Excessive appetites for video-games: An examination of the causes, consequences, and progression of problematic video-game playing

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Abstract

The present thesis aimed to investigate the causes and consequences of excessive involvement in video-game playing. Four studies, all involving a sample of highly-engaged Australian adults, were conducted in order to explore a range of influences on problematic behaviour.

In Paper 1, associations between problematic video-game playing and several gambling behaviours were examined. Contrary to expectations based upon previous theories of video-game ‘addiction’, non-significant associations were found between frequency of video-game play and frequency of gambling. Likewise, generally weak associations were found between problematic video-game playing and all gambling-related variables. It was concluded that previous theoretical accounts of problematic gaming may not sufficiently account for developments in technology or the changing preferences of video-game players.

In Paper 2, the social contexts of normal, as well as problematic, video-gaming behaviour were investigated. Peer group influence was found to be significantly related to the severity of problematic gaming. Whereas non-problematic gamers generally preferred solitary play in offline games, problematic gamers reported lower social support; were more likely to have a friend or family member with a video-gaming problem; and, were more likely to report social or competitive motivations for playing. It was concluded that the capacity for online games to create rewarding, social environments for individuals with existing social difficulties may help to explain why involvement with certain types of game are more likely to lead to problematic behaviour.

In Paper 3, a new measure of maladaptive cognitions related to video-game playing was constructed and validated. Cognitions were found to load on four distinct factors: (1) perfectionism, (2) cognitive salience, (3) regret, and (4)
behavioural salience. Scores on each of these scales were found to correlate with two measures of problematic gaming, a measure of emotional distress, and distinguished between problematic and non-problematic gamers. It was argued that these cognitions could be usefully addressed during clinical interventions and provided new avenues for research related to the treatment of Internet Gaming Disorder.

In Paper 4, longitudinal associations between problematic video-game playing and maladaptive cognitions (as measured by the scale created in Paper 3) were assessed. It was found that gaming-related perfectionism, cognitive salience, and regret served as risk factors for developing problematic behaviour 12 months later. Lower perfectionism scores were also found to serve as remission factors during this period. It was concluded that cognition scores could be used to inform long-term changes in gaming behaviour, and that interventions which aim to address these cognitions may have long-term efficacy for the treatment of gaming-related disorders.

In conclusion, the present thesis identifies several ways in which modern video-games, and modern video-game players, have evolved from those described in previous accounts of excessive involvement. The presented manuscripts provide new avenues for future research related to the treatment of gaming-related disorders.
Declaration

This work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution to Cameron Forrest and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

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List of Publications


Acknowledgements

This thesis represents the culmination of four years’ worth of blood, sweat, and even a few tears. This paltry section cannot possibly capture my eternal gratitude to everyone who has helped to make it a reality, and it is inevitable that some will be overlooked, for which I apologise. But you know who you are, and your contribution is no less significant or meaningful simply because it is not mentioned here.

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Finally, I would like to dedicate this thesis to my wife Laura, whom I married during my candidature. For all of my words – both philosophising and pure waffling – I find myself without means of describing the impact you have made on this thesis, on my life, and on who I am. You are all my reasons.
Chapter 1: Introduction and Literature Review

Video game fanatics essentially are cocaine addicts who get an instant rush from an electronic fix. (Zimbardo, as cited in Klein 1984)

An addiction is not merely something a person has learnt to do; but rather something that the person has come to depend on so strongly that he or she cannot stop. (Turner 2008)

A true addiction, even a behavioural addiction, has to mean much more than that someone does something a lot. (Gentile 2009)

The purpose of this section is to provide an overview of the extant literature on problematic video-gaming. It will begin with a brief history of video-gaming related research, including several accounts of video-gaming ‘addiction’, before discussing more recent developments in the field, as well as methodological challenges faced by modern researchers. In the process, factors which are known to influence problematic behaviour will be described in order to provide a context for the studies which comprised the present thesis.

Soper and Miller (1983) were among the first to propose criteria for video-game addiction, which were based on contemporary reports from clinicians. They noted the following similarities with other addictions:

- Individuals reported an inability to control the extent of their involvement
- Cognitive and behavioural preoccupation with the activity to the exclusion of other activities
- Affected individuals primarily socialising with other ‘addicts’
• Negative impact on other responsibilities and commitments
• Activity leading to negative affect, including feelings of guilt, detachment and helplessness
• Adverse physiological symptoms when attempting to cut back or cease involvement
• Habits supported by criminal activity (e.g. fraud, theft)

However, reports of problematic involvement remained largely anecdotal until Shotton’s (1989, 1991) seminal studies of self-styled ‘computer-dependents’. Grounded in public and media concerns that computers had the capacity to convert users into ‘junkies’ through processes that mimicked narcotic dependence, Shotton’s studies were among the first to provide empirical data on excessive computer users. Contrary to expectations, these individuals were found to be generally of adult age, well-educated, and – aside from their excessive habits – surprisingly normal. However, Shotton also noted that “computer dependents” typically began their involvement at an earlier age than non-dependent users, were often socially isolated, and particularly motivated by intellectual stimulation. These initial findings were formative in the development of research directions for the psychological study of problematic video-gaming. Griffiths (1991) argued that video-game addiction might result from a pre-existing addiction to television, coupled with the realisation that video-games, unlike other media, allow for user input. This interactive dimension is thought to be what makes video-games simultaneously more engaging and entertaining for players, but also what makes them particularly susceptible to problematic use.

In the following sections, the concept of video-game addiction will be discussed primarily from three perspectives: (i) player-related factors, i.e. demographic- and personality-based influences which may be specific to video-game
players; (ii) activity-related factors, i.e. structural characteristics specific to video-games that may be responsible for maintaining problematic involvement; and (iii) motivation-related factors, i.e. the more general relationship between video-games and players in terms of motives to play and gratifications received through play.

Are video-games addictive?

The concept of video-game addiction remains a contentious issue and current researchers continue to debate the most valid and reliable criteria. On the one hand, multiple authors have argued that any psychologically rewarding activity has the potential to lead to addiction if taken to excess (Orford 1985; Shaffer, Hall & Vander Bilt 2000; Weil 1972). Essentially, the argument is that since an addicted person uses the activity or substance in question to escape from his or her reality, any activity which can reliably and sufficiently alter one’s mood is likely to be participated in excessively by a small proportion of the population (Wood & Griffiths 2007). This has been extended from generally recognised conditions, such as substance dependence and pathological gambling, to ‘technological addictions’, including video-gaming (Griffiths 1995, 1996). One implication of this perspective is that it makes less sense to focus on specific addictive activities in order to understand the aetiological processes that drive problematic involvement; instead, it suggests a focus on addiction as a whole, as well as on individuals who seem to be more susceptible to developing addictions than others (Wood 2008a).

One useful conceptual framework is Brown’s general theory of addictions. According to Brown (1989), addiction would appear to involve several core elements:

- The activity cognitively or behaviourally dominates the person’s life
- The activity provides physiological arousal or relief from unpleasant feelings
• The activity requires increasing involvement in order to achieve the same level of arousal

• The activity causes conflict with others, work, obligations, or one’s self

A large number of studies have therefore focused on demonstrating these characteristics in relation to excessive video-game play. In his cognitive-behavioural perspective of video-game addiction, Turner (2008) asserted that addictions can develop through either positive or negative reinforcement, and that video-games potentially provide both: positive reinforcement in the form of physiological arousal and elation at succeeding, and negative reinforcement in the form of escapism. According to this view, video-gaming addiction, as with other addictions, develops in response to negative mood states; the individual discovers that video-games provide a reliable means of mood modification, and consequently comes to depend on them. The combination of positive and negative reinforcement received through play causes this behaviour to become so strongly conditioned that it becomes an additional problem to the pre-existing mood states.

However, although there is a general tendency to label any behaviour as addictive if it is repetitive and has negative consequences for the individual, psychological disorders should not be defined by social disapproval but by the underlying mechanisms that are responsible for maintaining that behaviour (Blaszczynski 2008). Furthermore, prematurely describing a behaviour as addictive runs the risk of creating ‘moral panics’ that exacerbate public fears about relatively harmless activities, while also trivialising genuine disorders (Cohen 2002; Wood 2008a, 2008b). Regarding video-gaming specifically, Wood (2008a) has provided case studies which suggest that: (a) some video-game players are labelled as ‘addicts’ by friends, family members, or significant others when there are no consequences of their gaming behaviour; (b) some people turn to video-games as a
way of avoiding pre-existing problems; (c) some people come to label themselves as addicts due to (a) and/or (b); and (d) some players have poor time management when it comes to controlling the extent of their involvement. Concerning this last point, Wood argued that time loss is the primary consequence of excessive video-game play, but whether this is considered to be negative relies on subjective value judgment. Accordingly, he suggested that excessive play might simply be a symptom of poor time management, rather than resulting from anything inherently addictive about video-gaming. For example, Blaszczynski (2008) has argued that a lack of control must be present in order for a behaviour to be classified as an addiction, and it is generally agreed that this is central to all addictions, especially behavioural ones. Although some evidence suggests that problematic online video-game use is associated with a lack of self-control (Kim, Namkoong, Ku & Kim 2008), relatively little research has been conducted to investigate this issue.

In line with these debates, Stern (1999) conducted a review which examined whether problematic video-gaming represents a ‘primary’ or ‘secondary’ problem. In particular, he considered whether excessive video-gaming could be classified as a relatively newly-discovered disorder that is dormant within the individual when video-games are unavailable, or whether the behaviour manifests as a result of existing conditions or deficiencies, such as insufficient social support, compulsiveness, or an ‘addictive personality’. Stern himself argued that problematic video-gaming represents a secondary condition – it serves to exacerbate other conditions by providing a new, impersonal way of interacting with others and entertaining one’s self, but otherwise is simply a new expression of extensively researched problems. However, a number of authors have argued in favour of establishing video-gaming addiction as a construct in its own right. Fisher (1994), for example, wrote that video-game addiction “may be characterised by a subjectively
experienced, overwhelming need to play, together with negative behaviour or feeling states consequent on this need which spill over into everyday social experience” (p. 549). She argued in favour of the construct on the grounds that ‘pathological’ players were found to spend significantly more time playing than social players, and for longer durations, as well as spending more money per week, being more likely to borrow money to play, borrowing greater amounts, and a greater self-awareness of playing to excess than non-pathological players.

Dill and Dill (1998) argued that video-games are created with the intention of maximising the player’s enjoyment, and frequently utilise reinforcement and punishment schedules that, while challenging, are nevertheless achievable, thereby encouraging goal-directed behaviour which may lead to excessive play. The ability to play in first-person perspective, as well as to select or create characters that align with the player’s own appearance, preferences, personality, or values, allow players to identify more strongly with their in-game personas and effectively participate as themselves in scenarios that are impossible outside the video-game medium. In a similar vein, Leung (2004) has suggested that the main appeal of video-games for addicted players is that they offer control to individuals who feel relatively powerless in their ‘real-world’ lives; players with existing difficulties relating to self-esteem or social support develop ways of negotiating the game world, solving puzzles or challenges presented to them, and have the opportunity to receive praise from fellow players upon successful performance. These features prove especially gratifying for these troubled individuals, facilitating patterns of play which interfere with other important aspects of their lives.

In summary, an increasing number of studies suggest that video-games represent a problematic activity for some players, but theorists disagree as to whether the underlying mechanisms responsible for this behaviour reflect a *bona fide*
addiction. In particular, authors have emphasised the necessity of establishing the construct in terms of aetiological processes that are argued to be common to all addictions, especially a lack of control.

*Comparisons with pathological gambling*

Due to this scepticism regarding the legitimacy of the construct, research concerning video-game addiction has relied on comparisons with other problematic behaviours, especially pathological gambling. This comparison was perhaps inevitable given that pathological gambling is the only behavioural addiction which has been endorsed by the American Psychological Association (Wood 2008a). Griffiths (1991) was among the first to suggest that video-gaming, like gambling, could be considered a non-substance addiction if taken to excess. He advocated the adaptation of DSM-III-R criteria for pathological gambling to amusement machine play (i.e. including arcade video-gaming), as well as a polythetic approach wherein the individual would be categorised as an addict if he or she met at least four of the nine criteria. These criteria were:

1. Frequent play
2. Increasing monetary involvement
3. A need to play more frequently in order to maintain the same level of arousal (i.e. tolerance effects)
4. Feelings of restlessness when unable to play
5. Chasing losses
6. Unsuccessful attempts to cease play
7. Prioritising play over school or work commitments
8. Play affecting other activities or responsibilities
9. Continued involvement despite negative financial consequences
Early empirical support for this perspective included a study by Rozin and Stoess (1993), who found that addiction scores for gambling and video-gaming correlated moderately ($r = .30$) among undergraduate students and their parents, and that this effect was one of the strongest associations among a range of potentially addictive behaviours. This finding was later replicated by Greenberg, Lewis and Dodd (1999), albeit with a markedly stronger effect ($r = .72$) when substance and behavioural addictions were compared separately. Fisher and Griffiths (1995) expanded this framework and noted numerous structural similarities between slot machines and arcade video-games, including: responding to predictable stimuli governed by a software loop; requirements for concentration and hand-eye co-ordination; goal-directed behaviour rewarded by aural, visual and incremental (points in video-games, cash in gambling) rewards; and opportunities for peer group interaction and approval.

As a result of this comparison, early measures of problematic video-gaming comprised of reworded DSM criteria for pathological gambling. Fisher (1994) developed the DSM-IV-JV, a scale for the assessment of arcade video-game addiction in youths, from DSM-IV gambling criteria. These criteria were progression and preoccupation, tolerance, withdrawal and loss of control, escape, chasing, lies and deception, illegal acts, family or schooling disruption, and financial bail-out. Early studies employing this measure generally concluded that arcade video-game playing resembled pathological gambling in some instances. Furthermore, as technology has progressed, distinguishing between gambling and gaming in modern scenarios has been complicated by the increasing use of video-game technology in gambling machines, as well as many video-games containing content related to gambling (Wood, Griffiths, Chappell & Davies 2004). This overlap of structural features has been used to justify comparisons between the two activities.
More recently, however, this approach has also received numerous criticisms. Wood (2008a) criticised the tendency for researchers to adapt existing criteria for gambling addiction – sometimes by simply substituting the word ‘gambling’ for ‘gaming’ – and pointed out important differences between the two activities. The first major difference is absence of financial incentive in video-gaming; whereas gambling rewards performance with monetary gain, and punishes poor performance with monetary loss, no such motivation exists in video-gaming (and if it does, it ceases to be video-gaming and instead becomes a form of gambling). This financial incentive is considered to be central to pathological gambling because it explains (a) why individuals begin gambling (i.e. for financial gain), (b) negative consequences of problematic involvement (i.e. financial loss), and (c) why individuals continue to gamble despite negative consequences (i.e. ‘chasing losses’). Conversely, video-games are generally played for fun, and excessive involvement does not generally carry significant financial ramifications. Indeed, gambling activities are generally not inherently entertaining, and as such the possibility for financial reward is argued by some researchers (e.g., Turner, 2008) to be the predominant motivation for participation. The second major difference is that the extent to which tolerance effects affect problematic video-gamers is unclear. For pathological gambling, tolerance refers to the individual needing to bet with increasing amounts of money in order to maintain the same level of arousal. For problematic video-gaming, systematic alterations are generally limited to increased speed or difficulty levels, although playing in groups or for status in competitive online communities may have similar effects.

In summary, the argument against comparing problematic video-gaming with pathological gambling is best summarised by Blaszczynski (2008):
Conceptually, simply adapting and applying a set of diagnostic criteria used to define one disorder ... to define a new disorder is not scientifically acceptable or logical. It must be empirically demonstrated that similar and consistent aetiological processes and principles apply across each related disorder. (p. 179)

In particular, since video-gaming does not require the financial investment that is considered central to the development of pathological gambling, it has been argued that video-gaming cannot be considered addictive until its own aetiological processes have been sufficiently determined.

Despite these concerns, studies of problematic video-gaming continue to employ measures which have been derived from criteria for pathological gambling. Many of these issues are discussed in Paper 1, and so shall not be repeated here in their entirety. Briefly, the main problem with the applicability of early studies of problematic video-gaming to modern scenarios is the evolution of the video-gaming environment. During the 1980’s and early 1990’s, video-games were played predominantly in arcades, where players would pay to play for a specified duration or until certain conditions were met (e.g. running out of ‘lives’). These financial and environmental constraints were the basis of comparisons between video-gaming and gambling; however, with the advent of home-based consoles and portable devices such as mobile phones, video-games can be played anywhere and without the constant monetary demands of coin-operated arcade machines. Consequently, many of the criteria for problematic video-gaming which have been derived from pathological gambling measures – especially those which refer to financial commitment and impact – are no longer applicable in modern settings. Although some authors have subsequently removed items related to financial commitment or criminal activity from problematic gaming measures (e.g. King, Delfabbro & Zajac
2011), this remains a limitation of extant research. Recent studies have begun to move away from this comparison, and instead focus on the personal, cognitive, social and environmental factors which may provide a better explanation of problematic behaviour.

Why might video-games be addictive?

Rau, Peng and Yang (2006) argued that the mechanism for online game addiction could be described using flow theory (Csikszentmihalyi 1975). This theory states that the addict becomes so involved in playing a game that his or her entire consciousness is absorbed, and sense of time becomes distorted, resulting in a so-called ‘flow’ state. This occurs most frequently when the player’s skill is sufficiently balanced with the challenge provided by the game. When players complete challenges that are matched to their skill levels, they experience empowerment, exhilaration, improved self-esteem, and higher self-efficacy. According to this theory, addiction is to this sense of self-worth rather than anything inherent within the game itself. Flow also results in time loss, a quality which is rated as a primary motivation to play by many gamers, and which may be particularly appealing to problematic players who play to escape from their offline realities (Wood & Griffiths 2007). As compared with other potentially reinforcing behaviours, such as lottery gambling, and more similar to slot-machines, video-games also contain a high event frequency with near-constant opportunities for ‘pay-offs’, which may further explain why individuals lose track of time while playing (King, Delfabbro & Griffiths 2010a). Game designers attempt to construct games such that the challenge increases as the player’s skill and familiarity with the game improves, providing constant reinforcement in the form of these flow states.
An alternative framework has been derived from two-factor humanistic needs theory (Herzberg 1966), which asserts that satisfaction and dissatisfaction, rather than representing opposite ends of a continuum, are actually independent of each other. Needs and motives can be broadly separated into ‘hygiene factors’, which decrease dissatisfaction if present but do not increase satisfaction, and ‘motivators’, which result in satisfaction if present but do not increase dissatisfaction if absent. According to this model, addicts and non-addicts can be separated according to whether online gaming represents a hygiene factor or a motivator for them. In support of this concept, Wan and Chiou (2006a) found that online game addicts scored more highly on measures of dissatisfaction, whereas non-addicts scored more highly on measures of satisfaction. Furthermore, levels of satisfaction and dissatisfaction were independent of the type of need being assessed (e.g. safety, love and belonging, self-esteem, self-actualisation). On the basis of this, the authors concluded that online game addiction stems from “the relief of dissatisfaction rather than the pursuit of satisfaction” (Wan & Chiou 2006a, p. 323).

Another framework proposed by Grüsser, Thalemann and Griffiths (2006) classified gaming behaviour as pathological if participants met three or more criteria from the World Health Organisation’s ICD-10. Gentile’s (2009) framework of videogame addiction was broadened to include additional factors, including salience, euphoria or relief, tolerance, withdrawal symptoms, conflict, relapse and reinstatement. King, Delfabbro and Zajac (2011) adapted Young’s (1998) Internet Addiction Test to create a 20-item scale which mapped onto Griffiths’ (2005) components model of addiction, including salience, tolerance, withdrawal, relapse, mood modification, and conflict.

These measures represent a relatively small sample of the more commonly used measures of problematic video-gaming. Although scales tend to differ in how
they operationalise each dimension, most consider negative consequences of play, preoccupation/salience, and mood modification to be paramount when classifying individuals as problematic players.

**Prevalence of problematic involvement**

Ferguson, Coulson and Barnett’s (2011) meta-analytic review of prevalence studies estimated that prevalence of problematic video-gaming in the general population is about 3.1%. In the absence of a ‘gold-standard’ measure, however, prevalence estimates vary widely according to the criteria used for problematic involvement. To illustrate, Gentile (2009) gave his participants the option to respond ‘yes’, ‘no’ or ‘sometimes’ to questions which comprised a measure of problematic video-gaming. He found that 19.8% of American video-gamers aged 8-18 could be classified as pathological gamers if ‘sometimes’ responses were coded the same as ‘yes’ responses; if scored as a ‘half-yes’, this figure fell to 8.5%, and if scored as a ‘no’, it became 7.9%.

Many studies of the general population have found insufficient levels of problematic gaming to provide reliable estimates, and consequently many researchers have chosen to focus on gaming populations specifically. Phillips, Rolls, Rouse and Griffiths (1995) found that 7.5% of players aged 11-16 could be classified as problematically involved using adapted DSM-III-R addiction criteria. Wan and Chiou (2006a) used an adapted Internet addiction measure and found that 46% of 182 Taiwanese adolescents highly engaged with online games could be considered addicted. Grüsser, Thalemann and Griffiths (2006) found that 11.9% of 7069 respondents to a questionnaire in an online gaming magazine met ICD-10 criteria for gaming addiction.
Challenges of video-gaming research

In addition to theoretical concerns, video-game researchers have been presented with numerous methodological challenges. In an early study by Griffiths and Dancaster (1995), the authors noted that, for a simple action video-game, none of their 24 participants rated their play during the study as ‘very exciting’, and suggested that longer playing periods during experimentation may be necessary in order to allow subjects to ‘get into the game’ and increase their physiological arousal. Furthermore, they suggested that games may need to have sufficient graphics, user-control, and be sufficiently challenging in order to be arousing. Finally, they highlighted the need for experiments to provide ecological validity when replicating gaming settings. As Wood and Griffiths (2007) have described, this can be especially challenging given that video-games are often played in relaxed social settings with close friends, and players generally establish patterns of behaviour and master skills over longer periods of time than are feasible for laboratory-based simulation. There is also a general reliance on self-report measures for frequency of play and problematic behaviour, which may risk underestimation due to denial or individuals losing track of time during play (Leung 2004). However, it is also difficult to envisage a non-invasive method of observation that would provide greater ecological validity.

King, Delfabbro and Griffiths (2009) separated the challenges faced by video-game researchers into three broad categories: player-specific factors, which relate to the personalities or behaviours of video-game players; researcher-specific factors, which relate to the researcher or research design; and external factors beyond the control of the researchers. Examples of player-specific factors include: prospective players being too engaged in video-games to participate at the time of research; players becoming defensive due to perceived antagonism between
psychological research and video-gaming; deliberate dishonesty due to denial, guilty, or embarrassment; video-games being so central to the individual’s life that he or she is unable to relate his or her behaviour to negative consequences; participating in research heightening the individual’s self-awareness, thereby removing the anonymity and escapism for which they play video-games; and participation being seen as a ‘one-way transaction’ without benefit to the participants. Researcher-specific factors include: the researchers being too demographically or socio-culturally different from participants, thereby inhibiting the extent to which participants feel the researcher is able to relate to them; gamers of different ages or with different preferences appearing in video-gaming venues at different times, and thus findings are affected by the time of day at which sampling takes place; the researchers’ unfamiliarity with video-game culture causing an inability to establish rapport with players; and discrepancies between laboratory and real-world findings caused by the inability for participants to choose their preferred games, settings, time, or length of play. Finally, external factors include: a lack of privacy in video-gaming environments which may affect participants’ responses; potential problems with obtaining permission from the management of video-game venues to research their clientele; and reluctance from the video-gaming industry to participate in research due to a general tendency in the media to emphasise the negative aspects of gaming.

Rapid technological advancement also means that research is in danger of becoming obsolete or outdated relatively quickly. Phillips et al. (1995) posited that contemporary video-games required more complex skills, and contained more realistic graphics, than the arcade video-games of the 1980’s, and consequently may have been more likely to lead to problematic involvement. Subsequent technological developments have offered exponential improvements in these regards, meaning that
these concerns are perhaps more pronounced when comparing modern video-games to those employed in studies throughout the 1990’s. An additional concern is whether to focus on video-games generally, or to focus on specific platforms such as PCs or handheld devices. In a study of English undergraduates, Wood and Griffiths (2007) found that the most popular platforms were dedicated gaming consoles, with 62.5% of participants using them at least once per week; this was followed in popularity by offline PCs (47.5%), mobile phones (27.5%), online PCs (25.0%) and portable gaming consoles (17.5%). It is unlikely, for instance, that mobile phone games can be reliably compared along meaningful structural characteristics to games played on dedicated consoles, since the former are more limited by processing power and tend to cater to less engaged players. These difficulties may be exacerbated by including semi-regular video-game players alongside ‘hardcore’ players in study samples, which may confuse findings and provide problems for interpretability.

With these potential limitations in mind, the following sections will describe factors that have been associated with problematic video-gaming in previous studies.

*Relationship with frequency of play*

There is mixed evidence for the association between problematic video-gaming and time spent playing video-games. Although it is generally agreed that problematic habits are usually associated with greater time expenditure, several authors have argued that this is not always the case (Charlton 2002; Charlton & Danforth 2007, 2010). It is possible for an individual to spend many hours per week playing video-games without it affecting other important aspects of his or her life, and it is also possible for video-gaming to have negative consequences for an individual despite a relatively low frequency of play (Griffiths 2010a). For example, Skoric, Teo and Neo (2009) found that, among a sample of 333 video-game players
in Singaporean elementary schools, time spent playing video-games on weekdays was positively correlated with English exam performance and unrelated to science and mathematics performance, whereas a measure of addictive tendencies was negatively related to all three. The authors interpreted these findings as indicating the possibility that investment with video-games does not necessitate poor time management, and can even have positive consequences such as improved language skills.

Despite findings such as these, high engagement is typically viewed as a necessary, but not sufficient, condition for problematic involvement, and most studies report sizeable correlations. Lemmens, Bushman and Konijn (2006) found that time spent per week playing video-games correlated with number of exhibited addictive symptoms at $r = .71$. Gentile (2009) found that pathological gamers played for twice as many hours per week as non-pathological gamers.

**Gender**

Gender has been one of the more extensively investigated correlates of problematic play. Historically, video-gaming has been viewed as a predominantly male pastime, due to a perceived tendency for technological pursuits to be more intrinsically motivating to males, as well as video-games generally being targeted and marketed towards male populations. Early research served to reinforce this notion. Fisher (1994) noted that a significantly higher proportion of adolescent regular video-game players were male, that mean scores on the DSM-IV-JV were significantly higher for males (1.09 vs. 0.57), and that males scored significantly higher on five of the nine criteria for pathological video-gaming. Likewise, Phillips et al. (1995) found that males aged 11-16 were 1.4 times more likely to admit to playing video-games than females, played for significantly longer periods at a time,
played more frequently, and were more likely to report neglecting homework and positive mood changes after playing. In addition, 37 of the 50 children who met criteria for addiction were male. Of particular note is a study by Greenberg et al. (1999) who found that observed gender differences for video-game addiction were greater than for any of their other measured addictions, and that this effect appeared to be unique to video-gaming among other technological addictions such as television and Internet use. Many other studies (e.g. Chan & Rabinowitz 2006; Chiu, Lee & Huang 2004; Delfabbro, King, Lambos & Pulgies 2009; Gentile 2009; Koezuka et al. 2006; Rau et al. 2006; Weaver et al. 2009) have reported similar findings.

Gender discrepancies appear to be particularly pronounced in online samples. For example, Grüsser et al. (2006) found that 84% of a sample of 7069 online gamers were male. Lo, Wang and Fang (2005) found no significant gender effect among a sample of Taiwanese college students for average length of online gaming session or weekly frequency of online game use. However, there were large differences in the number of online game players per gender (79.6% of males vs. 20.4% of females), and a significantly larger proportion of females reported never playing online games (87.6% vs. 50.6%). From this, the authors concluded that, although females were less likely to play online games, those who did so exhibited similar patterns of behaviour to their male counterparts. Similarly, Kim et al. (2008) found that 82.7% of 1471 respondents to an online survey on various Korean gaming websites were male, but gender differences for a measure of online game addiction were non-significant.

One explanation for these discrepancies is that males and females differ according to their preferences for structural characteristics within video-games. In their study of 382 university students and their associates, Wood et al. (2004) found that significantly more males held realistic settings, games being based on factual
events, character development over time, long or medium game duration, customisable game settings, multiplayer capabilities, sophisticated AI, skill development, ‘shooting things’, a variety of different forms of transport within a game, and ‘surviving against the odds’ as important to their enjoyment. Conversely, females reported greater preferences for cartoon-style graphics, fantasy settings, use of humour, short game duration, rapid advancement of play, physical feedback, solving puzzles, avoiding ‘dangerous places or spells’, finding things, collecting things, points accumulation, and finding bonuses. These findings have a number of important implications. First, they suggest that males and females differ in terms of the type of games that they prefer, which may affect studies that only focus on a particular game or genre. Second, the generally greater preference for multiplayer capabilities among males suggests that they might be more susceptible to problems related to play if online games (which generally facilitate multiplayer functions) hold greater addictive potential. The general preference among females for shorter game duration may represent an additional protective factor against problematic habits. Finally, the authors suggested that female preferences for finding and collecting items, points accumulation, and finding bonuses may represent a motivation to complete with one’s self and hence solitary play, as opposed to competing with others. Paper 2 of the present thesis describes the potential relationship between competition motives and problematic play in greater detail.

Some studies have also suggested gender differences for consequences of play. Weaver et al. (2009) found that, among a population sample of 562 Americans, female gamers scored more highly on measures of depression, Internet community support, and lower health status than female non-gamers. Male gamers scored more highly on BMI and Internet community support compared with male non-gamers. The authors suggested that these findings may reflect a tendency among female
gamers to use play as a means of ‘digital self-medication’ to remedy negative mood states by distracting themselves from real world concerns.

