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Is Video-Game Playing a Risk Factor for Pathological Gambling in Australian Adolescents?

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Abstract Very little research has been conducted to examine the relationship between video-game playing and gambling in adolescence. In this study, 2,669 adolescents aged 13–17 years were surveyed to obtained details of their involvement in gambling and video-game playing as well as a measure of pathological gambling (the DSM-IV-J). The results showed that, the frequency of video game playing was significantly related to pathological gambling, but that the effect size was very small and largely accounted for by the greater popularity of both activities amongst boys. There was some evidence for stronger associations between technologically similar activities, namely arcade video games and an interest in gaming machines, but other factors discussed in the paper may also account for this association. In summary, the findings suggested that playing video-games is unlikely to be a significant risk factor for pathological gambling during adolescence.

Keywords Adolescent gambling · Video games · Pathological gambling

Introduction

An important reason for the rapid expansion of the gambling industry in Australia during the last 15 years has been its ability to expand its appeal to a greater proportion of the population. Whereas in the past, gambling was predominantly an adult male past-time undertaken in very specific locations (e.g., casinos, racing outlets), the advent of advanced technology as well as the growth of gambling venues in suburban locations has provided opportunities for wider demographic groups to take an interest in gambling.

Although considerable attention has been directed towards the increased involvement of women in gambling, there has also been growing interest in examining how the expansion

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of gambling has affected young people, in particular, those aged under 18 years (Delfabbro and LeCouteur 2008; Delfabbro et al. 2005; Moore and Ohtsuka 1997, 2001).

Despite the fact that young people are not legally able to gamble for money until the age of 18 in most westernised countries, it has been found that this group is actively involved in gambling and very often experiences problems associated with their gambling. In Australia, for example, Delfabbro and Thrupp (2003) and Delfabbro et al. (2005) found that between 50 and 60% of young people aged 15–17 years gamble at least once per year and that gambling for money on private card games, sports events and lottery products were the most popular activities. These studies showed that around 10% of young people gamble at least one per week and 3–4% experience many of the symptoms of pathological gambling, including a preoccupation with gambling, a loss of time from study due to gambling, and a tendency to spend more than they can afford on gambling. Very similar results have been obtained in international studies in the United Kingdom (Fisher 1993, 1999; Wood and Griffiths 1998), in the United States (Shaffer and Hall 1996, 2001; Volberg and Moore 1999; Welte et al. 2008) and Canada (Derevensky and Gupta 2000; Gupta and Derevensky 1998; Ladouceur et al. 1994; Winters et al. 2002; Wynne et al. 1996).

As Dickson et al. (2002) have pointed out, there are a number of factors that have been identified as being associated with a higher risk of pathological gambling during adolescence. Those who experience difficulties with gambling are also more likely to engage in other risk-taking behaviours (e.g., substance use, stealing); boys are more likely to have problems with gambling than girls, and pathological gambling often coincides with poorer educational performance and psychosocial adjustment (Fisher 1999; Griffiths and Sutherland 1998; Gupta and Derevensky 1998; Hardoon et al. 2004; Jacobs 1987; Shaffer and Korn 2002; Stinchfield 2000). While these results do not of themselves imply that the factors identified are necessarily causally related, they at least suggest that pathological gambling is either a contributing factor to a multitude of developmental challenges during adolescence, or is symptomatic of these broader problems. Such findings also point to psychological and social patterns that are now identified as recognised pathways into problem gambling during adulthood. These tendencies include the use of gambling as a way to cope with negative psychological states, a gravitation towards antisocial or impulsive behaviour, or an involvement in peer groups that incorporate gambling into many social activities (Blaszczynski and Nower 2002; Nower and Blaszczynski 2004).

A number of factors have been identified to explain why young people become involved in gambling. Some of the best investigated of these include social and family influences (Delfabbro and Thrupp 2003; Hardoon and Derevensky 2001; Hardoon et al. 2004), belief systems (Derevensky et al. 2007), or personality factors (Dickson et al. 2002). However, it is also recognised that there other experiential factors particular to young people that enable them to gain familiarity with gambling before they are legally able to enter gambling venues. One view, although one that has not been extensively investigated, is that young people's interest and involvement in gambling has resulted from their greater familiarity with technology (Griffiths 1995). Young find it easy to gain access to gambling opportunities as a result of their familiarity with the Internet or mobile-phones, and are receptive to modern forms of gambling (particularly gaming machines) because of the apparent similarity between these games and other technology-based games with which they are familiar. An implication of this convergence of gambling with interactive digital and online technologies means that it is becoming increasingly difficult to separate gambling and video game playing (Wood et al. 2004b). Indeed, it has been recently argued that there is an increasing "convergence" of gambling and digital media, including, for example, the enabling of gambling on mobile phones and personal computers through

access to online gambling websites, as well as virtual casinos within interactive online environments, like Second Life (Griffiths 2008a).

