Does Exposure to Contingent Video-Game Tasks Influence Illusory Control on Non-Contingent Tasks?

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Abstract

In recent years, research has focused on how video game participation may associate itself with problematic gambling cognition and behaviour. Research has considered whether video games, which are skilled tasks, may cause players to generalise an illusion of control to chance gambling tasks. However, this effect has not been investigated experimentally. The current study examines whether exposure to contingent or skilled tasks (in this case, a skilled video game) influences perceptions of skill and control on subsequent non-contingent tasks as compared with a control group. Participants ($N = 64$) were divided into 2 pre-test conditions (skilled video game task vs. control) x 2 non-contingent test tasks (similar vs. dissimilar to the skilled task). A 2x2 factorial ANOVA was used to determine the effect of conditions and tasks on variables of illusory control and hypothetical wagering. The results showed that exposure to a video game task did not increase illusory control and wager size. The chance task's similarity to a video game also had no effect on illusory control, but did increase wager size. Consistent with previous literature, there was no association between self-reported video game playing frequency and illusory control or wager size. The findings are discussed in the context of future contingency learning research and interventions for problem gambling.

Declaration

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Chapter 1

Introduction

1.1 Contingency learning and the illusion of control

As a species, our survival frequently depends on assessing whether contingent relationships exist between events and our behaviour. Contingency learning is a key component of classical and operant conditioning theories, and refers to our ability to understand the relationship between actions and outcomes. According to this perspective, we adapt to the environment around us by learning when a particular response is necessary or unnecessary. Effective learning means that we learn to withhold responses when the probability of an outcome (O) given a response (R) (i.e., P(O/R)) is zero or lower than the probability of receiving a reward for not making a response (i.e., P(O/No R)). Such learning allows animals and humans to avoid expenditure of effort in unrewarding activities and, in theory, is thought to protect them from becoming overly involved in activities that are unlikely to yield long-term productive returns. For instance, if a flu tablet does not affect the recovery process, we are unlikely to keep ingesting it. Similarly, we are unlikely to keep pestering an employer for a pay rise if they have consistently refused such requests in the past.

Although a number of studies have shown that people are generally efficient at detecting differences in objective contingency in some situations (Wasserman, Elek, Chatlosh, & Baker, 1993; Alloy & Abramson, 1979), there is also evidence that humans can be prone to erroneous perceptions about the links between behaviour and outcomes. Such was the view of Langer (1975) who argued that people are prone to what she termed the ‘illusion of control’. The illusion of control is defined as a perception of control greater than what the situation truly warrants. In effect, people believe that their actions can affect outcomes more than is objectively the case. Langer (1975) argued that this effect arises because people are inherently motivated to seek control over their environments and have a tendency, borne out of ego-protective motivations, to perceive connections between actions and outcomes. Rather than perceive unpredictability that is difficult to manage, a belief in influence over environment was considered to be critical for human esteem.

In the review to follow, it will be argued that the illusion of control is a cognitive bias influenced by situational and individual difference variables, and possibly an interaction between both. It will be reasoned that the illusion of control can have detrimental consequences for individuals, particularly in relation to risk-taking activities such as gambling, where people may over-estimate their ability to achieve success. These arguments then form the basis for an investigation examining perceptions of control in relation to video games, which have come to be increasingly associated and entwined with gambling activities. This project examines the extent to which engagement in these skilled activities may influence people's perceptions of chance-based gambling activities through the process of generalisation.

1.1.1 Situational factors influencing the illusion of control

There are a number of important situational factors thought to increase people's susceptibility to the illusion of control. Langer (1975) asserted that the illusion arises when people confuse situations involving chance and skill. She argued that the effect could be demonstrated by examining what occurs when certain characteristics, typically associated with skilled tasks, are introduced into chance-determined tasks. In Langer's experiments, these skill factors included: an opportunity for competition; physical involvement; stimulus familiarity; opportunity for practice; opportunity for choice; and time spent thinking about actions and outcomes. Each of these was introduced in separate studies. For example, the effects of competition were demonstrated by showing that people typically placed larger wagers in a betting game pitted against a less confident opponent. Another study indicated that people, given opportunities to choose their lottery ticket, typically valued this ticket more than those who were given theirs at random. Another showed that practice or familiarity with tasks also increased perceptions of control. Because these elements are usually indicative of a skilled task, participants subconsciously undertook a bottom-up analysis of the task - because the task contained skill elements, its outcome must, therefore, be somewhat determined by skill.

A particular experiment from Langer (1975) - worth noting in more detail because of its relevance to the present project - involved manipulating participants' degree of familiarity with a stimulus. In Langer's experiment, participants needed to move a stylus along a series of interconnected paths in the hope of triggering a buzzer. In fact, the buzzer outcome was uncontrollable. Prior to the task's initiation, participants were either told to familiarise themselves with the task, without rewards or consequence, or not given this opportunity. Participants with this prior exposure to the task had increased belief in their control over the outcome before the task's initiation, and were more likely to compare their performance to that of a chess master once the task was completed.

Furthermore, participants placed in a condition in this experiment where they themselves moved the stylus (i.e. had physical involvement) were more likely to evaluate their performance as successful than those not given this opportunity. This study, as with others of Langer's, has been questioned by other researchers who argued that the accompanying denial of choice in the no-involvement condition might have been the true source of the effects observed (i.e., higher ratings of control). However, due to the difficulty of separating choice and physical involvement, subsequent studies have replicated the effect in the same manner as Langer (Ladouceur & Mayrand, 1987; Yarritu, Matute & Vadillo, 2014).

Langer also conducted research showing that sequence effects and emphasis on success or failure can influence the illusion of control (Langer & Roth, 1975). In that study, participants were pre-set to experience the same number of successful coin toss predictions. However, success was concentrated at particular times in the task for particular groups within the sample. Those who received feedback on early success in the task were found to perceive their skill as greater, and also predict more future success. Concentrating success at the beginning of a task (known as a descending success-slope) has been found to elicit a stronger illusion of control than at the end of a task (an ascending success-slope), which also elicits more than in a task with evenly distributed success grouping (a flat success-slope). (Jenkins & Ward, 1965; Alloy & Abramson, 1979; Orgaz et al., 2013). As Ejova, Navarro and Delfabbro (2013) conjectured, this may be due to the fact that perceptions of control are influenced by people's memory for successful outcomes such that people are more likely to remember wins that occur early or late in a sequence due to the well documented primacy and recency effects in memory research. Other illusion of control studies have also found that participants made more successful assessments of contingency when focusing on their level of control. In an "analytic" condition, where participants were instructed to assess how much control they had over an outcome, judgements of contingency were far greater than in a naturalistic condition (where participants were instead simply instructed to obtain a positive outcome) (Matute, 1996).

1.1.2 Individual differences influencing the illusion of control

There is related evidence that a number of individual difference variables may influence people's susceptibility to the illusion of control. Some of the most frequently researched examples include the need for outcome; personal affect; locus of control; desirability of control; and superstition and precognition.

A higher need for outcome has been found to be positively associated with the illusion of control. For example, Biner et al. (1995) conducted a study in which participants undertook a contingency task with hamburgers as their reward for successful performance. One group had breakfast beforehand, whereas the other did not. The results showed that the hungrier participants perceived greater levels of skill and control in a chance-based task than the other group, who presumably had a weaker desire for the outcome.

The role of affect in relation to the illusion of control has also been investigated. Studies show that depressed participants typically make more accurate contingency judgements than non-depressed participants in chance-based tasks (Alloy & Abramson, 1979; Martin, Abramson, & Alloy, 1979). This phenomenon is usually explained with reference to the concept of "depressive realism" and can be observed in comparisons of depressed and non-depressed individuals and also in studies involving the induction of temporary mood states (Alloy, Abramson & Viscusi, 1981). Anxiety, on the other hand, has been associated with a preference for greater physical involvement in an illusory control task (Friendland, Keinan & Regev, 1992), with anxious individuals thought to be more likely to be motivated to restore feelings of control.