However, recent studies have also begun to question whether gender disparities have changed as a result of the increasing proliferation of video-games in modern societies. Chumbley and Griffiths (2006) found that gender did not significantly predict participants’ propensity to play (i.e. to either continue playing or return to playing) in either a high or low negative reinforcement condition. However, they found that player skill decreased frustration due to increased difficulty, and suggested that previous findings that males were generally more skilled than females at playing video-games might explain the male bias in the gaming population. They also noted that this effect was likely to be cyclical, given that the majority of video-games tend to target and be marketed towards male audiences. In support of this view, Wood and Griffiths (2007) found in a sample of English undergraduates that males had been playing video-games for significantly longer than females (12.4 years vs. 9.2 years), but significantly more females (79%) underestimated the time they spent playing the experimental video-games than did males (58%). On the basis of these findings, they suggested that this might simply reflect a lack of experience with video-games, and that more accurate appraisals of time expenditure may come with increasing experience. Alternatively, some authors have suggested that findings such as this reflect a greater susceptibility to problematic behaviour among female players.

Cultural differences

Although research into cultural differences for video-gaming has been relatively limited, some evidence suggests that different motivations might be associated with problematic behaviour between cultures. For example, Chiu et al.
(2004) found that primary and junior high school students in Taiwan played fewer times and for fewer hours per week than Western children, and suggested that this might be due to differences in education systems or study pressure. This hypothesis was supported by non-significant cultural effects for the number of times children played outside of their own home, which may reflect varying household conditions. Similarly, Lee et al. (2007) suggested that Korean adolescents may experience greater educational pressures and expectations than Western students which, when combined with a lack of leisure activities, may cause them to alleviate their stress or boredom by playing easily accessible computer games.

Cultural differences have also been found between Western populations. In their study of adolescent males, Lemmens et al. (2006) found that Belgian participants reported greater desire to play video-games than Dutch participants, but that Dutch participants had higher scores on a measure of addiction and spent significantly more time playing. These findings are all the more puzzling considering the proximity and shared language between these two countries.

Other personal-level correlates of problematic video-gaming

On the whole, most research has suggested that video-game players do not seem to have a uniform personality (e.g. Griffiths 1991; Rozin & Stoess 1993). However, although effects are generally small, some research suggests that several personal-level variables may be associated with problematic involvement. These include sensation-seeking (Chiu et al. 2004), need for control (Leung 2004), social anxiety (Lo et al. 2005), attention difficulties (Chan & Rabinowitz 2006), education level (Lemmens et al. 2006), and narcissistic personality traits (Kim et al. 2008).

Findings related to age are somewhat limited due to a lack of cohort data. Salguero & Morán (2002) found non-significant differences between 13-15 and 16-
18 year-olds for gaming addiction scores, frequency of play, or duration of play, although they recommended that longitudinal research would be required to demonstrate whether problems persisted beyond adolescence. Smahel, Blinka and Ledabyl (2008) found that adolescent and young adult game players scored significantly higher on measures of addiction and identification with in-game characters as compared with adult players. They suggested that this may have been due to more limited identity development associated with age, leading to increased importance of video-games to one’s identity.

**Structural characteristics of video-games**

An alternative and relatively recent approach to focusing on personal-level correlates of problematic gaming has been to focus on individual structural features of video-games. The suggestion is that some structural characteristics may play a greater role in the initiation, development and progression of problematic video-gaming behaviour (King et al. 2010a). It is generally accepted that structural characteristics of electronic gambling machines influence gambling behaviour (Wood et al. 2004), and it has been suggested that the same may be true for some features of video-games.

According to Wood et al. (2004), structural characteristics of video-games include:

- Sound (e.g. realistic sound effects, narration)
- Graphics (e.g. realistic graphics, full motion video)
- Background and settings (e.g. realistic settings, fantasy settings, games being based on a film or book series)
- Length of game (i.e. duration)
- Rate of play (i.e. speed of uptake and familiarity)
• Advancement rate (i.e. speed of progress through the game)
• Use of humour
• Control options (e.g. ability to change sound, graphics, or difficulty settings)
• Game dynamics (e.g. quests/objectives, exploration, combat, skill development)
• Winning and losing features (e.g. score tallies, ability to save progress)
• Character development (i.e. customisability, skill or personality development)
• Brand assurance (e.g. loyalty to a franchise, product placement, celebrity endorsement)
• Multiplayer capabilities

However, these features were derived from self-reports of undergraduates, and this framework assumes that only those characteristics which players rate as important to their enjoyment are relevant. An alternative framework was provided by King et al. (2010a), which separated structural features into five categories:

• Social features, including social utility, social formation, leaderboard, and support network features
• Manipulation and control features, including user input, saving, player management, and non-controllable features
• Narrative and identity features, including avatar creation, storytelling, and theme and genre features
• Reward and punishment features, including general reward type, punishment, meta-game reward, intermittent reward, near miss, event frequency, event duration, and payout interval features
• Presentation features, including graphics and sound, franchise, explicit content, and in-game advertising features
Of these, social features (Baumeister & Leary 1995; Ducheneaut, Yee, Nickell & Moore 2006; Suler 2004) and competition features (Vorderer, Hartmann & Klimmt 2003) are thought to play a central role in addiction. However, relatively few studies have attempted to relate structural characteristics to problematic gaming. Wood et al. (2004) found that realistic sound and graphics were deemed by undergraduates to be particularly important to their enjoyment of a game, which has potential ramifications for technological developments which constantly improve the ‘realism’ of these features. Chumbley and Griffiths (2006) noted that reinforcement schedules in electronic gambling machines influenced behaviour through their effects on gamblers’ mood states, and hypothesised that the same may be true for video-games. In their study of 33 game-playing undergraduates aged 18-32, they found that in-game characteristics affected boredom, excitement, and frustration, but of these only boredom and excitement correlated with willingness to play. Consequently, the authors concluded that in-game factors such as reinforcement schedules determine game persistence by increasing the excitement of players which, in turn, affects their propensity to continue or return to playing. However, one limitation of this study was that it did not address whether it was sensory rewards offered by the game, or alternatively general goal-acquisition facilitated by the game, which promoted willingness to play. Beyond these studies, attempts to relate structural features to problematic behaviour have been relatively limited.

A useful implication of this approach is that it allows for inferences about behaviour which derive from psychological context, rather than global personality-based explanations (Wood et al. 2004). It also accounts for differences between genres of video-games, since different structural characteristics are present in different genres with predictable frequency.
‘Genre’ refers to categories of video-games that share structural characteristics. Although few formal classification schema have been proposed (e.g. Griffiths 1997), examples of genres include: ‘shooters’, which focus on shooting and killing enemies; ‘adventures’, which typically use fantasy settings and emphasise exploration; ‘role-playing games’, which emphasise character growth and customisability; and ‘simulation’ games, which simulate real-world activities such as sport, construction, or management. A concern for researchers is that different types of video-game may cater to different needs or gratifications, and as such may be more likely to be associated with problematic use. For example, Lee et al. (2007) separated online games into eight categories by agreement of two experts: simulation, role-playing, web board, community, action, adventure, shooting, and sports. Simulation games were preferred by all Internet addiction risk groups, but high-risk and potential-risk players showed considerably higher preferences for role-playing games as compared with ‘normal’ users. In addition, a greater proportion of high-risk users preferred shooters and playing with others (i.e. rather than solitarily). Role-playing game users had the highest Internet addiction scores, followed by shooters, action, simulation, web board, and sports users.

An additional consideration for researchers is separating online from offline play; whereas offline video-games generally emphasise solitary play and intrinsic rewards, such as improving performance or completing all available objectives, online games often emphasise social play and extrinsic rewards, often without any endpoint which offers limitless opportunities for problematically-involved players to fuel their behaviour (Griffiths 2008a, 2010a). Lo et al. (2005) found that Taiwanese students who played online games regularly tended to score lower on measures of interpersonal relationship quality as compared with light and non-playing
participants. They suggested that heavy users may be attracted to online games due to the ability to communicate with other players instantly and anonymously, and may therefore be used to overcome social anxiety.

Media and researchers alike have been particularly concerned with the addictive potential of ‘massively multiplayer online role-playing games’ (MMORPGs), a relatively new genre which emphasises online play, character growth, reward progression, and co-operative or competitive play with friends or strangers. They also allow players to have a large amount of control over their in-game characters (‘avatars’), ranging from physical appearance to skills and combat proficiencies, and players can form groups according to common goals, interests or beliefs, co-operating with each other to achieve in-game tasks. Since this can be done anonymously, players can interact in an environment where characteristics central to offline communication and social status, such as physical attractiveness or education level, have little or no relevance. Furthermore, disagreements and failing relationships can be ‘cast aside’ without consequence, and the player has the option of creating a different identity whenever desired (Lo et al. 2005).

The unique ability of role-playing games such as MMORPGs to allow players to choose different identities is also thought to cater to self-actualisation needs (Wan & Chiou 2006a). One study found that identification with in-game avatars correlated with addiction scores among MMORPG players \((r = .22;\) Smahel et al. 2008). Additionally, since thousands of players from around the world can play the same game simultaneously and international data on player performance is widely available, playing well can result in recognition and admiration from a large number of like-minded players. These features may be particularly rewarding to players with pre-existing social difficulties, thereby promoting excessive involvement. Paper 2 discusses these issues in greater detail.
The position of this thesis

Although the concept of video-gaming addiction has gained traction in recent years, there are various reasons why it is not yet widely accepted. One reason is that the concept of addiction itself is not particularly well defined; prior to its fifth edition, the DSM did not use the word ‘addiction’ at all in its classifications of behavioural disorders (Rendi, Szabo and Szabó 2007). Despite this, in addition to media reports and anecdotal evidence there are hundreds of scientific studies of problematic video-gaming, ranging from empirical reports to case studies and meta-analytic reviews, which collectively demonstrate that video-gaming represents a problematic activity for a small, but significant, proportion of the population. Researchers continue to debate the extent to which processes which have historically characterised addictions, such as withdrawal, tolerance, and impaired control, are present for problematic video-gaming, but affected individuals usually report negative mood states when unable to play, conflict with family, friends or significant others as a result of their investment in video-gaming, and a general preoccupation with video-games which interferes with their other commitments and responsibilities. Although it can be recognised that distinguishing addiction from, for example, ‘dependence’, ‘excessive use’, and ‘compulsion’ could be used to inform research on the psychological mechanisms underlying the development of problematic behaviour, this seems to be a secondary consideration in light of these negative consequences. There is also the possibility that there is no single set of processes which adequately accounts for the origins of problematic habits in every affected individual; therefore, until conclusive evidence emerges, other approaches which avoid the issue of addiction entirely may still prove to be equally fruitful for determining why some players become problematically involved where others do
not. The thesis which follows is particularly influenced by Orford’s (2001) assertion that excessive behaviour stems from the *relationship* between an individual and an activity, rather than the traits of the individuals or the characteristics of the activity alone. For example, skilled video-game play may offset low self-esteem, or substitute for perceived deficits in other areas of the individual’s life, such as deficient peer relationships. Although some individuals may be more susceptible to developing problematic habits, or some types of game may be more ‘addictive’ than others, it seems more likely that understanding why problematic gamers are drawn to video-games in terms of *how they think and feel about them* will be instrumental in determining why they feel unable to control the extent of their involvement. Furthermore, given that virtually all accounts of addiction assume that the problem is not transient, a longitudinal approach is crucial for understanding the extent to which factors related to problematic gaming influence behaviour over time. Due to the limitations of cross-sectional designs, previous studies have been largely unable to ascertain whether these factors represent causes or consequences of behaviour. The studies comprising the present thesis were conducted with these issues in mind.

The following chapter, the Exegesis, will provide an account of my own interests and motivations throughout the research programme, as well as discussing individually the rationale for each of the four studies comprising the present thesis.
Chapter 2: Exegesis

Preamble

The purpose of this chapter is to provide a rationale for the research programme which comprised the present thesis. This will begin with a general summary of my motivations to study problematic video-gaming, followed by a separate discussion of each paper to evaluate their individual contributions to the thesis.

I have been playing video-games for over two decades and personally borne witness to the shift in public attitude towards them during this period. The popular concept of a video-game player used to be of an intelligent white male, adolescent or young adult, socially awkward, and with relatively few competing interests for his attention. However, in the space of just 20 years, video-gaming has grown from a somewhat clandestine pastime to a dominant cultural force – especially in the West – and the transformations of the player base, societal attitudes towards play, and the nature of the games themselves has been marked. Whereas video-gaming was once limited to arcades, living rooms, and parents’ basements, modern games are virtually ubiquitous. New computers come pre-installed with at least a dozen games; public transport is plastered with advertisements for the latest AAA titles; children and adults alike play on their mobile phones in the street. This rise in popularity has obvious implications for research. Rarely have ‘video-game players’ been conceptualised simply as members of the general population, and the danger of studies becoming outdated or obsolete is perhaps more salient in cyberpsychology than in any other field.

During my initial review of the literature, I found that media reports and scientific studies tended to focus on the negative aspect of video-gaming, and centred on two main narratives. Firstly, the 1990’s popularised the notion that violent video-
games had the capacity to induce aggressive tendencies in otherwise innocuous minors. For example, the culprits of the Virginia Tech, Sandy Hook and Columbine mass shootings were all (and always tenuously) linked with violent video-games, and several reviews of the scientific literature purported to demonstrate both short- and long-term associations between violent content and violent behaviour (Anderson et al. 2010; Anderson & Bushman 2001; Anderson & Ford 1986). The second, more recent narrative has centred on the particularly addictive potential of MMORPGs, with reports of individuals effectively abandoning their partners, families, and/or jobs, surrendering themselves to their preferred ‘second lives’ in the virtual sphere. A famous example is of the Taiwanese video-gamer ‘Little Grey’, who took approximately 400 days to complete all in-game objectives in Blizzard Entertainment’s World of Warcraft (Brownlee 2009), while there are continued reports of serious harm or death caused in-part by extended video-gaming sessions (e.g. Cheung 2008; Roberts 2015; Spencer 2007).

Due to this portrayal of video-gaming as a damaging – even dangerous – social force, it is not surprising that video-game players have become somewhat disenfranchised with the scientific study of video-games. During the course of my research I have frequently been met with obstinacy, suspicion, and refusals to participate, and I have needed to invest significant effort to reassure participants of my research intentions. Gamers frequently make comparisons with other entertainment forms, especially television viewing, and question why definitions of excess and addiction seem to be more stringent when applied to some activities than others. Video-gaming, they argue, is simply their preferred leisure activity, and consequently it occupies a considerable proportion of their time; measures of playing frequency are therefore simply proxies for their available leisure time, and playing upwards of twenty or thirty hours per week does not necessitate negative
consequences – even if it seems excessive to an ‘outsider’. There was a perceived fundamental misunderstanding in the literature as to what constitutes a typical ‘gamer’, with a general reliance on second-hand accounts or popular opinions rather than naturalistic studies of how video-games are usually played. Although there were undoubtedly sections of the gaming population who played far more excessively than could be considered healthy or normal, public fears surrounding video-games seemed to rely on generalising these relatively small numbers of gamers to the entire gaming population.

However, the interactive component which makes video-games particularly engaging simultaneously appears to be responsible for making them prone to problematic use by susceptible portions of the population. Indeed, an observation I have made during the past few years – and which I believe is somewhat unique to video-gaming – is that the term ‘addictive’ is generally used in a positive way by gamers to describe games that are particularly immersive and enjoyable. Although this reinforces Wood’s (2008a) notion that time loss is the most desirable ‘side-effect’ of gaming for most players, it also captures the somewhat sceptical or blasé attitudes of many gamers towards the concept of addiction. Anecdotally, my experience is that most gamers will assume that problematic involvement is the fault of the affected individual, rather than resulting from some danger inherent within video-gaming. “I’ve played video-games all my life, and I’ve never had a problem” is a popular argument which is often employed to defend video-gaming from perceived attacks.

On the one hand, this argument has some merit: if the majority of video-gamers are able to play with no or few negative consequences, that would imply that (i) public and/or media concerns about video-gaming have been somewhat premature, and (ii) the answer to the question of addiction likely lies in the affected

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individuals rather than in the nature of the activity itself. On the other hand, the same is also true for other addictive activities, such as gambling, smoking, and drinking: these activities, too, are enjoyed in moderation by the majority of the population, but are still recognised as addictive and potentially dangerous to susceptible individuals. This recognition is crucial, because in its absence there is no perceived justification for support networks or treatment programmes for affected individuals. Although the social cost of video-gaming has probably been exaggerated in the media during the past four decades, the fact remains that the scientific literature is littered with accounts of players who suffer from genuine and severe difficulties related to video-games, ranging from physical conditions (e.g. repetitive stress disorders, carpal tunnel syndrome, eye strain) to perceived inabilities to control the extent of one’s involvement, social difficulties, and play interfering with academic or occupational pursuits. It became clear to me that, although the potential for video-games to have negative consequences for players should not be overstated, neither can it be denied: a minority of players appear to become problematically involved with video-games in processes that seem to mimic those for other appetitive (or ‘addictive’) behaviours. Although small in number within the context of the wider video-gaming population, the ubiquitousness of modern games is such that even small percentages of affected individuals can translate into thousands, if not millions, of players worldwide.

The overarching question of research related to problematic video-gaming, then, has been why this minority experiences problems when the majority does not. As described in the previous chapter, attempts to answer this question in the literature can be broadly separated according to three main approaches: (1) whether it is something specific to the affected individuals, especially their personalities; (2) whether it is something specific to a particular type of game(s) which makes them especially addictive; or (3) whether it is something specific to the function of video-
games in the lives of affected individuals, such as satisfying otherwise unfulfilled needs, online interaction substituting for deficient offline relationships, or feelings of powerless or inability which are alleviated through in-game successes. Beginning with my Honours project in 2010, which was also conducted at the University of Adelaide, the purpose of the present research programme was in part to evaluate which of these three approaches holds the most promise for future research. Each of the four papers of the present thesis was based on findings from an online survey of Australian adults highly engaged with video-games, and which included measures related to each of the three aforementioned approaches. The full survey (provided in Appendix 2) was administered to over 600 video-game players at four equidistant intervals over the course of 12 months, and included measures related to demographics, personal circumstances (such as employment and relationships), health, gambling involvement, frequency/nature of Internet and other technology use, perceived social support (Zimet, Dahlem, Zimet & Farley 1988), self-control (Tangney, Baumeister & Boone 2004), psychological distress (Lovibond & Lovibond 1995), and video-gaming habits, among others. Although not all of the data were ultimately used for the four papers comprising the present thesis, each paper (as well as my Honours study) can broadly be viewed as an attempt to address each approach: my Honours study and Paper 1 of the present thesis aimed to address the first approach, Paper 2 aimed to address the second approach, and Papers 3 and 4 aimed to address the third approach. Due to historical comparisons between video-gaming and gambling, my Honours study investigated the role of individual differences in problematic gaming using personality variables which had been found to explain a high proportion of variance in pathological gambling ($R^2 = .71$; Myrseth, Pallesen, Molde, Johnsen & Lorvik 2009). Although this same combination of variables was found to also predict problematic gaming, the observed effect was
markedly smaller ($R^2 = .22$), and only three of the ten personality measures were individually significant predictors of problematic gaming status. Although I revisited the comparison between these two activities in Paper 1, I interpreted these findings as reflecting the insufficiency of gambling-based approaches to understanding modern problematic video-gaming, and sought a more integrative framework that drew upon research related to a wider range of problematic behaviours. In designing the four studies which comprised the present thesis, I was especially influenced by Orford’s (1985; 2001) excessive appetites perspective of addiction, which emphasises common characteristics and processes between different addictions, such as the roles of environmental cues, societal and peer group norms, and conceptualising harm as relative to the individual’s personal, occupational and social circumstances. In particular, I have attempted to assess the roles of social (Paper 2) and cognitive (Papers 3 and 4) factors that appear to have relevance for other types of addiction, but for which evidence pertaining to problematic video-gaming has been limited.

The following paragraphs will discuss the individual contributions of the four papers to the present thesis in greater detail.

*Paper 1*

While conducting my review of video-gaming studies, I began with the earliest available literature because I was familiar with the rapid development of video-games throughout the past four decades, and I wanted to ascertain whether scientific study had evolved accordingly. In doing so, I identified about a dozen early studies of computer, Internet and video-game use which have become seminal to the field. It is not an overstatement to say that the majority of modern papers refer to at least one of these studies when relating findings to the literature.
I noticed that these studies shared a number of commonalities. First, there was the notion that video-games were not only addictive, but that addiction could be likened to other, recognised conditions, especially pathological gambling. Second, given that most of these studies were conducted no later than the mid-1990’s, they tended to focus on arcade rather than home-based video-gaming. Video-gaming addicts could therefore be seen essentially as gambling addicts, or even substance dependents; although the medium was new, the psychological processes that governed problematic use were argued to be more or less the same.

On face value, these comparisons made perfect sense: arcade video-games were played in large, specialised facilities that could be likened to casinos, where players could meet and socialise with friends or other like-minded individuals in environments that seemed to promote excessive use. Arcade video-games and electronic gambling machines also shared many structural characteristics, most crucially short session durations that encouraged repetition, instant and clearly-framed reinforcement, and the insertion of coins to play. In the United Kingdom, arcade video-game machines were even located on the same premises as slot machines, further blurring the lines between the two activities.

However, the gaming industry has shifted drastically during the past twenty years away from arcades and towards personal computers, home-based consoles, and portable devices such as mobile phones. These platforms have become many times more powerful than their 90’s arcade counterparts, and the games themselves have increased in duration, become more aesthetically pleasing, and are generally more engaging. It is possible that individuals who are highly engaged with modern video-games would have been completely disinterested in the earlier arcade games on which initial studies were based. If so, this would suggest that the psychodynamics of video-gaming have changed markedly during this period. Just as gambling research
has needed to take account of technological developments in the industry, such as online and ‘in-play’ betting, so too would video-gaming research need to evolve to reflect these changes.

Despite this, comparisons between addiction to modern video-games and pathological gambling are still made regularly, and continue to rely on theories that were derived from comparisons with arcade video-games: perhaps the majority of extant measures of problematic gaming are based on DSM gambling criteria. Is the continued comparison between problematic video-gaming and pathological gambling still valid in modern contexts, despite the evident changes in video-gaming characteristics, environments, and the demographics of players? Is research concerning the psychological mechanisms that underlie the development and progression of pathological gambling sufficient for problematic video-gaming, or do these need to be established for video-gaming in its own right? These questions framed the study which comprised Paper 1. In particular, I wanted to investigate suggestions that the structural similarities between video-gaming and gambling make both activities appealing to the same individuals. Some authors (e.g. Gupta & Derevensky 1996) had taken this further, suggesting that video-gaming during childhood or adolescence might be a risk factor for later pathological gambling. Essentially, the argument is that once an individual becomes proficient with video-games, he or she may be attracted to gambling due to perceived similarities between the two activities, as well as the added financial incentives of gambling which are more appealing than the points or credits to which one has become accustomed to winning. The individual may also be more likely to become problematically involved with gambling than non-gamers, because he or she incorrectly assumes that skill with video-games will carry over into chance-based forms of gambling, leading to false beliefs that facilitate compulsive behaviour. This paper attempted to investigate the
validity of these arguments in modern contexts by examining the gambling behaviours of highly-engaged, adult video-game players: if these suggestions were correct, then the implications were that (i) gambling would be particularly attractive to highly-engaged video-game players, and (ii) adult video-game players would be more likely to also be highly-engaged gamblers. In this way, Paper 1 summarised and extended the findings of my Honours study and provided a framework for the remainder of the thesis – whether to continue to rely on comparisons between video-gaming and gambling, as so many other studies have done, or whether to begin examining characteristics which may be specific to problematic gaming and problematic gamers.

Paper 2

The findings from the previous paper suggested that the psychodynamics of problematic video-gaming have changed since the 1990’s. Although this likely reflects changes in the demographics of the video-gaming population, the rapid technological advancements and changing structural features of games during this period may also be a contributing factor. Some authors (e.g. Griffiths & Hunt 1998) have suggested that certain structural characteristics may be especially ‘dependence-inducing’, and that this may explain why some video-game genres seem to be more frequently associated with problematic use than others.

In particular, anecdotal reports, media speculation, and emerging empirical evidence all suggest that online games such as MMORPGs represent the highest addictive potential of the video-gaming medium. When compared with offline games, the most prominent feature of MMOs is their facilitation of socialising with, co-operating with, and competing against other players. These types of games may be particularly appealing to individuals with difficulties in their offline social
relationships, which are then affected further by excessive involvement. These individuals may even come to prefer online socialisation due to its emphasis on anonymity and casual friendships that do not entail high levels of dedication or commitment outside of the virtual world (Caplan 2003; Lo et al. 2005).

One of the aims of this paper was to examine the validity of this perception of online gaming. As compared with offline games, are online games especially prone to problematic use? If so, is there a ‘safe’ way of becoming highly engaged with these types of games? One suggestion from previous research has been that playing with friends and family members may serve as a protective factor against excessive involvement with other games by helping players to keep track of their time expenditure, as well as serving to enhance rather than detract from offline relationships (Snodgrass, Lacy, Dengah & Fagan 2011). Indeed, although general theories of addiction often emphasise social and environmental factors, relatively little is known about the social and environmental circumstances of problematic video-game players. For instance, it is generally accepted that behaviours such as narcotic use can be ‘enabled’ by family members, partners, or friends that also partake in that activity. Likewise, environmental cues such as advertisements or the sights and sounds associated with a casino or racetrack can induce desire to gamble among pathological gamblers. These findings are valuable because they suggest avenues of treatment that complement cognitive approaches, focusing on drive-reduction rather than motivating the individual to resist the ‘urge’ to play. What social and environmental factors might be pertinent to problematic video-gaming? Any identified, modifiable influences on behaviour could prove useful to clinicians or individuals seeking to reduce their involvement.

Finally, structurally diverse games such as MMOs often take a ‘kitchen-sink’ approach such that they provide numerous ways of playing in order to cater to the
widest possible audience. An individual can elect to spend time ‘grinding’ solitarily, join and work together with his or her friends to complete some in-game objective, or compete against strangers for virtual rewards. Although most players will engage in all of these activities at some point, many come to prefer particular ways of playing to others. Can this be used to explain why some online players become problematically involved where others do not? Do different in-game activities cater to different gratifications, and which (if any) are more likely to be associated with problematic use? Findings related to these questions represent a midpoint between the more traditional approaches of focusing on personal factors such as personality, and on features of the activity itself; rather, they emphasise the relationship between the individual and the activity, which depends on social and environmental contexts that may be unique to each individual.

**Paper 3**

Studies of alcohol, smoking, narcotic and gambling addictions have revealed that different addictions often reflect similar thought patterns, such as diminished self-worth alleviated through participating in that activity, a perceived inability to cut back or cease involvement, and identities centred around the behaviour in question. In the case of pathological gambling, researchers have identified specific cognitions which appear to be associated with problematic involvement, such as beliefs in luck or higher powers, attributional biases, availability heuristics, and the ‘gambler’s fallacy’. By comparison, relatively few studies have examined cognitive correlates of problematic video-gaming. Although it has been established that problematic gamers often suffer from diminished self-esteem, have difficulty controlling the extent of their involvement, and feel restless or irritable when unable to play, cognitive criteria for problematic involvement have usually referred to preoccupation – that is,
thinking about gaming when not playing, planning the next opportunity to play, and so on. This represents a significant limitation of problematic gaming criteria because these thought patterns are commonly endorsed by problematic and non-problematic gamers alike, and therefore probably reflect high engagement rather than addiction (Charlton 2002; Charlton & Danforth 2007). Furthermore, efforts to integrate maladaptive cognitions into measures of problematic gaming have been relatively limited. The DSM-5’s working criteria for Internet Gaming Disorder provide a prime example:

1. Preoccupation or obsession (cognitive)
2. Withdrawal symptoms (affective)
3. Tolerance effects (as measured by frequency of play; behavioural)
4. Attempts to cut back or cease play (behavioural)
5. Displacement of other activities (behavioural)
6. Continued use despite knowledge of negative consequences (behavioural/cognitive)
7. Deceit about extent of involvement (behavioural)
8. Mood modification or escapism (behavioural/affective)
9. Negative impact on relationships or opportunities

Of these nine criteria, only two (criteria 1 and perhaps 6) refer to cognitive symptoms.

The identification of specific cognitions associated with problematic video-gaming is therefore a promising and under-utilised approach to understanding the role of video-gaming in the lives of problematic users. Although there have been some attempts to provide frameworks that group similar gaming-related cognitions according to their content (e.g. King & Delfabbro 2014a), there have been relatively
few efforts to investigate which cognitions are able to distinguish between problematic and non-problematic gamers.

The aims of this study were thus twofold: the first was to provide a measure of maladaptive cognitions that may be associated with problematic gaming. The second was to investigate which of these cognitions might be indicative of problematic involvement when present. In doing so, this study represented one of the first attempts to provide empirical evidence of specific cognitive differences between problematic and non-problematic video-game players. If particular cognitions were found to differentiate between problematic and non-problematic gamers, it would provide an explanation which does not centre on ‘addictive personalities’ or structural characteristics that are specific to video-games. It would also extend cognitive (Davis 2001) and integrative (Brown 1989; Orford 2001) perspectives of addiction to video-gaming, and would be of particular benefit to clinicians seeking to treat clients through cognitive interventions such as CBT. Although any preliminary cognitive measure would be of limited clinical use, it was hoped that cognitions could be grouped according to similar underlying themes which would then suggest directions for further cognitions-based video-gaming research.

**Paper 4**

Although extant research has identified many correlates of problematic video-gaming, a limitation has been that most studies have been cross-sectional and unable to establish whether these effects contribute to longer-term patterns of behaviour. Since addiction is generally conceptualised as a pattern of learned responses to emotional and environmental stimuli, Orford (2001), among others, has suggested that a longitudinal perspective is vital for determining how problematic behaviours arise and are then maintained. Despite this, relatively few longitudinal studies of
problematic video-gaming have been conducted, especially to investigate long-term changes in related factors as opposed to identifying the ‘usual’ course of addiction. Additionally, due to concerns that child or adolescent populations may be more vulnerable to developing video-gaming related problems (e.g. Kuss & Griffiths 2012), previous longitudinal studies have tended to focus on these age groups.