As Griffiths (1991a) points out, video games and gaming machines share a number of common characteristics. Both provide the interaction between players and technology and maintain player interest by providing a variable ratio pattern of reinforcement. Video games also, like gaming machines, allow players to accumulate credits based upon computer generated outcomes, and each share many structural characteristics (e.g., lights, sounds, graphical features, bonus features) that try to maintain player interest. Where the two activities differ is in the nature and determination of the outcomes. Whereas gaming machines involve placing financial stakes in order to obtain outcomes that are determined solely by chance, video-games involve the accumulation of points or credits based largely on the skill of players. Despite these differences, Griffiths' (1995) argued that both video game players and gamblers follow a similar playing philosophy: that is, to remain on their respective machine for as long as possible without losing. Thus, video-games and other forms of technology may influence young people's susceptibility to subsequent problems with gaming machines because this activity can give rise to a lifestyle that is increasingly reliant on technology for stimulation and enjoyment. A young person may find it difficult to find enjoyment in broader activities, including those that involve direct social interaction, and experience restlessness when unable to access their preferred games. More and more time may need to be spent to exceed previously obtained achievements in the game, or, in the case of arcade games, in obtaining money from various sources to maintain their involvement.

As Griffiths (1995) argues, although these behaviours are not necessarily problematic in themselves, they are, however, similar in form to patterns of behaviour commonly observed in those addicted to gaming machines. In line with this view, Brown (1989) presented a developmental model of a pathology of man–machine relationships, in which it was argued that children and adolescents who are attracted to the psychological rewards and decision making within video games may be at greater risk of becoming involved in gambling. That is, it is possible that playing video-games provides exposure to a style of entertainment (watching graphics, pressing buttons, obtaining outcomes) that is readily transferred to gaming machines of various forms. These issues were examined in a study by Gupta and Derevensky (1996). Over 100 low and high frequency video-game players were surveyed and asked to play a simulated video blackjack game. The results confirmed that high frequency players (defined as those who played at least once per week), were significantly more likely to gamble and tended to place higher bets on the blackjack task. The results also raised the possibility that high frequency video game players who took greater risks may have developed a false sense of security and confidence that they could exert control over the outcomes in much the same way that they were accustomed to doing when playing video games.

The Present Study

Since the Gupta and Derevensky study in 1996, very few studies have been undertaken around the world to investigate the possible link between adolescent video-game play and gambling, and no study of this nature has been undertaken in Australia. The Australian gambling market differs in several ways from other countries such as the United Kingdom and Canada in that video games are very rarely located at the same locations as other forms of gambling, most notably gaming machines. Whereas it is possible to encounter fruit machines and video games in amusement arcades in the UK or find gaming machines

outside gaming venues in Canada, Australian gaming machines are only located in designated gaming areas. For this reason, there is greater spatial separation or differentiation of the two activities, so that it may be less likely that young people will play both activities because they tend to be positioned in similar locations.

Accordingly, the aim of the present paper was to investigate the association between video-game play and adolescent gambling in a large sample of adolescents. In this study, students were administered measures of gambling and video-game participation as well as a measure of pathological gambling, so that it was possible to examine the association between video-games and gambling as well as pathological gambling. It was hypothesised that pathological gambling would be positively associated with a greater involvement in video-game playing. The study also examined whether, as has been often hypothesised, involvement in video-games is more likely to be associated with an involvement in more technologically based forms of gambling such as electronic gaming machines. At the same time, broader analyses that included non-EGM gambling were also undertaken so as to investigate the competing hypothesis; namely, that video gaming may be related to gambling in general, rather than just EGMs alone. As pointed out by an anonymous reviewer, much of the critical discussion of video games and gambling has related largely to the technological similarities, rather than analysis of the psychosocial profile of adolescents that undertake both activities. It is possible that the previously reported link between the two activities may be due to other factors. Adolescents, who gamble and play video games may be from families with less parental supervision, may have greater disposable income, spend more time outside the home with peers who frequent both video-game and gambling venues, or they may have a stronger interest in replicating in gambling the skills they have developed playing video games. If such factors do indeed play a role, then one might expect young video gamers to have an involvement in a wide range of gambling activities, including those (e.g., cards, racing, sports) involving some element of skill or knowledge.

Method

Sample

The total sample comprised 2,669 students including 50.5% males ($n = 1{,}348$), 49.2% females ($n = 1{,}314$) and 7 students whose gender was not identified on the survey (0.3%). Participating students were drawn from grades 8–13[1] across 6 schools in South Australia. Four schools were selected so as to obtain representation from each of the four major statistical districts in the metropolitan area and two schools were selected from major regional centres. Each of the schools was a co-educational government high school. The respondents ranged in age from 12 to 17 with a mean age of 14.63 years (SD = 1.42). These respondents were categorized into three groups to facilitate analysis, namely, years 8–9 ($n = 714$, 26.8%), years 10–11 ($n = 1{,}139$, 42.7%), and years 12–13 ($n = 816$, 30.6%). Eighty (3%) respondents identified themselves as being of Aboriginal or Torres Strait Islander descent and 297 (11.1%) reported that a language other than English was spoken at home. The majority of respondents ($n = 2{,}326$, 87.1%) indicated that they

[1] In Australia, students attend secondary school from Year 8 (age 13) to Year 12 (age 16–17 years). Students can undertake Year 12 over 2 years if they choose. The second year is called Year 13. Students in Year 13 are usually 17–18 years old.

intended to finish school at the end of year 12 or 13 and approximately one-third of the students indicated that their mothers had studied at university level (34.2%). A slightly smaller proportion reported that their fathers had studied at university (29.4%). To confirm whether there was any possible confounding of gender and age-related effects in subsequent analyses, a *t*-test was conducted to compare the age of males and females. This revealed no significant difference, $t(2,710) < 1$. All schools identified agreed to take part in the research and almost all students who were present on the day completed the survey (the absentee rate was reported by schools to be around 10%).

