" responses coded as 0. The internal consistency of the IGD scale was good for the current sample (Cronbach's $\alpha = .71-.78$). Consistent with

DSM diagnostic guidelines, respondents were classified as "addicted" if they accrued a score of 5 or greater (i.e., endorsing at least half of the items on the checklist) on the Pathological Video Game Use questionnaire.

In the General Media Habits form, respondents answered 8 questions about their video game playing habits. Sample questions assessed duration of video game play during the typical school day or weekend, as well as frequency of visits to arcades or gaming centers. For the purposes of this paper, we chose to focus on the number of hours (range: 0-10.5) that respondents reported playing each of their three favorite games on school days and weekends, as well as the genre of video game they reported playing. Genre categories were Action – which included first-person shooter, sports, and fighting games (e.g., "Halo", "Counterstrike"), Strategy – which included turn-based strategy, real-time strategy, and life-simulation games (e.g., "Rakion", "Habbo"), Role-playing (e.g., "Maple Story"), Music games (e.g., "Audition"), and Puzzle games (e.g., mostly internet browser-based mini games, e.g. "Bejeweled", "Pacxon" or "Hearts"). The participants' responses on the General Media Habits form were used to estimate the playing time for their three favorite games in these five main groups of genres by adding the times reported for school days and weekends. For responses representing time ranges (e.g., "3-5 hours"), the mean was used as the estimated gaming duration (e.g., 4 hrs/week). The favorite genre was determined for each individual as the genre with the highest number of reported gaming hours per week. Across all three waves, no favorite genre was identified for 473 individuals. The data from these participants were not included in the respective analyses testing for an effect of favorite genre. One thousand and twenty two (1022) individuals reported the most gaming hours for Role-playing games, followed by 1004 individuals playing primarily Action games. Most hours for Strategy games were reported by 209 individuals, followed by 174 Puzzle gamers and 100 Music gamers.

Results

A 3 (wave) \times 2 (school: primary, secondary) \times 2 (sex) \times 5 (favorite genre: Role-playing, Action, Strategy, Music, Puzzle) mixed-model analysis of variance on the number of symptoms did not reveal a main effect of the wave of measurements, $F(2,4933) = 1.12$; $p = .33$; $\eta^2_G = 0.01$, indicating that there were no differences in gaming addiction between repeated measurements. As there was also no significant interaction between wave and favorite genre, $F(8,4933) = 1.56$; $p = .06$, the IGD scores were averaged across the three waves in order to obtain the most reliable estimate of an individual's addiction score over the course of 2 years. The favorite genres were determined as the type of games with most gaming hours being reported on average across the three waves.

We first examined the relationship between sex, whether the student was in primary or secondary school, and favorite video game genre on the probability of being classified as being pathologically addicted to video games. Using a conservative criterion of pathological video game use (i.e., a minimum of 5 symptoms, with "sometimes" responses being considered as half a symptom; see Gentile [12]), 9.5% of the children were classified as addicted to video game play (11.4% of boys and 4.6% of girls, $F(1,2489) = 21.30$; $p < .001$; $\eta^2_G = 0.008$), with the incidence of pathological video game use being much higher in secondary school (12.7%) than in primary school (6.1%), $F(1,2489) = 83.80$; $p < .001$; $\eta^2_G = 0.03$. Of primary interest to the current report, and consistent with previous results, the incidence

of pathological video game use depended highly on the favorite genre of video games played, $F(4,2489)=3.46$; $p=.008$; $\eta^2_G=0.006$, with Role-playing games (12.7%) showing higher levels of gaming addiction than Action (9.5%), Strategy (8.2%), and Music (6.8%) games. The lowest prevalence of IGD was found for children playing Puzzle games (5.0%). Post-hoc comparisons revealed that the prevalence of IGD in Role-playing gamers differed significantly from all other genre groups, $p \leq .004$ (Cohen's $d_{Action}=0.14$; $d_{Strategy}=0.18$; $d_{Music}=0.24$; $d_{Puzzle}=0.32$; due to the unequal variances in different cells, Welch-Satterthwaite approximations to the degrees of freedom were used). The differences between Action, Strategy, and Music gamers were not significant, $p > .22$. The prevalence differed significantly between Puzzle and Action games, $p=.001$ ($d=0.22$); but not between Puzzle and Strategy, $p=.08$, or Puzzle and Music games, $p=.36$.

