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Abstract

An established body of research exists in which playing video games have been associated with potentially problematic behaviours, such as gambling. However, this position has recently been questioned in respect to the contemporary environments of both video gaming and gambling. This study investigates relationships between a range of gambling activities and the consumption of video games in general, and the newly emergent phenomenon of esports in particular. In addition, these practices are considered in relation to established measures assessing game addiction and problematic gambling. The study employs Partial Least Squares modelling to investigate data gathered via an international online survey (N=613). Video game addiction was found to be negatively associated with offline gambling, online gambling, and problem gambling. Video game consumption had only small, positive association with video game-related gambling and problem gambling. Consumption of esports had small to moderate association with video game-related gambling, online gambling, and problem gambling. The primary finding of this study are that contemporary video games are not, in themselves, associated with increased potential for problematic gambling, indeed, the position that problem gaming and problem gambling are fundamentally connected is questioned.

Keywords

Video Games, Esports, Gambling, Problematic Gambling, Game Addiction, Convergence

1. Introduction

There is an established body of research which addresses the potential associations between playing video games and a range of problematic behaviours, from aggressive or violent behaviour (Anderson et al., 2010; Olson et al., 2009) to substance abuse (Desai, Krishnan-Sarin, Cavallo, & Potenza, 2010; Williams, Yee, & Caplan, 2008). The relationship between video gaming and gambling is an aspect which has continuously received a significant amount of attention; the case has been made that gaming may serve as a pathway that increases the likelihood of developing problematic gambling behaviours. This position is one in which the structural similarities between gaming and electronic gambling are cited as a major influence (Fisher & Griffiths, 1995; Johansson & Götestam, 2004; Wood, Gupta, Derevensky, & Griffiths, 2004), as are the social benefits accrued for successful players (Griffiths & Wood, 2000), and misperceptions related to a sense of control (Gupta & Derevensky, 1996).

The concept of structural similarities between video gaming and gambling was first discussed almost three decades ago (Griffiths, 1991) and continues to be highly influential to this day (McBride & Derevensky, 2017). However, the focus of the original research was on coin-operated arcade games and gambling using slot machines (Griffiths, 1991; King, Delfabbro, & Griffiths, 2010a). It has been argued that, as both video games and gambling environments have undergone significant changes, the findings are no longer applicable to the contemporary practices of gaming and gambling (Forrest, King, & Delfabbro, 2016).

Driven primarily by online technologies (King, Delfabbro, & Griffiths, 2010b; King, Delfabbro, Kaptsis, & Zwaans, 2014) the convergence of gaming and gambling has taken on new forms (Lopez-Gonzalez & Griffiths, 2016). Technological developments have not simply changed the content of games, offering sophisticated immersive environments for example, but more

significantly they have changed the way that games are played. The spaces of play have dispersed, no longer centralised in arcades or the home, player-versus-machine has become player-versus-player via networked sessions. Business models such as "free-to-play" (Alha, Koskinen, Paavilainen, Hamari, & Kinnunen, 2014; Hamari, Hanner, & Koivisto, 2017) and social network games have introduced gambling-like mechanics back into video games. In addition, the expansion of virtual economies and goods (Hamari, Alha, Järvelä, Kivikangas, Koivisto, & Paavilainen, 2017; Hamari & Keronen, 2017; Lehdonvirta & Castronova, 2014) has obfuscated the use of real money for gambling-like activities in games; gambling-like mechanics are no longer easily identifiable for users (King et al., 2014; Gainsbury, Russell, King, Delfabbro, & Hing, 2016; Kim, Wohl, Salmon, Gupta, & Derevensky, 2015).

All this is happening in an environment where the presence of games and game-like experiences is ubiquitous (Raessens, 2006; Hamari, Huotari, & Tolvanen, 2015), one which has seen an increasing trend toward the liberalisation of gambling laws (Kingma, 2006; Fong, Fong, & Li, 2011; Markham & Young, 2015), and increased access to gambling activities via the internet and mobile devices (Choliz, 2016; Deans, Thomas, Daube, & Derevensky, 2016).

The phenomenon which most succinctly encapsulates these trends is that of esports; a form of sports where play is "facilitated by electronic systems", i.e. competitive video gaming organised into leagues and tournaments (Hamari & Sjöblom, 2017; Taylor, 2012). In esports, video games are the objects and the drivers of all activity, its "sportification" (Lopez-Gonzalez & Griffiths, 2016) has brought with it a host of activities associated with traditional sports: professionalization, regulation, fan communities, and gambling.

In addition to esports (Holden, Rodenberg, & Kaburakis, 2016), the convergence of gaming and gambling is evident in social gaming (Gainsbury, King, Abarbanel, Delfabbro, & Hing 2015; King et al., 2014) and the free-play modes offered by online casinos (Bednarz, Delfabbro, & King, 2013). It is understandable, therefore, that concerns have been raised over the potential for

video game players to be exposed to factors which may encourage problematic gambling (Bednarz et al., 2013; Griffiths, King, & Delfabbro, 2009; Parker, Taylor, Eastabrook, Schell, & Wood, 2008). Results have been mixed, with some studies showing a significant relationship between playing video games and increased participation in gambling (Wood et al., 2004; Gainsbury et al., 2016; Kim et al., 2015; McBride & Derevensky, 2017) while others have not found a clear relationship (Delfabbro, King, Lambos, & Puglies, 2009; King, Ejova, & Delfabbro, 2012; Forrest et al., 2016).