In Paper 3, maladaptive cognitions related to perfectionism, cognitive salience, regret, and behavioural salience were found to correlate highly with measures of problematic gaming, and could be used to distinguish between problematic and non-problematic gamers. However, whether these findings reflected causes or effects of problematic gaming could not be ascertained from the first wave of data alone. The aim of this paper, therefore, was to extend the cross-sectional findings from Paper 3 by making full use of all four waves of collected data, and to investigate the extent to which maladaptive cognitions at baseline could be used to inform changes in problematic behaviour over a period of 12 months. In doing so, this paper also examined the predictive validity of the new maladaptive cognitions measure created in Paper 3. In particular, I wanted to determine whether particular types of cognition may be more pertinent to changes in problematic behaviour than others.

Several previous longitudinal studies of problematic video-gaming have used an approach which classifies each participant into one of four groups according to whether and how their habits changed during the course of the study: those who were not problematically involved at any stage, those who were not problematically involved initially but became so, those who began problematically involved but were not by the end of the study, and those who were problematically involved for the duration of the study. Due to some difficulties with the suitability of other analytical procedures to the present dataset, as well as a desire to integrate the present findings
with those from previous studies, this approach was adopted for this paper also. An advantage of this approach was that it allowed for comparisons between the four groups for each cognition type, and hence the identification of possible risk, protective and remissive factors for the development of problematic behaviour. It was hoped that the findings from this paper would provide a more complete account of the efficacy of using maladaptive cognitions to understand how individuals develop, maintain, and recover from problematic involvement.
Chapter 3: Study 1

This chapter provides a summary of the rationale, methodology and findings from Study 1. Comparisons between gambling and video-gaming have provided the foundations for several models of gaming ‘addiction’, and many measures of problematic gaming have consisted of reworded DSM criteria for pathological gambling. Some theorists have argued that structural similarities between video-games and electronic gambling machines, such as reinforcement schedules and similar technology, may make both activities appealing to the same individuals. For individuals who have played video-games frequently in youth or adolescence, gambling may seem to be a more exciting and mature form of gaming with additional reinforcement potential in the form of financial rewards. Furthermore, prior video-gaming experience has been argued to serve as a risk factor for later pathological gambling due to mistaken assumptions about the role of skill versus luck in gambling. However, as video-gaming, gambling, and the technology which drives them have all evolved over time, the validity of comparisons between the two activities may be bound to a particular time period; specifically, clinical concerns about problematic video-gaming emerged when gaming primarily took place in designated locations called arcades, where similarities between arcade video-games and electronic gambling machines were more obvious. Conversely, modern video-gaming primarily takes place within the home or on portable consoles, tablets, or mobile phones, while the demographics of players and the content of the games themselves have changed markedly.

Despite this, several models of problematic gaming continue to rely on earlier comparisons with pathological gambling. Study 1 was designed to investigate the
relevance of these comparisons to modern scenarios by assessing the extent to which highly-engaged video-game players are concurrently engaged in gambling. This was assessed by measuring the gambling frequencies of highly-engaged adult video-game players. It was hypothesised that, if previous experiences with video-games increases the appeal of gambling due to structural similarities, then highly-engaged adult video-gamers would also exhibit substantial interest and involvement in gambling. It was also expected that this association would be stronger among problematically involved video-gamers, and among males, towards whom both gambling and video-gaming have historically been oriented.

Contrary to expectations, video-gamers were found to be generally disinterested in gambling as exhibited by consistently low reported frequencies of gambling over a three-month period. Video-gaming frequency was not found to be a significant predictor of gambling frequency, and although there was a small relationship between problematic tendencies and gambling frequency, this effect disappeared when controlling for demographic factors. It was concluded that previously observed similarities between gambling and gaming may not apply in modern scenarios, and that future models of gaming addiction need to focus on characteristics which are specific to video-gaming rather than relying on comparisons with pathological gambling.
PAPER 1: THE GAMBLING PREFERENCES AND BEHAVIORS OF A COMMUNITY SAMPLE OF AUSTRALIAN REGULAR VIDEO-GAME PLAYERS

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Statement of Contributions

Cameron Forrest (Candidate)
In collaboration with my supervisors, I was responsible for devising the research programme that led to this manuscript as well as primary authorship for this paper. I conducted the literature review, data collection, and all analyses, as well as drafting the original manuscript. I incorporated suggestions from my supervisors to create subsequent drafts, was the corresponding author and primarily responsible for responses and revisions based on feedback from reviewers.

Signed.................................................................Date.................................................

Daniel King (Co-author)
I was a co-supervisor for the research programme that led to the production of this manuscript. Mr. Forrest was responsible for writing this manuscript; my role was to comment on drafts, make suggestions, and to provide editorial input. I also provided advice on responding to comments by the journal reviewers and editor.
I hereby give my permission for this paper to be incorporated in Mr. Forrest’s submission for the degree of PhD in the University of Adelaide.
Paul Delfabbro (Co-author)

I was a co-supervisor for the research programme that led to the production of this manuscript. Mr. Forrest was responsible for writing this manuscript; my role was to comment on drafts, make suggestions, and to provide editorial input. I had an advisory role regarding data analyses, and provided advice on responding to comments by the journal reviewers and editor. I hereby give my permission for this paper to be incorporated in Mr. Forrest’s submission for the degree of PhD in the University of Adelaide.
Research has noted many similarities between video-gaming and gambling activities. It has been suggested that video-game players may also be attracted to gambling, although there is limited research on this possibility. The present study examined concurrent video-gaming and gambling habits in a sample of regular video-game players in Australia ($N = 485$, 84% male, $M_{\text{age}} = 25.8$). Gambling involvement was found to be a generally unpopular activity among regular video-game players. No significant association between frequency of video-game play and frequency of gambling was found. Although significant correlations between gaming ‘addiction’ scores and gambling frequency were identified, age was the only significant predictor of gambling when controlling for all remaining variables. These findings are critically discussed in the context of past research, and future research directions concerning the link between video-gaming and gambling are proposed.
INTRODUCTION

The potential ‘addictiveness’ of video-gaming has been a subject of debate for over two decades. One line of reasoning is that video-gaming may be addictive given its structural similarities with some electronic gambling activities. An analysis by Griffiths (1991), for example, compared arcade video-gaming and gambling on slot (or ‘fruit’) machines, concluding the former may be considered a “non-financial form of gambling”. This analysis has since been expanded, noting that both tasks involve responding to predictable stimuli governed by a software loop; require concentration and hand-eye co-ordination; the duration of a playing session can be extended by the player’s skill; and, reinforcement of ‘correct’ behaviour is achieved through visual, aural, and incremental rewards (Fisher & Griffiths 1995; Griffiths & Wood 2000). Additionally, successful outcomes in both activities (e.g., cash or points) are governed by intermittent reinforcement schedules. Players in both activities may receive peer group recognition and status when they do well (Griffiths & Wood 2000). Given these similarities, early measures of video-gaming addiction were developed using problem gambling measures. Fisher (1994), for example, among many others, reworded the DSM-IV-TR criteria for pathological gambling to accommodate video-gaming.

Video-gaming has been argued to influence a developmental pathway that may result in pathological gambling (Brown 1989; Fisher & Griffiths 1995; Griffiths 1991). Gupta and Derevensky (1996) have suggested that children who regularly play video-games often learn to exert control over them though they seem guided mostly by chance at first. During adolescence, this prior experience with video-games makes gambling more appealing due to perceived similarities between the two activities. Gambling may become pathological if the individual mistakenly believes
that his or her ability to control video-games will carry over into chance-based forms of gambling. This hypothesised link between video-gaming and gambling is one reason why many studies continue to employ measures of video-gaming addiction that are based on criteria for pathological gambling (Ferguson et al. 2011).

Historical comparisons of video-gaming and gambling may have become less valid given fundamental changes to the underlying technology of these activities. Given fewer technological restrictions, video-games have become more expansive and cinematic in scope, featuring interactive narrative, realistic virtual environments, and opportunities for online competition (King et al. 2010a). Many types of modern games are qualitatively different to arcade video-games—more popular at the time of earlier studies—which required coins to play, could only be played in special locations, and session length was generally short. Similarly, the nature of gambling has evolved in response to technological changes. Internet gambling, for example, has experienced exponential growth in popularity, and allows players to gamble from the comfort of their own homes or on mobile devices. Griffiths and Hunt (1998) have suggested that newer games could be more ‘dependence-inducing’ due to greater skill level requirements, improved graphical technology, and socially-relevant themes. There have also been significant changes in the demographics of the video-gaming user base. While early studies found that video-games were primarily played by male children and adolescents, a recent report from the Entertainment Software Association (2014) suggests that the average age of video-game players is now 31 years old and that 48% of players are female. Given these changes in the structural design and user experiences offered in video-games as well as the demographic composition of the gaming population, it is unclear whether previous comparisons between video-gaming and gambling may currently apply.
If video-gaming and gambling addiction may be considered similar disorders, given their comparable structural design, player motivations, and diagnostic criteria, then it might be assumed that players at risk of one disorder would be also at risk of the other. Few studies, however, have examined concurrent participation of video-gaming and gambling behaviours to examine such a link (King, Delfabbro, Kaptis & Zwaans 2014). Past research on arcade video-gaming has reported significant relationships between gambling and video-gaming behaviour, ranging from $r = .30$ among adolescents in the United Kingdom (Fisher 1993), to $r = .40$ among Canadian teenagers and young adults (Ladouceur & Dubé 1995), to $r = .72$ among American college students (Greenberg et al. 1999). More recent studies focusing on non-arcade forms of video-gaming, however, have generally reported smaller effects, ranging from $r = .12$ among German students (Walther, Morgenstern & Hanewinkel 2012) to $r = .18$ among Canadian high school students (Wood, Gupta, Derevensky & Griffiths 2004). Similarly, in King, Ejova and Delfabbro’s (2012) study, video-game players reported low levels of enjoyment of gambling and correctly attributed outcomes on a simulated gambling task to chance (as opposed to skill) more often than an age-matched, non-gaming sample.

**The present study**

If video-gaming is proposed to increase the likelihood of gambling involvement, then this association may be more commonly observed among those who report high levels of video-gaming activity. This study therefore aimed to examine the relationship between video-gaming and gambling preferences and behaviours in a sample of individuals who report regular video-gaming. This study also aimed to provide data from an Australian sample as only one study to date (Delfabbro et al. 2009) has examined concurrent video-gaming and gambling habits.
in this population. Finally, this study aimed to examine these relationships when controlling for gender. Historically, research has found that both video-gaming and gambling, at higher levels of involvement, are male-dominated activities. It is therefore possible that the small effects reported in recent studies may have a third variable explanation, that is, that males are generally more likely to be attracted to and participate in these activities.

Previous studies have reported a positive correlation between video-gaming and gambling. It was therefore hypothesised that frequency of video-gaming would be positively related to involvement in both monetary and points-based (‘simulated’) forms of gambling. An overlap in these behaviours among regular video-game players may suggest that both activities are appealing to the same individuals due to similarities in the gratifications they provide (e.g., competition, success and arousal). In accordance with this, it was hypothesised that the combination of gender, age, video-gaming frequency, and problem video-gaming scores would significantly predict overall frequency of gambling. Additionally, while many previous studies have reported a significant correlation between problematic involvement with video-games and time spent playing them, it is possible for some individuals to spend many hours playing video-games without developing problematic habits (Griffiths 2010a). It was therefore hypothesised that video-gamers who exhibit problematic behaviour would be involved in all forms of gambling to a greater extent than non-problem video-gamers. Finally, the greater popularity of both video-gaming and gambling among males has been consistently reported in previous studies, leading to three further hypotheses: male video-gamers would engage in both activities more frequently than female video-gamers, rates of problem video-gaming would be higher among male video-gamers, and gender would moderate any relationship
between video-gaming frequency, problematic video-gaming, and frequency of gambling.

METHODS

Participants

The study sample involved 485 Australian video-gamers (84.3% male) with an average of 16.4 years’ worth of video-gaming experience (SD = 6.9, range 0–36). Ages ranged from 16 to 68 (M = 25.8, SD = 7.4). Participants reported a diverse range of genre preferences, including role playing games (30.3%), shooters (23.1%), action/adventure (19.2%), strategy (12.6%), and sports (2.9%). Other preferences included simulation, puzzle, racing, fighters, arcade, and quiz/trivia. Participation by state was: South Australia 37.3%, New South Wales 20.6%, Victoria 19.4%, Queensland 9.9%, Australian Capital Territory 3.9%, Tasmania 2.1%, Northern Territory 0.6%. Aside from South Australia, this distribution is approximately in accordance with each state’s population (Australian Bureau of Statistics 2013). A disproportionate amount of participants were from South Australia as this is the state in which all authors resided, and was the only state for which recruitment was supplemented by offline methods.

Procedure

Online advertisements were posted at several video-gaming websites with predominantly Australian user bases. Flyers were also posted throughout the campuses of two South Australian universities. Prospective participants were provided with a link to a survey which was hosted on a web survey development site (i.e. SurveyMonkey). All participants who completed their surveys received a small
voucher in compensation for their time. This research was approved by the university’s Human Ethics Subcommittee.

Advertisements were addressed to individuals with a strong interest in video-gaming. Responses were included if the individual identified as a “video-gamer” (i.e., to select participants with a gamer identity—see King & Delfabbro 2014a) and reported playing video-games for at least 7 h per week (i.e., on average <1 h per day) in the previous 3-month period. In total, 657 responses were received, 530 of which were completed. Twenty-two participants were excluded because they did not meet the inclusion criteria. A further 23 responses were removed from analyses as they were deemed to be disingenuous.

Measures

The survey contained a range of questions pertaining to participants’ video-gaming habits, including prior experiences with video-games and weekly frequency of play. Surveys generally took 30–45 min to complete. All questions referred to participants’ experiences during the past 3 months.

Gambling Habits. Measures of gambling habits were adapted from Delfabbro and Thrupp (2003). Participants were asked how frequently they gambled for money and for credits or points online using 5-point scales where 1 = ‘never’, 2 = ‘once or twice’, 3 = ‘between one and three times per month’, 4 = ‘weekly’, and 5 = ‘daily’. For the purposes of analyses, the mid-points of these ordinal categories were then multiplied to provide 3-month gambling frequencies (i.e. never = 0 occasions, once or twice = 1.5 occasions, between one and three times per month = 6 occasions, weekly = 12 occasions, daily = 90 occasions). Participants were also asked to select their main gambling activity from a list of common activities, or to provide an open-ended ‘other’ response if their preferred activity was not listed.
The Game Addiction Scale (GAS; Lemmens et al. 2009) is a 21-item measure of problematic video-gaming based on Griffiths’ ‘components’ model of video-game addiction (2005). Participants were asked to rate the frequency at which they experienced symptoms of salience, tolerance, mood modification, relapse, withdrawal, conflict, and problems caused by their video-gaming. Responses are given on a 5-point Likert scale ranging from ‘never’ to ‘very often’. Scores can range from a minimum of 21 to a maximum of 105. The scale also contains seven subscales corresponding with each component of addiction. A subscale was considered ‘met’ if a participant’s average score on its items was 3 (‘sometimes’) or greater. A polythetic classification system was used such that participants’ video-gaming was considered problematic if they met at least four of the seven components. Cronbach’s alphas were: Salience subscale \( \alpha = .66 \), tolerance \( \alpha = .67 \), mood modification \( \alpha = .78 \), relapse \( \alpha = .79 \), withdrawal \( \alpha = .87 \), conflict \( \alpha = .77 \), problems \( \alpha = .67 \), total scale \( \alpha = .92 \).

Analytical strategy

GAS scores were summed across subscales to provide a continuous ‘total score’ of problematic video-gaming involvement. Three-month frequencies of gambling were estimated from participants’ ordinal responses. Visual examination of P-P and Q-Q plots for the resulting count data indicated that they were highly non-normal (\( D(485) = 0.43, p < .001 \)) due to a high number of zero responses. Pearson’s correlations were used to examine the univariate relationships between gambling frequency and all variables of interest. As problem gaming scores have been found to correlate highly with time spent playing video-games, partial correlations were also conducted to assess their independent effects on gambling frequency. Chi-square and two-tailed independent samples \( t \) tests were used to compare video-gamers who
gambled with those who did not gamble, as well as gamers who met GAS criteria for problematic video-gaming with those who did not, on all remaining variables of interest.

A series of regressions was conducted to assess the combined ability of gender, age, video-gaming frequency and problem gaming scores to predict gambling frequency. Gambling frequency was predicted from video-gaming behaviour as the former is generally regarded as the higher risk behaviour. Due to the non-normal distribution of the gambling frequency data described above, a negative binomial model was found to provide the best fit. Negative binomial regression is similar to Poisson regression and uses a log link function to transform overdispersed count data. Due to the high number of zero responses, a binary logistic regression model was also constructed predicting whether or not participants gambled at all during the past 3 months from the same variables. All calculations were performed using SPSS for Windows, version 20.0. Unless otherwise states, all tests are two-tailed.

RESULTS

Descriptives

Participants reported playing video-games for between 7 and 120 h per week ($M = 32.69$, $SD = 20.21$). Total GAS scores ranged from 21 to 105 ($M = 44.39$, $SD = 13.92$). The most frequently met symptom of addiction was mood modification (47.8%), followed by salience (40.0%), tolerance (26.4%), problems (21.4%), relapse (12.6%), conflict (9.9%), and withdrawal (9.3%).

The mean frequency of gambling during the 3 months prior to survey was 1.74 occasions ($SD = 9.57$). Participants generally preferred to gamble for money ($M$
= 1.41, SD = 6.30) than for credits or points online (M = 0.32, SD = 4.22). While estimated frequencies of gambling ranged from 0 to 180 (i.e. bidaily), rates of gambling were generally low. Indeed, only one quarter of participants (N = 125) reported gambling in any form during the 3 months prior to study. Among participants who gambled during the past 3 months, poker machines were most frequently given as their preferred form of gambling (29.4%), followed by lottery tickets and pools (28.6%), sports betting (15.9%), scratch tickets and cards (7.1%), horse or dog racing (5.6%) and internet gambling (2.4%).

Relationship between video-gaming and gambling frequency

Correlations between video-gaming behaviour, gambling behaviour and demographic variables are presented in Table 1. Frequency of video-gaming was significantly associated with male gender, younger age, and higher problem video-gaming scores but not with frequency of gambling for money or for credits or points online. Furthermore, even when controlling for problem gaming scores, partial correlations (all df = 482) between frequency of video-gaming and frequency of gambling for money (r = -.08) and frequency of gambling for credits or points online (r = .00) were non-significant (p > .05). However, small but significant relationships emerged when controlling for video-gaming frequency between problem gaming scores and frequency of gambling for money (r = .11, p < .05), but not frequency of gambling for credits or points online (r = .08).
Table 1: Pearson’s correlations (r) between video-gaming behaviours, gambling behaviours, and demographic variables (N = 485)

<table>
<thead>
<tr>
<th></th>
<th>Gender</th>
<th>Age</th>
<th>VG</th>
<th>GAS</th>
<th>Money</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>-.06</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VG</td>
<td>-.11*</td>
<td>-.10*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GAS</td>
<td>-.02</td>
<td>-.14**</td>
<td>.42***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Money</td>
<td>.03</td>
<td>.10*</td>
<td>-.04</td>
<td>.09*</td>
<td>.64***</td>
</tr>
<tr>
<td>Cred/Points</td>
<td>.10*</td>
<td>.10*</td>
<td>.04</td>
<td>.09*</td>
<td></td>
</tr>
</tbody>
</table>

Note: For Gender, male coded as 0, female as 1. VG = number of hours per week spent playing video games. GAS = total scores on the Lemmens Game Addiction Scale (Lemmens, et al. 2009). Money = estimated frequency of gambling for money during the past three months, Cred/Points = estimated frequency of gambling for credits or points online during the past three months. All tests two-tailed. *p < .05; **p < .01; ***p < .001

No significant differences were found between video-gamers who gambled during the past 3 months and those who did not for gender (χ²(df = 1, N = 485) = 1.72, p > .05), frequency of video-gaming (t(483) < 1) or GAS scores (t(483) = 1.12, p > .05), although those who did gamble were on average slightly older than those who did not (mean difference = 1.90 years, t(483) = 2.51, p < .05, d = 0.26).

Results from the negative binomial regression are presented in Table 2. Note that parameter estimates (B) correspond to the log-transformed dependent variable. Negative binomial regression does not have an equivalent statistic to R-squared reflecting the proportion of variance in the dependent variable explained by variance in the predictors; however, the overdispersion parameter (α in the table) is used to test the overall significance of the model. For the present data, the combined effects of gender, age, hours per week spent playing video-games, and problem gaming scores were found to significantly predict total gambling frequency over a 3 month period. However, individual effect sizes were either non-significant or relatively
small. The column labelled *incident rate ratios (IRR)* contains the exponentiated
coefficient values, and may be interpreted as with odds ratios for logistic regression.
Increasing age by 1 year was therefore associated with an 8% increase in expected
gambling frequency, while each additional point on the GAS was associated with a
3% increase in expected gambling frequency. However, gender and video-gaming
frequency were not significant predictors of gambling frequency when controlling
for the remaining variables. These findings are generally consistent with those from
the binary logistic regression, which are presented in Table 3. When predicting
whether participants gambled at all during the past 3 months, only age remained a
significant predictor (*OR* = 1.04).

**Table 2: Negative binomial regression predicting frequency of gambling from
gender, age, and video gaming behaviour (N = 485)**

<table>
<thead>
<tr>
<th></th>
<th>B (SE)</th>
<th>IRR</th>
<th>95% CI for IRR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lower</td>
</tr>
<tr>
<td>Intercept</td>
<td>-2.89** (1.01)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(\alpha)</td>
<td>8.51 (0.99)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender=male</td>
<td>0.28 (0.42)</td>
<td>1.32</td>
<td>0.57</td>
</tr>
<tr>
<td>Age</td>
<td>0.07** (0.01)</td>
<td>1.08</td>
<td>1.03</td>
</tr>
<tr>
<td>VG</td>
<td>0.00 (0.01)</td>
<td>1.00</td>
<td>0.99</td>
</tr>
<tr>
<td>GAS</td>
<td>0.03** (0.01)</td>
<td>1.03</td>
<td>1.01</td>
</tr>
</tbody>
</table>

Coefficients not adjusted to account for dispersion (Chi-square/df = 1.19). \(\alpha\) = dispersion parameter.

\(VG\) = number of hours per week spent playing video games. \(GAS\) = total scores on the Lemmens
Game Addiction Scale (Lemmens et al. 2009). Model Log Likelihood = -613.70, \(\chi^2(4) = 21.94, p < .001. **p < .01

Comparisons between problem and non-problem video-gamers

A total of 75 participants (83% male) were classified as ‘problem’ gamers
using polythetic GAS criteria. Two-tailed independent samples \(t\) tests comparing
problem and non-problem video-gamers are presented in Table 4. Non-significant differences were found between problem and non-problem gamers for age and previous experience with video-games. Problem video-gamers reported playing video-games for significantly more hours per week than non-problem gamers. However, contrary to expectations, there were no significant differences between problem and non-problem gamers according to any of the measures of gambling frequency.

Table 3: Binary logistic regression predicting gambling status from gender, age, and video-gaming behaviour (N = 485)

<table>
<thead>
<tr>
<th>Included</th>
<th>B (SE)</th>
<th>95% CI for IRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-2.80*** (0.60)</td>
<td>[0.78, 1.44]</td>
</tr>
<tr>
<td>Gender=male</td>
<td>0.36 (0.32)</td>
<td>[0.78, 1.44]</td>
</tr>
<tr>
<td>Age</td>
<td>0.04* (0.01)</td>
<td>[1.01, 1.04]</td>
</tr>
<tr>
<td>VG</td>
<td>0.00 (0.01)</td>
<td>[0.99, 1.00]</td>
</tr>
<tr>
<td>GAS</td>
<td>0.01 (0.01)</td>
<td>[0.99, 1.00]</td>
</tr>
</tbody>
</table>

$R^2 = .02$ (Cox and Snell), .03 (Nagelkerke). Model correctly identifies 73.6% of cases. Model $\chi^2(4) = 9.58, p < .05$. *$p < .05$, ***$p < .001$
Table 4: Comparisons between problem and non-problem video gamers (N = 485)

<table>
<thead>
<tr>
<th></th>
<th>Non-problem gamers</th>
<th>Problem gamers</th>
<th>t (df)</th>
<th>d</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>M (SD)</td>
<td>M (SD)</td>
<td>t (df)</td>
<td>d</td>
<td>r</td>
</tr>
<tr>
<td>Age</td>
<td>25.96 (7.41)</td>
<td>25.03 (7.04)</td>
<td>1.01 (483)</td>
<td>0.13</td>
<td>.06</td>
</tr>
<tr>
<td>Experience</td>
<td>16.56 (6.95)</td>
<td>15.68 (6.53)</td>
<td>1.02 (481)</td>
<td>0.13</td>
<td>.06</td>
</tr>
<tr>
<td>VG</td>
<td>30.34 (18.67)</td>
<td>45.51 (23.39)</td>
<td>5.32*** (92.03)</td>
<td>0.78</td>
<td>.36</td>
</tr>
<tr>
<td>Money</td>
<td>1.08 (2.73)</td>
<td>3.28 (14.62)</td>
<td>1.31 (74.95)</td>
<td>0.35</td>
<td>.17</td>
</tr>
<tr>
<td>Cred/Points</td>
<td>0.15 (1.15)</td>
<td>1.28 (10.39)</td>
<td>0.94 (74.33)</td>
<td>0.27</td>
<td>.13</td>
</tr>
<tr>
<td>All</td>
<td>1.22 (3.11)</td>
<td>4.56 (23.16)</td>
<td>1.25 (74.49)</td>
<td>0.35</td>
<td>.17</td>
</tr>
</tbody>
</table>

Gambling

Experience = years’ experience with video games systems. VG = hours per week spent playing video games. Money = estimated frequency of gambling for money during the past 3 months. Cred/Points = estimated frequency of gambling for credits or points online during the past 3 months. All Gambling = estimated frequency of gambling (any form) during the past 3 months. All tests two-tailed. ***p < .001

Gender comparisons

Interestingly, non-significant gender differences were found for reported 3-month frequencies of gambling for money (male M = 1.32, SD = 5.19; female M = 1.89, SD = 10.44; t(483) < 1), gambling for credits or points online (male M = 0.14, SD = 1.00; female M = 1.34, SD = 10.40; t(75.26) = 1.01, p > .05), and total gambling frequency (male M = 1.46, SD = 5.40; female M = 3.24, SD = 20.73; t(76.90) < 1).

In accordance with previous findings, males (M = 33.67, SD = 20.78) played video-games for significantly more hours per week than females (M = 27.41, SD = 15.88), t(127.99) = 2.99, p < .01. However, no significant differences were found for total GAS scores (male M = 44.50, SD = 13.98; female M = 43.79, SD = 13.62; t(483) < 1) or problem gaming status (χ²(df = 1, N = 485) < 1).
DISCUSSION

This study investigated a theorised association between gambling and video-gaming, and suggested that this link may not be as strong as initially thought. On the basis of early arguments that video-gaming might be one step in a pathway leading to pathological gambling (Brown 1989; Griffiths 1991), it was predicted that frequency of video-game playing would be positively related to extent of gambling involvement. However, video-gaming frequency did not correlate significantly with the frequency of gambling for money or for credits or points online, even when controlling for problem gaming scores. While the high number of zero responses makes effect sizes difficult to interpret, these findings were supported by a negative binomial regression that accounted for the non-normal distribution of the gambling frequency data. A statistical model including gender, age, video-gaming frequency, and problem video-gaming scores was able to significantly predict overall frequency of gambling, however the effect sizes were very small. Overall, age was the only reliable predictor of gambling frequency over a 3 months period.

It is noteworthy that gambling rates among Australian video-gamers in the present sample were generally low. These findings are markedly different from those found in earlier studies. Ladouceur and Dubé (1995), for example, found that 30% of frequenters of a video-game arcade in Canada gambled at least once per week, while Gupta and Derevensky (1996) reported that high frequency video-gamers were three times as likely to be gambling at least once per week relative to low frequency gamers. Instead, the present findings are more consistent with those from more recent studies (King et al. 2012; Walther et al. 2012; Wood et al. 2004), with
participants gambling on just two occasions during the 3 months prior to study, and only 26% reporting having gambled at any stage during that time. For comparison, a recent survey of South Australian adults found that 36.4% gambled at least once per month (Social Research Centre 2013).

There are several possible reasons for these discrepancies between older and more recent studies. The most likely explanation is that earlier research tended to examine a particular type of video-gaming (arcade machines) that had far greater parity to gambling than modern video-games. Another reason is that past studies tended to examine gambling and video-gaming habits among the general population, whereas more recent studies have used samples of regular video-gamers. While this latter approach does not allow for generalisation to the general population, it perhaps provides a better test of the proposition that regular video-gaming leads to a greater interest in gambling. The present study’s findings support suggestions that gambling is not an appealing activity to regular video-game players, who tend to value specific types of experiences that cannot be provided by chance-based gambling. Such properties may include high skill level requirements, the need for strategy and planning, reward progression cycles, as well as the greater capacity to create powerful social identifies within groups in virtual gaming worlds. A uses and gratifications approach (Sherry et al. 2006) to future research may provide additional evidence to support this assertion.

The demographics of video-gamers have also changed markedly since the 1990s in response to new types of video-games (e.g., social gaming) that cater to different markets. Earlier research tended to focus on male youths and adolescents; perhaps the majority of modern video-gamers have reached adulthood. The mean age of video-gamers in the present sample was 26, while prevalence studies have suggested that it might be closer to 31 (Entertainment Software Association 2014). It
may be that video-gaming remains a significant risk factor for later problematic gaming habits among youth and adolescents; however, the present findings suggest that the clear majority of individuals who grow up playing video-games do not develop an involvement with gambling that differs markedly from the wider population. Indeed, this study appears to support previous suggestions that gambling is a relatively unpopular activity among regular video-gamers (King et al. 2012). If video-gaming in youth remains a potential ‘gateway’ towards later pathological gambling, it may be that these activities become fully divergent by adulthood, with the transition from video-gaming to gambling resulting in behavioural replacement rather than concurrent involvement in both activities. Future studies could examine this by focusing on the video-gaming histories of adult pathological gamblers, with attention to particular types of gaming that may precede gambling involvement.