Measures

Gambling Habits

Participants were asked to indicate how often they had gambled on each of the major forms of gambling available in SA in the past 12 months. These included card games (e.g., poker, blackjack for money, private or commercially available), poker-machines, racing (horses, dogs), private or commercial sports betting (not including dog or horse-races), lotteries (X-lotto, Powerball or SoccerPools), keno, scratch tickets, bingo, and Internet gambling. Responses were scored on a five-point scale where 1 = 'never', 2 = '1–2 times per year', 3 = '3 times per year up to once per month', 4 = '2–3 times per month', and 5 = 'weekly or more often' (Delfabbro and Thrupp 2003).

DSM-IV-J

The DSM-IV-J (Fisher 1992), the adolescent version of the DSM-IV was used to distinguish between pathological and non-pathological gamblers. The DSM-IV-J is a 12-item scale that includes gambling behaviours such as a preoccupation with gambling, being restless or irritable when not able to gamble, chasing losses, spending lunch money on gambling, stealing to fund gambling and the presence of social conflict. The items are scored using a yes/no format with a total score of four or more indicative of problem gambling. The internal reliability in the present sample was found to be high, $\alpha = 0.82$. The DSM-IV-J was used rather than the revised DSM-IV-MR-J version so as to allow comparisons with other Australian studies. The DSM-IV-MR-J is a modified form of the DSM-IV-J that allows for multiple response categories for each item rather than binary responding. The multiple response (MR) version is thought to allow a more subtle assessment of variations in pathological gambling behaviour in adolescents.

Video-game involvement

Respondents were asked to indicate how often they had played (during the previous 12 months) on each of the different types of video game activity platforms included in the study. These platforms included TV games (Xbox, Nintendo, Playstation, and others), phone games, hand-held games (e.g., Gameboy), PC games, and arcade games (i.e., arcade machines in a licensed venue). Categories included "never", "once per week", "2–6 times per week" or "daily". Respondents were also asked to indicate how many hours they usually played each type of game. In addition, respondents who indicated playing any type of game daily were asked to report how many hours they would typically play on each occasion.

Procedure

Approval to proceed with the survey was received from the Department of Education and Children's Services and the School of Psychology's Human Research Subcommittee. After approval to conduct the study had been obtained from the relevant authorities, approval was sought from the individual school principals. Meetings were next arranged with the teaching staff of each school to provide instruction and training in how to administer the survey tool. This opportunity was also used to provide staff with background information on the project and to answer any questions relating to the project. The teachers were also provided with copies of the surveys, information sheets, consent forms and an instruction sheet detailing point by point how to administer the survey.

The information sheets were sent home to the parents by the teachers. The parents were able to withdraw their child from the study if they did not want them to take part (an opt-out strategy that is permitted under Government ethics guidelines). The teachers then specifically set aside class time to administer the survey (approximately 45 min) at a time considered suitable by the school principal. Once the survey was completed, the students were instructed to place their survey into a sealed envelope and return it to their teacher.

Results

Overall Gambling Patterns

The survey results indicated that over half of the respondents (56.3%) reported that they had gambled in the last 12 months, although it was also found that this overall participation rate varied as a function of age and gender. Boys (61.0%) were more likely to have gambled in the past year than females (51.7%), $\chi^2(1, N = 2{,}662) = 23.43$, $p < 0.001$. Year 12 and 13 students (62.7%) were slightly more likely to have gambled in the past year than the Year 8 and 9 students (54.7%), $\chi^2(2, N = 2{,}699) = 7.60$, $p < 0.05$. However, there was no significant association between ethnicity (Aboriginality or Torres Strait Islander (ATSI) or non-ATSI descent) or region (regional vs metropolitan schools) and overall gambling participation ($p > 0.05$). Very few young people gambled regularly. Of those who had gambled in the past 12 months, only 11.2% indicated gambling at least once a week (6.3% of the total sample).

Table 1 shows the frequency with which respondents engaged in each form of gambling. As can be seen, respondents were most likely to gamble regularly on card games, sports gambling and instant scratch tickets and were least likely to gamble regularly on electronic gaming machines and keno. Males (9.3%) were also found to be more likely to have gambled on a weekly basis than were females (3.2%), $\chi^2(1, N = 2{,}662) = 42.58$, $p < 0.001$. Further analysis revealed that individuals who identified themselves as being of ATSI descent were significantly more likely to have gambled on a weekly basis (15% compared to 6.1% of all other students), $\chi^2(1, N = 2{,}660) = 10.16$, $p < 0.001$. There was no association between gambling on a weekly basis and grade level.

There were a number of gender differences in relation to specific gambling activities. Boys were significantly more likely to gamble on card games (35.8% vs. 17.2% for girls), $\chi^2(\text{df} = 1, N = 2{,}734) = 121.4$, $p < 0.001$, on racing (21.2% vs. 16% for girls), $\chi^2(\text{df} = 1, N = 2{,}734) = 12.0$, $p < 0.01$, on sporting-events (19.5% vs. 10.1% for girls), $\chi^2(\text{df} = 1, N = 2{,}734) = 47.4$, $p < 0.001$, on lotteries (10% vs. 6.5% for