1.1. Aims of the Research

An environment has developed in which the prevalence of both video gaming and gambling as leisure activities has been accompanied by technological and cultural convergence, increased ease of access, and liberalisation of gambling regulations. As such, it is imperative that relationships between video gaming and gambling require continued investigation, with specific focus on newly emergent phenomena such as esports.

Currently, there is a dearth of research which addresses esports and gambling, what published work there is largely addresses the question of legal and regulatory issues (Schneider, 2015; Owens Jr, 2016). This deficit requires urgent attention as industry analysts predict the number of global esports viewers to reach 375 million by the end of 2017, with active participants in formal, mainstream esports gambling already exceeding 2.25 million. Furthermore, it is estimated that over 3 million people actively participate in the informal markets surrounding in-game items, such as skins lotteries (Grove & Krejcik, 2015).

This study, therefore, seeks to investigate relationships between the consumption of video games, esports and three different forms of gambling: offline, online, and video game-related gambling. The final category includes activities such as: betting on esports matches, playing fantasy

esports, paying to access randomly generated in-game items, using in-game items or currencies as wagers in third-party gambling sites, and social network gambling games. Both offline and online gambling refer to established practices such as betting, playing the lottery etc., in specific contexts. These factors give rise to the following research questions:

- RQ1: Is increased consumption of video games and esports associated with increased levels of gambling?
- RQ2: Are higher rates of problematic video gaming associated with higher rates of a) gambling activity, and b) problematic gambling?

The convergence of gaming and sports embodied by esports suggests that if video gaming is associated with increased gambling, it would be in this environment that any relationships would be most pronounced. Therefore, in order to investigate the stated research questions, the following target population was identified: video game players who also watched esports, and/or who had gambled within the previous 12 months. Online questionnaires with self-selected respondents are considered the most appropriate method of obtaining data from such populations (Griffiths, 2010). Advantages of this method include: increased access to target population, global reach, it is more cost-efficient than traditional random sampling techniques, and responses are less likely to be affected by the desire for social acceptance.

1.2. Research Model

This research is concerned with the relationship between consumption of digital media, in the form of video games and esports, and gambling behaviour, as such an involvement model (Binde, 2013) was developed to answer the research questions detailed above.

Previous research has linked increased consumption of video games to increased participation in gambling and raised likelihood of developing problematic gambling behaviours (Wood et al., 2004; McBride & Derevensky, 2017). This relationship has been explained in terms of structural similarities between gaming and gambling (Fisher & Griffiths, 1995; Johansson & Götestam, 2004), the accrual of social capital (Griffiths & Wood, 2000), and maladapted cognitions such as an overdeveloped sense of control (Gupta & Derevensky, 1996). Therefore, it is hypothesised that *Video gaming habits* will be positively associated with *Offline Gambling Habits* (H_1), *Online Gambling Habits* (H_2), and *Video Game-Related Gambling Habits* (H_3). The association is expected to be most pronounced in relation to *Video Game-Related Gambling Habits* and weakest for *Offline Gambling Habits.*

An interest in esports is born out of an initial interest in video games, esports being considered a subset of the wider gaming environment (Lee & Schoenstedt, 2011), therefore, *Esports viewing habits* is anticipated to be an additional predictor of involvement in gambling, one which is itself influenced positively by *Video Gaming Habits* (H_4). Accordingly, *Esports Viewing Habits* is hypothesised as positively influencing *Offline Gambling Habits* (H_5), *Online Gambling Habits* (H_6), and *Video Game-Related Gambling Habits* (H_7). The association is expected to be strongest for *Video Game-Related Gambling Habits* and weakest for *Offline Gambling Habits.*

Problematic gaming behaviour in particular has been theorised as being associated with problematic gambling (Griffiths & Wood, 2000; Johansson & Götestam, 2004; Parker et al., 2008). It is a logical expectation that game addiction (*GAS*) is positively influenced by the habits surrounding the consumption of video games (H_8) and, by extension, esports (H_9). It has been interpreted as such, and used in the same way, in previous research (Forrest et al., 2016). Mirroring the relationships outlined in H_1-H_3 and H_5-H_7, *GAS* is expected to show positive associations with *Offline Gambling Habits* (H_{10}), *Online Gambling Habits* (H_{11}), and *Video Game-Related Gambling Habits* (H_{12}).

Video game-related gambling is the newest form of gambling (heavily dependent upon technological developments that have facilitated contemporary video game forms, business models and online communities (Scholz, 2011; Taylor, 2012). Therefore, it is anticipated that it will be influenced by gambling habits of pre-existing formats, both *Offline Gambling Habits* (H_{13}), and *Online Gambling Habits* (H_{14}), with the former being weaker than the latter.

Including a measure of problematic gambling when investigating possible relationships between video game consumption and gambling behaviour has been recommended by researchers in the field (Forrest et al., 2016). It is noteworthy that problematic gambling has been found to be more strongly associated with online gambling than offline (Griffiths, Wardle, Orford, Sproston, & Erens, 2009; Olason et al., 2011). As a result, problem gambling (*PGSI*) is expected to be positively influenced by all types of gambling behaviour, with the strongest associations predicted to be for *Video Game-Related Gambling Habits* (H15) and *Online Gambling Habits* (H16), and weakest in relation to *Offline Gambling Habits* (H17).