Desirability of control, operationalised in a construct created by Burger and Cooper (1979), has been positively associated with the illusion of control in chance-based tasks. In other words, those who are more motivated to seek control may be more likely to perceive contingency. In a similar vein, it has been argued that locus of control might be associated with a greater susceptibility to the illusion, although the results for this measure have been inconsistent. While an internal locus of control (being more inclined to believing outcomes are under personal control) has been found in some literature to be positively associated with the illusion of control (Strickland, Lewicki & Katz, 1966), some have found it to be negatively associated (Hong & Chiu, 1988) or have an insignificant relationship (Benassi, Sweeney & Drevno, 1979). This may be because an external orientation of control may not necessarily relate to its relinquishment. Rothbaum, Weisz and Snyder (1982) argue that the illusion of control probably comprises two components: primary and secondary control. Primary control refers to the use of strategies and skill, and might reasonably be expected to relate to more internal locus of control. Secondary control, on the other hand, which relates to attempts to align oneself with external forces, such as luck or God, might also be associated with an illusion of control if such factors are the principle perceived source of influence over outcomes (Weisz & Snyder, 1982).

In line with this view, superstition and erroneous beliefs about chance have demonstrated positive relationships with an illusion of control (Rudski, 2004). A belief in luck construct developed by Darke and Freeman (1997) has a typically strong positive correlation with an illusion of control, seemingly regardless of whether participants believe they are holders of good or bad luck (Wohl & Enzle, 2002; Darke & Freedman, 1997). Furthermore, the practicing of erroneous rituals before or during a task is associated with perceived control (Legare & Souza, 2013).

1.2 The Role of the Illusion of Control in Gambling

Problem (or pathological) gambling is a recognised disorder in the DSM-V (American Psychiatric Association, 2010), defined as an episodic or persistent display of problematic gambling behaviours leading to “clinically significant impairment or distress”. Gambling disorder can be characterised by gambling with increasing amounts of money, unsuccessful efforts to control gambling, chasing losses, and jeopardising elements of one’s personal life (American Psychiatric Association, 2010). In Australia, the social cost of problem gambling is significant: $4.7 billion is lost each year, along with subsequent associations with suicide, mental illness, unemployment, and crime (Productivity Commission, 2010; Delfabbro, 2010).

There is considerable evidence that problem gambling may be influenced by an illusion of control. As identified by Raylu and Oei (2004), most gambling literature indicates that there are two main cognitive biases typical of a problem gambler: the perceived ability to directly or indirectly influence the outcome of a task, or the sustained belief that they can correctly predict outcomes. Attempts to control one’s environment, and subsequently overestimate chances of winning, are also shown to be the result of perceiving a chance gambling task as possessing contingent elements (Reid, 1986). People may also develop an illusion of control in tasks where there is some genuine, but small, element of contingency, such as predicting the outcome of sporting matches or poker games (Toneatto et al., 1997). There are also individual difference variables that appear to be related to people’s tendency to overestimation the degree of contingency. Examples including people’s level of stress (Friedland, Keinan, & Regev, 1992); alcohol consumption (Baron & Dickerson, 1999); or the level of negative affect (Dickerson, 1993). Stress and alcohol consumption may increase attempts to perceive or seek control, whereas negative mood can be associated with reduced perceptions of contingency (Alloy & Abamson, 1979).

Attempting to explain the association, White (1989) argued that this 'learning' of an illusion of control occurs in gambling tasks because players have to spend time orienting themselves to the game's structure, rules and outcomes. As a result, this orientation and familiarity are mistaken for an acquisition of skill, and an illusion of control is elicited. In his review of the literature, Toneatto (1999) suggested that illusory control "cooperates" with erroneous beliefs about the nature of luck, and regular gamblers may have stronger beliefs about how luck may be controllable, contagious, or reflective of a personal trait. Evidence suggests that there is a positive association between the illusion of control and problem gambling behaviour in both Western and Eastern cultures (Orgaz, Estévez, & Matute, 2013; Myrseth, Brunborg & Eidem, 2010; Toneatto et al., 1997; Emond & Marmurek, 2010; Hong & Chiu, 1988; Subramaniam, Chong, Browning & Thomas 2017; Perales et al., 2017). Barrault and Varescon (2013) also concluded that the illusion of control functioned as a reliable predictor for pathological gambling, and that it may develop and maintain problem gambling behaviour.

In light of this evidence, interventions for problem gambling (e.g., cognitive therapy) recognise the illusion of control as a factor that should be considered in designing treatments. Consistent with Raylu and Oei (2004), interventions consider the illusion of control as one of two core cognitive errors surrounding problem gambling, and tailor therapies to remove its influence. Cognitive-behavioral therapy (CBT), the most popular method of treatment for problem gambling (Cowlishaw et al., 2012), focuses on a cognitive restructuring process that encourages clients to examine erroneous beliefs about control and distance themselves from them (Chrétien et al., 2017). Common techniques within CBT include: clients listening to themselves ‘thinking aloud’ their erroneous beliefs about control (Freidenberg, Blanchard, Wulfert, & Malta, 2002); completing written exercises and readings about the realities of probability (Castren et al., 2013); and participating in virtual reality gambling tasks (Giroux et al., 2013). These interventions have been systematically validated as effective techniques to decrease problematic gambling thoughts and behaviours (Chrétien et al., 2017; Ladouceur et al., 1998), albeit with methodological deficiencies in treating gamblers who engage in more skill-oriented games such as poker or blackjack (Chrétien et al., 2017).

1.3 Skilled Tasks: The Example of Video Gaming

Unlike chance-based gambling, video games feature a high degree of skill. Because of this, players have a reasonable expectation of contingency. Video games have become extremely popular and pervasive over the last four decades. Indeed, within Australia, video games have reached universal availability across a range of consoles and modalities, and national usage rates reflect this prevalence. According to a 2015 report on Australian video game usage, 68% of Australians play video games, and a video game can be found in 98% of homes with at least one child (Brand & Todhunter, 2015). Furthermore, the national industry observed a 20% growth in 2014 (Brand & Todhunter, 2015) and total revenue exceeded $89 million (Australian Bureau of Statistics, 2017). An important trend for the current study is that recent advances have fostered an increasing technological link between video games and gambling. For example, advanced gambling games can be played using video-game consoles; gambling games may feature in larger role-playing games; people can play social casino games on electronic devices such as iPads and iPhones; some gaming machines can have bonus features which resemble video games; and people can now gamble on the outcomes of video game tournaments (King, Delfabbro & Griffiths, 2010). Because of this convergence, the separation between video gaming and gambling has become less distinct. Furthermore, their accessibility in conjunction has become an ingrained part of both industries (King et al., 2010).

Research shows that some demographic groups engage with video games more than others. Although the gaming population has diversified beyond the stereotype of a young male (Delfabbro, King, Lambos & Puglies, 2009), young Australian boys and men are certainly more likely to participate than any other demographic profile. While 75% of Australians under 35 years of age regularly play, only 47% of those over 35 do the same (Brand and Todhunter, 2015). In particular, children and adolescents play games at a much higher rate than any other age group - 88% of 5-24 year olds are reported to regularly engage in some form (Brand & Todhunter, 2015). A slightly higher proportion of the Australian gaming population remains male (53%) (Brand & Todhunter, 2015), but the gender imbalance has steadily weakened, with the female proportion of video gamers rising from its 38% mark in 2005 (Brand & Todhunter, 2015).

There have been many studies into the psychological effects of video gaming on players. While some have reported benefits in player visual perceptual abilities (Deveau, Lovcik, & Seitz, 2014); task switching (Karle, Watter, & Shedden, 2010), problem-solving skills (Yang, 2012); and memory and executive functions (Martinovic et al., 2014), there are also studies purporting negative consequences. Video game playing has been found to be positively associated with impulsive behaviour and poor planning (Bargeron & Homes, 2017), reward insensitivity (Duven, Müller, Beutal & Wolfling, 2015), and poorer academic performance (Sahin, Gumus, & Dincel, 2014).

Importantly, and of particular relevance to this thesis project, is that studies have also examined the relationship between video game playing and the illusion of control. A question has been raised as to whether playing video games, that inherently feature a high degree of personal control over situational outcomes, could lead to a misattribution of control in subsequent chance-based tasks that bear similar structural elements (Gupta & Derevensky, 1996; King, Ejova & Delfabbro, 2012). Langer (1975) asserted that an illusion of control may be learned from surrounding stimuli and cues, so that an inappropriately generalised illusion of control may be learned and transferred after exposure to skill-based video games. Furthermore, they may also encourage the misconception that players can practice and 'master' a chance task, as players can in a standard video game.