This study similarly presents mixed findings relating to the relationship between problematic video-gaming and gambling involvement. It was predicted that video-gamers exhibiting problematic behaviour would be involved in all forms of gambling to a greater extent. While problem video-gamers reported gambling nearly four times more frequently than non-problem players, these effects did not reach significance due to unequal group variances. When problem gaming scores were used as a continuous measure, however, small but significant effects emerged. It is again noteworthy that reported gambling rates were low even among problematic video-gamers. While these findings suggest that the relationship between video-gaming and gambling involvement may be mediated by the extent to which video-gaming habits have become problematic for the individual, the effect still appears to be considerably smaller than suggested by previous studies.

Finally, this study also examined gender in the relationship between video-gaming and gambling. Only a small correlation was found between male gender and
frequency of gambling for credits or points online, and no gender effect was found for frequency of gambling for money. The finding that female video-gamers gambled at least as frequently as males was intriguing, and in line with previous suggestions that, at least in terms of gambling, extensive involvement with video-games may have a greater effect on females than males (Gupta & Derevensky 1996). Furthermore, while male participants played video-games more frequently than females, no significant differences were found between genders for problem gaming scores, and gender was not a significant predictor of gambling frequency in either of the regression models.

The primary limitation of this study was its use of online methods for data collection, and consequently there may have been issues concerning participant self-selection and generalisability of the findings. As Griffiths (2010b) has pointed out, these disadvantages are similar to those experienced by researchers using offline methodologies. Furthermore, there are several benefits to using online methods, including reduced social desirability affecting participants’ responses, potentially more representative samples of the wider gaming population, and the ability to collect detailed data concerning sensitive information such as the problems caused by video-gaming or gambling activity. Nevertheless, the findings presented here are not necessarily generalisable to the wider population of regular video-game players. For example, the combination of online and offline recruitment methods for South Australian participants may have resulted in sample bias. Further research is needed to confirm the present results in other samples. Another limitation was that gambling habits were calculated as a frequency from ordinal responses, and that a measure of pathological gambling was not used. It is also possible that results pertaining to Australian video-gamers do not reflect relationships between video-gaming and gambling in other populations. For example, Australia differs from the United
Kingdom and Canada such that gambling machines may only be located in designated areas, and consequently they are rarely located in the same places as video-gaming machines. It has been suggested that this geographical separation may lead to lower levels of concurrent involvement (Delfabbro et al. 2009). Finally, the correlational nature of this study means that causation cannot be inferred for any reported associations.

CONCLUSION

Previously reported links between video-gaming and gambling may be less applicable to modern video-games likely as a result of major structural changes in video-gaming since the 1990s. The present study found that gambling was a generally unpopular activity in a sample of regular video-game players, and frequency of video-game play was not associated with frequency of gambling. While it is possible that heavy video-game use during youth or adolescence may remain a risk factor for later gambling involvement, the majority of adult regular and heavy video-game players do not appear to gamble frequently. Future research could adopt a longitudinal approach to determine whether and why certain forms of video-game playing, perhaps those with similar structural properties of gambling, leads to later gambling involvement. Alternatively, examining the video-gaming histories of current pathological gamblers could determine whether video-gaming made gambling more appealing to them. Finally, while many studies have focused on similarities between gambling and video-gaming, very few have focused on the apparent differences and the possibility that video-gaming may be protective against uptake of gambling. Future research could ask video-gamers how often they are exposed to gambling advertisements, and why they do not engage in gambling once
exposed. Such studies could reveal important differences in the perceptions of gambling among video-gamers relative to the general population.

Chapter 4: Study 2

This chapter provides a summary of the rationale, methodology and findings from Study 2. It has been widely documented that social factors can play a central role in the development and maintenance of addictive behaviours. For example, peer pressure is frequently associated with smoking in adolescence, and ‘social’ drinking or gambling represents a primary motivation to partake in these activities. However, models of problematic video-gaming have generally centred on factors that are specific to the affected individual, such as personality, or otherwise on structural features of particular kinds of video-game that may be especially ‘dependence-inducing’. Relatively little attention has been given to the social circumstances of problematic video-gamers, such as the number of other gamers in their households or social circles, which may serve to normalise excessive behaviour; if individuals primarily socialise with other highly-engaged players, their own problematic behaviour may not seem unusual or excessive by comparison. Furthermore, particular types of online video-games encourage co-operation and competition with strangers rather than with friends or family members, which may lead to increasing offline social isolation.

Study 2 therefore aimed to investigate the role of various social factors in problematic video-gaming. It was predicted that social and competitive motives to play, as well as time spent playing with strangers online, would be higher among problematic gamers. It was also anticipated that offline social support and time spent playing alone, with family members or with friends would be higher among non-
problematic gamers. These hypotheses were generally supported, and playing competitively against strangers online emerged as the most significant predictor of problematic gaming status. It was concluded that social influences, which have previously been treated as peripheral to personality and game-specific factors in models of gaming addiction, may be a useful focus for future research, as well as providing clinicians with an additional treatment approach for problematic video-gaming behaviour.
Statement of Contributions

Cameron Forrest (Candidate)

In collaboration with my supervisors, I was responsible for devising the research programme that led to this manuscript as well as primary authorship for this paper. I conducted the literature review, data collection, and all analyses, as well as drafting the original manuscript. I incorporated suggestions from my supervisors to create subsequent drafts, was the corresponding author and primarily responsible for responses and revisions based on feedback from reviewers.

Signed..................................................Date……………………………..

Daniel King (Co-author)

I was a co-supervisor for the research programme that led to the production of this manuscript. Mr. Forrest was responsible for writing this manuscript; my role was to comment on drafts, make suggestions, and to provide editorial input. I also provided advice on responding to comments by the journal reviewers and editor.
I hereby give my permission for this paper to be incorporated in Mr. Forrest’s submission for the degree of PhD in the University of Adelaide.

Signed.....................................................................Date……………………………..

Paul Delfabbro (Co-author)

I was a co-supervisor for the research programme that led to the production of this manuscript. Mr. Forrest was responsible for writing this manuscript; my role was to comment on drafts, make suggestions, and to provide editorial input. I had an advisory role regarding data analyses, and provided advice on responding to comments by the journal reviewers and editor.

I hereby give my permission for this paper to be incorporated in Mr. Forrest’s submission for the degree of PhD in the University of Adelaide.

Signed.....................................................................Date……………………………..
Social factors can play a significant role in the development and maintenance of excessive behaviours. The aim of this study was to examine how social factors may influence problematic video-game playing in an adult population. The social context of gaming was examined in a sample of 465 Australian adults ($M_{age} = 26.2$ years, $SD = 7.3$; 84.5% male) who played for an average of 33 hours per week. Participants completed a survey of their gaming patterns, motivations for gaming, and the social context of play (i.e. gaming peer group, social environment of gaming). Problem gamers spent a significantly greater proportion of their time playing online with strangers than non-problem gamers. Non-problem gamers tended to report solitary play in offline games. Problem gamers were also more likely to report playing for social or competitive reasons, having less support from friends and family, and having a friend or family member with a video-gaming problem. Peer group influence (e.g. social expectations or obligations to play regularly, group norms on ‘acceptable’ levels of play, in-group processes) significantly contributed to severity of problematic gaming. In line with predictions based on general theories of behavioural ‘addiction’, these findings suggest further studies on understanding the interaction between social factors and problem gaming symptoms.
Although addiction may be understood in terms of internal processes such as tolerance and withdrawal, many conceptual models have highlighted the importance of external factors, such as social networks and the environment. External cues in the environment, as well as social processes including in-group recognition, norms and expectations, have been known to influence addictive behaviours, including cigarette smoking (Leventhal, Keeshan, Baker & Wetter 1991) and pathological gambling (Herman 1976; Newman 1972). Orford (2001) has argued that excessive behaviours are “likely to lie as much in social norms and group pressure as in character and attitudes” (p. 141). A body of evidence suggests that excessive video-game playing may be considered under certain conditions an addictive behaviour that can cause substantial personal and social problems for an individual. For this reason, Internet gaming disorder is currently listed in the appendix of the DSM-5 as a condition warranting further study (APA 2013). Extant research has focussed on negative social consequences of gaming, such as loss of important relationships, alienation from family members, and interpersonal conflict. In this way, research has generally focussed on social consequences rather than causes or facilitators of addictive gaming. However, there is limited knowledge of the social factors and social context that contribute to this issue.

Orford’s (2001) ‘excessive appetites’ addiction model suggests that social processes may strongly influence the development of problematic habits. In this model, the concept of excess is situationally, socially, and culturally defined; that is, the acceptability of engaging in a particular activity at a particular time depends on social norms and expectations. In terms of video-gaming, the attitudes of peers, family, and society in general may have a normative influence on one’s behaviour.
An individual who resides in an environment where gaming is regarded positively may be more likely to play more frequently. A person’s habits may become problematic, however, if social rules concerning acceptable behaviour become too generalised, and the normal mental processes allowing the individual to discriminate between acceptable and unacceptable behaviour are compromised (Orford 2001). Associating with others who are problematically involved in an activity may interfere with self-corrective behaviour by preventing the individual from regarding his or her own habits as excessive (Lee & LaRose 2007). An individual may then believe that they are behaving in moderation despite evident interference with day-to-day responsibilities.

One challenge in researching social processes in problem video-gaming is that many social motives in gaming appear to be implicated in both normal and problematic behaviour. Jansz and Martens (2005), for example, found that 55% of participants in a Dutch LAN event reported being in a game-based ‘clan’, and that playing to join likeminded individuals was their strongest motive for playing. In-game social features, including the ability to converse, co-operate, or compete with other players, represent one of the main appeals of video-games, providing a sense of identify and belonging within their virtual worlds (King et al. 2010a). This is particularly the case with massively multiplayer online games (MMOs), in which social features allow thousands of players from around the world to play the same game simultaneously. However, as Charlton and Danforth (2007) have pointed out, high engagement does not necessarily indicate addiction. Therefore, although previous studies have found associations between higher frequency of gaming and social isolation (Roe & Muijs 1998), deficient social support (Ho & Lee 2001; Longman, O’Connor & Obst 2009), and lower quality of offline friendships (Kowert,
Domahidi, Festl & Quandt 2014), it cannot be assumed that these same factors are implicated in addiction to gaming.

A common experience in online video-gaming is the creation of relationships with other players with similar interests and gaming goals. It is thought that these relationships are easier to manage than offline relationships, given the narrower demands for social interaction (Caplan 2010). For example, the action of the game and requirement of each player to attend and respond to game information (e.g., objectives) means that players are not expected to sustain a conversation for the duration of play. The online context often has limited capacity for social interaction as compared to real life interaction, with a reliance on text or voice-only communication. Play experiences necessitate a focus on dynamic parallel and cooperation, which makes the experience collaborative and therefore has less of a burden on a player to socialise with others. In online gaming, socialising may typically involve conversation about the game, strategy or future actions, and past achievements. The online context makes it easier to share personal details due to its inherent anonymity (with associated lack of accountability), thereby making it feel ‘safe’ and largely consequence-free (Suler 2004). Given the complexity and demands of online games, players may create a schedule to play together on certain days that align with the online game’s internal scheduling of content. This commitment may create inflexibility for spontaneous social interaction in the real world, given that the player has arranged a gaming activity with a large group of other players who are dependent on that player to achieve particular gaming goals. Regular scheduling of group gaming may develop a preference for online gaming relationships as the group develops its own norms, including stories, nicknames, and humour. A preference for these relationships then develops, as well as the weakening of social bonds in the real
world, as those who do not play are perceived as lacking in understanding and may be viewed as less relatable and important to the individual.

Few studies have examined social factors in relation to problematic habits. Preliminary studies have identified some differences between problem and non-problem video-game players in terms of preferences for in-game social features, although the data are relatively limited. King, Delfabbro and Griffiths (2011) found that problem players were more likely to rate social elements such as competing with other players, sharing game-related information, and in-game co-operation as important to their playing experiences. It has also been suggested that online play may facilitate the normalisation of excessive behaviour by bringing an individual into contact with a greater number of highly engaged and/or problematic players. This stands in contrast to play with family or peers, who may create healthy norms for gaming (Snodgrass et al. 2011).

The present study

Building on previous research which has outlined social profiles for regular video-game players (e.g. Griffiths, Davies & Chappell 2004; Jansz & Martens 2005), the present study aimed to describe the social context of problem gaming. Amid concerns that children and adolescents may be at risk of developing video-gaming related problems (Kuss & Griffiths 2012), studies have prioritised the examination of habits in these populations, and it is unclear whether their findings are generalisable to older age groups. The social context of adult gaming is likely to differ from adolescents for a number of reasons. For example, some adults may have greater time and monetary capacity to pursue online relationships. Additionally, adults may be more at risk of social isolation in the real world, unlike those adolescents with social opportunities and connections through school and/or institutions that anchor
adolescents to a large group of same-aged peers in the real world. The present study aimed to determine which, if any, social factors are associated with problematic behaviour. It was hypothesised that motivations to play for social or competitive reasons, as well as higher proportions of time spent playing with strangers, would be positively associated with problematic habits. It was also hypothesised that offline social support, as well as higher proportions of time spent playing with friends or family members, would be negatively associated with problematic habits.

**METHOD**

*Participants and procedure*

Flyers advertising the study were posted throughout the campuses of two South Australian universities. Online advertisements were posted at several websites frequented primarily by Australian video-game players. Advertisements were addressed to individuals with strong interests in gaming, and participants were excluded from analyses if they reported playing for less than 7 hours per week (i.e. 1 hour per day on average). Participants were provided with a link to an online survey which took approximately 30-45 minutes to complete. All participants provided informed consent prior to beginning the survey, and those who completed it received a $10 voucher as compensation.

In total, $N = 465$ Australian regular video-game players (84.5% male) were recruited. Ages ranged from 18–68 years ($M = 26.2, SD = 7.3$). Participants reported playing video-games for between 7 and 120 hours per week ($M = 32.8, SD = 20.4$), and most reported having access to a dedicated gaming console (87.7%), a personal computer (82.6%), a laptop or notebook (77.8%), or a tablet or iPad (51.8%) at home. Participants most frequently listed PCs as their preferred gaming platforms.
(53.5%), followed by television-based consoles (35.9%), handheld consoles (5.2%), and mobile phones (4.9%).

**Measures**

Participants were asked to report on the following aspects of their play: weekly frequency of play; preference to play alone, competitively and/or co-operatively with others; proportion of time spent playing online versus offline, time spent playing with family, friends, and/or strangers, and solitary (asocial) play; and whether their habits had changed during the past three months. Participants were also asked how many of their friends, ‘real life’ and online, also played video-games (‘None’, ‘One or two’, ‘Some’, ‘Many or most’, ‘All of them’). Additional measures used in present analyses have been listed below.

*The Problem Video Game Playing Scale (PVP; Salguero & Morán 2002; $\alpha = .76$)* contains nine items and measures the extent to which an individual’s video-gaming habits have become problematic for them. Participants were classified as problem players if they met at least nine criteria relation to preoccupation, tolerance, loss of control, withdrawal symptoms, lies and deception, disregard for physical or psychological consequences of play, and family or schooling disruption. Participants could respond ‘yes’, ‘no’, or ‘sometimes’. Sometimes responses were scored the same as a yes in order to account for users who may attempt to downplay their problems.

*The Video Game Uses and Gratifications Instrument* (Sherry et al. 2006) measures self-reported motivations to play video-games. In accordance with the Uses and Gratifications paradigm (e.g. Rosengren 1974), it measures the function of video-game play within an individual’s life in terms of need satisfaction. For this study, only the competition (containing 4 items, $\alpha = .81$) and social interaction
(containing 2 items, $\alpha = .85$) subscales were used. Competition motives involve playing in order to prove to others that one is the fastest or most skilled at playing a game, as well as placing high value on the positive responses that this elicits from one’s peer group. Social interaction motives involve playing as a reason to associate with one’s friends or with other likeminded individuals, and using gaming as an opportunity to socialise and develop bonds with others. Responses are given on a 7-point Likert scale ranging from ‘strongly disagree’ to ‘strongly agree’.

The Multidimensional Scale of Perceived Social Support (Zimet et al. 1988) contains 12 items measuring the extent to which an individual feels satisfied with the social support that he or she receives. Responses are given on a 7-point Likert scale ranging from ‘strongly disagree’ to ‘strongly agree’. The scale is divided into three subscales, each containing four items, measuring perceived support from family ($\alpha = .91$), friends ($\alpha = .93$) and a significant other ($\alpha = .97$). For analyses, scores were averaged for each subscale.

Analytical Strategy

Categorical responses related to proportions of online and offline friends who play video-games were collapsed into two categories (1 = None/One or two/Some, 2 = Many or most/All of them). Chi-square comparisons and two-tailed independent samples $t$-tests were used to compare participants classified as problem and non-problem gamers using PVP criteria. Pearson’s correlations were used to assess univariate relationships between PVP scores and all continuous variables. A hierarchical regression model was constructed on the basis of these findings; known predictors of problematic habits (gender, age, frequency of play) were entered in the first step, followed by measured social factors in the second step. All calculations were performed using SPSS for windows, version 20.0.
RESULTS

Participants generally preferred to play video-games by themselves (44.7%) rather than co-operatively (36.6%) or competitively with others (18.7%). Participants who believed that they played more frequently now as compared with three months prior most commonly cited reasons relating to acquiring new games to play, university or school schedule changes, ending a job, and changes in relationship status. The most commonly cited reasons for playing less frequently were university or school schedule changes, not having anything desirable to play, not enjoying playing as much as they used to, starting a job, and changes in relationship status.

Social profiles of participants have been listed in Table 1, separated by gender. Male gamers were more likely to be in full-time employment or unemployed, and be single or married, while female gamers were more likely to be tertiary students and in long-term, non-married relationships. Non-significant gender differences were found for living circumstances.
Comparisons between problem and non-problem gamers

In total, 176 participants (37.8%) met PVP criteria for problematic gaming. Continuous PVP scores correlated positively with frequency of play ($r = .31$, $p < .001$), competition motives ($r = .37$, $p < .001$), social interaction motives ($r = .20$, $p < .001$), and percentages of time spent playing with strangers online ($r = .16$, $p < .001$)
and offline ($r = .11, p < .05$). PVP scores correlated negatively with age ($r = -.09, p < .05$), perceived support from a significant other ($r = -.13, p < .01$), family ($r = -.15, p < .01$), and friends ($r = -.21, p < .001$), as well as percentage of time spent playing alone offline ($r = -.13, p < .01$). Non-significant correlations ($p > .05$) were found between PVP scores and number of household members who play video-games, as well as percentages of playing time spent alone online, with family members online, with family members offline, with friends online, and with friends offline.

Chi-square comparisons revealed that participants classified as problem gamers were more likely to have a higher proportion of online friends or acquaintances who also play video-games ($\chi^2(1) = 7.08, p < .01, V = .12$) and were more likely to believe that a friend or family member had a problem related to gaming ($\chi^2(1) = 5.09, p < .05, V = .11$). Non-significant differences were found for employment status, relationship status, current living circumstances, and proportion of offline friends who play video-games.

Comparisons of means are presented in Table 2. Cohen’s $d$ has only been reported for statistically significant effects. Problem gamers reported playing more frequently, as well as spending a greater percentage of their time playing with strangers online, and being more strongly motivated to play for competitive or social reasons. Conversely, non-problem gamers reported spending more time playing alone offline, and perceived higher levels of support from their friends and families.
<table>
<thead>
<tr>
<th></th>
<th>Non-problem gamers</th>
<th>Problem gamers</th>
<th>( t (df) )</th>
<th>( d )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekly frequency of video-game playing (hours)</td>
<td>27.68 (17.64)</td>
<td>41.17 (21.87)</td>
<td>6.93*** (311)</td>
<td>0.70</td>
</tr>
<tr>
<td>Number of household members who play VGs</td>
<td>0.92 (1.02)</td>
<td>0.97 (1.02)</td>
<td>0.56 (463)</td>
<td></td>
</tr>
<tr>
<td>Percentage time spent playing:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alone (online)</td>
<td>18.66 (28.49)</td>
<td>20.44 (23.98)</td>
<td>0.69 (463)</td>
<td></td>
</tr>
<tr>
<td>Alone (offline)</td>
<td>44.80 (35.02)</td>
<td>35.02 (31.29)</td>
<td>3.12** (402)</td>
<td>0.29</td>
</tr>
<tr>
<td>With family members (online)</td>
<td>2.03 (6.92)</td>
<td>2.14 (5.67)</td>
<td>0.19 (463)</td>
<td></td>
</tr>
<tr>
<td>With family members (offline)</td>
<td>2.46 (6.84)</td>
<td>2.20 (6.02)</td>
<td>0.40 (463)</td>
<td></td>
</tr>
<tr>
<td>With real life friends (online)</td>
<td>12.56 (19.97)</td>
<td>14.13 (18.74)</td>
<td>0.84 (463)</td>
<td></td>
</tr>
<tr>
<td>With real life friends (offline)</td>
<td>5.34 (12.61)</td>
<td>4.05 (8.08)</td>
<td>1.34 (462)</td>
<td></td>
</tr>
<tr>
<td>With strangers (online)</td>
<td>14.01 (21.82)</td>
<td>21.41 (25.76)</td>
<td>3.18** (324)</td>
<td>0.32</td>
</tr>
<tr>
<td>With strangers (offline)</td>
<td>0.14 (1.09)</td>
<td>0.61 (3.83)</td>
<td>1.59 (193)</td>
<td></td>
</tr>
<tr>
<td>Perceived support from:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family</td>
<td>5.55 (1.42)</td>
<td>5.17 (1.47)</td>
<td>2.80** (463)</td>
<td>0.26</td>
</tr>
<tr>
<td>Friends</td>
<td>5.62 (1.28)</td>
<td>5.06 (1.46)</td>
<td>4.18*** (333)</td>
<td>0.42</td>
</tr>
<tr>
<td>Significant other</td>
<td>5.59 (1.82)</td>
<td>5.28 (1.93)</td>
<td>1.76 (352)</td>
<td></td>
</tr>
<tr>
<td>VGUGI – Competition</td>
<td>2.94 (1.29)</td>
<td>3.85 (1.46)</td>
<td>7.01*** (463)</td>
<td>0.67</td>
</tr>
<tr>
<td>VGUGI – Social interaction</td>
<td>3.91 (1.90)</td>
<td>4.39 (1.81)</td>
<td>2.70** (463)</td>
<td>0.26</td>
</tr>
</tbody>
</table>

Note: VGUGI = Video Game Uses and Gratifications Instrument (Sherry et al. 2006). All tests two-tailed. "\( p < .01 \), ***\( p < .001 \).
### Table 3: Hierarchical regression model predicting problem video-game playing scores from social variables (N = 501)

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>SE B</th>
<th>(\beta)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>3.22</td>
<td>0.44</td>
<td></td>
</tr>
<tr>
<td>Gender (Male=1)</td>
<td>-0.09</td>
<td>0.27</td>
<td>-0.02</td>
</tr>
<tr>
<td>Age</td>
<td>-0.02</td>
<td>0.01</td>
<td>-0.06</td>
</tr>
<tr>
<td>Weekly VG consumption (hours)</td>
<td>0.04</td>
<td>0.01</td>
<td>0.31***</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>2.31</td>
<td>0.71</td>
<td></td>
</tr>
<tr>
<td>Gender (Male=1)</td>
<td>-0.38</td>
<td>0.26</td>
<td>-0.06</td>
</tr>
<tr>
<td>Age</td>
<td>0.01</td>
<td>0.01</td>
<td>0.04</td>
</tr>
<tr>
<td>Weekly VG consumption (hours)</td>
<td>0.02</td>
<td>0.01</td>
<td>0.22***</td>
</tr>
<tr>
<td>VGUGI – competition</td>
<td>0.48</td>
<td>0.08</td>
<td>0.30***</td>
</tr>
<tr>
<td>VGUGI – social interaction</td>
<td>0.03</td>
<td>0.06</td>
<td>0.03</td>
</tr>
<tr>
<td>Perceived support from family</td>
<td>-0.03</td>
<td>0.07</td>
<td>-0.02</td>
</tr>
<tr>
<td>Perceived support from friends</td>
<td>-0.23</td>
<td>0.08</td>
<td>-0.14**</td>
</tr>
<tr>
<td>Friends/family with VG problem (Yes=1)</td>
<td>0.51</td>
<td>0.29</td>
<td>0.07</td>
</tr>
<tr>
<td>Proportion of online friends who play VGs</td>
<td>0.20</td>
<td>0.20</td>
<td>0.04</td>
</tr>
<tr>
<td>Time spent playing alone offline (%)</td>
<td>0.00</td>
<td>0.00</td>
<td>0.04</td>
</tr>
<tr>
<td>Time spent playing with family offline (%)</td>
<td>-0.01</td>
<td>0.01</td>
<td>-0.05</td>
</tr>
<tr>
<td>Time spent playing with strangers online (%)</td>
<td>0.01</td>
<td>0.01</td>
<td>0.08</td>
</tr>
<tr>
<td>Time spent playing with strangers offline (%)</td>
<td>0.07</td>
<td>0.04</td>
<td>0.07</td>
</tr>
</tbody>
</table>

Note: \(R^2 = .10\) for Step 1, \(\Delta R^2 = .14\) for Step 2 \(p < .001\). **\(p < .01\), ***\(p < .001\)
Results from hierarchical regression predicting continuous PVP scores from social variables are presented in Table 3. The final model accounted for 24% of variance in PVP scores, and the combination of measured social variables accounted for a further 14% of variance beyond the model which included only gender, age, and frequency of play. However, only gender, frequency of play, competition motives, and perceived support from friends remained significant predictors in the final model.

Results from the logistic regression model are presented in Table 4 and generally support those from the hierarchical model; the only exception was that gender was a non-significant predictor of problem gaming status.

Table 4: Logistic regression model predicting status as a problem video-game player from social variables (N = 501)

<table>
<thead>
<tr>
<th></th>
<th>B (SE)</th>
<th>95% CI for Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-2.11* (0.83)</td>
<td>Lower 0.36 OR 6.56 Upper 1.19</td>
</tr>
<tr>
<td>Gender (Male=1)</td>
<td>-0.43 (0.02)</td>
<td>0.36 0.65 1.19</td>
</tr>
<tr>
<td>Age</td>
<td>0.02 (0.02)</td>
<td>0.99 1.02 1.06</td>
</tr>
<tr>
<td>Weekly VG consumption (hours)</td>
<td>0.03*** (0.01)</td>
<td>1.02 1.03 1.04</td>
</tr>
<tr>
<td>VGUGI – competition</td>
<td>0.47*** (0.09)</td>
<td>1.34 1.59 1.90</td>
</tr>
<tr>
<td>VGUGI – social interaction</td>
<td>-0.04 (0.07)</td>
<td>0.83 0.96 1.10</td>
</tr>
<tr>
<td>Perceived support from family</td>
<td>-0.03 (0.08)</td>
<td>0.83 0.98 1.15</td>
</tr>
<tr>
<td>Perceived support from friends</td>
<td>-0.24** (0.09)</td>
<td>0.66 0.79 0.93</td>
</tr>
<tr>
<td>Friends/family with VG problem (Yes=1)</td>
<td>0.79* (0.32)</td>
<td>1.17 2.19 4.12</td>
</tr>
<tr>
<td>Proportion of online friends who play VGs</td>
<td>0.34 (0.22)</td>
<td>0.91 1.40 2.16</td>
</tr>
<tr>
<td>Time spent playing alone offline (%)</td>
<td>0.00 (0.00)</td>
<td>0.99 1.00 1.01</td>
</tr>
<tr>
<td>Time spent playing with family offline (%)</td>
<td>0.00 (0.01)</td>
<td>0.98 1.00 1.03</td>
</tr>
<tr>
<td>Time spent playing with strangers online (%)</td>
<td>0.01 (0.01)</td>
<td>1.00 1.01 1.02</td>
</tr>
<tr>
<td>Time spent playing with strangers offline (%)</td>
<td>0.06 (0.06)</td>
<td>0.95 1.06 1.19</td>
</tr>
</tbody>
</table>

Note: $R^2 = .20$ (Cox & Snell), .28 (Nagelkerke). Model correctly classifies 71.1% of cases. Model $\chi^2(13) = 114.11, \ p < .001. \ * p < .05, \ ** p < .01, \ *** p < .001.
DISCUSSION

This study aimed to examine social factors associated with problematic video-gaming and involved a sample of Australian adults with a high mean frequency of play ($M = 33$ hours) and a large proportion of problematic gamers (38%). Notwithstanding a much higher weekly playing frequency, the major difference between this group and others was that they played for competitive reasons. Problem gamers were also found to report lower social support from friends and family, playing for reasons of social interaction, spending more time playing online with strangers, and were more likely to report that a friend or family member had a gaming-related problem. Conversely, non-problem gamers reported spending more time playing by themselves offline. These findings are in line with frameworks of addiction (e.g. Griffiths 2005; Orford 2001) which highlight the role of social context in undertaking the maintenance of problematic behaviour.

It was predicted that motivations to play for social or competitive reasons would be positively associated with problematic gaming. This is based on previous research which has showed that individuals who are drawn to the social aspects of Internet use are more likely to develop problematic habits (Caplan 2003; van den Eijnden, Meerkerk, Vermulst, Spijkerman & Engels 2008), and that social interaction and competition motives predict frequency of play in child and adolescent populations (Sherry et al. 2006). In line with these findings, the present study found significant correlations between PVP scores and competition motives ($r = .37$) as well as social interaction motives ($r = .21$). Similarly, comparisons of means yielded significant differences between problem and non-problem players for both motive types, although effects were larger for competition motives ($d = 0.67$ vs. 0.26). However, both regression models indicated that only competition motives were a
significant predictor of problem gaming when controlling for other variables. In terms of King et al.’s (2010a) taxonomy of structural characteristics, it may be that problem players are those with preferences for ‘leader board’ features (e.g. achievement systems, multiplayer scoreboards, ‘hall of fame’), as opposed to social utility or support network features which emphasise the connections between players. Problem gamers appear to have a greater interest in challenging and defeating other players without becoming invested in knowing their opponents. These findings may reflect problem gamers’ increasing detachment from real world relationships or reflect the increasing importance that online gaming performance may have in maintaining self-esteem. Players may come to overvalue rewards related to gaming and develop maladaptive strategies for dealing with failures, such as needing to immediately play the game again in order to prove one’s ability to one’s self or others (Forrest, King & Delfabbro 2016; King et al. 2010a).