The path model used to investigate relationships between the consumption of both video games and esports and gambling activities is presented in figure 1:

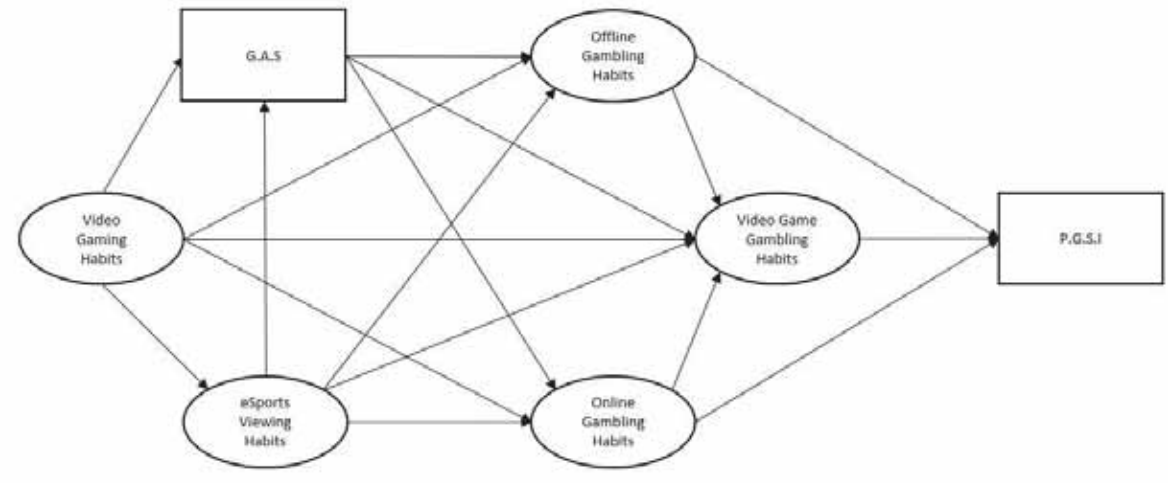

Figure 1: Path Model.

Model showing relationships between video game consumption and gambling activity.

2. Methods

The survey included two measures of problematic behaviour, the Game Addiction Scale (GAS; Lemmens & Valkenburg, 2009) and the Problem Gambling Severity Index (PGSI), derived from the Canadian Problem Gambling Index (CPGI; Ferris & Wynne, 2001). Playing video games, watching esports, and gambling habits were assessed using items which measured frequency, average weekly hours, and average monthly spend (in US$) for each activity.

2.1. Participants and Procedure

A sample of 869 video gamers was collected, from a total of 2,397 responses, via an online survey publicised across social media channels and online discussion forums dedicated to video gaming and esports. The survey was available for a period of one month, between November and December 2016. As an incentive to participate, valid respondents were entered into a prize draw to win a $50 gift-card. A filter question was included, those that failed were excluded from the sample, also excluded were those who reported playing no video games within the previous 12 months. The final sample consisted of 613 respondents, 25.57% of total responses, of which: the modal range was 18 – 21 (31.5%) (table 1); 98.2% played video games once a week or more (table 2); 50.1% watched esports once a week or more (table 2); 32.8% gambled offline within the previous 12 months, 34.4% had gambled online and 47.5% had gambled in relation to video games (table 3); 91.4% were male (table 4), a figure also reflected in previous studies of both active esports players (Weiss & Schiele, 2013) and internet gamblers (Gainsbury, Wood, Russell, Hing, & Blaszczynski, 2012).

Age Ranges of Sample (n=613)

	n	*%*	*Cumulative %*
Information Not Provided	11	1.8	1.8
14 or Under	11	1.8	3.6
15 - 17	152	24.8	28.4
18 - 21	193	31.5	59.9
22 - 25	104	17.0	76.8
26 - 29	71	11.6	88.4
30 - 33	32	5.2	93.6
34 - 37	12	2.0	95.6
38 - 41	12	2.0	97.6
42 - 45	11	1.8	99.3
46 - 49	2	.3	99.7
50 or Over	2	.3	100.0
Total	613	100.0	

Table 1: Demographics – Age

Video Game and esports Consumption Frequencies of Sample (n=613)

	Video Game Play Frequency			*Esports Viewing Frequency*		
	n	*%*	*Cumulative %*	*n*	*%*	*Cumulative %*
Never	-	-	-	79	12.9	12.9
Less Than Once a Month	2	.3	.3	83	13.5	26.4
About Once a Month	4	.7	1.0	50	8.2	34.6
2 - 3 Times a Month	5	.8	1.8	94	15.3	49.9
About Once a Week	11	1.8	3.6	96	15.7	65.6
2 - 6 Times a Week	176	28.7	32.3	145	23.7	89.2
Every Day	415	67.7	100.0	66	10.8	100.0
Total	613	100.0		613	100.0	

Table 2: combined video game and esports consumption frequencies

Gambling Participation Rates of Sample (n=613)

	Offline		*Online*		*Video Game-Related*	
Gambled in last 12 months?	*n*	*%*	*n*	*%*	*n*	*%*
Yes	201	32.8	211	31.4	291	48.5
No	412	67.2	402	68.6	322	52.5
Total	613	100	613	100	613	100