This link between illusory control and video gaming has now become a focus of attention in the gambling literature. In a study involving participants who regularly played video games or gambled, King et al. (2012) tested illusory control on a gambling task in the two groups, while also measuring how frequently video game players gambled and vice versa. For the regular video game players (who played around twenty hours per week), perception of direct and superstitious control over the outcome was significantly lower than that in a normal comparison sample from Ejova, Delfabbro and Navarro (2010). However, in the sample of regular gamblers (who played on electronic gaming machines at least once per week), video game playing hours had a significant positive association with illusion of control (once controlling for problem gambling and demographic factors). Furthermore, these regular gamblers had a high level of agreement with the statement "My experience at video games helped me win". So while more regular video game players may not transfer an illusion of control from their medium of choice, video game play may influence illusory control in community members interested in gambling.

Some researchers argue that potential associations between video gaming and gambling follow a developmental model (Brown, 1989; Fisher & Griffiths, 1995). Gupta and Derevensky (1996) argued that the experience of video game learning could influence young people's approach to gambling task orientation. Although most gambling games are not as influenced by player practice and skill acquisition as video games, a false comparison may be made, and the player could believe that over time they can influence a gambling task in the same way they learned to control video games through experience (Gupta & Derevensky, 1996). As a result, there have been several studies of the overlap between video games and gambling in studies of young people. In one study, Gupta and Derevensky (1996) were able to identify that high frequency video game players (aged between 9 and 14) were more likely than lower frequency video game players to be "at risk" for problem gambling, wager more in a gambling task, and be more likely to perceive that some skill was involved with gambling. However, the age range of the participants and outdated conceptions of high and low frequency video game playing significantly hindered the study's ability to be generalised to a wider, more contemporary population. In a subsequent study from Wood, Gupta, Derevensky and Griffiths (2004) adolescent problem gamblers (aged 10-17) were significantly more likely to frequently play video games, or play video games at an excessive rate. Studies of this age group, across cultures, have similarly found that rates of adolescent gambling, along with positive appraisals of gambling, are positively correlated with video game playing (Calado, Alexandre, & Griffiths, 2014; McBride & Derevensky, 2016; Fu & Yu, 2015).

Another important reason to suspect potential transfer effects relating to perceptions of skill is that there are many structural similarities between video gaming and gambling. Discussions of this topic first emerged in the studies of Mark Griffiths in the UK, who examined the relationship between arcade video games and “fruit machines”. Fruit machines are British gambling devices (using video poker media) with a low-stakes monetary reward system (Griffiths, 1991a). Because of their availability to British youths under the age of 18, and their strategic placement in traditional video game arcades, Griffiths hypothesised that there would be a significant correlation between video gaming and fruit machine play (Griffiths, 1991b; Griffiths, 1993). Griffiths indeed found links between arcade video game playing and fruit machine playing: 68% of fruit machine players surveyed also participated in arcade games (Griffiths, 1990). While this was primarily attributed to the strategic placement of fruit machines in video game venues (Griffiths, 1990), it was substantiated that structural characteristics unique to the fruit machine experience provided an unwarranted perception of control (Griffiths, 1993; Parker & Griffiths, 2006).

However, it is important to recognise that not all researchers necessarily agree that video games and gambling are related. Indeed, Wood, Griffiths, Chappell and Davies (2004) argued that modern improvements to video games in areas of graphics, gameplay and realism allow clear separation between video games and gambling, which perhaps negate some of the earlier arguments concerning structural similarities. Forrest et al. (2016) also subscribed to the view that ongoing structural changes in video gaming may further differentiate the activities. Furthermore, in a recent Australian study, Forrest, King and Delfabbro (2016) found that, while gaming addiction scores correlated with gambling frequency, age was the only significant predictor of gambling when controlling for all other variables. King et al. (2012) also found that regular video gamers regarded participating in a chance gambling task less enjoyable than a control sample, and were less likely to attribute wins to their own skill.

Much of the literature's evidence, however, arises from correlation studies that have examined co-involvement in the two classes of activity rather than investigating the potential for actual transfer effects in experimental contexts. Although some insights can be gained by comparing the susceptibility to the illusion of control in people who engage in gambling, video gaming and both activities, there may be other variables that explain the differences observed. A stronger test of the idea therefore is to examine whether differential exposure to a skilled video game task (with contingent outcomes) can influence illusory control and wager size in a chance task (with non-contingent outcomes) as compared with individuals who do not have this exposure.

1.4 The Current Study

Accordingly, the current study reports the findings of a laboratory-based experiment that examined participant performance on chance-determined (non-contingent) tasks after exposure to a skilled video-game task (as compared with no such exposure). In this experiment, participants played a skilled video game. They were then asked to rate the amount of control exerted in a subsequent chance task and to virtually wager on how confident they were to obtain a certain criterion level of performance. One of Langer's (1975) early experiments showed that perceived control and confidence increased significantly when prior exposure to task stimuli was given. In this study, prior exposure to a contingent task (as a means of similarly orienting participants' feelings of control) was predicted to increase perceived control and wager size in a chance task. Learned helplessness research has also demonstrated that non-contingency, once learned, can be generalised to a situation with contingency introduced (Seligman, 1972). It was predicted that this generalisation of learning will be applicable for the illusion of control; that is, once learned, contingency will be generalised to a non-contingent situation.

In addition to this basic manipulation, the current study investigated whether this effect on the illusion of control would be stronger if the task were more similar in content to the original pre-test skilled task. Studies in learned helplessness have found that perceptions of non-contingency are more strongly generalised to subsequent tasks that are similar in type (Tiggemann & Winefield, 1978). It was reasoned that a similar principle of generalisation would apply to illusion of control effects, as well as increase wager size. It was also reasoned that video game elements could act as a situational skill cue similar to those presented by Langer (1975), as they are superficial indicators of a contingent task.

Given a previous positive association found in regular gamblers (King et al. 2012), the current study examined correlations between frequency of video game play and the illusion of control. However, regular video gamers in King et al. (2012) had no significant association between hours played and illusory control or gambling behaviours. Similarly, the regular gamblers themselves had a non-significant relationship between hours played and gambling behaviours. It was therefore predicted that a general sample would share these non-significant associations with the illusion of control and wager size.

Measures assessing beliefs about chance and problem gambling severity were also taken as control variables to acknowledge the role that these individual differences can play in eliciting an illusion of control.

1.5 Hypotheses

1. Participants exposed to the video game task prior to either of the two illusory control tasks will perceive greater illusory control and will risk larger wagers than participants not exposed to the video game task.

2. Due to generalisation effects, participants undertaking the illusory control task with a similar theme to the pre-test video game task will perceive greater illusory control and risk larger wagers than participants in the dissimilar illusory control task (which does not have a common theme, nor a superficial resemblance to a video game).

3. Hours of video games played per week (measured through self-report) will have non-significant associations with illusory control scores and wager size.

Chapter 2

Method

2.1 Participants

The sample comprised 64 participants (48 male, 16 female) aged 18 to 58 years (*M* = 22.3, *SD* = 6.6). This included 12 first-year psychology students (18.8%) participating for course credit. To comply with ethical requirements, participants had to be aged 18 years and over, and not currently be receiving treatment for gambling-related problems. Most participants (*N* = 57, 89.1%) were born in Australia. 3 (4.7%) participants reported working full-time, 6 (9.4%) part-time, 41 (64.1%) casually, and 13 (20.3%) reported not being in paid work. One participant also reported being self-employed. No participants reported not completing high school, 51 (79.7%) listed high school as their highest level of completed education, 3 (4.7%) had completed a certificate or diploma, and 10 (15.7%) had completed a bachelor degree or higher.

2.2 Sampling Procedure

Participants from the community were recruited through advertising posted in the North Terrace campus of the University of Adelaide, and via social media site Facebook. (Appendix A contains the advertising used in both print and Internet settings). All community members were entered into a draw to win one $50 JB Hi-Fi voucher as reimbursement for their time. Undergraduate psychology students were recruited from the Experimental Management System (EMS) from the School of Psychology, and received one course credit for up to 45 minutes of participation. The study was available to community and student groups from Friday 19th May, 2017 to Thursday 31st August, 2017.