Table 1 Number (%) of adolescents gambling on each activity at each frequency

	Never *n* (%)	Less than monthly *n* (%)	2–3 times per month *n* (%)	Weekly or more often *n* (%)
Card games for $	1,892 (70.9)	551 (20.6)	102 (3.8)	60 (2.2)
EGM	2,468 (92.5)	96 (3.6)	13 (0.5)	11 (0.4)
Racing	2,090 (78.3)	462 (17.3)	23 (0.9)	17 (0.6)
Sports	2,185 (81.9)	323 (12.1)	30 (1.1)	46 (1.7)
X-lotto	2,355 (88.2)	187 (7.0)	21 (0.8)	22 (0.8)
Keno	2,336 (87.5)	225 (8.4)	19 (0.7)	12 (0.4)
Scratch tickets	1,547 (58.0)	906 (34.0)	107 (4.0)	43 (1.6)
Bingo	2,222 (83.3)	318 (11.9)	28 (1.0)	20 (0.7)
Internet gambling	2,484 (93.1)	67 (2.5)	16 (0.6)	23 (0.9)

girls), $\chi^2(\text{df} = 1, N = 2{,}734) = 13.2$, $p < 0.01$, on keno (11.7% vs. 7.4%), $\chi^2(\text{df} = 1, N = 2734) = 14.6$, $p < 0.01$, and on the Internet (5.6% vs. 2.2% for girls), $\chi^2(\text{df} = 1, N = 2734) = 20.6$, $p < 0.001$, whereas girls were more likely to have played bingo (15.4% vs. 11.8% for boys), $\chi^2(\text{df} = 1, N = 2734) = 7.6$, $p < 0.01$.

Pathological Gambling

The majority of students in the sample reported experiencing no problems with their gambling, as classified by the four point cut off of the DSM-IV-J. However, using these criteria, 63 or 2.4% or respondents could be classified as problem gamblers. In addition, 6.4% of the current sample endorsed 1–3 items on the DSM-IV-J and could be considered 'at risk'. A total of 90.6% of respondents endorsed no items on the scale ('not at risk'). The rate of pathological gambling was lowest in the Year 8–9 group (1.6%) and higher in the Year 10–11 (3.3%) and Year 12 (2.7%). Boys were more likely to be pathological gamblers than girls (3.5% vs. 1.2%), $p < 0.001$.

Video Game Playing: Overall Summary

Table 2 displays the frequency with which the students surveyed engaged in various forms of video game play. Reference to the columns detailing the number of hours usually played and the frequency with which the students played both indicate that respondents were most likely to play TV video games and PC games most regularly, whereas arcade games were played infrequently and for short periods.

Those who indicated playing daily reported usually playing for 2.55 h on average (SD = 2.01).

Demographic Differences in Video-Game Play

Gender differences were evident for TV games, $\chi^2(1, N = 2{,}662) = 145.40$, $p < 0.001$, hand-held games, $\chi^2(1, N = 2{,}662) = 33.48$, $p < 0.001$, and PC games, $\chi^2(1, N = 2{,}662) = 82.84$, $p < 0.001$, where boys were significantly more likely than girls to play these games daily. These differences were borne out in *t*-test comparisons of the

Table 2 The frequency with which students played various video games

	Hours played *M* (SD)	Never *n* (%)	Once per week *n* (%)	2-6 times per week *n* (%)	Daily *n* (%)
TV games (e.g., Xbox, Nintendo, Playstation)	1.60 (1.56)	744 (27.9)	860 (32.2)	600 (22.5)	327 (12.3)
Phone games	0.38 (0.89)	1,262 (47.3)	843 (31.6)	268 (10.0)	137 (5.1)
Hand-held games (e.g., Gameboy)	0.44 (1.03)	1,838 (68.9)	401 (15.0)	154 (5.8)	97 (3.6)
PC games	1.34 (1.72)	1,004 (37.6)	706 (26.5)	492 (18.4)	287 (10.8)
Arcade games	0.18 (0.69)	1,957 (73.3)	312 (11.7)	61 (2.3)	25 (0.9)

estimated frequency of play per year as based upon recoding the ordinal categories in the survey into absolute frequencies, e.g., 2–6 times per week = 4 × 52 = 208 times per year daily = 365 times per year. Boys played every type of game platform apart from phone-based games significantly more often than girls every year (Table 3). The largest differences were observed for TV games and PC games. Boys played TV-based or console games 2.5 times more often than girls and PC games almost twice as often per year.

Video-Game Playing and Gambler Status

The frequency of video-game playing expressed in terms of the number of sessions per year was compared across the three groups of gamblers: no risk, at risk, and pathological. As shown in Table 4, pathological gamblers played hand-held games and arcade games significantly more frequently than 'at risk' gamblers, who in turned played at a higher frequency than those 'not at risk'. In addition, pathological gamblers and 'at risk' gamblers each played TV games and phone games more frequently than those 'not at risk'. These results therefore confirmed that those students who are more at risk of gambling-related problems are more likely to have a heavier involvement in video-game play.