Table 3: gambling participation in last 12 months

Gender Breakdown of Sample (n=613)

	n	*%*	*Cumulative %*
Information Not Provided	11	1.8	1.8
Male	560	91.4	93.1
Female	38	6.2	99.3
Other/Non-Binary	4	.7	100.0
Total	613	100.0	

Table 4: Demographics – Gender

2.2. Measurement

The GAS short form (Lemmens & Valkenburg, 2009) is an established, previously-validated scale; it has been demonstrated to be as effective as the longer 21 item measure and was chosen in order to minimise participant fatigue. It addresses issues of salience, tolerance, mood modification, relapse, withdrawal, conflict and problems resulting from play. Items are rated on a five-point Likert scale, ranging from "never" to "very often", an item would be considered as being met if the respondent answered 3 (sometimes) or higher. The authors propose two approaches to categorisation: the monothetic, where all items must be met, and the polythetic, where four out of seven items must be met. An alternative approach, utilised by Forrest et al. (2016), was adopted by this study in which the total GAS scores are summed, providing a continuous scale of problematic gaming behaviour. This was felt to be a useful approach as it presents a more nuanced picture of problematic behaviour. Cronbach's alpha for the present study was $\alpha = .809$.

The PGSI (Ferris & Wynne, 2001) is a widely-used, 9 item self-assessment measure addressing a range of problematic gambling behaviours, as well as consequences of those behaviours. Possible responses to the items are "never", "sometimes", "most of the time", and "almost always", they are scored in order to assign participants to one of four groups. Scoring is as follows: "never" = 0, "sometimes" = 1, "most of the time" = 2, and "almost always" = 3. Cronbach's alpha for the present study was $\alpha = .822$.

The sample was classified according to each of the measures described above, results are provided in tables 5 to 7.

PGSI Categorisation of Sample (n=613)

	n	*%*	*Cumulative %*
Non-problem Gambler	318	51.9	51.9
Low Risk	162	26.4	78.3
Moderate Risk	107	17.5	95.8
Problem Gambler	26	4.2	100.0
Total	613	100.0	

Table 5: PGSI categorisation

Addiction Rates of Sample (n=613) by GAS Criteria

	GAS Monothetic Criteria			*GAS Polythetic Criteria*		
	n	*%*	*Cumulative %*	*n*	*%*	*Cumulative %*
Not Addicted	573	93.5	93.5	322	52.5	52.5
Addicted	40	6.5	100.0	291	47.5	100.0
Total	613	100.0		613	100.0	

Table 6: GAS addiction classification by alternative criteria

GAS Score of Sample (n=613)

	Values
Valid	613
Mean	17.49
Std. Deviation	5.488
Variance	30.120
Range	28
Minimum	7
Maximum	35

Table 7: GAS cumulative score statistics

Formative variables for habits relating to the consumption of video gaming, esports watching, offline gambling, online gambling, and video game-related gambling were created using

the following items: frequency of activity, average weekly hours spent on activity, and average monthly spend on activity. Analysis was conducted using SmartPLS 3.

3. Results

The model was tested using Partial Least Squares Structural Equation Modelling (PLS-SEM) as it is best suited to predictive studies (Chin, Marcolin, & Newsted, 2003) and those models featuring latent, formative and reflective constructs (Hair, Hult, Ringle, & Sarstedt, 2016). Furthermore, it is a form of multiple linear regression which is the recommended analytic method when using a self-selected data sample (Heckman, 2013).

The model utilises formative constructs to measure consumption habits, therefore, traditional methods of assessing construct validity, based on reflective constructs, such as factor loadings, AVE values, convergent validity, and discriminant validity are not applicable (Diamantopoulos & Winklhofer, 2001; Wang, French & Clay, 2015). However, construct validity has been established as 11 outer VIF values are lower than 3.3, with the remaining four being lower than 5, meaning collinearity is not an issue (Diamantopoulos & Siguaw, 2006; Hair et al., 2016). Furthermore, bootstrapping showed all t-values for outer weights are greater than 2.57, providing clear evidence of the significance of the outer loading at $\alpha=0.01$ (Hair et al., 2016). Full tables showing outer loadings and outer VIF values are included in the appendices.

With the validity of the constructs established, evaluation of the model can begin.