2.3 Study Design

The study was completed on campus in an experimental laboratory at the University of Adelaide. Participants completed pen and paper assessments that measured basic demographic information; beliefs about chance; problem gambling severity; and video game playing frequency, perceived ability, and genre preference. After completing these measures, participants were allocated to experimental groups based upon a 2 Condition x 2 Task between groups ANOVA design. Half of the study's participants (allocated into the priming condition) played a video game task for fifteen minutes, whereas the others did not (the control condition). All participants completed one of two illusory control tasks (measuring virtual gambling behaviour) and then answered questions about their perceived control over the illusory control task and the connections between their behaviours and the task's outcomes. One of these illusory control tasks (completed by half of the participants in each condition) was dissimilar in content to the pre-test task, and the other was similar in content (completed by the remaining half of participants in each condition). Thus, there were effectively four groups of equal size: (1) no priming, dissimilar task; (2) no priming, similar task; (3) priming, dissimilar task; (4) priming, similar task. The Human Research Ethics Subcommittee in the University of Adelaide's School of Psychology approved the study design and procedure (approval number 17/33).

2.3.1 Software

Multiple Arcade Machine Emulator (MAME) software was used to emulate the video game (*Sea Wolf*) used in the priming condition. No participant data was stored on this software. Visual Studio Version 10 software was used for both of the illusory control tasks, which recorded participant wagering data during task completion. As the software did not have the capability to store this wagering data after closing the task window, both tasks had their data stored via a separate Microsoft Excel spreadsheet.

Sea Wolf is a 1976 arcade game that originally operated on arcade machines in a pay-for-play format. In this iteration in MAME software, players (positioned as a ship on the screen's baseline) use the space bar to vertically fire torpedoes at ships dashing horizontally across the screen. (See Figure 2.1) Using the left and right arrow keys, players can also adjust their own ship's position for strategic purposes. Points are accrued for hitting ships, with hits on faster ships earning players more points. The game terminates by players running out of 'fuel', which depletes as players move their ship across the baseline. The game ends with a "GAME OVER" message, after which participants in the study were permitted to hit the space bar to start a new game.

Figure 1. Sea Wolf gameplay. Displays target ship (top center), mid-flight torpedo (vertical dash, middle right), time remaining (bottom center), and progressive score (bottom right).

Participants completed all tasks on one of the laboratory's two computers, both of which ran on Windows Vista.

2.4 Survey Measures

2.4.1 Demographics and Video Game Experience

Participants were asked questions that requested demographic information such as their age, sex, education, employment, and country of birth (See Appendix B for full item list). Video game playing frequency was also assessed, with participants reporting how many hours of video games they played in a typical week in the last 12 months. Participants also indicated their hours of video games played in a typical week in the last twelve months, their perceived video game ability relative to the rest of the population, and preferred video game genre.

2.4.2 Drake Beliefs About Chance Inventory (DBC)

This inventory developed by Wood and Clapham (2005) is a 22-item self-report measure used to quantify erroneous beliefs held about chance. Questions include "It is good advice to stay with the same pair of dice on a winning streak", and "I have a special system for lottery numbers". The inventory has two dimensions (illusory control and superstition), assessed by 11 items each. All items are measured on a scale of 0 (*strongly agree*) to 5 (*strongly disagree*). (See Appendix C for full item list). Item 11 ("I do not consider myself to be a superstitious person") is reverse scored. The scores are summed to a total ranging between 22 and 110. In Wood and Clapham's (2005) development of the inventory, the DBC demonstrated high internal consistency ($\alpha > .91$).

2.4.3 Problem Gambling Severity Index (PGSI)

This 9-item self-report measure developed by Ferris and Wynne (2001) asks participants to respond to a series of statements relating to their gambling behaviour in the previous 12 months. Items include “Have you bet more than you could really afford to lose?” and “When you gambled, did you go back another day to try to win back the money you lost?”. Each item is measured on a 4-point scale that ranges from 0 (*never*) to 3 (*almost always*). (See Appendix D for full item list). Scores are totaled to a sum between 0 and 27, and participants can be classified according to risk categories: low level problems (1 to 2); moderate level problems (3 to 7); and problem gambling (8+). The PGSI has displayed high internal inconsistency scores ($\alpha > .80$), outperforming other problem gambling measures (Holgraves, 2009).

2.5 Outcome Measures

2.5.1 Dissimilar Illusory Control Task: Light Onset Task

In this computerised task, participants were told that their objective was to illuminate a light bulb, and that their decision to click (or not click) a button on the screen labeled “GET BULB” would have four potential outcomes: (1) click and the light bulb appears illuminated; (2) click and the light bulb appears not illuminated; (3) not click and the light bulb appears illuminated; (4) not click and the light bulb appears not illuminated. After pressing “PLAY GAME” on the screen, a red dot was displayed, signaling that participants had three seconds to either click or not click on the “GET BULB” button. If the button was clicked, the red dot disappeared and was immediately replaced by the light bulb. If it was not clicked, the red dot was replaced by the light bulb after the three seconds. There was no contingency between clicking or not clicking and the light bulb's illumination status - the program was coded to have the same sequence of illuminated/non-illuminated results across all trials. 25 of the 50 trials resulted in an illumination.

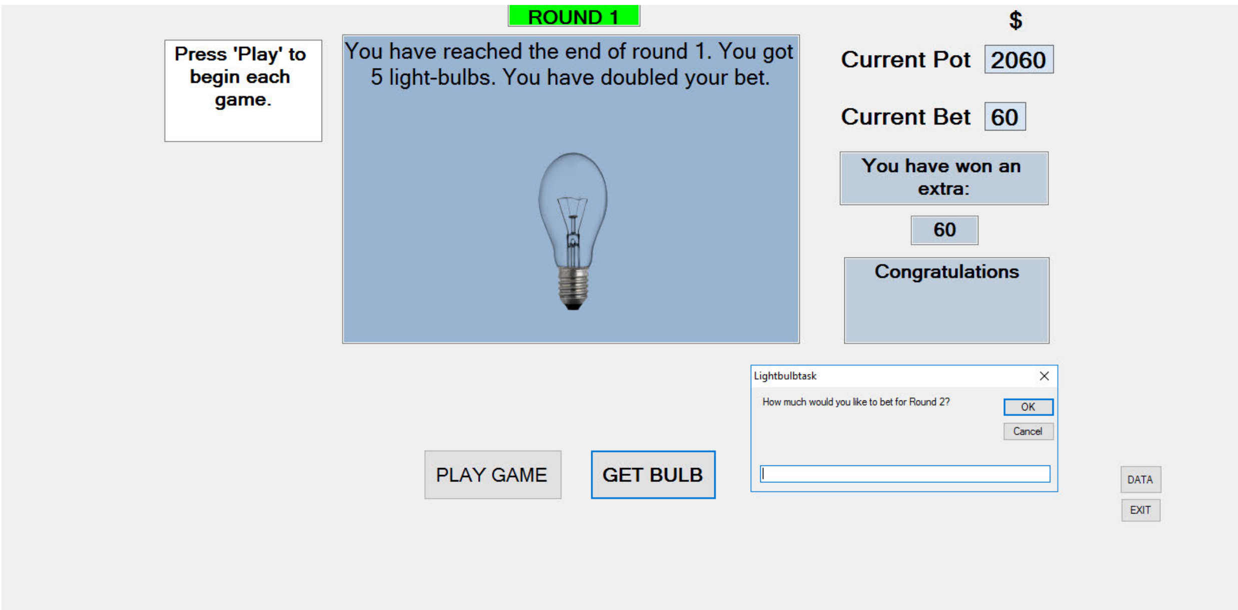

Figure 2. Dissimilar illusory control task. Displays round number (top center), the result of each trial and round (center), current pot and bet (top right), bet result (middle right), and bet input for the next round (bottom right).