However, an additional genre \times school interaction, $F(4,2489)=3.46$; $p=.008$; $\eta^2_G=0.005$, indicates that the genre effect was less evident in primary school (6.3%, 6.6%, 6.5%, 3.7%, and 2.8% addicted Role-playing, Action, Strategy, Music, and Puzzle gamers, respectively) than in secondary school (18.5%, 12.6%, 9.9%, 8.0% and 9.0% addicted Role-playing, Action, Strategy, Music, and Puzzle gamers, respectively). The contrasts for individual comparisons are depicted in Table 1. It is evident again, that the specific genre differences are more pronounced in secondary school children than in primary school children.

Because dichotomizing individuals as addicted or not addicted is a rather coarse method of analysis, we also considered the actual number of symptoms endorsed. The number of symptoms (max: 10) reported ranged between 0 and 9 ($M=2.18$; $SD=1.44$). A 2 (school: primary, secondary) \times 2 (sex) \times 5 (favorite genre: Role-playing, Action, Strategy, Music, Puzzle) mixed-model analysis of variance on the number of symptoms revealed that boys ($M=2.35$; $SD=1.49$) had significantly higher IGD scores than girls ($M=1.71$; $SD=1.18$), $F(1,2489)=43.87$; $p<.001$; $\eta^2_G=0.017$. IGD scores were also higher for children in secondary school ($M=2.30$; $SD=1.62$) than for children in primary school ($M=2.04$; $SD=1.20$), $F(1,2489)=44.28$; $p < .001$; $\eta^2_G=0.017$. Most importantly, there was also a significant main effect of genre, $F(4,2489)=3.39$; $p=.009$; $\eta^2_G=0.005$, with the highest IGD scores being seen for Role-playing gamers ($M=2.44$; $SD=1.52$), intermediate scores for Action ($M=2.28$; $SD=1.36$), Music ($M=2.19$; $SD=1.17$) and Strategy gamers ($M=2.10$; $SD=1.40$), and the lowest scores for Puzzle gamers ($M=1.81$; $SD=1.21$). Post-hoc comparisons revealed that Role-playing games were associated with higher IGD scores than all other games, $p \leq .05$ ($d_{Action}=0.11$; $d_{Strategy}=0.23$; $d_{Music}=0.17$; $d_{Puzzle}=0.43$). There were again no significant differences between Action, Strategy, and Music games, $p > .07$. IGD scores for Puzzle gamers, by contrast, were significantly lower than any other genre group, $p \leq .03$ ($d_{Action}=0.36$; $d_{Strategy}=0.22$; $d_{Music}=0.32$). However, the genre effect interacted with school, $F(4,2489)=5.02$; $p < .001$;

$\eta^2_G=0.008$, indicating that it was more pronounced in secondary school than in primary school children. Indeed, as can be seen in Figure 1A – there is only a clear patterning of genres in secondary school children (with Role-playing > Action > Music > Strategy > Puzzle), whereas primary school children showed a similar (and lower) level of gaming addiction for Role-playing, Action, Music, and Strategy games (only Puzzle games seem to be associated with even lower levels of gaming addiction in primary school children). Post-hoc comparisons revealed a few significant contrasts for primary school children (Role-playing > Puzzle, $p=.009$; $d=0.33$; Action > Puzzle, $p < .001$; $d=0.43$; Strategy > Puzzle, $p=.02$; $d=0.31$). For secondary-school children, Role-playing games were associated with significantly higher IGD scores than any other genre ($p \leq .002$; $d_{Action}=0.24$; $d_{Strategy}=0.38$; $d_{Music}=0.31$; $d_{Puzzle}=0.45$). The difference in IGD scores between Action and Puzzle games was only marginally significant ($p=.07$; $d=0.24$). The remaining contrasts were not significant. The ANCOVA did not reveal any other significant interactions, $F<1.21$.

Interestingly, the main effect of genre, $F(2,2129)=5.47$; $p=.004$, and the genre \times school interaction, $F(2,2223)=4.77$; $p=.009$; $\eta^2_G=0.004$, were still found (as well as the other two main effects and the genre \times school interaction) when only the three main groups of favorite genres (Action, Role-playing, Strategy) were included in the analysis. This indicates that the genre effects on IGD were not related solely to differences in the Music and Puzzle categories.