In addition, it was predicted that offline social support would be associated with lower levels of problematic video-game play. A number of studies has found negative correlations between offline social support and frequency of play (Ho & Lee 2001; Kowert et al. 2014; Longman et al. 2009; Roe & Muijs 1998), and the present findings appear to confirm this observation for problematic involvement. Although modest correlations were found between problem gaming scores and perceived support from friends, family, and a significant other, comparisons of means and regression models confirmed these findings for perceived support from friends only. This is in line with suggestions that, although parental involvement may be more important during childhood when habits are formed, peer groups may be more relevant as habits are sustained throughout adolescence and adulthood (Paez, Maloney, Kelsey, Wiesen & Rosenberg 2009). It also supports King and Delfabbro’s (2014a) view that gaming as a means of gaining social acceptance is one of the
important cognitive factors that appear to be highly correlated with Internet gaming disorder. In essence, this belief refers to the increasing sense that individuals will only be accepted or belong in online communities involving other players, and/or that video-games can be used to protect against failure in other important life areas.

Our results also support the important role that peer group influence may have in maintaining or normalising problematic behaviour. Having a higher number of friends who play video-games may cause an individual to overgeneralise what is considered to be acceptable playing behaviour (Orford 2001). Consistent with this view, problem gamers in the present study reported having a greater proportion of online, but not offline, friends who also play video-games as compared with non-problem players. These observations are similar to findings reported by Snodgrass et al. (2011) who found that playing with ‘actual-world’ friends was a significant, negative predictor of problematic play, whereas playing with strangers was positively associated with problematic habits. Collectively, these findings may indicate that problematic habits develop when adult players come to find the challenge of playing against their offline friends insufficient, and turn to the Internet in order to find more skilled players against whom they can hone their abilities. Players may then find themselves socialising primarily in online environments with high frequency players, amongst whom their own habits do not seem unusual or excessive. This suggestion is supported by the finding that problem gamers reported spending significantly greater proportions of their time playing with strangers online, rather than alone, with friends, or with family members. ‘Strangers’ as defined in this study may include online acquaintances, and more precisely embodies those individuals with whom the player has no meaningful association or connection in offline settings.

Finally, qualitative self-reports implied that changes in commitments pertaining to schooling, employment, or relationships were the most frequent reasons
for changes in playing frequency. Despite this, non-significant differences were found between problem and non-problem gamers for employment status, relationship status, and current living circumstances. These findings indicate that most gamers, even those who are problematically involved, are able to balance their social commitments with high frequency of play to at least some extent. However, the perceived lack of social support among problem gamers may suggest that the social circumstances of frequent players are better understood in terms of the stress that excessive play places on real world relationships. For example, social commitments may result in an inability to play as often as desired, leading to an impaired ability or reluctance to form close relationships. Future studies could investigate this by measuring effects of problematic play in terms of strain on external commitments (i.e. as opposed to ordinal differences between problem and non-problem gamers), as well as examining barriers to forming new relationships among problem gamers.

METHODOLOGICAL CONSIDERATIONS AND CONCLUSIONS

This study identifies multiple social correlates of problematic video-game play in a highly-engaged sample of Australian adults. These findings suggest that preference for social video-game play should be considered more risky in terms of problem gaming when players seek persistent competitive play without associated socialising. Peer group influence, in the form of offline social support and the gaming behaviour of online friends and acquaintances, appears to be particularly important for this population. These findings extend previously identified relationships between social influences and other addictive behaviours to problem gaming, and support models of gaming addiction which emphasise the role of these factors. It is hoped that these findings will provide some further avenues for
intervention, as well as guiding future studies aiming to identify other modifiable correlates of problematic play.

The primary limitation of this study was its non-representative sample. Participants were recruited from multiple sources, and further research will be needed to clarify the extent to which findings generalise to the wider video-game playing population. It is possible that competition motives as measured in the present study have been conflated with other psychological factors that increase vulnerability to excessive behaviour, such as self-esteem, social anxiety, or other non-gaming related insecurities, and further research is necessary to disentangle these constructs. The correlational nature of this study also means that it is not clear whether the social correlates of problematic play reported here represent causes or effects of behaviour, and longitudinal research is necessary to examine this.

There are several clinical implications of this study. Problematic players who are seeking to reduce their gaming may need to develop a non-gaming social support system. The role of social isolation in maintaining excessive play should be discussed in therapy, with a goal of promoting avenues for social interaction away from gaming. Clinicians could help clients to schedule activities with non-gamers and assist in the development of social skills for dealing with the offline environment, focusing on different demands for conversation and lack of competing demands for attention in real world situations. Interventions could also target perceived social obligations to play that contribute to an inflexible pattern of gaming. Players may feel guilty or as though they are letting their online acquaintances down if they do not play on particular days or at particular times. Finally, problematic gamers may need to learn to repair any issues in offline relationships that have occurred due to conflict with gaming habits. Encouraging the involvement of real life friends in play may help to enhance the social aspect of gaming for these players.
Chapter 5: Study 3

This chapter provides a summary of the rationale, methodology and findings from Study 3. Although problematic video-gaming has most frequently been conceptualised as a behavioural addiction, several authors have presented cognitive frameworks which focus on persistent and recurring patterns of thoughts that are argued to be responsible for maintaining involvement in excessive behaviour despite negative consequences. Such maladaptive cognitions have been demonstrated for other types of addiction, such as false beliefs about the nature of chance in gambling, but relatively little attention has been given to specific cognitions that might be associated with problematic video-gaming. Although multiple frameworks for understanding gaming-related cognitions have been proposed, operationalising cognitive influences on behaviour has generally relied on measures of preoccupation, or the extent to which the individual thinks about video-games when not playing. This fails to capture the complexity of gaming-related cognitions and implies that thought patterns are essentially uniform across problematic gamers.

Study 3 aimed to redress this by providing a new measure of maladaptive cognitions related to video-gaming. Twenty-two items were derived from previous cognitive frameworks of gaming addiction, and were administered to a sample of highly-engaged adult players. Items were designed to reflect processes that appear to be central to other addictions, such as regret and self-blame, the importance of the activity to one’s identity, and anticipation of pay-offs. Principal components analysis revealed that the 18 retained items loaded on four distinct factors, representing four different classes of cognitions. The resulting scale was validated using two measures of gaming addiction and a measure of psychological distress. All four sub-scales were found to be associated with frequency of play, were predictive of problematic
gaming scores and status, and were significantly associated with depression, anxiety, and stress among adult players. Although preliminary in nature, it was concluded that the scale represented a valid and reliable measure of maladaptive cognitions related to gaming, and provided a promising new avenue for understanding problematic behaviour. Unlike simple preoccupation measures, the newly-created scale also provides a means for understanding cognitive differences between different cases of problematic video-gaming.
Statement of Contributions

Cameron Forrest (Candidate)

In collaboration with my supervisors, I was responsible for devising the research programme that led to this manuscript as well as primary authorship for this paper. I conducted the literature review, data collection, and all analyses, as well as drafting the original manuscript. I incorporated suggestions from my supervisors to create subsequent drafts, was the corresponding author and primarily responsible for responses and revisions based on feedback from reviewers.

Signed.........................................................Date……………………………..

Daniel King (Co-author)

I was a co-supervisor for the research programme that led to the production of this manuscript. Mr. Forrest was responsible for writing this manuscript; my role was to comment on drafts, make suggestions, and to provide editorial input. I also provided advice on responding to comments by the journal reviewers and editor.

I hereby give my permission for this paper to be incorporated in Mr. Forrest’s submission for the degree of PhD in the University of Adelaide.
Paul Delfabbro (Co-author)

I was a co-supervisor for the research programme that led to the production of this manuscript. Mr. Forrest was responsible for writing this manuscript; my role was to comment on drafts, make suggestions, and to provide editorial input. I had an advisory role regarding data analyses, and provided advice on responding to comments by the journal reviewers and editor.

I hereby give my permission for this paper to be incorporated in Mr. Forrest’s submission for the degree of PhD in the University of Adelaide.
Research has shown that some individuals can develop excessive patterns of videogaming, leading to significant psychological and interpersonal problems. Recent reviews of problematic gaming suggest that treatment is best approached from a cognitive-behavioural perspective. However, relatively little research has examined the underlying cognitive factors that might be usefully targeted in an intervention. To address this gap, we present the findings of a study involving \( N = 485 \) adult regular video-game players (84% male, \( M_{\text{age}} = 26 \) years) who completed a questionnaire about gaming activity, problematic gaming, and problematic cognitions. Gaming cognitions fell on four dimensions: (1) perfectionism, (2) cognitive salience, (3) regret, and (4) behavioural salience. All cognition subscales correlated moderately to highly with two different measures of problematic gaming (\( r = .49–.76 \)), as well as a measure of emotional distress (DASS-21; \( r = .25–.35 \)). Large effect sizes (\( d = .87–1.96 \)) were found when comparing problematic and non-problematic gamers on all four cognition types. This study is among the first to provide empirical evidence for cognitive differences between problematic and non-problematic video-game players, and to identify specific cognitions which could be practically addressed in clinical settings. The implications for the further development and refinement of clinical approaches to problematic gaming, including formulation, assessment, and intervention, are discussed.
INTRODUCTION

Maladaptive cognitions have long been thought to play a central role in addiction (Walker 1992). Previous research has identified the influence of erroneous thoughts in excessive behaviours, particularly pathological gambling (Baboushkin, Hardoon, Derevensky & Gupta 2001; Goodie & Fortune 2013) and pathological Internet use (PIU; Davis 2001). Despite international debate on its conceptualisation (Griffiths et al. 2015; Petry et al. 2014), Internet Gaming Disorder (IGD) has been listed in Section 3 of the DSM-5 as a condition warranting further investigation (APA 2013) and appears to bear numerous similarities to other behavioural addictions. Amid concerns that interventions for IGD that focus solely on attaining behavioural changes may be ineffective if underlying cognitions are not addressed (Peng & Liu 2010), an emerging body of work has attempted to identify specific cognitions related to IGD (King & Delfabbro 2014a; 2014b; Komnenić, Filipović & Vukosavljević-Gvozden 2015).

According to Davis’ (2001) model, cognitive distortions represent a proximal cause of PIU and are enacted whenever a stimulus associated with the Internet is present. Maladaptive cognitions related to Internet use pertain to thoughts about the self, others, and the world. Thoughts about the self involve rumination reflecting themes of having limited self-efficacy in the real world, such as “I am only good on the Internet” and “I am worthless offline, but online I am someone.” Such thoughts underlie positive expectancies about using the Internet and may develop habitual patterns of using the Internet to deal with stress or emotional discomfort. Thoughts about others and the world include distortions such as “the Internet is the only play I will be respected” and “people treat me badly offline.” Another key feature of PIU cognition is the persistent and intrusive nature of thoughts about the Internet, which
includes planning the next time that one will use the Internet. Although the individual may have insight into the problematic nature of their Internet use, the individual rationalises that continued playing will help to alleviate associated feelings of guilt or regret about problematic behaviour.

Davis’ model also distinguished between ‘generalised’ and ‘specific’ forms of PIU. While generalised PIU involves using a range of Internet activities to avoid responsibilities, specific PIU involves a specific use of a particular function of the Internet. Examples of specific PIU include the pathological use of online gambling, sexual material, auction houses, and stock trading services (Davis 2001). Within this model, IGD may be considered a specific PIU. Indeed, in many studies of Internet activities, video-game playing often emerges as having the strongest associations with compulsive Internet use (Meerkerk, van den Eijnden & Garretsen 2006). Based on this model, it is evident that maladaptive cognitions play a significant role in IGD (Liu et al. 2014; Zhou, Yuan & Yao 2012). Peng and Liu (2010) reported that a five-item scale measuring maladaptive cognitions, including those proposed by Davis, significantly predicted online gaming dependency in Chinese adults. Furthermore, these cognitions had greater predictive validity of problematic gaming than male gender and frequency of play, i.e., factors which had previously been found to be among the strongest predictors of problematic habits. Additional studies have examined cognitive aspects of IGD, however these studies have tended to be limited by a focus on preoccupation, rather than a broader view of the content of gaming-related beliefs and assumptions (see King & Delfabbro 2014a).

Cognitive-behavioural therapy (CBT) aims to help clients to identify and deal with cognitions that underlie problematic behaviour. The process of ‘cognitive restructuring’ is often employed to help a patient recognise and challenge erroneous or distorted thought patterns related to an appetitive activity (Baboushkin et al. 2001;
Davis 2001). On limited evidence (see King, Delfabbro, Griffiths & Gradisar 2011; King & Delfabbro 2015), CBT may be a promising treatment for video-game related disorders, with some studies reporting that CBT may be an effective short-term treatment for Internet and video-game addiction (Griffiths & Meredith 2009; Lemos, De Abreu & Sougey 2014). Li and Wang (2013) found that rumination, short-term thinking, and all-or-nothing thinking associated with online game addiction could be reduced through CBT. However, a limitation of empirical and treatment studies on gaming cognition is the tendency to rely on the problematic criteria (i.e., preoccupation) to assess cognition, given the lack of a specialised measure of gaming cognition. By analogy, this may be considered akin to measuring dysfunctional anxious beliefs within an anxiety disorder by relying on a single item that assesses the tendency to experience fearful thoughts. A tool for measuring maladaptive cognitions associated with problematic video-game playing is therefore desirable from a clinical perspective, as it may aid clinicians in identifying the specific thoughts responsible for maintaining problematic behaviour. It would also enable clinicians to assess progress and changes in these cognitions during and post-treatment.

Specific cognitions associated with problematic gaming

Cognitive dissonance theory (Festinger 1957) provides one explanation for how video-gaming cognitions relate to problematic behaviour. Individuals may become highly invested in video-games if they spend large amounts of time and/or money playing them. If habits begin to interfere with daily life, the individual experiences dissonance in the form of regret due to feelings of personal responsibility for the negative consequences of play. Most players are able to successfully adjust their behaviour to reduce this dissonance. However, some players
instead reaffirm the value of video-game playing to themselves in order to justify the negative consequences (Chiou & Wan 2007). This allows them to reduce their dissonance while also maintaining problematic habits. Chiou and Wan demonstrated this process through two experiments. The first study showed that players who feel responsible for their behaviour would be more likely to shift their attitudes towards video-games from positive to negative. The second study showed that players with a higher invested cost in video-game playing would be less likely to engage in attitude-discrepant behaviour. These findings suggest that the extent to which an individual feels personally responsible for the negative consequences associated with his or her behaviour, as well as willingness to adjust habits accordingly, may help to distinguish problematic from non-problematic players.

King and Delfabbro (2014a) proposed a framework for understanding video-game related cognitions which specifies four categories. Beliefs about game rewards and tangibility includes cognitions related to preoccupation with play, increased cognitive salience of video-games, the over-valuation of in-game rewards, and an attachment to an avatar or online identity. Maladaptive and inflexible rules about video-gaming behaviour include cognitions that create rigidity and consistency in the players’ patterns of gaming, and serve to justify continued use despite mounting evidence that the game is causing harm to the player. Such cognitive processes include the ‘sunk cost’ effect, which highlights that problematic players might continue to play in order to justify their previous actions and commitment. This can be especially pronounced in games with objectives which can take several hours to complete, or which are only available for a set period of time, as is often the case in massively multiplayer online games (MMOs). Failing to reach a goal before the end of a playing session may therefore result in a loss of progress of up to several hours. Gaming as a source of self-esteem or ego-protection entails playing in order to
compensate for other perceived deficits of the self. Problematic users may have low self-esteem and come to redefine their self-worth in terms of their video-game playing abilities, and their performance and gaming investment becomes the measure of their self-esteem. If the individual has perfectionistic tendencies, then they may hold unrealistic expectations of their playing ability and achievements, reflecting an inability to cease play until ‘victory’ has been achieved. This may be an explicit goal set by the game, or it may be self-developed, such as obtaining a ‘perfect’ character build. Finally, *gaming as a means of gaining social acceptance* includes playing games to avoid ‘real life’ stressors, as well as playing within communities of video-game players in order to feel a sense of relatedness or belonging that is believed to be unattainable in the real world.

Historically, comparisons between gambling and video-game playing have led to conceptual confusion regarding pathological involvement with these activities. Numerous structural similarities have been noted between slot or ‘fruit’ machines and arcade video-games in particular, such as predictable stimuli governed by a software loop, requirements for concentration and hand-eye co-ordination, and the use of visual, aural and incremental rewards (Fisher & Griffiths 1995; Griffiths 1991; Griffiths & Wood 2000). However, the primary difference between these activities is that rewards in gambling are generally received as a function of chance, whereas video-games generally reward a player’s skill. Accordingly, modern video-game players typically value experiences that cannot be provided by gambling, such as those involving strategy and planning (Forrest, King & Delfabbro 2015). While gambling typically involves monetary gain, video-games provide intangible rewards such as points or items as a marker of progress and winning. Some games, especially MMOs, provide many of these in-game rewards that work concurrently and interact with each other. Some players may therefore be motivated by a sense of ‘completion’
which drives them to explore and complete every aspect of the game (Delfabbro & King 2013; King, Delfabbro & Griffiths 2010a). Furthermore, due to variable ratio reward schedules inherent within video-games, players might be motivated by the belief that their next reward is ‘just around the corner’ (Griffiths & Wood 2000). This may make it difficult to stop playing when players anticipate a payoff, rationalising that they should and ‘need’ to finish the current level, quest, or objective, and feel restless or irritable if they are unable to do so. Given that new objectives are constantly presented to the player, this can lead to a belief that no amount of time spent playing is ‘long enough’ (King & Delfabbro 2009). Another potentially maladaptive belief is the expectation that one can become ‘the best’ at a game with sufficient time and dedication, which may be unrealistic in the context of competing responsibilities (King et al. 2010b).

*The present study*

Problematic gaming cognition represents an understudied but promising area of research in IGD. Using past frameworks (Caplan 2010; Davis 2001; Delfabbro & King 2013; King & Delfabbro 2014a) as a guide, the present study aimed to assess maladaptive cognitions associated with problematic video-game play. In order to inform clinicians using targeted cognitive interventions such as CBT, it was hoped that this study might provide some practical direction for identifying cognitions that are strongly associated with problematic gaming. A series of items about problematic gaming cognition were developed based on current theory and were administered to a sample of Australian regular video-game players. The study aimed to examine the psychometric properties and factor structure of these items. Construct validity was investigated through the concurrent use of two scales of video-gaming ‘addiction’, as well as a measure of emotional distress. It was predicted that higher cognition scores
would differentiate higher levels (i.e., IGD cut-offs) or problematic video-game playing.

METHOD

Participants and procedure

A sample of 657 Australian video-game players was recruited using a combination of online and offline methods (see Forrest et al. 2015). In brief, online advertisements were addressed to regular video-game players in Australia. Participants were excluded if they did not report playing video-games for at least 7 h per week on average (i.e., 1 h per day). The final sample comprised of 485 regular video-game players (84.3% male, age range 16–68, \( M = 25.8, SD = 7.4 \)). Participants reported playing video-games for between 7 and 120 h per week (\( M = 327, SD = 20.2 \)). Rates of problematic gaming were 16–38% (see Section 2.3). Further information concerning participant demographics has been reported elsewhere (Forrest et al. 2015).

Selection of cognition items

Items were developed based on extant models of gaming cognition (Caplan 2010; Davis 2001; Delfabbro & King 2013; King & Delfabbro 2014a). A total of 22 items aimed to assess cognitions which previous accounts have suggested may be associated with problematic video-game playing. In particular, items were designed to address the following: distraction from external commitments such as work or study; using play as a means of procrastination; rumination and cognitive salience (Delfabbro & King 2013; King & Delfabbro 2014a); playing to preserve one’s self-concept (Delfabbro & King 2013; King et al. 2010b); the need to be ‘the best’ at a
particular game or games (King et al. 2010b); inability to cease play if close to completing some objective (Delfabbro & King 2013; Griffiths & Wood 2000; King & Delfabbro 2009); and regret due to the consequences of excessive or problematic play (Chiou & Wan 2007; Orford 2001). Where possible, items were made to be self-referent so that responses would reflect participants’ thoughts about, rather than descriptions of, their behaviour. Participants were asked how frequently each item reflected their gaming experiences during the past three months. A 5-point response format where 1 = ‘Never’, 2 = ‘Rarely’, 3 = ‘Some of the time’, 4 = ‘Most of the time’, and 5 = ‘Always’ was used as it was thought to represent the best compromise between ease of use and response variance. A copy of the problematic gaming cognition measure is available by request to the corresponding author.

Measures

Participants completed a comprehensive survey relating to their video-gaming habits. Surveys took 30–45 min to complete, and all participants who completed their surveys received a voucher worth $10 as compensation. In addition to the cognition items, participants reported how frequently they played video-games during an average week, and responded to two measures of problematic video-game playing as well as a measure of negative affect. Additional measures included:

The Problem Video Game Playing Scale (PVP; Salguero & Morán 2002) is a widely used, 9-item measure of problematic video-game use based on DSM-IV criteria for substance abuse and pathological gambling. Participants could respond ‘yes’, ‘no’ or ‘sometimes’ to each item. Sometimes responses were coded the same as a yes in order to account for players who may attempt to downplay their problems. A polythetic scoring system was used such that participants were considered to be problematic video-game players if they met at least five out of the nine criteria. In
total, 184 participants (37.9%) were classified as problematic video-game players using these criteria. Cronbach’s alpha for the present study was $\alpha = .76$.

The Lemmens Game Addiction Scale (GAS; Lemmens et al. 2009) is a 21-item measure of problematic video-game use. Participants were asked how frequently they experienced each of the listed symptoms of problematic play during the past three months. Responses were given on a 5-point scale where 1 = ‘Never’, 2 = ‘Rarely’, 3 = ‘Sometimes’, 4 = ‘Often’, and 5 = ‘Very often’. The scale contains seven subscales reflecting Griffiths’ (2005) components of video-game addiction (salience, tolerance, mood modification, relapse, withdrawal, conflict, problems caused by play), and a component was considered ‘met’ if the average scores on its subscale was three or greater. Participants were classified as problematic video-game players if they met at least four out of seven components. This scoring system resulted in 75 participants (15.5%) being classified as problematic video-game players. Cronbach’s alpha for the total scale in the present study was $\alpha = .92$.

The Depression Anxiety Stress Scales-21 (DASS-21; Lovibond & Lovibond 1995) is a 21-item measure of psychological distress. The total scale is separated into three subscales, each containing 7 items, reflecting symptoms of depression, anxiety, and stress. Participants were asked the extent to which they felt each item applied to them during the past three months. Responses were given on a 4-point scale, where 0 = ‘Did not apply to me at all’, 1 = ‘Applied to be to some degree, or some of the time’, 2 = ‘Applied to me a considerable degree, or a good part of the time’, and 3 = ‘Applied to me very much, or most of the time’. Scores may also be summed across subscales to provide a ‘total’ measure of general psychological distress. Cronbach’s alpha values in the present study were as follows: depression $\alpha = .92$, anxiety $\alpha = .81$, stress $\alpha = .84$, total scale $\alpha = .94$. 
Analytical strategy

Principal components analysis with oblique rotation was used to identify factors underlying shared variance on cognition items. Various models that retained different numbers of factors were examined before deciding on a final solution; scree tests were used to supplement Kaiser’s criterion of retaining factors with eigenvalues greater than one. Items which did not contribute to a simple factor structure were removed during this process. Competing models were evaluated in terms of conceptual clarity and congruence with previous research.

The internal consistencies of the subscales comprising the final model were assessed using Cronbach’s alpha. Construct validity was assessed by examining correlations with negative affect (i.e. DASS-21 scores) and ability to distinguish between problematic and non-problematic video-game players (using both PVP and GAS criteria). Participants classified as problematic and non-problematic players were compared on each subscale using two-tailed independent samples t-tests. Logistic regression was used to predict status as a problematic video-game player from the combination of subscale scores and frequency of play. All analyses were performed using SPSS for Windows, version 20.0.
## RESULTS

*Table 1: Factor loadings based on a principal components analysis using promax rotation for 18 items comprising the video-game related cognitions scale (N = 485)*

<table>
<thead>
<tr>
<th>Item</th>
<th>Factor loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. I feel I must be the best at any game I undertake.</td>
<td>.92</td>
</tr>
<tr>
<td>9. I hate the thought of another gamer working out or achieving something before I do.</td>
<td>.78</td>
</tr>
<tr>
<td>15. I feel like a failure if I can’t solve a particular part of a game.</td>
<td>.74</td>
</tr>
<tr>
<td>6. It’s important for me to be good at video-games.</td>
<td>.72</td>
</tr>
<tr>
<td>16. If I don’t play as well as I’d hoped, I keep blaming myself.</td>
<td>.72</td>
</tr>
<tr>
<td>2. I cannot bear giving up playing a game if I think I’m close to completing my objective.</td>
<td>.50</td>
</tr>
<tr>
<td>20. I can’t function without video-games.</td>
<td>.92</td>
</tr>
<tr>
<td>10. I can’t stop thinking about video-games.</td>
<td>.87</td>
</tr>
<tr>
<td>4. I keep thinking about something I experienced in a video-game well after I have stopped playing.</td>
<td>.69</td>
</tr>
<tr>
<td>12. Video-games are the only thing I’m good at.</td>
<td>.60</td>
</tr>
<tr>
<td>1. I get distracted from my work when I can’t complete or solve a game.</td>
<td>.40</td>
</tr>
<tr>
<td>7. I find that I play video-games more when I have something else I’m supposed to do.</td>
<td>.38</td>
</tr>
<tr>
<td>17. I wish I didn’t play video-games so much.</td>
<td>.93</td>
</tr>
<tr>
<td>5. I feel bad after playing for a long period of time.</td>
<td>.87</td>
</tr>
<tr>
<td>11. I regret the real life consequences of playing video-games.</td>
<td>.83</td>
</tr>
<tr>
<td>21. I engage in repetitive tasks for long period of time (‘grinding’) in order to achieve certain game outcomes.</td>
<td>.91</td>
</tr>
<tr>
<td>19. I play the same game over and over at different difficulty levels.</td>
<td>.76</td>
</tr>
<tr>
<td>22. I find it hard to give up once I’ve invested so much time in a game.</td>
<td>.58</td>
</tr>
</tbody>
</table>

Note: Factor loadings < .3 have not been reported. Factor 1 = perfectionism, Factor 2 = cognitive salience, Factor 3 = regret, Factor 4 = behavioural salience.
The final factor structure for the video-game related cognitions scale is presented in Table 1. Four of the initial 22 items (items 8, 13, 14 and 18) were removed as they did not contribute to a simple factor structure. Scree tests supported a four or six factor solution, and four factors were extracted using Kaiser’s criterion and promax rotation. The Kaiser-Meyer-Olkin measure of sampling adequacy for the final model was .90, and Bartlett’s test of sphericity was significant ($\chi^2(153) = 3622.11, p < .001$).

Table 2: Descriptive statistics for measures of problematic video-game playing, negative affect, and video-game related cognitions (N = 485)

<table>
<thead>
<tr>
<th>Scale</th>
<th>Min</th>
<th>Max</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekly frequency of video-gaming (hours)</td>
<td>7</td>
<td>120</td>
<td>32.69</td>
<td>20.21</td>
</tr>
<tr>
<td>Problematic video-gaming</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PVP</td>
<td>0</td>
<td>9</td>
<td>3.84</td>
<td>2.27</td>
</tr>
<tr>
<td>GAS</td>
<td>21</td>
<td>105</td>
<td>44.39</td>
<td>13.92</td>
</tr>
<tr>
<td>DASS-21</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td>0</td>
<td>21</td>
<td>4.67</td>
<td>4.88</td>
</tr>
<tr>
<td>Anxiety</td>
<td>0</td>
<td>21</td>
<td>2.93</td>
<td>3.47</td>
</tr>
<tr>
<td>Stress</td>
<td>0</td>
<td>21</td>
<td>4.73</td>
<td>3.98</td>
</tr>
<tr>
<td>General psychological distress</td>
<td>0</td>
<td>63</td>
<td>12.33</td>
<td>11.06</td>
</tr>
<tr>
<td>Cognitions scale</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perfectionism</td>
<td>6</td>
<td>30</td>
<td>11.67</td>
<td>4.74</td>
</tr>
<tr>
<td>Cognitive salience</td>
<td>6</td>
<td>30</td>
<td>11.28</td>
<td>4.32</td>
</tr>
<tr>
<td>Regret</td>
<td>3</td>
<td>15</td>
<td>5.67</td>
<td>2.84</td>
</tr>
<tr>
<td>Behavioural salience</td>
<td>3</td>
<td>15</td>
<td>6.25</td>
<td>2.43</td>
</tr>
<tr>
<td>Total</td>
<td>18</td>
<td>90</td>
<td>34.87</td>
<td>11.48</td>
</tr>
</tbody>
</table>

Using the existing literature on video-game related cognitions, factors were labelled according to their underlying themes. Factor 1 (‘perfectionism’) comprises 6 items, $\alpha = .83$; Factor 2 (‘cognitive salience’) comprises 6 items, $\alpha = .81$; Factor 3
‘regret’) comprises 3 items, $\alpha = .81$; and Factor 4 (‘behavioural salience’) comprises 3 items, $\alpha = .73$. These estimates of internal consistency were deemed acceptable given the relatively low number of items in each subscale. Summing each subscale to provide a ‘total score’ of video-game related cognitions also yielded a high internal consistency, $\alpha = .90$.