Participants were also instructed to wager on their own performance during the task, which was split into 5 rounds of 10 trials each (total of 50 trials). Before each round, participants were required to wager on their own performance from a virtual 'pot' of $2000. A win occurred if five or more light bulbs were illuminated in the subsequent round, and a loss occurred if participant illuminated four or less. In the event of a win, the amount wagered was returned in double (e.g. if $100 was wagered on the first round, $200 would be returned making the new pot $2100). In the event of a loss, the amount wagered was relinquished (e.g. if $100 was wagered on the first round, the new pot would be $1900). The five rounds had a win-loss-win-loss-win sequence. (See Appendix E for full task instructions, stimuli and illumination/non-illumination sequence). To calculate gambling behaviour outcome measures, adapted from Martinez, Bonnefon and Hoskens (2009), participants' total wager amount across the task was divided by five (*average wager size*) and divided by the total amount held in each round's opening pot (*investment percentage*).

After completing all 50 trials, participants were asked (via pen and paper) to indicate their perceived level of control over illuminating the light bulb on a 100-point scale (*perceived control*) and to indicate how many of their 50 responses caused the bulb'(*perceived connection*). These illusory control measures were adapted from Balzan, Delfabbro, Gallently, and Woodward (2013).

2.5.2 Similar Illusory Control Task: Submarine Task

The other half of participants were assigned to a computer task with very similar instructions to the light onset task, but with a structure and objective that superficially resembled *Sea Wolf*. Participants were instructed that their goal was to detect an invisible submarine moving amongst nine segments of sea (using a "radar signal") by clicking on any segment. During each trial (titled as a "mission") participants were given ten radar signals before they were informed if they had been successful. Participants were told that clicking on a segment while the submarine was passing through would result in successful detection (see Figure 2.3). Conversely, not doing so would result in confirmation of non-detection. In fact, there was no contingency between clicking on the segments and successful detection; this task was also pre-programmed for a particular sequence of wins and losses between trials. This sequence was identical to that of the dissimilar illusory control task. 25 of the trials resulted in a detection.

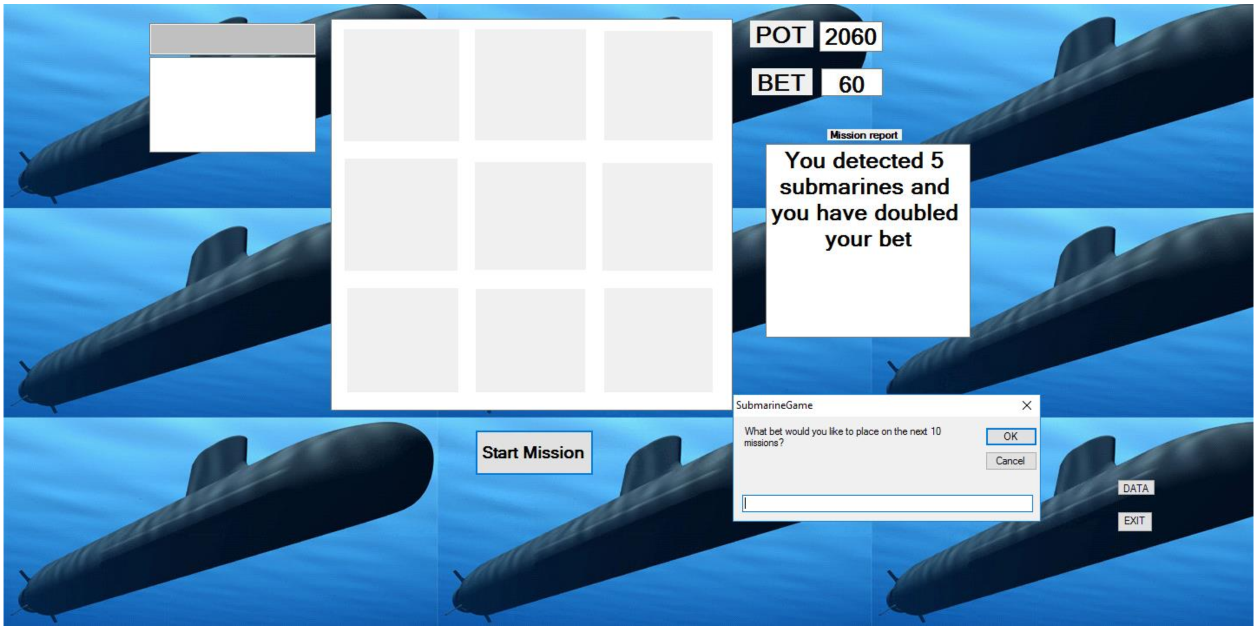

Figure 3. Similar illusory control task. Displays field of detection (center), "Start Mission" command (bottom center), current pot and bet (top right), bet result (middle right), and bet input for the next round (bottom right).

In identical fashion to the dissimilar task, participants wagered on their performance across five rounds of ten seas each. The starting pot and win-loss sequence between rounds remained the same, as did the measuring of gambling outcome measures (Martinez et al., 2009). (See Appendix F for full task instructions, stimuli and detection/non-detection sequence).

After completing all 50 trials, participants completed Balzan et al.'s (2013) illusory control measures via pen and paper, this time adapted to the submarine task. Participants were asked to indicate their perceived level of control over detecting the submarine on a 100-point scale (*perceived control*) and to indicate how many of their 50 responses caused the submarine's detection (*perceived connection*).

2.6 Procedure

2.6.1 Information and Consent

Participants either signed up to the study via the University of Adelaide's Research Participation System (RPS) (if they were students from the Psychology 1 cohort), or contacted the experimenter via email or telephone (if they were participants from the community). Upon contact, they were given the laboratory's location, and provided with the expectation that the study would take no longer than 45 minutes. Psychology 1 students were granted with one participation credit for their participation, and community members were entered into the draw to win a $50 JB Hi-Fi gift voucher.

Upon arrival, participants were given a study information sheet that detailed inclusion and exclusion criteria (see Appendix G), followed by a brief consent form where participants supplied their email addresses for prize draw information and a debrief of the research findings (see Appendix H). Participants were advised that this information would be kept separate from any other data collected during the research.

2.6.2 Questionnaire, Priming, and Illusory Control Tasks

Once providing informed consent, and once Psychology 1 students had provided their RPS ID number for course credit allocation, pen and paper survey measures (demographics and video game experience, DBC, PGSI) were undertaken. Participants were allocated to one of the 2x2 conditions (primed vs. not primed, control vs. video game illusory control task) by the experimenter during this time.

Once completing the survey measures, participants were directed to one of the laboratory's two computer rooms. Those in the priming condition were directed to either play *Sea Wolf* for fifteen minutes (timed and terminated by the experimenter) and those in the non-priming condition were immediately directed to one of the two illusory control tasks. Those in the priming condition were also directed to their particular illusory control task once the fifteen minutes of playing had concluded; the experimenter closed their game's window and opened the task's window to proceed.

Participants in all conditions answered the illusory control outcome measures via pen and paper immediately after completing their task. The experimenter then recorded their wager data, stored on the illusory control task window, to an Excel spreadsheet on their personal computer. At the completion of the study, participants were offered an information sheet that provided facts about gambling, along with directions to gambling support services if needed (see Appendix I).

Chapter 3

Results

3.1 Analytical Procedures

The first stage in the data analysis was to generate descriptive statistics for relevant demographic, psychometric and experimental measures and to examine the distribution of scores for outliers and other qualities (e.g., non-normality) that might influence the robustness of parametric testing. Pearson's *r* was used to examine the relationship between metric variables. The principal hypotheses were investigated using a 2 Condition (priming, no priming) x 2 Task (similar, dissimilar) factorial ANOVA. Hierarchical regression analyses were then used to test the relationship between metric predictor variables and outcome measures. Some ad hoc exploratory analyses were also conducting using Welch's independent samples *t*-tests. Bootstrapping procedures were used throughout the analyses to examine the stability of results in recognition of the relatively small sample size. These previous analyses were run through IBM SPSS Statistics (Version 24.0.0.1). *Post hoc* power analyses, run through G*Power (Version 2.0.1.0), determined that power across the main analyses ranged from 0.30 to 0.76 (all below a typically desired 0.8). Given the effect sizes found and the significance criterion of $p = 0.05$, the desired sample size for all analyses to reach statistical power of 0.8 would be $N = 164$ (i.e. 41 participants in each of the four groups).