In order to ensure that the results above were not contaminated by large differences in the playing time by genre (e.g., that those individuals whose favorite genre was Role-playing were extremely avid players, while those individuals whose favorite genre was Action were only occasional players), we also conducted an ANCOVA with hours playing the favorite genre as a covariate. Interestingly, the main effect of favorite genre was not significant, $F(4,2489)=0.73$; $p=.57$, indicating that the overall genre differences were strongly influenced by differences in playing time. However, we still found the school \times genre interaction, $F(4,2489)=2.62$; $p=.03$; $\eta^2_G=0.004$, implying that there were genre differences in secondary school, but not in primary school (Figure 1). The ANCOVA also confirmed the main effects of school, $F(1,2489)=20.86$; $p<.001$, and sex, $F(1,2489)=16.89$; $p<.001$. Finally, IGD scores were compared in children who reported more than 4 hours/week of game play within the same genre (i.e., reasonably regular gamers; see Figure 1B). Consistent with the overall analysis, we also found the crucial interaction between school and the three main genres, $F(2,840)=4.26$; $p=.014$; $\eta^2_G=0.01$, in this sub-population. There was also a main effect of school, $F(1,840)=19.53$; $p<.001$; $\eta^2_G=0.023$, as well as a marginal school \times sex interaction, $F(1,840)=3.31$; $p=.07$, indicating that the sex differences disappeared in the “regular” secondary school gamers (if Puzzle and Music games are not considered) (Figure 1).

Table 1: Between-genre contrasts of the percentage of Internet Gaming Disorder (p -values).

		Action	Strategy	Music	Puzzle
Primary	Role-playing	.766	.929	.241	.005; $d=0.24$
	Action		.950	.193	.002; $d=0.24$
	Strategy			.318	.080
	Music				.696
Secondary	Role-playing	<.001; $d=0.21$	<.001; $d=0.30$	<.001; $d=0.36$.004; $d=0.32$
	Action		.245	.050; $d=0.19$.256
	Strategy			.502	.801
	Music				.773

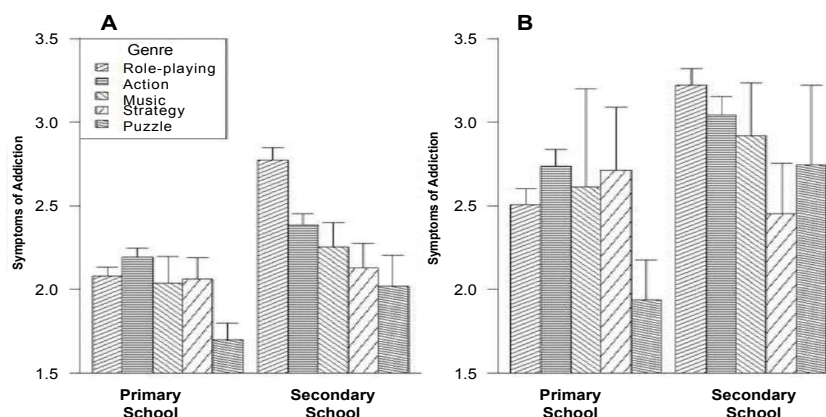


Figure 1: Symptoms of IGD in primary and secondary school children as a function of the video game genre. Number of IGD symptoms endorsed as a function of game genre (Role-playing, Action, Music, Strategy, or Puzzle games) with most gaming hours reported in the entire sample (A), and in children who reported more than 4 weekly gaming hours in the respective genre (B).

Discussion

Overall, our analyses revealed a prevalence rate of roughly 9.5% in this sample of Singaporean youths. This rate falls squarely in the range reported by previous studies of IGD in international samples [21,41-47]. Also consistent with the existing literature, we found that the rate of “addicted” boys was more than 3 times the rate of “addicted” girls [12,39,41,48-64] and that the rate was significantly higher in secondary-school-aged children as compared to primary-school-aged children [18,50,53]. Of primary interest to the current report though was the relationship between being players of certain genres of video games and the endorsement of symptoms of IGD. Although the majority of the literature on IGD has considered all games en masse (i.e., lumped all game types together), the few studies that have differentiated players by genre have suggested that some game types – in particular Role-playing games, and to a lesser extent Strategy and Action games – are more strongly associated with symptoms of IGD than others [5,36-39]. Our data overall showed a similar pattern – with players of Role-playing games being more likely to be categorized as addicted and also endorsing a significantly greater number of IGD symptoms than players of Action or Strategy games, and then with Action and Strategy game players being higher in both measures than players of Puzzle games. This relation held even when equating the genres in terms of total playing time. Interestingly though, this pattern was only observed in secondary-school-aged children. No such trend was seen in the younger children where IGD scores were roughly equivalent across the three main genres of games.