Multiple Regression: Predictors of Video Game Playing

Given that boys were more likely to experience difficulties with gambling and also to play video games frequently, it is possible that the link between video-game playing and gambling is not causal, but due to other common antecedent factors, which are discussed subsequently in this article. However, as a starting point, it is useful to consider the extent

Table 3 Gender differences in the frequency of video game play per annum

	Boys *M* (SD) *n* = 1,348	Girls *M* (SD) *n* = 1,314	*t*(2,662)	*d*
TV games (e.g., Xbox, Nintendo, Playstation)	163.3 (130.4)	62.6 (92.8)	22.6	0.90
Phone games	57.9 (96.7)	60.0 (94.6)	<1	0.01
Hand-held games (e.g., Gameboy)	49.4 (99.9)	21.3 (60.6)	8.48	8.48
PC games	129.9 (134.0)	65.0 (100.6)	13.8	13.8
Arcade games	20.7 (59.2)	12.1 (43.6)	4.1	4.1

Table 4 Frequency of video game play per annum in relation to gambler status

	Not at risk *M* (SD) *n* = 2,144	At risk *M* (SD) *n* = 151	Problem *M* (SD) *n* = 54	*F*(2,2346)	Post hoc	η^2
TV games (e.g., Xbox, Nintendo, Playstation)	149.25 (112.93)	178.65 (123.79)	194.13 (133.48)	9.19***	3 > 1; 2 > 1	0.01
Phone games	96.78 (106.57)	132.57 (116.57)	163.17 (135.04)	18.27***	3 > 1; 2 > 1	0.01
Hand-held games (e.g., Gameboy)	53.36 (96.26)	52.33 (94.40)	119.24 (138.70)	13.02***	3 > 1,2	0.01
PC games	127.55 (119.30)	156.82 (127.02)	140.49 (128.77)	4.65**	2 > 1	<0.01
Arcade games	29.97 (71.52)	51.83 (87.61)	91.00 (121.19)	23.19***	3 > 2,1;2 > 1	0.02

Note. All post hoc tests significant at 0.05 level

*** $p < 0.001$

** $p < 0.01$

1 = not at risk; 2 = at risk; 3 = problem gamblers, η^2: 0.01–0.06 = small effect size; 0.07–0.13 = moderate effect size; 0.14+ = large effect size

to which the association remains once one has controlled for gender, given that boys appear (for a number of reasons to be discussed) may be more likely to engage in both activities. For this reason, a series of hierarchical multiple regression analyses was undertaken to examine whether pathological gambling was still related to the frequency of video game playing after controlling for the influence of gender. In each of these analyses, gender was entered on the first step and the frequency scores on the second. Each person's DSM-IV-J score was the dependent measure. The frequency with which young people played arcade games and TV console games was significantly related to DSM-IV-J scores even after controlling for gender. However, the beta values for the frequency of play in both models were very small and the addition of these variables explained only a very small amount of variance (<1%) in DSM-IV-J scores. In other words, although there was an association between the frequency of video game play and pathological gambling, the strength of this effect was very small.

High-Frequency Video-Game Play and Pathological Gambling

Another way in which one can examine the possible links between video-game playing and gambling is focus on high frequency video-game players because it may be that a certain threshold of involvement needs to be achieved before one observes any strong differences in gambling behaviour. To investigate this possibility, the video-game frequency data were recoded and combined so as to identify a group of young people ($n = 574$) who played video-games at least daily. When this group was compared with the rest of the sample, their DSM-IV-J scores were found to be significantly higher ($M = 0.41$, SD = 1.25 vs. $M = 0.16$, SD = 0.78), $t(2,649) = 4.45$, $p < 0.001$ ($d = 0.25$). The same difference was observed when the results were confined to boys only ($M = 0.48$, SD = 1.36 vs. $M = 0.24$, SD = 0.96), $t(2,649) = 3.22$, $p < 0.001$ ($d = .21$). Both of these effect sizes were small, although more substantial than those obtained in the regression analyses described above.

Video Gaming and Participation in Specific Activities

A final analysis examined whether the frequency of participation in different types of video game might be related to participation in certain types of gambling. A series of *t*-test comparisons showed that the frequency of almost all forms of video-game participation was higher when young people reported gambling on any of the individual activities listed above. Since this effect is very likely influenced by the fact that boys are more likely to gamble and play video games, this analysis was repeated for boys only. Once again a very similar pattern of results emerged. Boys who gambled on cards, gambled on TV, phone and arcade games more frequently; EGM gamblers played arcade games more frequently, sports gamblers played all video game platforms except PCs more frequently, lottery and keno gamblers played arcade and phone games more frequently, and scratch ticket players gambled more frequently on TV games, phone cards and arcade games. All of these differences were significant, $p < 0.05$ based on independent samples *t*-tests with Cohen's *d* effect sizes in the small to moderate range (0.2–0.3).[2] These findings suggested that the frequency of various forms of video game playing were not uniquely related to any one particular type of gambling. For example, video game playing was no more likely to be observed for more technologically based forms of gambling such as EGM gambling. In fact, EGM gambling was associated with lower frequencies of video game playing on all platforms except arcade games.

Discussion

The aim of this investigation was to examine whether young people who played video-games more frequently were more likely to be involved with gambling and to report symptoms of pathological gambling. The study also examined whether an involvement in arcade video-games was a particular risk factor for under-aged involvement in EGM gambling. Although the results were generally consistent with previous studies (e.g., Gupta and Derevensky 1996) that have shown a significant association between video-game playing and gambling, the results also question the strength and validity of this relationship. Apart from the fact that the relationship was generally small, it was found that the effect almost disappeared altogether once gender had been controlled. Similarly, although more substantial effect sizes ($d > 0.20$) were obtained when high frequency video game players were compared with the rest of the sample, the results still suggest that frequent video game playing remains only a relatively minor risk factor for development of pathological gambling in adolescence. Moreover, the results also showed little evidence that video game playing was a particularly strong risk factor for EGM gambling, which is most commonly associated with gambling-related problems in Australia and the most technologically similar to video games. In fact, the variety of video game playing was greater if young people gambled on non-EGM forms of gambling, including activities involving skill (cards, sports, racing) as well as lottery-style games.