Table 2 provides descriptive statistics for the scales and subscales used to validate the cognitions scale. Table 3 presents correlations between scores on all scales. Each cognition subscale correlated moderately with every other subscale (min. $r = .38$), and bore significant, positive associations with frequency of play (min. $r = .16$), as well as two measures of problematic video-game play (min. $r = .49$) and negative affect (min. $r = .25$).

Table 4 provides comparisons of means between problematic and non-problematic video-game players for video-game related cognitions. Analyses have been performed separately for PVP and GAS criteria for problematic video-game play. According to both measures, problematic video-game players scored significantly more highly on all four subscales, with effects ranging from $d = .87$ (‘regret’) to $d = 1.85$ (‘cognitive salience’). These findings are mostly supported by two logistic regression models which predicted status as a problematic video-game player (Table 5). Of the four cognition types, cognitive salience and regret appear to be the most consistent predictors of problematic video-game playing status, although effects appear to differ depending on the criteria used.

Behavioural salience was not found to be a significant predictor of status as a problematic video-game player using either PVP or GAS criteria. It is also noteworthy that, for the model using GAS scores, frequency of play was not found to significantly predict status as a problematic video-game player when video-game related cognitions were held constant.
Table 3: Correlations between frequency of play, problematic video-game playing, negative affect, and video-game related cognitions (N = 485)

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Frequency of play</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. PVP</td>
<td>.30*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. GAS</td>
<td>.42**</td>
<td>.74***</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. DASS-21 Depression</td>
<td>.20*</td>
<td>.30***</td>
<td>.38***</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. DASS-21 Anxiety</td>
<td>.21*</td>
<td>.26***</td>
<td>.33***</td>
<td>.64***</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. DASS-21 Stress</td>
<td>.12**</td>
<td>.31***</td>
<td>.38***</td>
<td>.72***</td>
<td>.76***</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Perfectionism</td>
<td>.29**</td>
<td>.56***</td>
<td>.64***</td>
<td>.30***</td>
<td>.25***</td>
<td>.32***</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Cognitive salience</td>
<td>.40**</td>
<td>.66***</td>
<td>.76***</td>
<td>.35***</td>
<td>.32***</td>
<td>.35***</td>
<td>.64***</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Regret</td>
<td>.16**</td>
<td>.49***</td>
<td>.65***</td>
<td>.32***</td>
<td>.27***</td>
<td>.30***</td>
<td>.38***</td>
<td>.44***</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Behavioural salience</td>
<td>.36**</td>
<td>.49***</td>
<td>.53***</td>
<td>.32***</td>
<td>.29***</td>
<td>.29***</td>
<td>.52***</td>
<td>.61***</td>
<td>.31***</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>11. Total cognitions scale</td>
<td>.38**</td>
<td>.70***</td>
<td>.82***</td>
<td>.40***</td>
<td>.35***</td>
<td>.40***</td>
<td>.86***</td>
<td>.88***</td>
<td>.64***</td>
<td>.73***</td>
<td>1</td>
</tr>
</tbody>
</table>

*p < .01, **p < .001.
Table 4: Comparisons of means between problematic and non-problematic video-game players for video-game related cognitions (N = 485)

<table>
<thead>
<tr>
<th></th>
<th>Non-problematic gamers</th>
<th>Problematic gamers</th>
<th>t (df)</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>PVP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perfectionism</td>
<td>9.93</td>
<td>3.55</td>
<td>14.52</td>
<td>5.07</td>
</tr>
<tr>
<td>Cognitive salience</td>
<td>9.31</td>
<td>2.77</td>
<td>14.50</td>
<td>4.47</td>
</tr>
<tr>
<td>Regret</td>
<td>4.81</td>
<td>2.27</td>
<td>7.09</td>
<td>3.11</td>
</tr>
<tr>
<td>Behavioural salience</td>
<td>5.44</td>
<td>1.97</td>
<td>7.57</td>
<td>2.53</td>
</tr>
<tr>
<td>Total</td>
<td>29.49</td>
<td>7.62</td>
<td>43.67</td>
<td>11.31</td>
</tr>
<tr>
<td>GAS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perfectionism</td>
<td>10.79</td>
<td>4.03</td>
<td>16.51</td>
<td>5.40</td>
</tr>
<tr>
<td>Cognitive salience</td>
<td>10.25</td>
<td>3.31</td>
<td>16.91</td>
<td>4.87</td>
</tr>
<tr>
<td>Regret</td>
<td>5.10</td>
<td>2.36</td>
<td>8.84</td>
<td>3.16</td>
</tr>
<tr>
<td>Behavioural salience</td>
<td>5.90</td>
<td>2.21</td>
<td>8.13</td>
<td>2.72</td>
</tr>
<tr>
<td>Total</td>
<td>32.03</td>
<td>8.87</td>
<td>50.39</td>
<td>11.78</td>
</tr>
</tbody>
</table>

Note: PVP = Problem Video Game Playing Scale (Salguero & Morán 2002), GAS = Game Addiction Scale (Lemmens et al. 2009). N = 184 participants (37.9%) classified as problematic gamers using PVP criteria; N = 75 participants (15.5%) classified as problematic gamers using GAS criteria. *p < .001
Table 5: Logistic regressions predicting status as a problematic gamer from frequency of play and video-game related cognition scores (N = 485)

<table>
<thead>
<tr>
<th></th>
<th>B (SE)</th>
<th>95% CI for Odds Ratio</th>
<th>Lower</th>
<th>Odds Ratio</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1 (PVP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-6.85***</td>
<td>(0.61)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency of play</td>
<td>0.01*</td>
<td>(0.01)</td>
<td>1.00</td>
<td>1.01</td>
<td>1.03</td>
</tr>
<tr>
<td>Perfectionism</td>
<td>0.09**</td>
<td>(0.03)</td>
<td>1.02</td>
<td>1.09</td>
<td>1.17</td>
</tr>
<tr>
<td>Cognitive salience</td>
<td>0.29***</td>
<td>(0.05)</td>
<td>1.21</td>
<td>1.33</td>
<td>1.46</td>
</tr>
<tr>
<td>Regret</td>
<td>0.17**</td>
<td>(0.05)</td>
<td>1.08</td>
<td>1.19</td>
<td>1.30</td>
</tr>
<tr>
<td>Behavioural salience</td>
<td>0.09</td>
<td>(0.06)</td>
<td>0.96</td>
<td>1.09</td>
<td>1.23</td>
</tr>
<tr>
<td>Model 2 (GAS)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-10.22***</td>
<td>(1.06)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency of play</td>
<td>0.02</td>
<td>(0.01)</td>
<td>1.00</td>
<td>1.02</td>
<td>1.03</td>
</tr>
<tr>
<td>Perfectionism</td>
<td>0.12*</td>
<td>(0.05)</td>
<td>1.02</td>
<td>1.12</td>
<td>1.23</td>
</tr>
<tr>
<td>Cognitive salience</td>
<td>0.33***</td>
<td>(0.06)</td>
<td>1.24</td>
<td>1.38</td>
<td>1.55</td>
</tr>
<tr>
<td>Regret</td>
<td>0.41***</td>
<td>(0.07)</td>
<td>1.32</td>
<td>1.50</td>
<td>1.71</td>
</tr>
<tr>
<td>Behavioural salience</td>
<td>-0.12</td>
<td>(0.09)</td>
<td>0.75</td>
<td>0.89</td>
<td>1.06</td>
</tr>
</tbody>
</table>

Model 1: $R^2 = .38$ (Cox & Snell), .51 (Nagelkerke). Model -2LLR = 415.48, $\chi^2(5) = 228.37, p < .001$. Model correctly classifies 79.8% of cases. Model 2: $R^2 = .34$ (Cox & Snell), .58 (Nagelkerke). Model -2LLR = 218.53, $\chi^2(5) = 199.22, p < .001$. Model correctly classifies 90.7% of cases. *$p < .05$, **$p < .01$, ***$p < .001$.

**DISCUSSION**

This study aimed to examine maladaptive cognitions associated with problematic video-game playing. A new 22-item questionnaire based on theoretical models of cognitive factors of IGD was administered to a large sample of regular gamers with a high representation of problematic gaming. Factor analysis of 18 items
derived from previous frameworks extracted four subscales, reflecting thoughts related to perfectionism, cognitive salience, regret, and behavioural salience. Although each of these constructs has been considered to differentiate severity levels of video-game ‘addiction’, this study is among the first to provide empirical evidence of cognitive differences between problematic and non-problematic players.

The finding that video-game related cognitions discriminate between problematic and non-problematic video-game players is in line with cognitive theories of technological addiction (Davis 2001), and is consistent with findings for other behavioural addictions, especially pathological gambling (Baboushkin et al. 2001; Raylu & Oei 2004). As predicted, all subscales were found to correlate highly with both PVP and GAS scores, and moderately with all DASS-21 subscales. Frequency of play, which has previously been identified as one of the strongest predictors of problematic behaviour, was also a non-significant predictor of problematic gaming status when controlling for all cognition types. Collectively, these findings indicated good psychometric properties of the developed scale, although further studies will be necessary to confirm the identified factor structure, as well as how the scale works in different populations.

The assumption of this study was that maladaptive cognitions may be partly responsible for an individual maintaining problematic gaming behaviour despite being faced with negative consequences. Although an understanding of how specific thoughts first arise and then are maintained in gaming was beyond the scope of this study, significant differences were observed between problematic and non-problematic players for all four cognition types. However, further analysis suggested that certain cognitions may be more pertinent to problematic gaming than others. Cognitive salience in particular was a significant predictor of problematic gaming status when using both measures of addiction ($OR = 1.33–1.38$), whereas behavioural
Salience was not significant in predicting problematic gaming status in both regression models. Items comprising the behavioural salience subscale appear to represent thoughts related to repetition (“I play the same game over and over at different difficulty levels”) and time expenditure (“I find it hard to give up once I’ve invested so much time in a game”). The cognitive salience subscale incorporated rumination (“I can’t stop thinking about video-games”), distraction from other activities (“I get distracted from my work when I can’t complete or solve a game”), as well as importance of video-games to one’s identity (“Video-games are the only thing I’m good at”). The present findings suggest that cognitive salience provides a strong explanation for why problematic video-game playing interferes with players’ lives; it may not be the case that gamers are ‘too busy’ playing video-games to meet their other commitments, but that video-games dominate thoughts to such an extent that they are unable to concentrate on anything else when not playing. This is in line with models which have emphasised the role of cognitive, rather than behavioural, symptoms of problematic video-game playing and IGD (Caplan 2010; Davis 2001; Delfabbro & King 2013; King & Delfabbro 2014a).

Significant differences between problematic and non-problematic gamers were also found for cognitions relating to regret. Such thoughts included “I wish I didn’t play video-games so much”, as well as “I regret the real life consequences of playing video-games”. In line with Chiou and Wan’s (2007) findings, this suggests that problematic video-game players feel some personal responsibility for the negative consequences of their gaming, but continue to play anyway due to high investment. Although problematic players are able to reduce their cognitive dissonance by reaffirming this investment to themselves, their regret appears to remain and re-emerge at particular times and possibly most often when not gaming. Orford (2001) has suggested that ambivalence, the act of maintaining both positive
and negative attitudes towards a substance or activity, constitutes one of the primary
cognitive characteristics of addiction. In terms of problematic video-game play,
regret may serve to exacerbate existing, negative emotional states, for which
problematic players continue to turn to video-games in order to alleviate. This
finding suggests some avenues in psychological intervention for helping individuals
to identify ambivalence and develop practical goals to reduce it. For example,
motivational interviewing techniques (Miller & Rollnick 2012) may be helpfully
applied to identify discrepant views about gaming, and work toward building
readiness and commitment to change behaviour in line with goals for gaming
behaviour.

Due to the relative lack of empirical evidence on maladaptive cognitions
associated with problematic video-game playing, little direction has been given to
clinicians regarding how to address them. However, some papers (Dong & Potenza
2014; Griffiths & Meredith 2009; King et al. 2010b) have outlined some ways in
which cognitions might be treated through interventions such as CBT. For example,
the perceived need to continue playing a game until an objective has been completed
(as measured by ‘perfectionism’ in the present study) could be addressed by having a
client record their motivations to play, and then evaluating after a playing session
whether these motivations have been satisfied. This may help the client to recognise
that they no longer play video-games for enjoyment. Clients possessing these
cognitions may also have unrealistically high expectations for their own
performances on video-games, holding themselves to higher standards than other
players and discrediting their successes. Treatment could focus on helping gamers to
adjust their expectations of their gaming, be less critical of themselves, and broaden
the scope of self-esteem beyond gaming pursuits (Germer & Neff 2013; Neff 2003).
Educating clients about how reward schedules are incorporated into game design and
how they may be setting unrealistic standards for their gaming may also help them to identify why no amount of playing time feels ‘long enough’, and that large periods of their play time are not actually sent enjoying the game. The desire to be ‘the best’ at a video-game or games might be addressed by helping the client to appreciate how unrealistic this expectation is in modern gaming environments, where international data on player performance is widely available. It may also be worth considering whether scheduled intermittent breaks from gaming might create opportunities for players to reflect on their unhelpful thoughts about gaming, as well as experiment with the natural consequences of not following a persistent and regimented style of gaming. Setting goals to participate in other non-gaming entertainment, leisure and hobby activities may challenge facilitating beliefs underlying problematic use, and develop or rediscover non-gaming priorities and values.

LIMITATIONS AND FUTURE DIRECTIONS

The cognition scale is preliminary at this stage. The psychometric properties of the subscales could be improved by validating them in other samples, such as casual video-game players or the wider population, as well as adding items loading on the same factors to improve internal consistency. A limitation of this study was its non-representative sample, which was recruited from multiple sources and may not be representative of the wider video-game playing population. Further research is necessary to confirm whether the effects reported here generalise to other populations. Finally, the correlational nature of this study means that the direction of causality could not be determined. In addition to assessing the test-retest reliabilities of the subscales, prospective studies could examine whether the cognitions identified here represent causes or consequences of behaviour.
In future studies, we hope to extend these findings by identifying other types of cognitions that may be associated with problematic habits. Some suggestions from previous research include thoughts about gaining power and status through play (Ng & Wiemer-Hastings 2005); thoughts of escape from the real world (Sherry et al. 2006); and, thoughts of the computer as a companion or friend (Griffiths 2000). There is also a need to understand how the cognitions identified in this study may be influenced by or interact with social or interpersonal factors, such as peer pressure or group norms. For example, it may be that psychological valuing of in-game rewards may become heightened in groups with members that collectively value specific items, even beyond the contextual value of the in-game item (i.e., some in-game items may have both contextual and social value). Social gaming groups may also develop specific preferences for particular items, including purely cosmetic items, which may make them particularly desirable to players to feel part of the group. Another possibility is that competitive gaming (i.e., competing against other players) may increase cognitive regret following in-game failure or losses to a greater extent than solitary playing situations.

CONCLUSION

The present study provides empirical evidence that maladaptive cognitions may distinguish problematic and non-problematic video-game players. In short, it may be helpful to consider problematic video-gaming using cognitive concepts beyond preoccupation. Perfectionism, cognitive salience, regret, and behavioural salience represent four types of such cognitions, and their identification provides new avenues to explore in cognitive-based intervention. The capacity to measure these cognitions is essential to the task of cognitive restructuring, by enabling clinicians to
monitor changes and progression over time. Additionally, these cognitions may be useful as psychoeducation for individuals by assisting the identification of thoughts linked to problematic habits. Treatment studies for IGD are relatively rare, but it seems that CBT is the most frequently used treatment type (Lemos et al. 2014). It is hoped, then, that these findings may guide further studies and interventions directed at cognitive processes of problematic gaming.
Chapter 6: Study 4

This chapter provides a summary of the rationale, methodology and findings from Study 4. Orford (2001), among others, has argued that a longitudinal perspective is vital for understanding the development and progression of addictions. Cross-sectional studies are limited in that they only provide a ‘snapshot’ of an addiction, providing no information about the factors which are responsible for the initiation of that activity, or which are responsible for remission from problematic involvement. In short, only longitudinal studies are equipped to ascertain the extent to which factors are differentially associated with changes in a problematic behaviour, and until cross-sectional associations are investigated longitudinally it is not clear whether they represent causes or consequences of behaviour. Previous longitudinal studies of problematic video-gaming are relatively few, and have generally focused on child or adolescent populations. Although this may be the most useful approach for understanding the origins of problematic involvement, the social, cognitive and behavioural circumstances of adult players are sufficiently different that it cannot be inferred that factors relevant to one population are necessarily relevant to the other.

For these reasons, Study 4 aimed to provide further validation of the maladaptive cognitions created in Study 3 by assessing the extent to which different cognitions were associated with changes in problematic video-gaming among adults over the course of 12 months. Using an approach common to previous longitudinal studies of gaming, participants were classified according to whether, and how, their problematic involvement changed throughout this period. This allowed for the simultaneous determination of whether each type of cognition represented risk or remissive factors for problematic gaming. Increases in three of the four cognition
types were associated with individuals becoming problematic video-gamers, while one cognition type – perfectionism – was especially important for remission from problematic gaming. This study is one of the first to provide evidence for differential longitudinal associations between types of maladaptive cognitions related to video-gaming, further points to the utility of maladaptive cognitions for understanding changes in problematic behaviour, and substantiates the validity of the newly-created cognitions measure.
PAPER 4: MALADAPTIVE COGNITIONS PREDICT CHANGES IN PROBLEMATIC GAMING IN HIGHLY-ENGAGED ADULTS: A 12-MONTH LONGITUDINAL STUDY

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School of Psychology, University of Adelaide

Manuscript under review

Statement of Contributions

Cameron Forrest (Candidate)

In collaboration with my supervisors, I was responsible for devising the research programme that led to this manuscript as well as primary authorship for this paper. I conducted the literature review, data collection, and all analyses, as well as drafting the original manuscript. I incorporated suggestions from my supervisors to create subsequent drafts, was the corresponding author and primarily responsible for responses and revisions based on feedback from reviewers.

Signed..........................................................Date.................................

Daniel King (Co-author)

I was a co-supervisor for the research programme that led to the production of this manuscript. Mr. Forrest was responsible for writing this manuscript; my role was to comment on drafts, make suggestions, and to provide editorial input. I also provided advice on responding to comments by the journal reviewers and editor.
I hereby give my permission for this paper to be incorporated in Mr. Forrest’s submission for the degree of PhD in the University of Adelaide.

Signed.....................................................................Date……………………………..

Paul Delfabbro (Co-author)

I was a co-supervisor for the research programme that led to the production of this manuscript. Mr. Forrest was responsible for writing this manuscript; my role was to comment on drafts, make suggestions, and to provide editorial input. I had an advisory role regarding data analyses, and provided advice on responding to comments by the journal reviewers and editor.

I hereby give my permission for this paper to be incorporated in Mr. Forrest’s submission for the degree of PhD in the University of Adelaide.

Signed.....................................................................Date……………………………..
ABSTRACT

Maladaptive cognitions related to problematic video-gaming is a growing area of research related to Internet gaming disorder (IGD). IGD interventions which target these cognitions may be a more effective treatment than those which focus on preoccupation or behavioural changes alone. Although some research has found cross-sectional associations between maladaptive cognitions and problematic video-gaming, it is unclear whether cognitions predict changes in gaming behaviour over time. The present study used an 18-item measure of gaming cognition, assessing perfectionism, cognitive salience, regret, and behavioural salience, to predict changes in two different measures of problematic video-gaming over the course of 12 months. The sample included 465 Australian adults (85% male, $M_{age} = 26.2$ years). The results indicated that those who became problematic gamers during the study had higher baseline scores on perfectionism ($d = 1.20$), cognitive salience ($d = 0.32–0.74$) and regret ($d = 0.69$) than those who remained non-problematic gamers. Those who became non-problematic gamers had lower baseline perfectionism scores ($d = 0.34–0.62$) than those who remained problematic gamers. Cognitive changes accounted for a further 16–28% of variance in problematic gaming scores beyond gender, age, and frequency of play. These findings suggest that maladaptive gaming cognitions may warrant further attention in clinical trials in order to achieve long term therapeutic outcomes.
INTRODUCTION

Research interest in problematic video-gaming has grown exponentially over the past two decades. A notable development in the field was the inclusion of ‘Internet gaming disorder’ (IGD) in Section III of the DSM-5 as a condition warranting further study (APA 2013). One aspect of the IGD formulation that has attracted interest and debate is its cognitive dimension. Specifically, it has been argued that ‘preoccupation’ alone may not encompass the complexity of thought processes that drive problematic gaming. Some authors have suggested, for example, that video-gaming may have cognitive features such as irrational thinking, expectancy beliefs, or exaggerated cognitive responsiveness to gaming stimuli (Haagsma, Caplan, Peters & Pieterse 2013; Kim & Davis 2009; Li & Wang 2013; Wan & Chiou 2007). Research studies have reported a positive association between the presence of maladaptive gaming cognitions and severity of IGD symptoms (e.g. Liu et al. 2014; Peng & Liu 2010; Zhou et al. 2012). On this basis, it has been suggested that interventions that target these cognitions may be an effective treatment for IGD (Griffiths & Meredith 2009; King & Delfabbro 2015; Lemos et al. 2014). However, relatively little research has been conducted to identify the specific cognitions that may be most strongly related to problematic habits.

A review by King and Delfabbro (2014a) identified four main categories of maladaptive cognitions related to IGD: (1) beliefs about game rewards and tangibility, (2) maladaptive and inflexible rules about video-gaming behaviour, (3) gaming as a source of self-esteem or ego-protection, and (4) gaming as a means of gaining social acceptance. Guided by this framework, a study by Forrest et al. (2016) derived 18 items measuring these cognitions. A factor analysis indicated the items loaded on four distinct factors: (1) Perfectionism referred to thoughts about wanting
to be ‘the best’ at a particular game or games, self-blaming if unable to play as well as expected, and the inability to cease play if completing some objective; (2) **Cognitive salience** included thoughts related to being unable to function without video-games, ruminating about games when not playing, and using play as a means of distraction from work or other activities; (3) **Regret** included thoughts related to personal responsibility for the negative consequences of play, and the need to reduce one’s frequency of play; and (4) **Behavioural salience** included thoughts related to repetition of particular in-game behaviours, as well as investment due to time expenditure (i.e. a ‘sunk cost’ effect). Each of these four factors correlated positively with frequency of play, two different measures of problematic habits, and symptoms of psychological distress (i.e., depression, anxiety, and stress). Additionally, significant differences were found between problematic and non-problematic gamers for all four cognition types, and only behavioural salience was a non-significant predictor of problematic gaming status when controlling for all other variables.

At this stage, maladaptive cognitions related to video-gaming appear to be a promising avenue for research related to the treatment of IGD. However, the current knowledge base is composed mainly of cross-sectional studies that preclude statements of causality, and it is not clear whether these cognition scores might predict changes in behaviour over time.

*Longitudinal studies of video-gaming*

Prospective studies of media habits (e.g. Bessiere, Pressman, Kiesler & Kraut 2010; Dong, Lu, Zhou & Zhao 2011; Dong, Wang, Yang & Zhou 2013; Ko et al. 2015; Sun et al. 2012; van den Eijnden, Spijkerman, Vermulst, van Rooij & Engels 2010; Yen et al. 2012; Yu & Shek 2013) have generally subsumed video-gaming under broader categories such as ‘screen-based behaviour’ (i.e. including television
viewing) or ‘Internet addiction’, which includes other activities such as information browsing, social networking, Internet-hosted gambling, and use of pornographic material. Studies of Internet addiction have often assumed Davis’ (2001) cognitive model of pathological Internet use (PIU), which distinguishes between ‘generalised’ and ‘specific’ forms of PIU. Generalised PIU involved the overuse of multiple Internet-based activities for procrastination, whereas specific PIU involves problematic engagement in a particular Internet-based behaviour. According to this model, video-gaming has therefore most frequently been treated as one activity which contributes to generalised PIU. This represents a limitation of extant PIU research, in that combining behaviours together may obscure the effect of particular types of media use (Carli et al. 2013). As van Rooij, Schoenmakers, van den Eijnden and van de Mheen (2010) have stated, most individuals seem to become problematically involved with specific uses of the Internet rather than to the medium itself.

Relatively few studies have examined longitudinal predictors of problematic video-gaming, focussing instead on simple measures of frequency of electronic media use. In one of the most comprehensive longitudinal studies on problematic gaming, Gentile et al.’s (2011) study of 3034 Singaporean school children reported that the frequency of play, impulsivity, and social competence predicted pathological involvement with video-games two years later. Subsequent studies have identified additional long-term predictors of problematic gaming, including: parent-child closeness (Choo, Sim, Liau, Gentile & Khoo 2015); social competence, self-esteem, and loneliness (Lemmens, Valkenburg & Peter 2011); perceived behavioural control (Haagsma, King, Pieterse & Peters 2013); peer problems, male gender, low academic self-concept, and playing as a response to encountered problems (Mößle & Rehbein 2013); being in a single-parent family, low experienced school well-being, and
weaker social interaction (Rehbein & Baier 2013); attention problems (Ferguson & Ceranoglu 2014); lower academic achievement, higher than average height, presence of older siblings, and previous victimisation by traditional bullying (Yang et al. 2014); and RSA withdrawal (i.e., a physiological mechanism comparable to sensation-seeking; Coyne et al. 2015). However, these studies have mostly examined habits in child or adolescent populations and therefore less is known about adult gamers. Although younger people may be at greater risk of developing gaming-related problems (Kuss & Griffiths 2012), the extent to which these findings are generalisable to older age groups is unclear.

The present study

The present study aimed to determine whether maladaptive cognition scores can predict changes in problematic video-gaming over time. If changes in these cognitions are associated with changes in problematic habits over time, then interventions may be required to target these cognitions (see King & Delfabbro 2014b). Given that problematic video-gaming only affects a small proportion of the population, the most effective way to study this population was by conducting longitudinal analyses involving highly-engaged players who are more likely to experience problems associated with video-gaming (Scharkow, Festl & Quandt 2014). The present study therefore involved a sample of highly-engaged Australian adults, who completed a survey of their habits and gaming-related cognitions over 12 months. It was predicted that participants who became problematic gamers would score higher on the cognition measures than those who did not become problematic gamers. It was also predicted that participants who became non-problematic gamers would score lower on the cognition measures than those who remained problematic.
gamers. Finally, it was predicted that long-term changes in problematic behaviour scores would be positively associated with long-term changes in cognition scores.

METHOD

Participants and procedure

Recruitment for the study was conducted using a combination of online and offline methods; flyers distributed throughout the campuses of two South Australian universities supplemented online advertisements posted on websites frequented primarily by Australian video-gamers. All advertisements were addressed to individuals with strong interests in video-gaming. Participants were directed to an online survey, during which they provided informed consent and an email address through which they could be contacted to participate in subsequent waves of data collection. Measurement occurred over the course of 9 months at four equally-spaced intervals (i.e. baseline = $T_1$, 3 months = $T_2$, 6 months = $T_3$, 9 months = $T_4$). All questions referred to experiences during the past three months; therefore, each participant provided data for a 12-month period without gaps in measurement. Participants who completed their surveys received a voucher worth $10 at each stage.

Inclusion criteria were that participants had to be aged 18 or older and play video-games for at least 7 hours per week (i.e., on average one hour per day) at baseline. Of the 657 initial responses received, 192 were excluded on the basis of these criteria or for providing disingenuous responses. Final participation rates were as follows: $T_1 N = 465$, $T_2 N = 374$, $T_3 N = 329$, $T_4 N = 290$. Multiple imputation was used to deal with missing data (see section 2.3).
Measures

Participants completed a survey on an online hosting website which took 30-45 minutes to complete. In addition to providing demographic information, participants reported how frequently they played video-games during a typical week in the last 3 months (in hours), and completed the measures listed below.

Video-gaming cognitions: 18 items were used to measure maladaptive cognitions related to video-gaming, separated into four subscales. Perfectionism (6 items, $T_1 \alpha = .83$) measured thoughts such as wanting to be a better player than others, self-blame or feelings of failure if unable to complete or solve parts of a game, and being unable to cease play until objectives have been completed. Cognitive salience (6 items, $T_1 \alpha = .81$) measured thoughts related to being unable to function or focus on other activities due to ruminating about video-games, as well as the importance of gaming to one’s identity. Regret (3 items, $T_1 \alpha = .81$) measured thoughts about feeling guilty or wanting to reduce one’s frequency of play due to negative consequences. Behavioural salience (3 items, $T_1 \alpha = .74$) measured thoughts about repetitive in-game behaviours, as well as difficulty in ceasing play due to time investment. Responses were given on a 5-point scale where 1 = ‘Never’, 2 = ‘Rarely’, 3 = ‘Some of the time’, 4 = ‘Most of the time’, and 5 = ‘Always’. Further information on how these scales were constructed has been reported elsewhere (Forrest et al. 2016).

The Game Addiction Scale (GAS; Lemmens et al. 2009; $T_1 \alpha = .93$) is a 21-item measure of the extent to which an individual’s video-gaming habits have become problematic in terms of symptoms related to salience, tolerance, mood modification, relapse, withdrawal, conflict, and problems caused by play. Responses are given on a 5-point Likert scale (‘never’ to ‘very often’), providing a potential minimum score of 21 and a potential maximum of 105. Each of the 7 symptom types
is measured by individual subscales which are considered ‘met’ if the average score on their items is 3 (‘sometimes’) or greater. For the purposes of analyses, participants were classified as problematic gamers if they met at least 4 of the 7 criteria. Rates of problematic involvement were as follows: \( T_1 \) 15.7\%, \( T_2 \) 12.3\%, \( T_3 \) 11.2\%, \( T_4 \) 9.2\%.

*The Problem Video Game Playing Scale (PVP; Salguero & Morán 2002; \( T_1 \) \( \alpha \) = .76)* is a 9-item measure of problematic gaming which measures habits in terms of preoccupation, tolerance, loss of control, withdrawal, escape, lies and deception, disregard for physical or psychological consequences of play, and disruption to family or work commitments. Participants could respond ‘yes’, ‘no’ or ‘sometimes’ to each item, and sometimes responses were coded the same as a yes in order to account for participants downplaying their problems. Scores therefore ranged from a minimum of 0 to a maximum of 9. A score of 5 or higher resulted in participants being classified as problematically involved with video-games at a given wave. Using these criteria, rates of problematic gaming were: \( T_1 \) 37.8\%, \( T_2 \) 33.8\%, \( T_3 \) 32.5\%, \( T_4 \) 29.5\%.