3.2 Descriptive Statistics

3.2.1 Video Game Self-Reported Measures

The majority of participants (*N* = 60, 93.7%) reported playing video games at least once in a typical week. Hours played in a typical week (*M* = 5.5, *SD* = 5.9) ranged between 0 and 28, with: 32 of the identified players engaging in less than 5 hours per week (50%); 25 playing 5-15 hours per week (39.1%); and 3 playing more than 15 hours per week (4.7%). Twelve different video game genres were identified as participants' favourites, with the most popular being sport (42.2%), followed by open world (17.2%), first person shooter (10.9%) and massively multi-player online role-playing (4.7%).

There were significant gender differences in perceived video game playing ability, although there was no significant difference in the numbers of video game hours played per week (Females: *M* = 4.7, *SD* = 5.8 vs. Males: *M* = 5.8, *SD* = 5.9), $t(62) < 1$. Females rated themselves as falling into a lower skill percentile in the population (*M* = 40.3**,** *SD* = 23.1) than males (*M* = 60.5, *SD* = 15.4); $t(62) = 3.26$, $p < .01$ 95% CI [-30.3, -10.0]. There was a small to moderate positive relationship between self-rated video game ability and video game hours played, *r (N* =64) 0.29, $p < 0.05$, 95% CI [0.07, 0.50]. No association was found between age and perceived video game ability or between age and video game hours played per week.

3.2.2 Beliefs about Chance and Gambling Severity

The average DBC score was 44.0 (*SD* = 11.4) (range of 27 to 70, as compared with a theoretical range of 22 to 110) which indicates that the sample, as a whole, scored more towards the less superstitious end of the scale. There was no gender difference in DBC score as well as no correlations between DBC scores and: video game hours played per week; participant age; or PGSI scores (all $p > 0.05$).

The average PGSI score was 1.6 (*SD* = 2.1), with a minimum of 0 and a maximum of 9 (from a theoretical range of 0 to 27). Twenty-nine participants recorded a 0 (45.3%), 20 (31.3%) returned low risk scores; 14 (21.9%) had moderate level problems; and, one participant scored in the problem gambler range. Males (*M* = 1.9, *SD* = 2.1) scored significantly higher than females (M = 0.6, SD = 1.5), $t(62) = 2.13$, $p < .05$, 95% CI [0.8, 2.4]. There were no correlations between the PGSI and any of video game hours played, age, or DBC score (all $p > 0.05$).

3.2.3 Outcome Measures

Table 3.1 displays the perceived control and perceived connection for groups based on illusory control tasks and priming conditions. The mean perceived control (as measured by the question “On a scale of 0-100, how much control do you think you had over the light bulb’s illumination/submarine’s detection?”) was 16.3 (*SD* = 24.2) across all experimental conditions with 31 (48.4%) perceiving a level of control greater than 0. The mean perceived connection (as measured by the question “Of the fifty trials/missions you participated in, how many times do you think the light bulb’s illumination status/submarine’s detection status was the result of your action?”) was 11.2 (*SD* = 15.2) across all experimental conditions with 30 participants (46.9%) perceiving a level of connection greater than 0. For both variables, there was no significant association found for either gender or age.

Table 1

Mean and (SD) of perceived control and connection in the 4 experimental conditions.

	Perceived Control (1 - 100%)			Perceived Connection (1 - 50)		
	Dissimilar Task	Similar Task	Overall	Dissimilar task	Similar Task	Overall
Not primed	5.6 (12.2)	24.1 (23.9)	14.8 (20.9)	6.0 (11.0)	14.6 (16.0)	10.3 (14.2)
Primed	19.4 (30.4)	16.1 (24.9)	17.8 (27.4)	13.6 (18.6)	10.6 (14.0)	12.1 (16.2)
Overall	12.5 (23.9)	20.1 (24.4)		9.8 (15.5)	12.6 (14.9)	

Note. Dissimilar task = light onset task; Similar task = submarine video-game style task.

Table 3.2 displays the wagering measures (average wager and investment) for groups based on illusory control tasks and priming conditions. Average wager (total of the five wagers in a participant's task, divided by five) had a mean of 270.8 (*SD* = 267.0) across all experimental conditions. The mean investment percentage (total of the five wagers in a participant's task, divided by the total of all five rounds' pots) was 13.7% (*SD* = 11.7%) across all experimental conditions. For both variables, there was no significant relationship found with either gender or age.

Table 2

Mean and (SD) of average wager and investment percentage in the 4 experimental conditions.

	Average Wager			Investment Percentage		
	Dissimilar Task	Similar Task	Overall	Dissimilar Task	Similar Task	Overall
Not primed	224.4 (202.3)	336.1 (275.2)	280.2 (244.3)	11.4 (9.44)	16.7 (12.6)	12.6 (11.3)
Primed	219.6 (365.0)	303.0 (196.6)	261.3 (291.5)	10.1 (12.9)	16.7 (11.1)	13.4 (12.3)
Overall	222.0 (290.3)	319.5 (235.9)		10.7 (11.1)	16.7 (11.7)	

Note. Dissimilar task = light onset task; Similar task = submarine video-game style task.

3.3 Two-Way Factorial ANOVA

The 2 Condition x 2 Task ANOVA was conducted with four dependent variables of interest (perceived control, perceived connection, average wager, and investment percentage). For perceived control, there was no significant main effect of Condition, $F(1, 64) < 1$, or Task type, $F(1, 64) = 1.63$, $p > .05$, or Condition x Task type interaction, $F(1, 64) = 3.32$, $p > .05$ (See Figure 4). Similar results were obtained for the perceived connection outcome measure. There was no main effect of Condition, $F(1, 64) < 1$, Task type, $F(1, 64) < 1$, and no significant interaction, $F(1, 64) = 2.36$, $p > .05$.

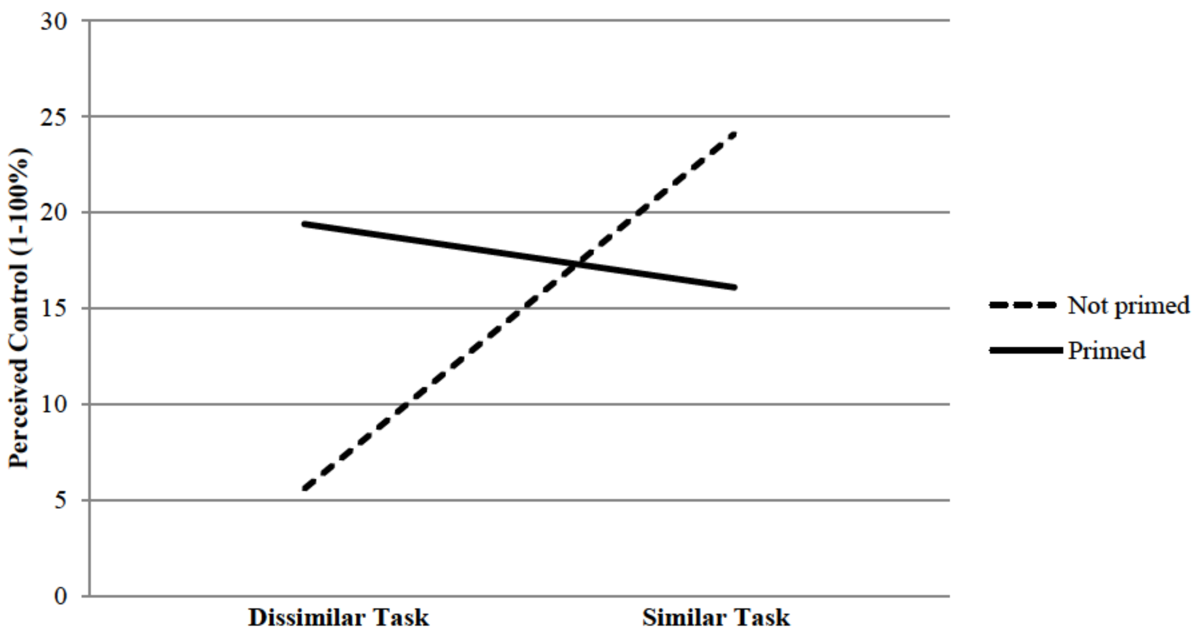

Figure 4. Mean perceived control in the four experimental conditions. ($N = 64$).