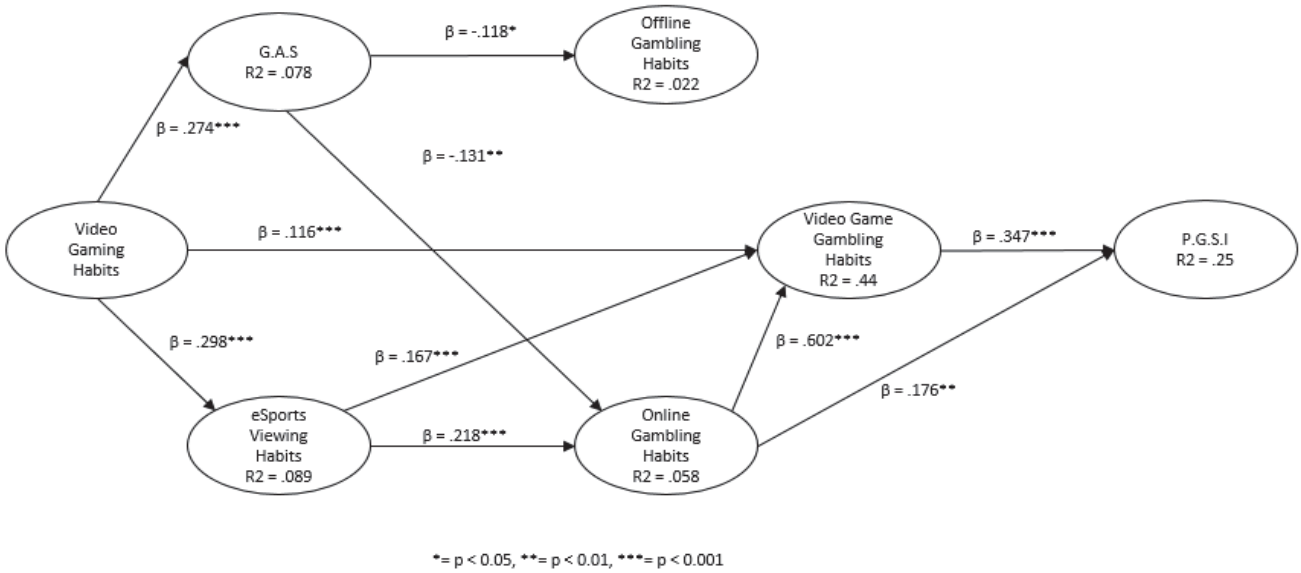

Figure 2: PLS-SEM model with path coefficients and R2 values (significant relationships only).

Path model showing coefficients for significant relationships and R2 values for all variables.

Figure 2 shows the direct effects between the variables in the model, for the purposes of clarity only statistically significant effects are included. All 5 "habits" variables are latent variables comprising measures of: frequency of activity, average weekly hours spent on activity, and average monthly spend, in US$, on activity. Table 8 reports all direct effects and total effects.

Direct and Total Effects

	Direct				*Total*			
			95% CI				*95% CI*	
	β	*P*	*Lower*	*Upper*	β	*P*	*Lower*	*Upper*
GAS -> Off. Gam.	-0.118*	0.015	-0.207	-0.018		*same as direct*		
GAS -> On. Gam.	-0.131**	0.001	-0.206	-0.047		*same as direct*		
GAS -> VG Gam.	0.027	0.393	-0.033	0.089	-0.05	0.223	-0.131	0.031
Off. Gam. -> PGSI	0.051	0.343	-0.054	0.154	0.044	0.359	-0.048	0.14
Off. Gam. -> VG Gam.	-0.019	0.737	-0.119	0.103		*same as direct*		
On. Gam. -> PGSI	0.176**	0.005	0.055	0.298	0.385***	<0.001	0.294	0.473
On. Gam. -> VG Gam.	0.602***	<0.001	0.498	0.7		*same as direct*		
VG Gam. -> PGSI	0.347***	<0.001	0.237	0.452		*same as direct*		
VG Habits -> GAS	0.274***	<0.001	0.173	0.36	0.279***	<0.001	0.182	0.359
VG Habits -> Off. Gam.	-0.012	0.82	-0.11	0.093	-0.014	0.75	-0.092	0.078
VG Habits -> On. Gam.	-0.04	0.391	-0.124	0.055	-0.011	0.813	-0.095	0.089
VG Habits -> VG Gam.	0.116***	<0.001	0.051	0.177	0.167***	<0.001	0.084	0.256
VG Habits -> Esp. Habits	0.298***	<0.001	0.226	0.365		*same as direct*		

Esp. Habits -> GAS	0.018	0.692	-0.075	0.101	*same as direct*			
Esp. Habits -> Off. Gam.	0.104	0.152	-0.01	0.278	0.102	0.159	-0.014	0.275
Esp. Habits -> On. Gam.	0.218***	<0.001	0.132	0.331	0.216***	<0.001	0.129	0.328
Esp. Habits -> VG Gam.	0.167***	<0.001	0.09	0.25	0.296***	<0.001	0.204	0.403
GAS -> PGSI	*no direct effect*				-0.046*	0.028	-0.085	-0.002
VG Habits -> PGSI	*no direct effect*				0.055*	0.03	0.01	0.11
Esp. Habits -> PGSI	*no direct effect*				0.146***	<0.001	0.096	0.209

GAS = total score for Lemmens' Game Addiction Scale. PGSI = Problem Gambling Severity Index Categorisation. Off. Gam. = Offline Gambling Habits. On. Gam. = Online Gambling Habits. VG Gam. = Video Game-Related Gambling Habits. VG Habits = Video Game Playing Habits. Esp. Habits = Esports Watching Habits.

Table 8: Direct and total effects

In regard to H_2 and H_2 no statistically significant relationships were observed, those effects which were in evidence showed only small, negative associations. However, for H_3 a statistically significant, positive association was observed, although the effect size was small ($\beta = 0.116$). The expectation that the associations between video game consumption and gambling habits be most pronounced in relation to *Video Game-Related Gambling Habits* is supported as it was the only significant association.

Video Gaming Habits are a moderately strong predictor of esports consumption ($\beta = 0.298$), with the relationship being significant ($p = <0.001$), supporting H_4. The relationships between *Esports Viewing Habits* and both *Online Gambling Habits* (H_6) and *Video Game-Related Gambling Habits* (H_7) show statistically significant relationship was observed, with a moderate positive association ($\beta = .218$) and a moderate positive association ($\beta = .218$), respectively. No statistically significant relationship was observed in respect to *Offline Gambling Habits* (H_5), that which was observed showed a small positive association. The lack of association with offline gambling in part validates the stated expectation, however, counter to expectations the strongest association was found with *Online Gambling Habits* rather than *Video Game-Related Gambling Habits*.