**Analytical strategy**

Little’s test indicated that data could be considered missing completely at random for the purposes of analyses, \( \chi^2(366) = 410.76, p > .05 \). Using SPSS for Windows version 21, multiple imputation was used to provide values for all missing data. Multiple imputation uses all available data to provide estimations for any missing data, the final values of which are calculated as the averages of five such estimations. Imputing data in this manner allows analyses to be performed on responses from all participants, rather than excluding cases listwise or pairwise.

In accordance with strategies used in previous studies (Gentile et al. 2011; Ko, Yen, Yen, Lin & Yang 2007; Meerkerk et al. 2006; Scharkow et al. 2014), two
sets of analyses were conducted. First, participants were classified into four groups according to whether they could be classified as problematic gamers at $T_1$ and $T_4$. Participants were classified separately for PVP and GAS criteria. Participants who were non-problematic gamers at both $T_1$ and $T_4$ formed the ‘Never’ group. Those who were non-problematic gamers at $T_1$ but were problematic gamers at $T_4$ formed the ‘Starts’ group. Those who were problematic gamers at $T_1$ but were non-problematic gamers at $T_4$ formed the ‘Stops’ group. Finally, those who were problematic gamers at both $T_1$ and $T_4$ formed the ‘Stays’ group. These groups were compared using chi-square analyses and one-way ANOVA with planned comparisons. Comparisons between the Never and Starts groups were used to identify potential risk factors of problematic gaming, whereas comparisons between the Stops and Stays groups were used to identify potential remission factors. Then, two hierarchical regression models were constructed predicting changes in problematic gaming scores (calculated as $T_4 - T_1$). Gender, age, frequency of play, and baseline problematic gaming scores were entered in the first step, and baseline and changes in cognition scores were entered in the second step.

RESULTS

Using GAS criteria, significant differences were found between all four groups for perfectionism ($F(3, 461) = 50.31, p < .001$), cognitive salience ($F(3, 461) = 75.67, p < .001$), regret ($F(3, 461) = 60.37, p < .001$) and behavioural salience ($F(3, 461) = 17.65, p < .001$), but not for age ($F(3, 461) = 1.80, p > .05$). These findings were consistent with those for PVP classification (perfectionism $F(3, 461) = 50.26, p < .001$; cognitive salience $F(3, 461) = 85.86, p < .001$; regret $F(3, 461) = 30.70, p < .001$; behavioural salience $F(3, 461) = 34.85, p < .001$; age $F(3, 461) = 0.38, p >$
.05). However, findings from planned contrasts were not consistent between measures. Tables 1 (GAS) and 2 (PVP) show the results of baseline comparisons between the Never/Starts and Stops/Stays groups. Using GAS classification, participants who became problematic gamers during the study had significantly higher perfectionism, cognitive salience, and regret scores at baseline than those who remained non-problematic gamers, and those who became non-problematic gamers had significantly higher perfectionism scores at baseline than those who remained problematic gamers. However, when using PVP classification, significant differences were found only for cognitive salience (Never/Starts) and perfectionism (Stops/Stays) scores. Despite these inconsistencies, the evidence generally suggested that perfectionism, cognitive salience, and regret are the most relevant when comparing problematic and non-problematic gamers longitudinally. Higher scores for these cognitions may be risk factors for developing problematic habits, whereas lower scores appear to predict a subsequent reduction in problematic behaviour over time.
Table 1: Baseline comparisons (planned contrasts) between Never, Starts, Stops and Stays groups using GAS criteria (N = 465)

<table>
<thead>
<tr>
<th></th>
<th>Never (N = 374)</th>
<th>Starts (N = 18)</th>
<th>Test statistic</th>
<th>Effect size</th>
<th>Stops (N = 48)</th>
<th>Stays (N = 25)</th>
<th>Test statistic</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender=male</td>
<td></td>
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<td></td>
<td>316 (84.5)</td>
<td>17 (94.4)</td>
<td>1.33 (1)</td>
<td></td>
<td>37 (77.1)</td>
<td>23 (92.0)</td>
<td>2.50 (1)</td>
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</tr>
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<td>M (SD)</td>
<td>26.54 (7.33)</td>
<td>23.11 (5.74)</td>
<td>1.96 (461)</td>
<td>1.96 (461)</td>
<td>25.42 (6.85)</td>
<td>24.96 (7.40)</td>
<td>0.26 (461)</td>
<td></td>
</tr>
<tr>
<td>Perfectionism</td>
<td>10.61 (3.86)</td>
<td>15.33 (5.36)</td>
<td>3.69** (18)</td>
<td>1.20</td>
<td>15.50 (4.68)</td>
<td>18.72 (6.19)</td>
<td>2.28* (39)</td>
<td>0.62</td>
</tr>
<tr>
<td>Cognitive salience</td>
<td>10.11 (3.25)</td>
<td>12.56 (4.10)</td>
<td>2.49* (18)</td>
<td>0.74</td>
<td>16.48 (4.84)</td>
<td>17.88 (5.04)</td>
<td>1.14 (47)</td>
<td></td>
</tr>
<tr>
<td>Regret</td>
<td>4.89 (2.15)</td>
<td>6.39 (2.52)</td>
<td>2.48* (18)</td>
<td>0.69</td>
<td>8.83 (3.22)</td>
<td>9.08 (3.09)</td>
<td>0.32 (51)</td>
<td></td>
</tr>
<tr>
<td>Behavioural salience</td>
<td>6.59 (2.64)</td>
<td>7.67 (2.95)</td>
<td>1.66 (461)</td>
<td>1.66 (461)</td>
<td>9.23 (2.86)</td>
<td>8.72 (2.85)</td>
<td>0.77 (461)</td>
<td></td>
</tr>
</tbody>
</table>

Note: *p < .05, **p < .01.
Table 2: Baseline comparisons (planned contrasts) between Never, Starts, Stops and Stays groups using PVP criteria (N = 465)

<table>
<thead>
<tr>
<th></th>
<th>Never (N = 241)</th>
<th>Starts (N = 48)</th>
<th>Test statistic</th>
<th>Effect size</th>
<th>Stops (N = 87)</th>
<th>Stays (N = 89)</th>
<th>Test statistic</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender=male</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N (%)</td>
<td>206 (85.5)</td>
<td>40 (83.3)</td>
<td>0.15 (1)</td>
<td></td>
<td>73 (83.9)</td>
<td>74 (83.1)</td>
<td>0.02 (1)</td>
<td></td>
</tr>
<tr>
<td>M (SD)</td>
<td>26.44 (6.99)</td>
<td>26.60 (7.72)</td>
<td>0.14 (461)</td>
<td>0.14</td>
<td>25.97 (8.33)</td>
<td>25.58 (6.63)</td>
<td>0.35 (461)</td>
<td>0.34</td>
</tr>
<tr>
<td>Perfectionism</td>
<td>9.81 (3.65)</td>
<td>10.63 (2.94)</td>
<td>1.68 (79)</td>
<td>0.32</td>
<td>13.82 (4.80)</td>
<td>15.52 (5.19)</td>
<td>2.26 (173)</td>
<td>0.34</td>
</tr>
<tr>
<td>Cognitive salience</td>
<td>9.11 (2.77)</td>
<td>10.00 (2.67)</td>
<td>2.09* (69)</td>
<td></td>
<td>14.09 (4.68)</td>
<td>15.08 (4.31)</td>
<td>1.45 (172)</td>
<td></td>
</tr>
<tr>
<td>Regret</td>
<td>4.62 (2.08)</td>
<td>5.23 (2.56)</td>
<td>1.54 (60)</td>
<td></td>
<td>6.68 (3.01)</td>
<td>7.29 (3.09)</td>
<td>1.33 (174)</td>
<td></td>
</tr>
<tr>
<td>Behavioural salience</td>
<td>6.05 (2.59)</td>
<td>6.17 (2.02)</td>
<td>0.28 (461)</td>
<td></td>
<td>8.46 (2.83)</td>
<td>8.69 (2.46)</td>
<td>0.58 (461)</td>
<td></td>
</tr>
</tbody>
</table>

Note: *p < .05
Findings from the hierarchical regression models predicting $T_1$–$T_4$ changes in problematic gaming scores are presented in Table 3. Separate models were constructed using GAS and PVP scores. According to both models, higher baseline cognitive salience and regret scores, and increases in cognitive salience, regret, and behavioural salience predicted increases in problematic gaming scores over 12 months. The GAS model found additional effects for baseline frequency of play and perfectionism scores. When controlling for all other variables, baseline and changes in cognition scores accounted for a further 16–28% of changes in problematic gaming scores.

**DISCUSSION**

This study aimed to determine whether known cross-sectional relationships between maladaptive cognitions and problematic video-gaming can be used to inform changes in behaviour over time. In a sample of highly-engaged gaming adults, it was found that individuals who became problematic gamers over the course of one year scored higher on measures of perfectionism, cognitive salience, and regret at baseline than those who remained non-problematic gamers. Gamers whose habits became non-problematic during this period had lower baseline perfectionism scores than those who remained problematically involved. These findings therefore demonstrate longitudinal associations between changes in gaming-related cognitions and problematic gaming.
Table 3: Hierarchical regression predicting changes in problem gaming scores from baseline and changes in gaming-related cognitions over 12 months (N = 465)

<table>
<thead>
<tr>
<th>Step</th>
<th>Variable</th>
<th>GAS (B (SE))</th>
<th>β</th>
<th>ΔR²</th>
<th>PVP (B (SE))</th>
<th>β</th>
<th>ΔR²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Constant</td>
<td>8.15*** (2.19)</td>
<td>-0.01 (0.50)</td>
<td></td>
<td>-0.01 (0.19)</td>
<td>-0.02 (0.07)</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>Gender=Male</td>
<td>-0.24 (0.86)</td>
<td>-0.01</td>
<td>-0.07 (0.01)</td>
<td>-0.02 (0.03)</td>
<td>0.00 (0.01)</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>Age T₁</td>
<td>0.02 (0.05)</td>
<td>0.01</td>
<td>-0.01 (0.01)</td>
<td>-0.02 (0.19)</td>
<td>0.00 (0.01)</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>Age change</td>
<td>-0.29 (0.32)</td>
<td>-0.02</td>
<td>0.03 (0.07)</td>
<td>0.02 (0.07)</td>
<td>0.02 (0.07)</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>Frequency of play T₁</td>
<td>0.03 (0.02)</td>
<td>0.05</td>
<td>0.00 (0.01)</td>
<td>0.00 (0.01)</td>
<td>0.02 (0.01)</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>Frequency of play change</td>
<td>0.09*** (0.03)</td>
<td>0.12</td>
<td>0.00 (0.01)</td>
<td>0.02 (0.02)</td>
<td>0.02 (0.01)</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>GAS/PVP T₁</td>
<td>-0.70*** (0.04)</td>
<td>-0.77</td>
<td>-0.66*** (0.05)</td>
<td>-0.68 (0.07)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.459</td>
<td></td>
<td></td>
<td>.411</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 2</td>
<td>Perfectionism T₁</td>
<td>0.26* (0.12)</td>
<td>0.10</td>
<td>0.02 (0.03)</td>
<td>0.03 (0.03)</td>
<td>0.03 (0.03)</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td>Perfectionism change</td>
<td>0.09 (0.13)</td>
<td>0.03</td>
<td>-0.02 (0.03)</td>
<td>-0.03 (0.03)</td>
<td>-0.03 (0.03)</td>
<td>-0.03</td>
</tr>
<tr>
<td></td>
<td>Cognitive salience T₁</td>
<td>0.90*** (0.15)</td>
<td>0.31</td>
<td>0.11*** (0.03)</td>
<td>0.21 (0.03)</td>
<td>0.21 (0.03)</td>
<td>0.21</td>
</tr>
<tr>
<td></td>
<td>Cognitive salience change</td>
<td>1.34*** (0.14)</td>
<td>0.43</td>
<td>0.17*** (0.03)</td>
<td>0.31 (0.03)</td>
<td>0.31 (0.03)</td>
<td>0.31</td>
</tr>
<tr>
<td></td>
<td>Regret T₁</td>
<td>0.88* (0.20)</td>
<td>0.19</td>
<td>0.11*** (0.04)</td>
<td>0.14 (0.04)</td>
<td>0.14 (0.04)</td>
<td>0.14</td>
</tr>
<tr>
<td></td>
<td>Regret change</td>
<td>1.32*** (0.21)</td>
<td>0.25</td>
<td>0.16*** (0.05)</td>
<td>0.17 (0.05)</td>
<td>0.17 (0.05)</td>
<td>0.17</td>
</tr>
<tr>
<td></td>
<td>Behavioural salience T₁</td>
<td>0.15 (0.18)</td>
<td>0.03</td>
<td>0.05 (0.04)</td>
<td>0.06 (0.04)</td>
<td>0.06 (0.04)</td>
<td>0.06</td>
</tr>
<tr>
<td></td>
<td>Behavioural salience change</td>
<td>0.46* (0.19)</td>
<td>0.09</td>
<td>0.13** (0.04)</td>
<td>0.15 (0.04)</td>
<td>0.15 (0.04)</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.280</td>
<td></td>
<td></td>
<td>.155</td>
</tr>
</tbody>
</table>

Note: *p < .05, **p < .01, ***p < .001.

Past research (Choo et al. 2015; Davis 2001) has emphasised the psychological symptoms of problematic gaming, including suggestions that CBT may be the most effective short-term treatment for IGD. Despite this, intervention strategies have generally targeted preoccupation or behavioural changes which may lack efficacy (King & Delfabbro 2014b; Peng & Liu 2010). This study identified four types of gaming-related cognitions which increase or decrease in frequency as a function of changes in problematic habits. Differences in cognitive salience and
regret were particularly influential. Cognitive salience, as measured in this study, refers to believing that one is unable to function without video-games, thinking about them constantly when unable to play to the point of distraction from external commitments or responsibilities. Scores on the Regret scale reflect thoughts related to personal responsibility for the negative consequences of play and wanting to reduce one’s involvement accordingly. However, results from planned comparisons differed depending on the criteria used for problematic gaming. The explanation for these discrepancies is not clear from the present findings alone as relatively few studies have compared different measures of problematic gaming. However, of the two measures used in this study, the GAS might provide more clinical information (King, Haagsma, Delfabbro, Gradisar & Griffiths 2013). Furthermore, although changes in behavioural salience scores significantly predicted changes in problematic gaming scores, planned contrasts found non-significant differences between the Never/Starts and Stops/Stays groups. These findings lend support indirectly to other models of gaming problems that emphasise cognition (Caplan 2010; Davis 2001). Although problematic gamers may play to excess such that they no longer have time for their external commitments, it may also be useful to consider behavioural changes in cognitive terms; that is, that gaming may come to dominate an individual’s thoughts such that they are unable to concentrate on other activities when unable to play. However, it is also possible that the three items comprising the behavioural salience subscale do not adequately measure the range of behavioural symptoms which might be associated with problematic habits. Future studies may be able to provide additional items according to the identification of other such behaviours. For example, competition and social interaction (Caplan 2003; Sherry et al. 2006) have been associated with problematic gaming. Although the desire to be ‘the best’ is measured by the existing perfectionism scale, the behavioural salience
scale might also be strengthened by the inclusion of items assessing thoughts about specific behaviours related to these motives.

Longitudinal regression analyses likewise found that cognitive salience and regret were the most relevant predictors of long-term changes in problematic gaming scores. In both models, higher baseline regret, higher baseline cognitive salience, and increases in regret, cognitive salience and behavioural salience predicted increases in problematic gaming scores over 12 months. Furthermore, the combination of baseline and changes in all four cognition types accounted for a further 16–28% of variances in changes in problematic gaming than the combination of gender, age, frequency of play, and baseline problematic gaming. These variables had been included as the most consistent predictors of problematic habits throughout the IGD literature, but only changes in frequency of play remained a significant predictor when controlling for cognition scores. Interestingly, changes in perfectionism were non-significant predictors in both models, and baseline perfectionism scores were a significant predictor only in the model which used GAS classification. This supports previous suggestions that certain types of cognitions are more relevant to problematic habits than others. Discrepancies between the regression models and planned contrasts likely reflect the use of problematic gaming scores as a continuous measure versus using cut-off scores to classify individuals as problematically involved. Although validation of criteria for ‘addiction’ is beyond the scope of this study, it is clear that maladaptive cognitions related to video-gaming contribute to problematic habits longitudinally as well as cross-sectionally.

Although not a primary focus of this study, it was also found that a relatively high proportion of problematic gamers became non-problematic gamers during the study. Using PVP criteria, 49% of participants who were classified as problematic gamers at $T_1$ became non-problematic gamers by $T_4$. This figure increased to 66%
when using GAS criteria, and is consistent with studies that have identified longitudinal declines in symptom severity among adults (Konkolý Thege, Woodin, Hodgins & Williams 2015; Möble & Rehbein 2013; Scharkow et al. 2014). In a comparable study of Australian adults, King, Delfabbro and Griffiths (2013) found that participants who identified as problematic gamers, as well as those who did not, both experienced decreases in symptoms over 18 months. In line with their suggestions, these findings may indicate maturation or spontaneous recovery effects which have been observed for other addictions such as pathological gambling (Anglin, Brecht, Woodward & Bonett 1986; Toneatto et al. 2008). Although children and adolescents may be at greater risk of developing problematic habits (Kuss & Griffiths 2012), these results emphasise that findings pertaining to the etiology of IGD should not be generalised to other age groups.

LIMITATIONS AND FUTURE DIRECTIONS

This study had some limitations that warrant discussion. The cognition measure developed for this study is only preliminary at this stage and would benefit from further validation. The measure may also benefit from refining its items to improve internal consistency, as well as the identification of other cognition types which might be associated with problematic habits. The study sample was recruited from multiple sources and is unlikely to be representative of the general video-gaming population, especially since highly-engaged gamers were targeted in order to provide higher rates of problematic involvement. Further studies are necessary to determine whether the reported relationships between maladaptive cognitions and problematic gaming are reflected in other populations. Furthermore, despite successfully recruiting a sample with high rates of problematic gaming, sample sizes
for the Starts, Stops and Never groups were small, especially when using GAS criteria. Small sample sizes increase risk of type II error, and it is therefore possible that some null hypotheses have been incorrectly retained. Dropout was also relative highly despite offering rewards for participation. Future studies using adult video-gamers will need to address ways of retaining participants such as reducing survey length or using shorter intervals between measurements.

The presented analyses assume that maladaptive cognitions are a cause of problematic habits. However, as with other comorbid issues (e.g. stress and academic performance), it is likely the presence of one symptom or condition reinforces the other. For example, Gentile et al. (2011) found that impulsivity predicted pathological gaming, but also increased after participants became pathological gamers. The results reported here should therefore not be interpreted as an attempt to resolve the ‘chicken or egg’ problem of whether maladaptive cognitions or problematic behaviours arise first. To this end, case studies and qualitative data would be especially useful.

CONCLUSION

Previous longitudinal studies of problematic video-gaming have generally focused on consequences rather than causes of play. This study suggests that changes in gaming-related cognitive salience, regret, and to a lesser extent perfectionism, may explain changes in problematic gaming habits. We have provided a preliminary measure of these cognitions which show cross-sectional as well as longitudinal associations with problematic involvement. It is hoped that these findings will be useful to clinicians treating patients who seek to redress the imbalance between their gaming and other commitments, or self-help information that would allow
individuals to identify the types of maladaptive thought patterns that appear to be associated with problematic levels of gaming.
Chapter 7: General Conclusion

Overview of thesis aims

The purpose of this thesis was to identify new potential correlates of problematic video-gaming, as well as the extent to which changes in these factors are associated with changes in behaviour over time. The following research questions were examined:

Paper 1

- To what extent are highly-engaged adult video-gamers concurrently involved with gambling?
- Is video-gaming a risk factor for later gambling involvement?
- Do previous comparisons between pathological gambling and problematic video-gaming remain valid in modern contexts?

Paper 2

- What social factors are associated with problematic video-gaming?
- Are various types of social gaming behaviour related to problematic habits?
- How do social motives to play relate to preferences for particular genres, in-game activities, and problematic behaviour?

Paper 3

- Can gaming-related cognitions be used to differentiate between problematic and non-problematic players?
- What types of cognitions are differentially associated with problematic behaviour?
- How does the presence of particular cognitions relate to psychological distress?
Paper 4

- Can maladaptive cognitions be used to inform changes in problematic gaming behaviour over time?
- Which cognitions represent risk, protective or remissive factors for problematic gaming?

Review of papers

Paper 1

This paper investigated the gambling habits of highly-engaged adult video-game players. In contrast with early suggestions that both activities appeal to the same individuals, adult gamers were found to be infrequent gamblers. Additionally, no association was found between gaming and gambling frequencies, and problem gaming was found to be a weak predictor of gambling habits. These findings aligned closely with recent suggestions that adult video-gamers are generally disinterested in gambling, and that modern structural dissimilarities between the two activities – specifically the role of skill in gaming versus the role of luck in gambling – might mean that video-gaming actually serves as a protective factor against gambling involvement. Criteria and measures of problematic behaviour derived from early studies of arcade video-games therefore appear to be less relevant to modern scenarios.

Paper 2

This paper examined social correlates of problematic gaming. The principal finding of this study was that problematic gamers appear to be particularly motivated by competition, especially against strangers in online environments. This may partially explain why problematic gamers are drawn to, and spend excessive amounts
of time playing, genres such as MMOs which provide anonymity and facilitate online interaction. Conversely, non-problematic gamers were found to prefer playing solitarily offline and report higher offline social support, particularly from friends. In summary, social relationships and motivations to play were found to be important considerations for explaining problematic gaming behaviour, and social interventions – such as involving friends and family in play – may help to protect against the development of problematic habits.

**Paper 3**

This paper sought to provide and validate a new measure of maladaptive cognitions related to problematic gaming. Eighteen items derived from previous research were separated into four subscales which measured gaming-related perfectionism, cognitive salience, regret, and behavioural salience. Each cognition type was associated with problematic gaming and psychological distress, and could be used to distinguish between problematic and non-problematic gamers. Although only tentative conclusions could be drawn from these findings due to the preliminary nature of the cognitions measure, the principal contribution of this study was identifying specific types of thoughts related to problematic gaming that could be targeted through clinical intervention.

**Paper 4**

Following from Paper 3, the aim of this paper was to further investigate the utility of maladaptive cognitions for explaining long-term changes in problematic gaming behaviour. Using all four waves of collected data, it was found that baseline cognitions related to perfectionism, cognitive salience, and regret predicted changes in problematic gaming status 12 months later. Specifically, increases in these three
cognition types were associated with individuals becoming problematically involved with video-games, and decreases in perfectionism appeared to be a remissive factor. These findings suggested that maladaptive cognitions can be used to understand long-term as well as short-term changes in problematic gaming behaviour, and that some cognition types (especially perfectionism) may be more relevant in this regard.

Summary of main findings

On the basis of general and integrative models of addiction, this thesis focused specifically on factors associated with problematic video-gaming which had been previously neglected in the literature. It has provided empirical evidence for the influence of multiple social influences on gaming behaviour, as well as a new measure of maladaptive cognitions which shows both short-term and long-term associations with problematic gaming. All identified correlates of problematic gaming are theoretically modifiable, and advice has been provided regarding how they might be addressed through clinical intervention. Collectively, the present findings also suggest that previous accounts of problematic video-gaming, especially those which have relied on comparisons with pathological gambling, no longer sufficiently account for behaviour in modern contexts. Finally, this thesis has provided much needed data on the gaming habits of Australian adults, a demographic on whom studies have been particularly limited.

Overall significance

General theories of addiction (e.g. Orford 1985; Shaffer et al. 2000; Weil 1972) have posited that any psychologically rewarding activity has the potential to lead to addiction if taken to excess. Some authors (e.g. Wood 2008a) have argued that research should therefore focus on processes which seem to be common to all
addictions. Emerging evidence, including that which has been presented in this thesis, suggests that problematic use of technologies such as the Internet and video-games may be driven by processes that have been observed for other addictive activities. Specifically, in terms of Brown’s (1989) core facets of addiction, the studies comprising this thesis suggest that problematic video-gaming (i) cognitively and behaviourally dominates the individual’s life, although cognitive factors may be responsible for driving behaviour; (ii) provides relief from unpleasant feelings, including a perceived lack of social support from friends, family members, significant others, and regret caused by the negative consequences of play; and (iii) causes conflict with offline relationships (in the case of online gaming), responsibilities, and especially one’s self, as characterised by the simultaneous maintenance of both positive and negative attitudes towards gaming. This ambivalence towards video-games among problematic users most likely results from a combination of positive and negative reinforcement received through play, which causes behaviour to become so strongly conditioned that it becomes an additional problem to the pre-existing mood states which the player initially turned to video-games to alleviate (Turner 2008). Although Brown also posited a fourth component, that the activity should require increasing involvement in order to achieve the same level of arousal (i.e. tolerance), Orford (2001) has argued that such effects are typical of substance-based, rather than behavioural, addictions and may not be a necessary component of addictions in general. Instead, the evidence provided in this thesis suggests that social and cognitive processes are especially pertinent to problematic video-gaming. Examples of these processes include the normalising influence of friends and online acquaintances; strong motivation to compete against other players, perhaps driven by the desire to be ‘the best’ at a game and/or deriving self-esteem primarily through playing performance; and being so preoccupied with video-gaming
that the individual cannot concentrate on non-gaming relationships or responsibilities. Contrary to Wood’s (2008a) assertion that time loss is the main negative consequence of excessive video-game play, data from the present thesis also suggest that problematic gamers are significantly more distressed than non-problematic gamers, and are more likely to tend towards depression, anxiety, and stress which affects other areas of their lives. However, problematic habits also appear more likely to develop in response to negative moods and thought patterns which, using Stern’s (1999) terminology, may suggest that problematic gaming represents a secondary rather than primary condition. Nevertheless, the identification of several processes which may be unique to problematic video-gaming suggests that research focus on video-gaming as a potentially harmful activity is justified.

Some authors (e.g. Blaszczynski 2008; Wood 2008a) have warned against prematurely labelling problematic video-gaming as an addiction, since doing so has the potential to exacerbate public fears about gaming while also trivialising more serious disorders. For this reason, Orford (1985, 2001) has suggested that the term ‘excessive appetite’ may be more appropriate since it avoids connotation with substance-based disorders, and hence assumptions that processes which are typical of these conditions (such as withdrawal and tolerance effects) must be present. In the case of video-gaming, this seems to be especially relevant to comparisons with pathological video-gaming, which appear to be less valid in modern contexts than twenty years ago. Indeed, on the basis of the evidence provided in this thesis, the excessive appetites framework appears to be particularly useful for understanding the mechanisms which drive problematic video-gaming. First, potentially ‘addictive’ activities are understood to have multiple causes which interact with each other. In the case of problematic video-gaming, these appear to include personality and demographic variables, but also the structural features of the game in question,
social influences and group norms, as well as opportunities for play. Second, the excessive appetites model emphasises that the activity can serve different functions between problematically involved individuals, and even within the same individual over time. In accordance with this perspective, the present thesis has provided evidence that, although competition and social motives appear to be especially relevant to problematic gaming, other factors such as deficient social support and perfectionist tendencies may help to explain differences in the presentation of problematic gaming between affected individuals. Third, since excessive attachments are assumed to be a dynamic process, Orford (2001) has emphasised the importance of a longitudinal perspective, especially since changes in behaviour and attitudes towards the activity constitute the rule rather than the exception. The present thesis has provided preliminary evidence in support of adopting this perspective for problematic video-gaming, both for understanding how cognitions can be used to inform changes in behaviour over time, but also for how the activity itself has changed over time, and is likely to continue to do so. Collectively, the present findings also suggest that theories based on relatively simple predispositions towards problematic gaming should be treated with some measure of scepticism. Fourth, the excessive appetites framework holds that progression of problematic behaviour involves the generalisation of circumstances which are considered by the individual to be appropriate or acceptable for partaking in that behaviour. Findings from the present studies suggest that associating primarily with other highly-engaged players, especially those who are not personally known to the individual outside of gaming contexts, is particularly ‘risky’ or ‘dangerous’ in the sense that the individual may come to prefer online socialisation to the detriment of existing offline relationships (Caplan 2003) and/or fail to regard their play as excessive or problematic (Lee & LaRose 2007). Finally, the excessive appetites model posits that the same mood
modifying effects which make an activity initially appealing to an individual also provide relief from the negative consequences of excessive involvement. This leads to a cyclical process which exacerbates negative mood states, while also causing the behaviour to become even more strongly conditioned. The present thesis suggests that social and cognitive interventions may be especially useful for breaking this cycle. Examples of possible cognitive interventions include assisting the individual to realise the function of gaming within their lives, that they no longer play for enjoyment but out of perceived obligations to play, and experimenting with the natural consequences of acting in discordance with their regimented patterns of play. In terms of social intervention, involving offline friends, family members, and/or significant others in play may help to keep habits in perspective, while also serving to enhance rather than detract from offline relationships (Snodgrass et al. 2011).

In summary, the principal contribution of this thesis to the field is its specification of mechanisms for the development and maintenance of problematic video-gaming which do not rely on personality- or activity-based explanations. Historically, the negative consequences of video-gaming have been attributed either to some property of the activity itself, or to some fault of the individual. This thesis has been presented as an investigation of a third approach, that is, that problematic video-gaming results from a maladaptive relationship between the individual and the activity. This relationship has been conceptualised as a learned behaviour which develops over time, which develops in response to perceived deficits in other aspects of the affected individual’s life, and which is affected by multiple extraneous influences. These influences include perceived social support, as well as the normalising effects of friendship groups, and empirical evidence has been provided in support of this. The relationship is also characterised by a pattern of thoughts which affects the individual’s life not through its occupation of the individual’s time,
but through its total dominance of the individual’s mind. Although the personality of
the individual and the structural characteristics of video-games remain important
considerations, neither is sufficient to account for problematic habits among so-
called ‘addicts’.