The same analysis was conducted for average wager and investment percentage. There was no significant main effect of Condition, $F(1, 64) < 1$, or Task type, $F(1, 64) = 2.11$, $p > .05$, for average wager, or Condition x Task type interaction, $F(1, 64) <1$. For investment percentage, there was no main effect of Condition, $F(1, 64) < 1$, but the Task type main effect was significant with the investment percentage found to be higher for the similar task, $F(1, 64) = 4.24$, $p < .05$. (See Figure 5). The Condition x Task Type interaction was non-significant, $F(1, 64) < 1$.

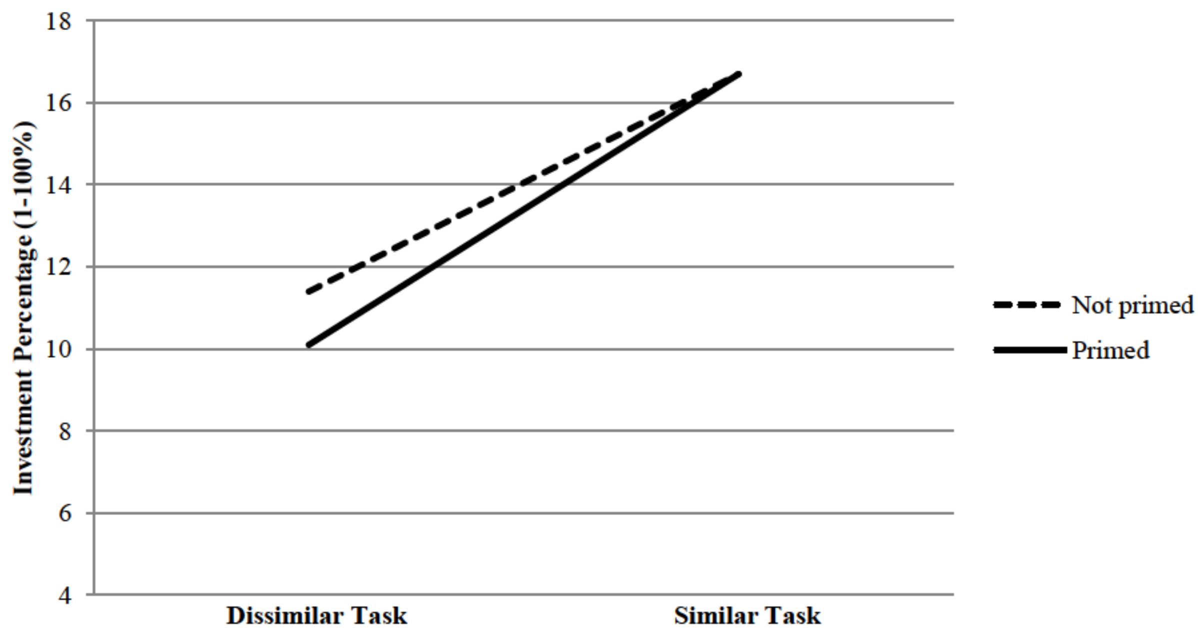

Figure 5. Mean investment percentage in the four experimental conditions. ($N = 64$).

3.4 Correlation Analysis

Table 3.3 displays Pearson product moment correlations across outcome, psychometric, demographic and video game playing variables. Perceived control and perceived connection are displayed as continuous variables, but their distributions are significantly affected by the large proportion of cases where participants responded '0' (i.e., no control or connection) at the conclusion of their tasks ($N = 22$, or 34.4%). To account for this, both variables were additionally classified as binary (i.e., control/connection = 0, or control/connection > 0) and used in point bi-serial correlations.

Hypothesis 3 predicted that video game hours would not be associated with illusory control (perceived connection and perceived control) and gambling behaviours (average wager and investment). No significant correlation was found between video game playing and any of the four outcome variables. Bootstrapping procedures confirmed that video game hours did not have a significant association with perceived control, (95% CI [-.14, .29]), perceived connection, (95% CI [-.14, .21]), average wager, (95% CI [-.14, .36]), or investment (95% CI [-.12, .41]). These non-significant results were sustained when controlling for priming condition and task type. Furthermore, illusory control variables remained insignificant when controlling for DBC scores, as did gambling variables when controlling for PGSI scores. However, perceived video game playing ability had a moderate negative correlation with perceived connection when recoded into a binary form, 95% CI [-.56, -.12]. This was the only video game related measure that had a significant association with any form of outcome variable.

There were no significant correlations found between either of the illusory control measures (perceived control and perceived connection) and either of the wagering behaviours (average wager, investment percentage), all $p > .05$.

Table 3

Pearson's r *correlations between study variables of interest.*

Variable	1	2	3	4	5	6	7	8	9	10	11
1. Age											
2. Sex	-.09										
3. Perceived control (total)	-.13	.11									
4. Perceived control (binary)	-.16	.00	.60***								
5. Perceived connection (total)	-.17	-.05	.49***	.48***							
6. Perceived connection (binary)	-.03	-.18	.48***	.63***	.70***						
7. Average wager	-.07	.01	.09	-.07	-.12	-.13					
8. Investment	-.08	-.02	.14	.01	-.12	-.10	.94***				
9. DBC	-.24	-.29*	.10	.23	.20	.24	-.10	-.09			
10. PGSI	-.10	-.26*	.00	.04	-.07	-.15	-.22	-.17	.07		
11. Video game hours	-.12	.08	.07	.05	.03	.00	.09	.15	.02	-.05	
12. Video game ability	-.13	.45***	-.06	-.10	-.12	-.35**	.14	.18	-.05	.24	.29*

Notes. **p* < .05 (two-tailed), ***p* < .01, ****p* < .001. DBC = Drake Beliefs about Chance Inventory, PGSI = Problem Gambling Severity Index, 'Video game ability' = percentage of the population participant perceived themselves to be more skilled than.

3.5 Exploratory analyses

3.5.1 Independent Samples *T*-Tests

While most of the hypotheses yielded insignificant results, several ad-hoc exploratory analyses undertaken using Welch's independent samples *t*-tests revealed some additional insights. For example, the perceived control of participants placed in the condition with no priming and the light onset task (i.e. the condition with all video game components removed) (*M* = 5.6, *SD* = 12.2) was significantly lower than those in all other conditions (*M* = 19.9, *SD* = 26.2), t(62) = -2.09, p < .05, 95% CI [-27.8, -0.6]. However, there was a non-significant difference in perceived connection between this particular condition (*M* = 6.0, *SD* = 11.0) and all others (*M* = 12.9, *SD* = 16.0), t(62) = 1.60, *p* > .05, 95% CI [-15.6, 1.7].

Furthermore, in the condition without priming, there was a significant difference between tasks for perceived control, *t*(30) = 2.74, *p* < .05, 95% CI [-32.1, -4.76], with those in the similar task displaying significantly higher levels of control than those participating in the dissimilar task. However, perceived connection did not differ between the tasks, *t*(30) = 1.77, *p* > .05, 95% CI [-18.5, 1.34]. Conversely, perceived control and perceived connection ratings did not differ between task types in the primed group, both *t*(30) < 1.

A further analysis of a significant relationship reported in the correlational analyses found there was a significant difference in perceived video game ability (as a percentage relative to the rest of the population) between the 30 participants who perceived no connection (*M* = 62.6, *SD* = 18.6) and the 34 who did perceive a connection (*M* = 49.1, *SD* = 18.4), *t*(62) = 2.91, *p* < .01, 95% CI [4.23, 22.7].

Chapter 4

Discussion

4.1 Overview of Study and Main Findings

The principal aim of this study was to examine whether exposure to a skill-based or contingent task appears to influence illusory control and hypothetical wagers in subsequent chance or non-contingent tasks. A secondary aim was to examine whether task similarity would also influence the possible transfer of learning from the pre-exposure task to the test tasks (chance tasks). In general, there was limited support for the main hypotheses. Pre-exposure to a skill-based video-game game did not appear to be related to subsequent ratings of perceived control and wager size in the chance tasks. In partial support for the study's second hypothesis, task similarity also had no effect on perceived control scores, but wager size was significantly higher in the similar task. However, exploratory analyses revealed that participants who were not primed did provide higher perceived skill ratings when participating in the similar task than those who undertook the dissimilar chance task, and that this task similarity increased wager size. In keeping with the third hypothesis, video game playing frequency had no significant association with perceived control and wager size. The study also showed that perceived video game ability had an unexpected moderate negative point bi-serial correlation with illusory control ratings in the chance task.