Although the link between gambling and video-games was the primary focus of this investigation, the results further highlighted the strong influence of gender as a predictor of involvement in both activities. Boys were found to be significantly more likely than girls to play most forms of video-games and to play more frequently. The reason why boys gamble

[2] Full Mean (SD)s for the 19 significant differences are available from the author, but not reported in the text in the interests of parsimony.

and play video games more frequently than girls has been discussed in a number of studies. Studies have reported that males experience stronger positive affect when playing video games (Hoeft et al. 2008), are generally more competitive video game players than females (Wood et al. 2004a), tend to be more persistent in spatial games involving three-dimensional rotation in games (Lucas and Sherry 2004). Males are often less likely to feel threatened by the online gaming environment and tend to experience less sexual harassment and hostility than females (Jantzen and Jensen 1993). Video games are also often specifically marketed to males using strong masculine stereotypes in the artwork and characters (Norris 2004). All of these factors suggest that gender is a strong confounding factor (or common antecedent) in any statistical analyses involving both video games and gambling among adolescents. For these reasons, any future research that fails to consider the effect of gender will therefore overstate the strength of any observed relationship between video game playing and gambling.

At the same time, the results also showed that gender is unlikely to be the only factor that may influence the reported association between video game playing and gambling. As shown in this article, even when one confines comparisons only to boys, video game participation rates are still found to be higher amongst those who gamble. Such findings leave open the possibility that there may be a number of other common or antecedent factors that might contribute to a greater involvement in both activities. In this study, it was not possible to include further detailed questions about video games due to constraints on the length of the survey, but it is possible to examine the plausibility of several possible explanations that be advanced. First, in studies relating to video-games (e.g., Griffiths 1995), it has been argued that the association between the two activities might be due to the proximal location of both activities in arcades. In the United Kingdom, it is common to find video-games located next to fruit machines, or in conjunction with hybrid amusement machines that combine elements of chance and skill. In Australia, this argument is less easy to sustain because gaming machines can only be provided in clearly designated gaming areas that are set apart from other activities. Although a very small number of hotels have video-game areas within the same building which might increase the likelihood of gambling and video-gaming at the same time, this factor is unlikely to have been influential given that video games, including arcade games, can be played in many stand-alone centres in shopping centres, gaming lounges and cinema complexes.

A second possibility for the association observed is that both gambling and video-games might fulfil similar needs or motivations. When played at a "healthy" level, it is thought that these activities may fulfil various 'intrinsic' motivations, such a desire for fun and excitement, the pleasure of learning, exploring, or trying something new, as well as provide opportunities to test one's skills (Chantal et al. 2001; Griffiths and Hunt 1995). If this were true, one might expect stronger associations between participation in video-game playing and more skilled, intrinsically rewarding gambling activities such as card games or sports-betting. However, the results suggest that those who play video games more frequently tend to be more likely to gamble on a variety of gambling tasks (lotteries and more skill-based activities), which is not entirely consistent with the view that adolescents attempt to translate of video-game skills and expectations of control to gambling.

Accordingly, it may be necessary to consider a third, more sociological explanation, namely, that those who tend to spend more time playing video games and gambling do so because they have greater opportunity or ability to do so. Adolescents who are less involved with other activities (e.g., sport, school work), who have greater disposable income, less parental supervision at home, or whose peer activities revolve around gaming style activities, may be more likely to gamble and play video games. In some cases, the

social nature of these activities can often be the primary motivation to spend time in the activity in that both activities can create a sense of community. For gamblers, this has been described in terms of players banding together to beat "the system", whereas, for video game players, this may occur when players share common goals of overcoming various difficult challenges within the video game. Within such social groups, there may be associated social rewards, including the respect and admiration gained from other players for having achieved certain goals or outcomes (Cole and Griffiths 2007; Griffiths 1991b; Griffiths and Delfabbro 2001). Alternatively, those who engage in these activities very frequently may enjoy the feeling or independence, rebellion or risk associated with undertaking activities that might not always be approved of by their parents or teachers.

All of the factors described so far may explain why young people come to share an interest in both video games playing and gambling, but do not necessarily explain why some young people might engage in these activities to potentially problematic levels. Some researchers have argued that these activities may provide a form of avoidant-based coping or escape from stress, and may even engender some altered states of awareness (Diskin and Hodgins 1999; Wood et al. 2007) as predicted by Jacobs's *General Theory of Addictions* (1986). However, the status of video game playing as a form of addiction remains somewhat tenuous due to doubts about the genuine presence of impaired control and the likelihood of significant harm arising (Blaszczynski 2008; Wood 2007), although it is accepted that excessive playing, as with many common activities, can have negative psychological, social and economic impacts on individuals (Chappell et al. 2006; Griffiths 2008b; Salguero and Moran 2002).