Methodological limitations

The primary limitation of this research programme has been its reliance on
participant self-selection and self-report measures of playing habits. Video-gaming
research is often criticised for its assumption that participants provide an accurate
account of their play; denial and a desire to portray video-gaming in a positive light
likely render this assumption somewhat tenuous, especially among individuals who
are problematically involved. It is difficult, however, to envisage a non-intrusive
method of data collection that would improve on the methods employed throughout
this thesis without significantly inflating time expenditure, as well as cost. Motivated
by previous suggestions regarding the importance of establishing rapport with the
gaming population (King et al. 2009), I took great lengths throughout the research
programme to engage with participants, maintaining a presence on online messaging
boards, encouraging them to ask questions and keeping them informed about my
study results, while still ensuring their anonymity. Nevertheless, the findings
presented here should not be generalised beyond highly engaged Australian adults
until sufficient evidence emerges to suggest congruence between this and other
populations.

Furthermore, the cognitions scale employed in Papers 3 and 4 is preliminary
in nature and further research is required to establish how it behaves in other
samples. Although it displayed acceptable internal consistency given the relatively
low number of items assessing each construct, it would benefit from additional items
to measures other aspects of gaming-related perfectionism, cognitive salience, regret, and behavioural salience. Additionally, further subscales could eventually be included according to the identification of other types of thoughts which accompany problematic involvement.

In explaining the significance of the findings, it has also been assumed that cognitions related to problematic gaming are potentially modifiable through personal application and/or clinical intervention. This assumption represents one of the main tenets of treatments such as CBT which aim to help individuals first understand, and then overcome, maladaptive thought patterns that lead to regimented behaviours. However, such treatments are invariably assisted rather than prescribed, and require motivation, i.e. a desire to change, from the affected individual. Due to denial and the lack of a well-defined ‘cut-off’ point between addiction and high engagement, it cannot be concluded that the presence of maladaptive cognitions is necessarily indicative of problematic involvement, or that gamers who report them will even regard them as maladaptive. Instead, they must be understood in terms of the individual’s competing needs and responsibilities. The approaches advocated here are therefore presented as one of several treatment options which supplement each other, but which are of limited use individually.

**Future directions**

Several research directions were suggested by the present findings, particularly as concerns the role of social and cognitive factors in problematic video-gaming. It is hoped that the cognitions scale provided in Paper 3 will help to guide future research by providing a new measure of negative impact on players’ lives, which can be tracked according to changes in playing time, playing methods, and the introduction of clinical or self-driven interventions. The early success of the measure
in distinguishing problematic from non-problematic players may also help to stimulate a more cognitive approach to understanding problematic gaming which does not rely on simple preoccupation, behavioural measures such as frequency of play, or comparisons with pathological gambling. This would help to distance gaming research from outdated models of addiction which have not sufficiently accounted for changes in the gaming environment. It would also be useful to identify whether cognitions change as a function of preferences for various types of game; for example, perfectionism is likely to be more relevant in games that emphasise competition and player scores, whereas behavioural salience is likely to be more relevant for games which include a greater density of repetitive tasks.

Furthermore, the social correlates of problematic gaming identified in Paper 2 could be integrated into treatment programmes as a means of supplementing behavioural and cognitive approaches. Studies which examine the modification of these social influences, such as the involvement of friends and family in play, in relation to problematic habits would be especially useful. It is anticipated that, as the popularity of video-gaming continues to grow and recognition of problematic involvement becomes more widespread, the number of individuals seeking treatment will increase accordingly. Since it has been argued throughout this thesis that the psychodynamics of problematic video-gaming may be somewhat unique to each individual, it would be useful to ascertain the efficacy of multiple treatment avenues.

Finally, a number of other measures were included in the questionnaire on the basis of theoretical links with problematic gaming, but ultimately were not used in the four papers comprising the present thesis. These included measures of physical health, general Internet use, self-control, and dissociation while playing. Of the included measures, the cognitions scale was also the only one for which longitudinal associations with problematic gaming were investigated. It would also be valuable to
examine the factors identified here in other samples; it would be intriguing, for instance, to ascertain whether gaming-related cognitions are associated with curiosity or intention to play in casual or non-gaming samples, and whether they are able to predict later problematic involvement.

**Concluding statement**

Historically, the majority of scientific research on video-gaming has focused on its potential to negatively influence the lives of players. On the basis of extant research, video-gaming appears to be a potentially problematic activity which is enjoyed in moderation by the vast majority of users, but which represents a substantial problem for a minority. This recognition is important for legitimising the problematic gaming construct, so that individuals can firstly recognise when their own habits have become problematic, and then seek treatment which is based on best evidence. Orford (2001) has suggested that, for everyday activities that are potentially addictive, the question perhaps should not be why the minority becomes addicted, but why the majority does not. It has been noted that societies are most vulnerable to addictive activities when they are first introduced to them, such as alcohol in indigenous cultures. The majority of Western society has now been introduced to video-gaming in some form, and although admissions for problematic gaming may increase as the legitimacy of the construct becomes more established, rates of problematic involvement in the wider population remain low relative to the number of players. This in itself suggests that findings related to gaming ‘addiction’ are not grounds for a moral panic, and that the games themselves are not inherently problematic. However, it is not yet clear whether this means that the worst has passed, and that society is becoming accustomed to the presence of video-games, or whether the process is cyclical and that rates of problematic gaming will continue to
fluctuate with the introduction of new technologies. Until further evidence emerges in support of either view, measured vigilance seems to be the most appropriate stance.

Furthermore, addiction research is often guilty of ignoring the positive aspects of the activity in question, which invariably represent the reasons for which most consumers (even those who ultimately become addicted) are attracted to that activity in the first place. These aspects include, but are not limited to, the relief of boredom, stress, depression, and the enhancement of relationships. A balanced consideration of the impact of an activity on society must therefore take these benefits into account. It is not for psychologists, or scientists generally, to make value judgements about whether an activity is ‘good’ or ‘bad’ on the whole, but to ensure that findings are presented in their proper context, that individuals are not criticised for partaking in an activity which most are able to enjoy in moderation, but also to provide evidence-based help to the minority who need it.
References


Appendix 1. Participant information form

About this study

My name is Cameron Forrest and I am conducting this study as part of my Ph.D in Psychology at the University of Adelaide. I am looking to investigate the causes, consequences and development of video gaming habits in the hope of assessing several models of problematic video gaming, as well as improving our understanding of the social context in which problematic habits can develop.

Participation in this study is entirely voluntary and you are free to withdraw at any time. All of the researchers have an interest in gaming and have played video games for many years. While participation may not be of any direct benefit to you, it is hoped that the information you provide will help to improve our understanding of problematic video gaming. Participation will require you to provide responses to a questionnaire which will take between 30 and 45 minutes to complete. We ask all participants to affirm informed consent prior to beginning the questionnaire.

This study is longitudinal, meaning that the same questionnaire will be given to all participants on multiple occasions. At the beginning of the questionnaire you will be asked to provide contact details such that the researchers will be able to contact you to repeat the questionnaire in future. This is designed to see how your gaming habits and social context change over time. You may also need to provide a residential mailing address to receive your remuneration. After initial assessment, you will be contacted to complete the questionnaire four more times at three-month intervals (i.e. after three, six, nine and twelve months have elapsed). The contact
details you provide will be kept for the duration of the study in accordance with the University of Adelaide’s Privacy Policy (available at http://www.adelaide.edu.au/policies/62) and will only be used to ensure all of your responses are kept together. While the results from this study may be published, your personal responses will be in no way identifiable or traceable to you.

**Ethics of this study:** This project has received ethics approval from the School of Psychology’s Human Ethics Subcommittee. While it is not expected that there will be any adverse effects of participation in this study, in the event that you experience anxiety or discomfort as a result of your participation contact information for the University of Adelaide’s Counselling Service are as follows:

University of Adelaide Counselling Service
Telephone +61 (08) 8303 5663
Facsimile: +61 8303 6363
Email: counselling.centre@adelaide.edu.au

In the event that you believe your video-gaming has become problematic, help is available from your GP and from organisations such as On-Line Gamers Anonymous (http://www.olganon.org/).

**You should retain a copy of this information sheet and the following consent form.**

Researcher contact information:
By giving your consent below, you affirm that:

1. You have read the above information and agree to take part in the study.
2. You are at least 16 years of age.
3. You are currently residing in Australia.
4. You give permission for the research team to contact you in three months’ time for a follow-up survey.
5. You have been given the opportunity to contact the research team for further information prior to commencing the study.
6. You have been informed that, while information gained during the study may be published, you will not be identified and your personal results will not be divulged.

7. You understand that you are free to withdraw from the project at any time.

☐ I hereby give consent in accordance with the above.
Appendix 2. Study questionnaire

The requirements of this survey are such that some questions are ‘forced choice’ and require you to select an answer from a list. Others are very similar or seem to overlap. While this can be frustrating, it is intentional and necessary for the purposes of the study. An opportunity to leave comments will be given at the end of the survey.

As thanks for your participation in this study, you have the option of receiving a voucher from either JB Hi-Fi (http://www.jbhifi.com.au/) or Ozgameshop (http://www.ozgameshop.com/). When selecting your preferred voucher type, please keep in mind the following:

**JB Hi-Fi vouchers:** Participants requesting JB Hi-Fi vouchers will receive both an electronic and a ‘hard copy’ version for use in stores or on the JB Hi-Fi website. The electronic version will be emailed to the address provided below. To receive the hard copy, you will also need to provide an Australian mailing address in the space given.

**Ozgameshop vouchers:** Participants requesting Ozgameshop vouchers will receive an electronic version for use on the Ozgameshop website only. This will be emailed to the address provided below. New customers will need to register an account, and a link to do so will be provided in the email containing your voucher. Existing Ozgameshop customers should note that vouchers are tied to the email address provided – if you wish to redeem your voucher with your existing account, you will need to give the same email address you use for your Ozgameshop account in the space below.
1. Please provide an email address in the space below. This will be used to ensure that your responses are kept together, send reminders about follow-up surveys, and provide you with your voucher codes.

2. Preferred voucher type

□ I do not wish to receive a voucher

□ Ozgameshop $10 voucher (this will be sent to your email address)

□ JB Hi-Fi $10 voucher (you will need to provide an Australian mailing address including your name below)

3. State or territory

□ A.C.T. □ Queensland

□ New South Wales □ Northern Territory

□ South Australia □ Tasmania

□ Victoria □ Western Australia

4. Where did you hear about this study?

□ Advertisement at the University of Adelaide/University of South Australia

□ Advertisement on a website
□ From a friend

□ At a LAN/Internet cafe

5. Gender

□ Male

□ Female

6. Age (in whole years, as of last birthday) ________________

7. Current employment status

□ Full-time employment

□ Part-time employment

□ Student (tertiary)

□ Student (secondary)

□ Unemployed

□ Homemaker

□ Other (please specify) _________________________________

8. Relationship status

□ Single

□ In a long-term committed relationship

□ Married

□ Other (please specify) _________________________________

9. Current living situation

□ Living alone

□ Living with parent(s)

□ Living with roommate(s)

□ Living with spouse/partner
10. Household internet access

☐ Broadband – wired (e.g. DSL, ADSL, cable)  ☐ Broadband – wireless (Wi-Fi)

☐ Dial-up  ☐ None

☐ Don’t know

All questions refer to the past three months.

11. How many hours of sleep do you get on most nights? ________

12. Do you regularly feel tired?

☐ Yes  ☐ No

☐ Sometimes

13. On average, during the past three months how many times a week do you take part in at least 30 minutes of…

<table>
<thead>
<tr>
<th>Activity</th>
<th>Less than 1</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5 or more</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light activity (i.e. a stroll)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Moderate activity (i.e. brisk walking)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Strenuous activity (i.e. running)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
14. Do you smoke tobacco (e.g. cigarettes, cigars)?

□ Yes  □ No

15. Have you gambled at all during the past three months?

This may include poker-machines, racing (horses, dogs), sports, lottery tickets or pools, scratch tickets, bingo, or internet gambling.

□ Yes

□ No  PROCEED TO QUESTION 18

16. How many times have you gambled to win the following during the past three months?

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Once or twice</th>
<th>Between one and three times per month</th>
<th>Weekly</th>
<th>Daily</th>
</tr>
</thead>
<tbody>
<tr>
<td>For money</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For credits</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>or points online</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

17. What was the main gambling activity in which you participated?

□ Poker-machines  □ Racing (horses, dogs)

□ Sports (not including dog or horse-races)  □ Lottery tickets or pools

□ Scratch tickets  □ Bingo
18. Thinking about the past three months, for how many hours do you normally engage in the following activities on a weekday (Mon-Fri)?

- Going on the Internet for professional use
- Going on the Internet for personal use
- Listening to music
- Watching television/movies
- Reading books

19. Thinking about the past three months, for how many hours do you normally engage in the following activities on a weekend day (Sat-Sun)?

- Going on the Internet for professional use
- Going on the Internet for personal use
- Listening to music
- Watching television/movies
- Reading books

20. Which of the following devices do you own or have access to at home (Tick all that apply)

- MP3-player/iPod
- Mobile phone
- Personal computer
- Tablet/iPad
- Laptop/notebook
- Gaming console
- None of the above
21. For how many years have you been using the following devices?

Internet ______
Video game systems ______
Mobile phones ______

22. How many text messages and calls do you make from a mobile phone on an average day?

Text messages ______
Calls ______

23. What percentage of your Internet time during the past three months has included each of the following? Please ensure answers add up to 100%.

Social networking (incl. chat/messaging/forums) ______
Information browsing (incl. videos, articles, news sites, reading forums, guides) ______
Playing video games (incl. mini-games, Farmville) ______
Shopping and online auctions (e.g. eBay) ______
Online gambling (incl. playing “free play” casinos) ______
Work / study purposes (e.g. wikis, researching) ______

24. Have you…

25. The following questions relate to your Internet use during the past three months.

(1 = ‘No’, 2 = ‘Sometimes’, 3 = ‘Yes’)

When I am not on the Internet, I keep thinking about it. □ □ □
I spend an increasing amount of time on the Internet. □ □ □
I have tried to control, cut back, or stop using the Internet, or I usually go on for a longer period than I intended. □ □ □
When I can’t go on the Internet I get restless or irritable. □ □ □
When I feel bad, e.g. nervous, sad or angry, or when I have problems, I go on the Internet more often. □ □ □
Sometimes I conceal my Internet use from others (e.g. parents, friends, teachers). □ □ □
In order to use the Internet I have skipped classes or work, or lied, or stolen, or had an argument or a fight with someone. □ □ □
Because of going on the Internet I have reduced my homework, or □ □ □
schoolwork, or I have not eaten, or I have gone to bed late, or I spent less time with my family.

26. Please indicate the extent to which you agree with the following statements using the scale given below.

Questions refer to your offline or ‘real life’ relationships.


<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is a special person who is around when I am in need.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>There is a special person with whom I can share my joys and sorrows.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My family really tries to help me.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I get the emotional help and support I need from my family.</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>I have a special person who is a real source of comfort to me.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My friends really try to help me.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can count on my friends when things go wrong.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can talk about my problems with my family.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have friends with whom I can share my problems.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
joys and sorrows.

There is a special person in my life who □ □ □ □ □ □ □ cares about my feelings.

My family is willing to help me make □ □ □ □ □ □ □ decisions.

I can talk about my problems with my □ □ □ □ □ □ □ friends.

27. Using the scale provided, please indicate how much each of the following statements reflects how you typically are.

(1 = ‘Not at all like me’, 2 = ‘Sometimes’, 3 = ‘About half of the time’, 4 = ‘Much of the time’, 5 = ‘Very much’)

<table>
<thead>
<tr>
<th>Statement</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am good at resisting temptation.</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>I have a hard time breaking bad habits.</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>I am lazy.</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>I say inappropriate things.</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>I do certain things that are bad for me, if they are fun.</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>I refuse things that are bad for me.</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>I wish I had more self-discipline.</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>People would say that I have iron self-discipline.</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Pleasure and fun sometimes keep me from getting work done.</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>
I have trouble concentrating. □ □ □ □ □

I am able to work effectively toward long-term goals. □ □ □ □ □

Sometimes I can’t stop myself from doing something, even if I know it is wrong. □ □ □ □ □

I often act without thinking through all the alternatives. □ □ □ □ □

28. Please read each statement and use the scale below to indicate how much the statement applied to you over the past three months

(1 = ‘Did not apply to me at all’, 2 = ‘Applied to me to some degree, or some of the time’, 3 = ‘Applied to me a considerable degree, or a good part of the time’, 4 = ‘Applied to me very much, or most of the time’)

I found it was hard to wind down. □ □ □ □ □

I was aware of dryness of my mouth. □ □ □ □ □

I couldn’t seem to experience any positive feeling at all. □ □ □ □ □

I experienced difficulty breathing (e.g. excessively rapid breathing, breathlessness in the absence of physical exertion). □ □ □ □ □

I found it difficult to work up the initiative to do things. □ □ □ □ □

I tended to over-react to situations. □ □ □ □ □

I experienced trembling (e.g. in the hands). □ □ □ □ □

I felt that I was using a lot of nervous energy. □ □ □ □ □

I was worried about situations in which I might panic and make a □ □ □ □ □
fool of myself.

I felt that I had nothing to look forward to. □ □ □ □

I found myself getting agitated. □ □ □ □

I found it difficult to relax. □ □ □ □

I felt down-hearted and blue. □ □ □ □

I was intolerant of anything that kept me from getting on with what I was doing. □ □ □ □

I felt I was close to panic. □ □ □ □

I was unable to become enthusiastic about anything. □ □ □ □

I felt I wasn’t worth much as a person. □ □ □ □

I felt that I was rather touchy. □ □ □ □

I was aware of the action of my heart in the absence of physical exertion (e.g. sense of heart rate increase, heart missing a beat). □ □ □ □

I felt scared without any good reason. □ □ □ □

I felt that life was meaningless. □ □ □ □

29. During the past three months, have you ever had a period of time when you were feeling ‘up’ or ‘high’ or so full of energy or full of yourself that you got into trouble, or that other people thought you were not your usual self?

Do not consider times when you were intoxicated on drugs or alcohol.

This may include: having elated mood, increased energy, needling less
sleep, having rapid thoughts, being full of ideas, having an increase in productivity, motivation, creativity or impulsive behaviour.

□ Yes □ No

30. Do you consider yourself a ‘video gamer’?

□ Yes □ No

31. Who purchased the first console or PC on which you played video games?

□ Myself □ Parent(s)
□ Brother or sister □ Friend
□ Other (please specify) ____________________________

32. When you first began playing video games, who did you usually play with? Choose the best answer from the list below.

□ By myself □ With parent(s)
□ With sibling(s) □ With friend(s)
□ Other (please specify) ____________________________

33. How many different video games are you currently playing (i.e. ‘in progress’ or ‘on the go’)? ________

34. How many games have you bought in the past three months? ________
35. How many games have you preordered, or do you anticipate buying, in the next three months? _______

36. Which video game genre have you spent the most time playing during the last three months? Please choose one answer only.

- □ Strategy
- □ Puzzle
- □ Role playing (including MMO)
- □ Action/adventure
- □ Sports
- □ Simulation
- □ Racing
- □ Shooter
- □ Role playing (including MMO)
- □ Arcade
- □ Card/dice
- □ Quiz/trivia
- □ Classic board games
- □ Don’t know

37. In general, do you prefer to play video games with others (i.e. co-op / same team), against others (competitively) or by yourself?

- □ By myself
- □ With others (co-op/same team)
- □ Against others (competitively)

The following tables concern your video gaming habits during a typical week. All questions refer to your habits during the past three months.

38. For how many hours do you play video games on a typical weekday (Mon-Fri)?
39. For how many hours do you play video games on a typical weekend day (Sat-Sun)?
Morning (6am-12pm) _____
Afternoon (12pm-5pm) _____
Evening (5pm-10pm) _____
Night (10pm-6am) _____

40. What would you say is the average length of one of your video gaming sessions? (in hours) ________

41. Do you feel like you’ve played “long enough” at the end of a gaming session?

☐ Every time                    ☐ Usually, in about 90% of cases
☐ Frequently, in about 70% of cases     ☐ Sometimes, in about 50% of cases
☐ Occasionally, in about 30% of cases       ☐ Rarely, in less than 10% of cases
☐ Never

42. On which of the following platforms have you played video games during the past three months? Choose as many as apply.

☐ Dedicated console (e.g. Playstation, Xbox, Wii)  ☐ PC
43. **On which of the following platforms have you spent the most time playing video games during the past three months? Select one option only.**

- □ Handheld console (e.g. PSP, DS, 3DS)
- □ Mobile phone
- □ None of the above

44. **During the past three months, what percentage of your video gaming time has been spent playing with the following people: (please ensure they add up to 100%)**

- By yourself (online) _____
- By yourself (offline) _____
- With family members (online) _____
- With family members (offline) _____
- With real life friends (online) _____
- With real life friends (offline) _____
- With strangers (online) _____
- With strangers (offline) _____

45. **Would you like to be able to spend more time playing video games?**

- □ Yes
- □ No
46. Have your video gaming habits changed much during the past three months?

☐ Yes, I play more now than I did three months ago

☐ Yes, I play less now than I did three months ago

**PROCEED TO QUESTION 48**

☐ No, I play roughly the same amount now as I did three months ago

**PROCEED TO QUESTION 49**

47. Why do you play video games more now compared with three months ago? Tick as many as apply.

☐ University / school schedule change

☐ Ended a job

☐ Relationship status change

☐ Acquired new games to play

☐ Other (please specify) ________________________________________________

**PROCEED TO QUESTION 49**

48. Why do you play video games less now compared with three months ago? Tick as many as apply.

☐ University / school schedule change

☐ Started a new job

☐ Relationship status change

☐ Nothing I wanted to play

☐ Don’t enjoy playing as much as I used to

☐ Other (please specify) ________________________________________________

49. Please show how much you agree or disagree with these statements using the scale provided.
1 2 3 4 5 6 7

I play video games because they met me do things I can’t do in real life.

I find that play video games raises my level of adrenaline.

I feel proud when I master an aspect of a game.

I play video games when I have other things to do.

Video games keep me on the edge of my seat.

I like to play to prove to my friends that I am the best.

My friends and I use video games as a reason to get together.

I find it very rewarding to get to the next level.

Video games allow me to pretend I am someone/somewhere else.

I play video games instead of other things I should be doing.

I play video games because they stimulate my emotions.

When I lose to someone, I immediately want to play again in an attempt to beat him/her.

I play until I complete a level or win a game.

I like to do something that I could not normally do in
real life through a video game.

Often, a group of friends and I will spend time playing video games.

It is important to me to be the fastest and most skilled person playing the game.

I enjoy finding new and creative ways to work through video games.

I enjoy the excitement of assuming an alter ego in a game.

I play video games because they excite me.

I get upset when I lose to my friends.

50. Do you have a gaming console or PC located in your bedroom?

☐ Yes  ☐ No

51. How many members of your household, other than yourself, play video games?________________

52. To your knowledge, how many of your friends (including ‘real life’ friends and online friends/acquaintances) play video games regularly?

<table>
<thead>
<tr>
<th>None</th>
<th>One or two</th>
<th>Some</th>
<th>Many or most</th>
<th>All of them</th>
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<tr>
<td>‘Real life’ / offline friends</td>
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</tbody>
</table>
53. Do you believe that any of your friends or family members have a problem related to video gaming?

□ Yes

□ No  PROCEED TO QUESTION 55

54. Which of your friends / family members do you believe has a problem related to video gaming? Select as many as apply.

□ ‘Real life’ / offline friend(s)  □ Online friend(s) / acquaintance(s)

□ Parent(s)  □ Brother(s)

□ Sister(s)

□ Other (please specify) ________________________________________________________________

55. If you asked them, do you think your parents, friends or partner would say you have ever had a problem related to video gaming?

□ Yes (currently)  □ Yes (previously)

□ No

56. Do you believe that you have ever had a problem related to video gaming?

□ Yes, I currently have a problem related to video gaming

□ Yes, I have previously had a problem related to video gaming but do not any longer

PROCEED TO QUESTION 63
☐ No, I have never had a problem related to video gaming

PROCEED TO QUESTION 70

57. What is the nature of your problem?

☐ Physical injury
☐ Psychological problem (‘addiction’)

☐ Other (please specify) ________________________________________________

58. How long ago did your problem begin?

_____________________________________________________

59. Have you sought professional help?

☐ Yes
☐ No

60. Have you ever considered seeking professional help but didn’t know where to go?

☐ Yes
☐ No

61. Which games have contributed the most to your problem?

____________________________________________________________________

62. How many times in the past has video gaming been problematic for you?

If this is the first time, please enter ‘0’ (zero). _______

PROCEED TO QUESTION 70
63. How many times in the past has video gaming been problematic for you? 

________

64. What was the nature of your problem(s)?

☐ Physical injury  ☐ Psychological problem (‘addiction’)

☐ Other (please specify)  _________________________________________________

65. How long ago did your problem begin? ________________________________

66. When did your problem end? ________________________________

67. Did you seek professional help?

☐ Yes  ☐ No

68. Did you ever consider seeking professional help but didn’t know where to go?

☐ Yes  ☐ No

69. Which games contributed the most to your problem?

____________________________________________________________________

70. Questions relate to occurrences during the past three months.

(1 = ‘No’, 2 = ‘Sometimes’, 3 = ‘Yes’)
When I am not playing video games, I keep thinking about them (i.e. remembering games, planning the next game, etc.).

I spend an increasing amount of time playing video games.

I have tried to control, cut back or stop playing video games, or I usually play over a longer period than I intended.

When I can’t play video games I get restless or irritable.

When I feel bad, e.g. nervous, sad or angry, or when I have problems, I play video games more often.

When I lose in a game or I have not obtained the desired results, I need to play again to achieve my target.

Sometimes I conceal my video game playing from others (e.g. parents, friends, teachers).

In order to play video games I have skipped classes or work, or lied, or stolen, or had an argument or a fight with someone.

Because of playing video games I have reduced my homework, or schoolwork, or I have not eaten, or I have gone to bed late, or I spent less time with my family.

71. How often during the last three months…


Have you become angry when unable to play?

Did you spend much free time on games?
Did you play longer than intended? □ □ □ □ □
Were you unable to reduce your game time? □ □ □ □ □
Have you felt addicted to a game? □ □ □ □ □
Did you have fights with others (e.g. family, friends) over your time spent on games? □ □ □ □ □
Did you spend increasing amounts of time on games? □ □ □ □ □
Did you think about playing all day long? □ □ □ □ □
Has your time on games caused sleep deprivation? □ □ □ □ □
Did you feel bad after playing for a long time? □ □ □ □ □
Have you become stressed when unable to play? □ □ □ □ □
Have you neglected other important activities (e.g. school, work, sports) to play games? □ □ □ □ □
Have you felt bad when you were unable to play? □ □ □ □ □
Were you unable to stop once you started playing? □ □ □ □ □
Have you played games to release stress? □ □ □ □ □
Have you neglected others (e.g. family, friends) because you were playing games? □ □ □ □ □
Have you played games to feel better? □ □ □ □ □
Have others unsuccessfully tried to reduce your game use? □ □ □ □ □
Did you play games to forget about real life? □ □ □ □ □
Have you failed when trying to reduce your game time? □ □ □ □ □
Have you lied about time spent on games? □ □ □ □ □
72. When you played video games during the last three months…

(1 = ‘Never’, 2 = ‘Rarely’, 3 = ‘Occasionally’, 4 = ‘Frequently’, 5 = ‘All the time’)

1 2 3 4 5

Did you ever feel like you had been in a trance? □ □ □ □ □

Did you ever feel like you had taken on another identity? □ □ □ □ □

Did you ever feel like you were outside yourself – watching yourself? □ □ □ □ □

Did you ever experience a memory blackout for a period? □ □ □ □ □

73. How often have the following statements been features of your gaming over the last three months?

(1 = ‘Never’, 2 = ‘Rarely’, 3 = ‘Some of the time’, 4 = ‘Most of the time’, 5 = ‘Always’)

1 2 3 4 5

I get distracted from my work when I can’t complete or solve a game. □ □ □ □ □

I cannot bear giving up playing a game if I think I’m close to completing my objective. □ □ □ □ □

I feel I must be the best at any game I undertake. □ □ □ □ □

I keep thinking about something I experienced in a video game well after I have stopped playing. □ □ □ □ □
I feel bad after playing for a long period of time.

It’s important for me to be good at video games.

I find that I play video games more when I have something else I’m supposed to do.

Once I’ve started a game, I find it hard to return to other activities until I’ve finished it.

I hate the thought of another gamer working out or achieving something before I do.

I can’t stop thinking about video games.

I regret the real life consequences of playing video games.

Video games are the only thing I’m good at.

I have used video game playing as a way of avoiding other important commitments (e.g. work, study)

I can’t move on from a game until I’ve explored every part of it.

I feel like a failure if I can’t solve a particular part of a game.

If I don’t play as well as I’d hoped, I keep blaming myself.

I wish I didn’t play video games so much.

Video gaming is a part of who I am.

I play the same game over and over at different difficulty levels.

I can’t function without video games.

I engage in repetitive tasks for long periods of time (‘grinding’) in order to achieve certain game outcomes.
I find it hard to give up once I’ve invested so much time in a game.

74. During the past three months, to what extent has your video gaming and internet use helped you to cope with the following?

Select ‘N/A’ if you have not used that activity to cope with a given issue.

(1 = ‘Not at all’, 2 = ‘Rarely’, 3 = ‘Some of the time’, 4 = ‘A lot of the time’, 5 = ‘N/A’)

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Thank you for participating! You will be contacted in three months’ time at the email address you provided for a follow-up questionnaire. Due to processing times please allow up to two weeks to receive your voucher. If you have not received it by this time, or you wish to discuss this survey, you are welcome to contact me at my university email address: cameron.forrest@adelaide.edu.au

If you wish to leave any comments or feedback, please do so in the space provided.