Video Gaming Habits are a moderately strong predictor of *GAS* (β = 0.274), with the relationship being significant (p = <0.001), thereby validating (H_8). No statistically significant relationship was observed for esports (H_9), that which was observed showed a small positive association.

Surprisingly, no statistically significant relationship was observed in regard to H_{12}, however, for both H_{10} and H_{11} statistically significant associations were observed, although the effects were small and, counter to expectations, negative (β = -0.118) and (β = -0.131), respectively.

Video Game-Related Gambling Habits had no statistically significant relationship with *Offline Gambling Habits*, as such H_{13} is not supported, whereas a statistically significant, and strong positive relationship was observed with *Online Gambling Habits* (β = .602). As such, H_{14} is endorsed, as is the expectation that the influence of *Online Gambling Habits* on *Video Game-Related Gambling Habits* is stronger than that of *Offline Gambling Habits*.

A statistically significant relationship was observed between problem gambling (*PGSI*) and *Video Game-Related Gambling Habits* and *Online Gambling Habits* with a strong positive association (β = .347) and a moderate positive association (β = .176), respectively. Therefore, both H_{15} and H_{16} are supported. No statistically significant relationship was observed for H_{17}, that which was observed showed a small positive association. The difference in effect size between *Video Game-Related Gambling Habits* and *Online Gambling Habits* is somewhat surprising. However, the total effects are very similar, with online gambling rising to β = .385. The mediated effects of *GAS* (β = -.046) and *VG Habits* (β = .055) on *PGSI* are, again, significantly lower than that of watching esports (β = .146).

Overall, measures associated with video gaming account for just 2.2% of the variance of offline gambling habits, with the only statistically significant relationship being that of *GAS*. The negative relationship suggests that the higher the game addiction score, the less likelihood there is

of participation in offline gambling. A similar relationship is in evidence between *GAS* and online gambling habits.

The amount of variance in online gambling habits explained by the model is higher than that of offline gambling habits, but is still very small (R2 = .058). Together these results suggest that video gaming in itself does not have any significant relationship to established gambling practices.

The strong relationship between online gambling and video game-related gambling is unsurprising, however, the degree of this relationship is unanticipated. Indeed, online gambling seems to be the biggest predictor of video game-related gambling, over and above either consuming video games or watching esports. That said, the total effect value of watching esports on video game-related gambling is almost double the direct effect, ($\beta = .296$), the relationship between the two is, therefore, a strong one.

The model explains 25% of the variance of *PGSI*, approaching the 26% required for the effect to be considered large (Cohen, Cohen, West, & Aiken, 2013). The direct effects of video game-related gambling on *PGSI* are substantially more than those of online gambling habits. Only 7.8% of *GAS* was explained, however, a clear and strong relationship with game consumption habits is evident. While the initial assumptions were not that video game consumption habits would entirely explain *GAS*, a more substantial overall effect was expected.

Considering RQ1, the situation appears to be more nuanced than expected as, despite the fact that the consumption of video games is a predictor of esports viewing habits, their individual relationships with different gambling activities vary somewhat. Both *Video Gaming Habits* and *Esports Viewing Habits* have statistically significant relationships with video game-related gambling. However, only *Esports Viewing Habits* shows any other statistically significant

relationships, with *Online Gambling Habits*, and that is, somewhat surprisingly, stronger than with video game-related gambling.

We can say, therefore, that the consumption of esports is associated with increased gambling in mediated contexts (via video games and the internet) but not with offline gambling. The situation in respect to the consumption of video games is, however, more ambiguous, with only a small association shown to exist with video game-related gambling.

The situation in regard to RQ2 is more emphatic as the model shows that problematic video gaming is not associated with higher rates of either gambling activity or problematic gambling. In fact, it appears that higher rates of problematic gaming, as measured using GAS, seem to act against involvement in both online and offline gambling, and for the development of problematic gambling behaviour.

4. Discussion

The main findings of this research are that: first, there are no strong associations between the consumption of video games or esports, and gambling activity; and second, that problematic video gaming has a small, but significant, negative association with both gambling in general, and problematic gambling in particular. These, and other issues of interest arising from the study, are discussed below.

This research theorised that an interest in esports is born partly out of a pre-existing interest in, and consumption of video games, however, the small amount of variance of esports consumption explained by gaming habits suggests that this view is too simplistic, although there is evidence of a fairly strong relationship between the two. An almost identical relationship seems to exist between video gaming and GAS scores. This is particularly significant as researchers in the field of addiction studies have often used either frequency of gaming or time spent gaming as a

primary indicator of addictive behaviour (Van Rooij, Schoenmakers, Vermulst, Van Den Eijnden, & Van De Mheen, 2011; Lemola et al., 2011; Weinstein, 2010; Festl, Scharkow, & Quandt, 2013). This research shows such an approach to be overly simplistic; even using a combination of consumption measures proves to be a poor indicator of potentially problematic gaming. This is clear evidence that problematic video game playing differs from other conditions for which consumption measures are a good indicator of addictive behaviour (Sassen et al., 2011; Rehm et al., 2013).