Limitations and Future Directions

Although this study had a number of positive features, including a large sample size and a high response rate, it is important to acknowledge the limitations of the research design. All of the findings were based on self-report measures, so one cannot be entirely confident that all respondents provided an accurate assessment of their own behaviour. Some may have over or under-stated their involvement in video-game playing or gambling (see Charlton 2002), or deliberately downplayed the extent of any problems they might have been experiencing. The study design is also cross-sectional so that the results can only be used to examine associations between reported behaviours at one point in time, rather than to draw conclusions about the underlying development or emergence of behavioural patterns. It is not possible, for example, to show that there is any causal relationship between video games and gambling and, as has been discussed, there are a number of possible common antecedent factors that may account for the association and which need to be further investigated. Finally, no attempt was made in this study to assess video-game playing in greater detail. For example, it might have been useful to obtain more specific details concerning young people's involvement in video-game activities that feature gambling, or to examine the intensity of their gambling, or the prevalence of any problems associated with video-game playing.

Many of these limitations could be addressed in future prospective studies that include more detailed questions concerning video-game playing, and which include a variety of measures that track specific behavioural patterns more carefully over time (e.g., short-term diary methods). Another possibility might be to examine the specific nature of video-games in more detail to identify participants' preference for specific structural features of video games and how these might subsequently influence preferences for specific gambling activities. For example, it would be of interest to determine how many young people

practise gambling on video-game systems that provide simulation casino games. It would also be important to determine to what extent young people differentiate between video games and gaming machines in terms of the controllability of outcomes. For example, to what extent does the experience of control and success on video-games lead to similar expectations when young people turn their attention to chance-determined outcomes on gaming machines.

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References

Blaszczynski, A. (2008). Commentary: A response to "Problems with the concept of video game addiction": Some case study examples". *International Journal of Mental Health and Addiction, 6*, 179–181.

Blaszczynski, A., & Nower, L. (2002). A pathways model of pathological gambling. *Addiction, 97*, 487–500.

Brown, R. I. F. (1989). Gaming, gambling, risk-taking, addictions and a developmental model of a pathology of man-machine relationships. In J. Klabberg, D. Croowell, H. de Jong, & W. Scheper (Eds.), *Simulation gaming*. Oxford: Pergamon Press.

Chantal, Y., Vallerand, R. J., & Vallieres, E. F. (2001). Motivation and gambling involvement. *The Journal of Social Psychology, 135*, 755–763.

Chappell, D., Eatough, V., Davies, M. N. O., & Griffiths, M. D. (2006). Everquest—It's just a computer game right? An interpretative phenomenological analysis of online computing addiction. *International Journal of Mental Health and Addiction, 4*, 205–216.

Charlton, J. P. (2002). A factor-analytic investigation of computer 'addiction' and engagement. *British Journal of Psychology, 93*, 329–344.

Cole, H., & Griffiths, M. D. (2007). Social interactions in Massive Multiplayer Online Role-playing gamers. *CyberPsychology and Behaviour, 10*, 575–583.

Delfabbro, P. H., Lahn, J., & Grabosky, P. (2005). *Adolescent gambling: A report on recent ACT research*. Canberra: ACT Gambling and Racing Commission.

Delfabbro, P. H., & LeCouteur, A. (2008). *A decade of gambling research in Australia and New Zealand (1992–2007): Implications for policy, regulation and harm minimization*. Adelaide: Independent Gambling Authority of South Australia.

Delfabbro, P. H., & Thrupp, L. (2003). The social determinants of gambling in South Australian adolescents. *Journal of Adolescence, 26*, 313–330.

Derevensky, J. L., & Gupta, R. (2000). Prevalence estimates of adolescent gambling: a comparison of the SOGS-RA, DSM-IV-J, and the GA 20 questions. *Journal of Gambling Studies, 16*, 227–251.

Derevensky, J., Gupta, R., & Baboushkin, H. R. (2007). Underlying cognitions in children's gambling behavior: Can they be modified? *International Gambling Studies, 7*, 281–298.

Dickson, L., Derevensky, J., & Gupta, R. (2002). The prevention of gambling problems in youth: A conceptual framework. *Journal of Gambling Studies, 18*, 97–159.

Diskin, K. M., & Hodgins, D. C. (1999). Narrowing of attention and dissociation in pathological video lottery gamblers. *Journal of Gambling Studies, 15*, 17–28.

Fisher, S. E. (1992). Measuring pathological gambling in children: The case of fruit machines in the UK. *Journal of Gambling Studies, 8*, 263–285.

Fisher, S. E. (1993). Gambling and pathological gambling in adolescents. *Journal of Gambling Studies, 9*, 277–287.

Fisher, S. E. (1999). A prevalence study of gambling and problem gambling in British adolescents. *Addiction Research, 7*, 509–538.

Griffiths, M. D. (1991a). The observational study of adolescent gambling in UK amusement arcades. *Journal of Community and Applied Social Psychology, 1*, 309–320.

Griffiths, M. D. (1991b). Amusement machine playing in childhood and adolescence: A comparative analysis of video games and fruit machines. *Journal of Adolescence, 14*, 53–73.

Griffiths, M. D. (1995). *Adolescent gambling*. London: Routledge.

Griffiths, M. D. (2008a). Digital impact, crossover technologies and gambling practices. *Casino and Gaming International, 4*, 37–42.