The current genre classification was used as a means to extend the research on adult IGD into the realm of the younger game playing demographic. While there are robust genre differences in both IGD prevalence and severity in adults [65], no such trend appeared for the very young children in this sample. It will be for future work to determine if this is because young children are not susceptible to the differential influence of various genres, or because the games that young children play within these genres lack the critical ingredients that exist in these game types played by older children and adults. It could be the case that the overlapping reward structures which propel players of, for example, Role-playing games, to continue playing are eschewed by younger players due to the difficulty of maintaining these responsibilities online. However, it is notable that the specific

exemplar games within the categories differed strongly between the primary school children and the secondary school children. It may be that classifying games by genre means little for games designed for a younger audience. If children are playing these games in a manner entirely different from that of adults, then perhaps the issue lies in individual differences that may predispose a child to play any game pathologically. Knowing how dangerous IGD can be in the adult population (i.e. losing a job or relationship), and that a reasonably large percentage of the sample could be classified as “addicted,” the need to curb childhood IGD is obvious.

One clear limitation of the current work is that the correlational nature of the results makes it impossible to infer a causal relationship. Our data cannot determine whether playing Role-playing, Action, Strategy, Music, or Puzzle video games causes certain IGD symptoms, or whether individuals who naturally choose to play these genres possess certain traits that predispose them to certain pathological behaviors. Another limitation is the nature of the categorization scheme. Here we categorized games as belonging to one of five prominent genres. This scheme was utilized 1) so as to be in agreement with other existing work in the field, and thus allow results to be readily compared, and 2) because these categories provided the best solution to the problem of capturing variance across the game types while still allowing for sufficient power within each cell. For example, ideally, just within the Role-playing genre, one would differentiate between sandbox role-playing games, action role-playing games, massive multi-player online role-playing games, rogue role-playing games, tactical role-playing games, etc. – however, doing so would require an enormous data set. The use of genres as predictors of IGD is only a proxy for what are likely to be the specific characteristics of games most associated with the development of IGD. And indeed, as the literature progresses, it may be the case that a categorization scheme based upon only certain game aspects may be most appropriate for use in the IGD field and this scheme may or may not align with the classic genre approach. Currently, for instance, there are many games from what are considered distinct genres, each of which has ‘sandbox’ modes. These ‘sandbox’ games allow the player to freely roam about the game environment and interact with the other game elements (i.e. pedestrians in a city, animals in the forest, etc.), as opposed to pushing players through a rigid path (i.e. going through the tunnels

of an underground army compound), without the ability to explore. Thus, if 'sandbox' gameplay is found to be important, it would induce a new categorization structure. Such a structure would place together some games that are currently considered as belonging to different categories (e.g. there are examples of Action, Strategy, and Role-playing games that have sandbox modes), while separating some games that are currently considered as belonging to the same category (e.g. not all Action games have a sandbox mode). While our study is the first to consider the role of video game genre in predicting IGD in children (as opposed to simply utilizing the superordinate category of video games), such future classification schemes will require collecting information that is even more detailed regarding individual patterns of gameplay. It will not be sufficient to simply know what games an individual plays; instead, it will be critical to assess how the individual plays each game. This is true not only of whether the individual plays a given game in 'sandbox' mode or not, but includes many other potentially important gameplay characteristics. For example, although the disorder has been titled "Internet Gaming Disorder," it is currently unclear whether online games are differentially related to IGD than purely offline games. Because most modern games permit either single-player or multi-player (i.e. online) gameplay, this will need to be assessed. Then, within multiplayer games, there are many potential types of social interactions, including interactions that can be either purely antagonistic/anti-social, purely cooperative/pro-social, or some mixture therein. The current data set provides some direction in determining what characteristics may be of greatest interest for future work. In particular, because Role-playing games were found to be disproportionately associated with IGD as compared to other types of games, sub-characteristics that are more common in Role-playing games should be at the forefront of this research (e.g. Role-playing games commonly do not have distinct end states, Role-playing games often have a substantial character creation system that allows the avatar to be individualized, Role-playing games allow the character's skills and traits to be developed according to the players gameplay style, etc.).

Conclusion

Consistent with previous work in the field, players of different game genres had differential likelihoods of demonstrating the negative life outcomes consistent with IGD. Our study is the first, however, to examine the relationship between genre and IGD in children. We found that although the pattern in older children was similar to that previously observed in adults, there was little effect of genre in the younger children. One future direction is to determine if this represents a true developmental effect (wherein young children are less susceptible to the active ingredients in some game genres) or if this is instead related to the fact that young children tend to simply not play games that have the key active ingredients. Similar to the rating system used to caution parents against purchasing excessively violent games for their children, it is vital to understand the addictive potential of certain video games. Most important, the current work helps to establish a foundation upon which future work can build so as to more fully understand IGD and help those who suffer from their pathological behavior.

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Conflict of Interest

All authors have no potential conflicts of interest to disclose.

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