The small amount of variance in online and offline gambling habits explained by the range of game-related measures is at odds with the stated expectations of this research. This, and the fact that the model was unable to find statistically significant relationships between video game consumption and gambling activities not related to video games, is in contrast to a large body of work (Wood et al., 2004; Gainsbury et al., 2016; Kim et al., 2015; McBride & Derevensky, 2016). Instead, it provides support for research which questions proposed links between the practices of gaming and gambling (Delfabbro et al., 2009; King et al., 2012; Forrest et al., 2016). Indeed, the negative relationship between game addiction score and both online and offline gambling suggests that problematic gaming and problematic gambling are clearly distinct from one another. It seems instead that those who score more highly on measures of game addiction are unlikely to migrate to gambling behaviours, despite the apparent structural similarities (Johansson & Götestam, 2004; Wood et al., 2004; McBride & Derevensky, 2016). Critics of this position might reasonably argue that the negative correlation between game addiction score and gambling habits is due to limited resources; people are unable to participate in both activities concurrently, and if the opportunity to play video games were removed, they would be highly likely to seek similar gratifications from gambling. However, the results of this research refute such an argument as the overall, mediated relationship between game addiction score and *PGSI* is both negative and statistically significant. Furthermore, video game habits show statistically significant positive relationships with both game addiction score and *PGSI*, while the game addiction score has a negative relationship with *PGSI*.

There appears to be, therefore, an aspect of video gaming itself which serves to prevent the uptake of gambling and the development of associated problematic behaviours (Forrest et al., 2016).

Problematic gambling has a moderate to large amount of variance (25%) explained solely by behaviours relating to the consumption of gambling, (frequency, hours spent gambling per week and money spent gambling per month). This is noteworthy when compared to the low amount of variance (7.8%) for problematic gaming using the same measures, suggesting that the nature of problematic gaming is distinct from other behavioural conditions. As such, the findings support the call for specific measurement tools to be developed rather than using those derived mainly from substance use disorders (Petry, 2013; Kardfelt-Winther, 2015; King & Delfabbro, 2016; Demetrovics & Király, 2016).

Although video game-related gambling habits have a more pronounced direct effect on *PGSI* than online gambling habits, the total, mediated, effects are comparable in strength. It is likely that the similarity of the overall influence of these two forms of gambling can be attributed to the fact that video game gambling is almost exclusively facilitated via online media. Aspects of online gambling such as increased ease of access, anonymity and the use of digitised/virtual currencies have been identified as characteristics of online gambling which facilitate problematic behaviours (Derevensky & Gupta, 2007; Gainsbury, Hing, Delfabbro & King, 2014; Lopez-Gonzalez & Griffiths, 2016).

Further evidence of the strong relationship between online gambling and video game-related gambling can be found in the high β value between the two. Although the development of the model theorised that causality to run in a certain direction, it cannot be proved as this study is correlational in nature. It may be that those who are interested in games and who also gamble online are likely to then begin gambling in relation to video games, alternatively it may be that those who develop an interest in video game gambling then go on to explore other forms of gambling in the online environment.

A somewhat surprising finding was that video gaming habits had a reasonably small correlation with video game-related gambling, indeed it was the smallest of all observed relationships, both in direct and mediated effects. Of those variables related to video gaming in general, it was the consumption of esports that displayed the strongest relationship to video game-related gambling. Furthermore, it was the only measure that had any statistically significant, positive, relationship with either online or offline gambling. It seems clear, therefore, that rather than playing video games, it is the consumption of esports that is a more significant predictor of increased participation in gambling. Whether this is due to any specific characteristics of esports itself, or if gambling is associated with esports in the same way that it is with traditional sports (Hill & Clark, 2001; Udovicic, 1998) is something that requires further investigation.

4.1. Implications

The first notable implication of this research is that the use of gaming frequency or time spent gaming as a shorthand for addictive behaviour is over-simplistic and inaccurate. Therefore, researchers and professionals in the field of addictive behaviours must utilise more robust measures in order to minimise the risk of misdiagnosis.

A further lesson is that different approaches are required to understand and address problematic gaming and problematic gambling, ones which are based more on the individual circumstances and characteristics of each activity. Therefore, the approach whereby problem gaming is understood through the lens of gambling is questionable and likely to be ineffective. As such, criteria for assessing problematic gaming which have been developed from those based on problematic gambling or Substance Use Disorder, require a thorough overhaul.

Finally, the role and effect of esports, rather than video gaming per se, should be taken into consideration when evaluating the potential to develop problematic gambling behaviours. And,

consequently, particular attention should be paid to this context when developing therapeutic approaches or treatment programmes.

4.2. Limitations

This research incorporated the lessons of previous studies by utilising more robust measures for consumption than simply using frequency of gaming, and by including a measure of problematic gambling (Forrest et al., 2016). Nevertheless, it remains the case that the most notable limitation of this research was the collection of data via an online survey, as such it is open to the standard criticisms directed at self-selected samples. The benefits of this approach, however, include greater access to the target population than techniques employed in probability sampling, and reduced scope for responses to be guided by social acceptance or feelings of embarrassment. This is especially pertinent in relation to potentially sensitive topics such as gambling or problematic gaming (Griffiths, 2010).