Griffiths, M. D. (2008b). Video-game and Internet addiction. In C. A. Essau (Ed.), *Adolescent addiction: Epidemiology, assessment and treatment*. New York: Academic Press.
Griffiths, M. D., & Delfabbro, P. H. (2001). The biopsychosocial approach to gambling: Contextual factors in research and clinical interventions. *eGambling*, *5*, 1–34. Available at http://www.camh.net/egambling.
Griffiths, M. D., & Hunt, N. (1995). Computer game playing in adolescence: Prevalence and demographic indicators. *Journal of Community and Applied Social Psychology, 5*, 189–193.
Griffiths, M., & Sutherland, I. (1998). Adolescent gambling and drug use. *Journal of Community and Applied Social Psychology, 8*, 423–427.
Gupta, R., & Derevensky, J. (1996). The relationship between gambling and video-game playing behavior in children and adolescents. *Journal of Gambling Studies, 12*, 203–209.
Gupta, R., & Derevensky, J. L. (1998). Adolescent gambling behavior: A prevalence study and examination of the correlates associated with problem gambling. *Journal of Gambling Studies, 16*, 227–251.
Hardoon, K., & Derevensky, J. (2001). Social influences involved in children's gambling behaviour. *Journal of Gambling Studies, 17*, 191–215.
Hardoon, K., Gupta, R., & Derevensky, J. (2004). Psychosocial variables associated with adolescent gambling. *Psychology of Addictive Behaviours, 20*, 170–179.
Hoeft, F., Watson, C. L., Kesler, S. R., Bettinger, K. E., & Reiss, A. L. (2008). Gender differences in the mesocorticolimbic system during computer game-play. *Journal of Psychiatric Research, 42*, 253–258.
Jacobs, D. F. (1986). A general theory of addictions: A new theoretical model. *Journal of Gambling Behavior, 2*, 15–31.
Jacobs, D. F. (1987). *Effects on children of parental excess in gambling*. Paper presented at the seventh international conference on gambling and risk taking, Reno, NV.
Jantzen, G., & Jensen, J. F. (1993). Powerplay—Power, violence and gender in video games. *AI and Society, 7*, 368–385.
Ladouceur, R., Dubé, D., & Bujold, A. (1994). Gambling among primary school students. *Journal of Gambling Studies, 10*, 363–370.
Lucas, K., & Sherry, J. L. (2004). Sex differences in video game play: A communication-based explanation. *Communication Research, 31*, 499–523.
Moore, S., & Ohtsuka, K. (1997). Gambling activities of young Australians: Developing a model of behavior. *Journal of Gambling Studies, 13*, 207–236.
Moore, S., & Ohtsuka, K. (2001). Youth gambling in Melbourne's West: Changes between 1996 and 1998 for Anglo-European background and Asian background school based youth. *International Gambling Studies, 1*, 87–102.
Norris, K. O. (2004). Gender stereotypes, aggression, and computer games: An online study of women. *CyberPsychology & Behavior, 7*, 714–727.
Nower, L., & Blaszczynski, A. (2004). The pathways model as harm minimisation for youth gamblers in educational settings. *Child and Adolescent Social Work Journal, 21*, 25–45.
Salguero, R. A. T., & Moran, R. M. B. (2002). Measuring problem video game playing in adolescents. *Addiction, 97*, 1601–1606.
Shaffer, H. J., & Hall, M. N. (1996). Estimating the prevalence of adolescent gambling disorders: A quantitative synthesis and guide toward standard gambling nomenclature. *Journal of Gambling Studies, 12*, 193–214.
Shaffer, H., & Hall, M. N. (2001). Updating and refining prevalence estimates of disordered gambling behaviour in the United States and Canada. *Canadian Journal of Public Health, 92*, 168–172.
Shaffer, H., & Korn, D. (2002). Gambling and related mental disorders: A public health analysis. *Annual Review of Public Health, 23*, 171–212.
Stinchfield, R. (2000). Gambling and correlates of gambling among Minnesota public school students. *Journal of Gambling Studies, 16*, 153–173.
Volberg, R., & Moore, W. (1999). *Gambling and problem gambling among adolescents in Washington State: A six-year replication study 1993 to 1999*. Olympia: Washington State Lottery.
Welte, J. W., Barnes, G. M., Tidwell, M. O., & Hoffman, J. H. (2008). The prevalence of problem gambling among U.S. adolescents and young adults: Results from a national survey. *Journal of Gambling Studies, 24*(11), 9–133.
Winters, K. C., Stinchfield, R. D., Botzet, A., & Anderson, N. (2002). Prospective study of youth gambling behaviours. *Psychology of Addictive Behaviors, 16*, 3–9.
Wood, R. (2007). Problems with the concept of video game "addiction": Some case study examples. *International Journal of Mental Health and Addiction, 6*, 169–178.
Wood, R. T. A., & Griffiths, M. D. (1998). The acquisition, development and maintenance of lottery and scratchcard gambling in adolescence. *Journal of Adolescence, 21*, 265–273.

Wood, R. T. A., Griffiths, M. D., Chappell, D., & Davies, M. N. O. (2004a). The structural characteristics of video games: A psycho-structural analysis. *CyberPsychology & Behavior, 7*, 1–10.

Wood, R. T. A., Griffiths, M. D., & Parke, A. (2007). Experiences of time loss among videogame players: An empirical study. *CyberPsychology & Behavior, 10*, 38–44.

Wood, R. T. A., Gupta, R., Derevenksy, J., & Griffiths, M. D. (2004b). Video game playing and gambling in adolescents: Common risk factors. *Journal of Child and Adolescent Substance Abuse, 14*, 77–100.

Wynne, H. J., Smith, G. J., & Jacobs, D. F. (1996). *Adolescent gambling and problem gambling in Alberta*. Edmonton: Alberta Alcohol and Drug Abuse.