A potential issue specific to this particular survey was the seeming lack of diversity in respondents, with only 6.2% of participants being female. Whilst this is similar to other research (Weiss & Schiele, 2013; Gainsbury et al., 2012; Sjöblom, Törhönen, Hamari, & Macey, 2017) it is significantly lower than estimated levels of female participants in either video gaming, 41% (ESA, 2016), or watching esports casually, 36% (EEDAR, 2015). The characteristics of this dataset may be the result of the channels by which the data was collected; the most significant source of respondents was Reddit, a social news and discussion website which has previously been criticised for its lack of diversity (Speed, 2015; Zuckerman, 2012). An additional reason for the disparity between male and female respondents may be that this research is concerned with the relationship between video gaming and gambling, the latter is a pastime in which male participation largely outweighs female, and in which males favour sports betting, casino games and internet gambling in

general (Gainsbury et al., 2012; McDaniel & Zuckerman, 2003; Welte, Barnes, Wieczorek, Tidwell, & Parker, 2002; Gupta & Derevensky, 1998; Hing & Breen, 2001) all of which are the predominant forms of gambling associated with video games.

5. Conclusions

Increased consumption of video games has a positive association with both game addiction score and video game-related gambling. However, as game addiction score has a negative correlation with both video game-related gambling and PGSI category there exists an unidentified aspect of video game play which serves to reduce the appeal of gambling for heavy gamers. On the other hand, increased consumption of esports is strongly associated with increased participation in online and video game -related gambling and moderately associated with increased potential for problematic gambling behaviour.

The findings of this study are that modern video games do not, in themselves, act as developmental pathways to gambling. Furthermore, they question the claims that problem gaming and problem gambling are fundamentally connected. Instead, it seems that video games are simply a vehicle, like many other activities, employed to fulfil particular needs derived from the activity of gambling. The "sportification" (Lopez-Gonzalez & Griffiths, 2016) of video games, in the form of esports, is just one example of the way in which it is the convergence of digital culture, rather than video games themselves, that facilitates gambling.

6. Declaration

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Appendix A: Outer Loadings

Outer Loadings

				95% CI	
	β	*t*	*p*	*Lower*	*Upper*
GAS Sum <- GAS	1.000			1.000	1.000
Off. Gam. Freq. -> Off. Gamb.	0.974***	19.038	<0.001	0.809	0.999
Off. Gam. Spend -> Off. Gamb.	0.833***	9.838	<0.001	0.620	0.944
Off. Gam. Hours -> Off. Gamb.	0.877***	8.542	<0.001	0.595	0.986
On. Gam. Freq. -> On. Gamb.	0.976***	49.151	<0.001	0.920	0.996
On. Gam. Spend -> On. Gamb.	0.878***	21.235	<0.001	0.785	0.945
On. Gam. Hours -> On. Gamb.	0.893***	21.477	<0.001	0.799	0.960
PGSI Group <- PGSI	1.000			1.000	1.000
VG Gam. Freq. -> VG Gamb.	0.923***	33.091	<0.001	0.856	0.966
VG Gam. Spend -> VG Gamb.	0.895***	25.825	<0.001	0.812	0.948
VG Gam. Hours -> VG Gamb.	0.923***	30.332	<0.001	0.856	0.974
VG Play Freq. -> VG Habits	0.688***	7.568	<0.001	0.462	0.821
VG Play Spend -> VG Habits	0.472***	3.505	<0.001	0.218	0.742
VG Play Hours -> VG Habits	0.948***	21.437	<0.001	0.822	0.990
Esp. Watch Freq. -> Esp. Habits	0.836***	11.127	<0.001	0.650	0.942
Esp. Watch Spend -> Esp. Habits	0.653***	4.881	<0.001	0.366	0.880
Esp. Watch Hours -> Esp. Habits	0.916***	15.979	<0.001	0.761	0.980

GAS Sum/GAS = score for Game Addiction Scale. PGSI Group/PGSI = Problem Gambling Severity Index Categorisation. Off. Gam. = Offline Gambling Habits. On. Gam. = Online Gambling Habits. VG Gamb. = Video Game-Related Gambling Habits. VG Habits = Video Game Playing Habits. Esp. Habits = Esports Watching Habits. Off. Gam. = Off. Gambling. On. Gam. = Online Gambling. VG Gam. = Video Game-Related Gambling. VG Play = Video Game Playing Habits. Esp. Watch = Esports Watching Habits. Freq. = Frequency (of activity). Spend = Average Monthly Spend (on activity, in US$). Hours = Average Weekly Hours (on activity).

Appendix B: Outer VIF Values

Outer VIF Values

	VIF
Off. Gam. Freq.	2.69
Off. Gam. Spend	3.658
Off. Gam. Hours	3.426
On. Gam. Freq.	3.125
On. Gam. Spend	3.552
On. Gam. Hours	3.81
VG Gam. Freq.	2.934
VG Gam. Spend	2.757
VG Gam. Hours	2.858
VG Play Freq.	1.334

VG Play Spend	1.091
VG Play Hours	1.415
Esp. Watch Freq.	2.17
Esp. Watch Spend	1.177
Esp. Watch Hours	2.152

Off. Gam. = Off. Gambling. On. Gam. = Online Gambling. VG Gam. = Video Game-Related Gambling. VG Play = Video Game Playing Habits. Esp. Watch = Esports Watching Habits. Freq. = Frequency (of activity). Spend = Average Monthly Spend (on activity, in US$). Hours = Average Weekly Hours (on activity).