4.2 Detailed Analysis of Findings

4.2.1 Illusion of Control

Despite what was predicted, being exposed to the contingent video game did not have a significant effect on perceived control in a subsequent chance task. This is not consistent with the effects reported by Langer (1975), who found that orientation to a task, with slight differences to a test task, significantly increased perceptions of control. Nor is it consistent with learned helplessness research, where being exposed to a non-contingent situation has been shown to significantly affect perceived control when contingency is introduced (Seligman, 1972). Task similarity also had no significant effect on perceived control, inconsistent with the learned helplessness findings of Tiggeman and Winefield (1978). In their study, participants were more likely to perceive non-contingency if a task presented superficial similarities to a non-contingent task. However, exploratory analyses revealed that the similar task had significantly higher perceived control ratings than the dissimilar task in the condition without priming. This lends some credence to task similarity having an impact, as it could be contended that priming altered the effect for the rest of the sample. However, if the effect had been significantly strong, a significant Condition by Task interaction effect should also have been observed.

As predicted in the third hypothesis, video game hours played per week did not have a significant association with perceived control. This reflects the literature's inconsistent links between video game activity and perceived control, in particular the findings of King et al. (2012). Their study found that while a positive association between video game hours and illusory control was found in a sample of regular gamblers, regular video gamers' hours played had no such significant association. In the present sample, most participants had low levels of involvement in gambling and scored low on the problem gambling measure, perhaps indicating that King et al.'s (2012) significant link was confined to those with a greater interest in gambling.

Correlational analysis found that those who perceived some connection (i.e. perceived connection > 0) reported themselves as significantly less skilled at video games than those who perceived no connection. Due to the absence of significant associations between other video gaming measures and the outcome variables, the meaning of this finding is unclear. However, it does reflect findings from King et al. (2012) wherein regular video gamers were significantly less likely to attribute gambling successes to chance than a control sample. This may be because more proficient video gamers are better able to detect the difference between contingent video game tasks and games of chance.

4.2.2 Virtual Gambling Behaviours

Likewise, being primed with the video game task was not associated with significantly higher wager sizes. This prediction was made on the assumption that higher wagers would be the result of increased illusory control after priming, as per the aforementioned work of Langer (1975). However, investment percentage was significantly higher in the similar task. This suggests that participant confidence was higher in the similar task, consistent with effects found in learned helplessness research by Tiggeman and Winefield (1978). This finding is also consistent with Langer (1975), where superficial skill cues, acquired from natural experience, increased risk-taking in chance tasks. It is reasonable to suggest that for participants in this sample (93.8% of whom played video games once per week) these video game elements acted as a situational skill cue.

Video game playing frequency had no such correlation with virtual gambling behaviours, again supporting the findings of King et al. (2012), whereby neither regular video game players, nor regular gamblers, displayed significant associations between video game hours played and gambling behaviours. The present results, while unique in their testing of the relationship in a laboratory setting, are not consistent with claims in earlier literature that video game play can foster detrimental gambling cognition and behaviour (Gupta & Derevensky, 1996; Fisher & Griffiths, 1995).

4.3 Implications and Future Directions

The current study provides some evidence that video game elements affect wager behaviour in a virtual chance gambling task. The findings indicate that video game playing frequency is not associated with illusory control or wager behaviour, and that preliminary exposure to a skilled video game task does not affect these outcome variables.

While the results do indicate that video game elements elicit higher wagers, the specific gaming elements responsible for this link were not examined. This becomes more problematic when considering previous literature (Gupta & Derevensky, 1996; Griffiths, 1993; Wood et al., 2004), which proposes a variety of video game characteristics that may be responsible for a link between video gaming and illusory control. As a result, future research should also undertake investigations into how particular characteristics of video games (e.g., sound, graphics, objectives) can affect illusory control and wager behaviour.

The experimental nature of this research meant that investigation of real and consequential gambling behaviours was not feasible. A more naturalistic design could detail examine gambling behaviours such as financial expenditure and gambling frequency, and investigate whether these variables are associated with how similarly the elements of their chosen gambling tasks mirror that of a video game. This could clarify the effect observed in this study whereby a task resembling a video game significantly increased investment percentage.

Significantly, the study does not separate whether the effects observed were unique to video games, or more generalisable to the effects (and lack thereof) one could observe from another contingent task. A replication study with a focus on a more ordinary contingent task (void of video game elements) could investigate whether this study's results are indicative of broader patterns in contingency learning, or confined to the effects of skilled video game media.

Due to this study's methodological limitations (discussed below) and inconsistent results, more research is vital before any practical application is considered. However, if stronger effects emerge in subsequent literature, problem gambling interventions could involve teaching clients to better discriminate between contingency and non-contingency in electronic gambling media. Furthermore, if superficial elements of video games can truly elicit increased levels of perceived control and wager size, CBT could incorporate this generalisation of contingency as an erroneous implicit belief to combat in homework exercises and one-on-one discussions with clients.

4.4 Strengths and Limitations of the Current Study

The primary strengths of this study include the controlled manipulation of video game play to better discern a link between skilled task exposure and illusory control. Furthermore, its manipulation of video game elements in an illusory control task makes it possible to examine the impact of these situational skill cues in a similar manner to classical illusion of control literature.

While much of the literature investigating the relationship between video gaming and gambling cognition has relied on naturally occurring video gaming and gambling variables, the current study was able to examine a potential cognitive relationship in a contrived setting on a general sample.

However, the methodology used was not without its weaknesses. Wood, Griffiths, Chappell and Davies (2004), when assessing how video game media has altered a link between gaming and gambling, demonstrated that the three most important structural components of a video game for frequent users are realism in sound, graphics and setting. While this study simply wanted to establish a link between play and control, there were insufficient resources to develop a more realistic and engaging software platform. Future studies should aim to utilise more realistic video games that can accurately emulate a contemporary video gaming experience.

Occasionally, participants required help from the researcher to understand the instructions in the illusion of control tasks (see Appendices E and F). This lack of understanding may have led to problems in learning the tasks' rules, properly evaluating action-outcome links, and completing the task as the research intended. While precautions were taken to ensure that the instructions were clear and comprehensive, there is a chance that many participants had an insufficient grasp of their expectations and were unable to properly evaluate their level of control over the task's outcomes. In particular, the light-onset task proved difficult, as many participants expressed that they believed clicking the "GET BULB" button repeatedly was the only way to progress. Tasks with more familiar or simpler controls are advisable for future research.

Despite the critique of the literature's traditional investigation of adolescents and young adults, an overwhelming majority of participants recruited for this study were young and/or male. Overall, the sample had a mean age of 22.1, with 59 (92.2%) under 25 years old. Furthermore, 48 (75%) were male and 44 (68.8%) were males under 25 years old. Because of the typical demographics of Australian video gaming (Brand and Todhunter, 2015), it is most probable that the sample acquired were more frequent video gamers than the rest of the population. The reason for this over-representation of young people is due to the research's execution on a university campus, as well as the study's advertising (see Appendix A) appealing to those who enjoyed video gaming and gambling (activities which share a predominantly male audience). Replicated studies with a more gender-balanced sample and a broadly distributed age range are recommended.

Finally, *post hoc* power analysis revealed the sample size (N = 64) was too small for attaining desired power (0.8) given the effect sizes obtained (statistical power ranged from 0.30 from 0.76) through. It was determined that a sample of N = 164 was required to bring all analyses to a power of 0.8 given their effect sizes and significance criterion of $p < .05$. In future, increased participant incentive and a greater time frame for data collection are advised to increase sample size.

4.5 Conclusions

This study provides limited evidence that exposure to skill-based video game cues influence subsequent performance on a non-contingent or chance-based task. While the study attempted to exert some laboratory control over effects which are hypothesised to occur in realistic settings, more refined studies are needed to investigate how contingent task priming (and video games in particular) can influence people's behaviour in situations of this nature. The findings highlight the need for further research into contingency priming, the significance of superficially contingent elements in tasks with a wagering component, and the role that video games may play in eliciting illusory control.

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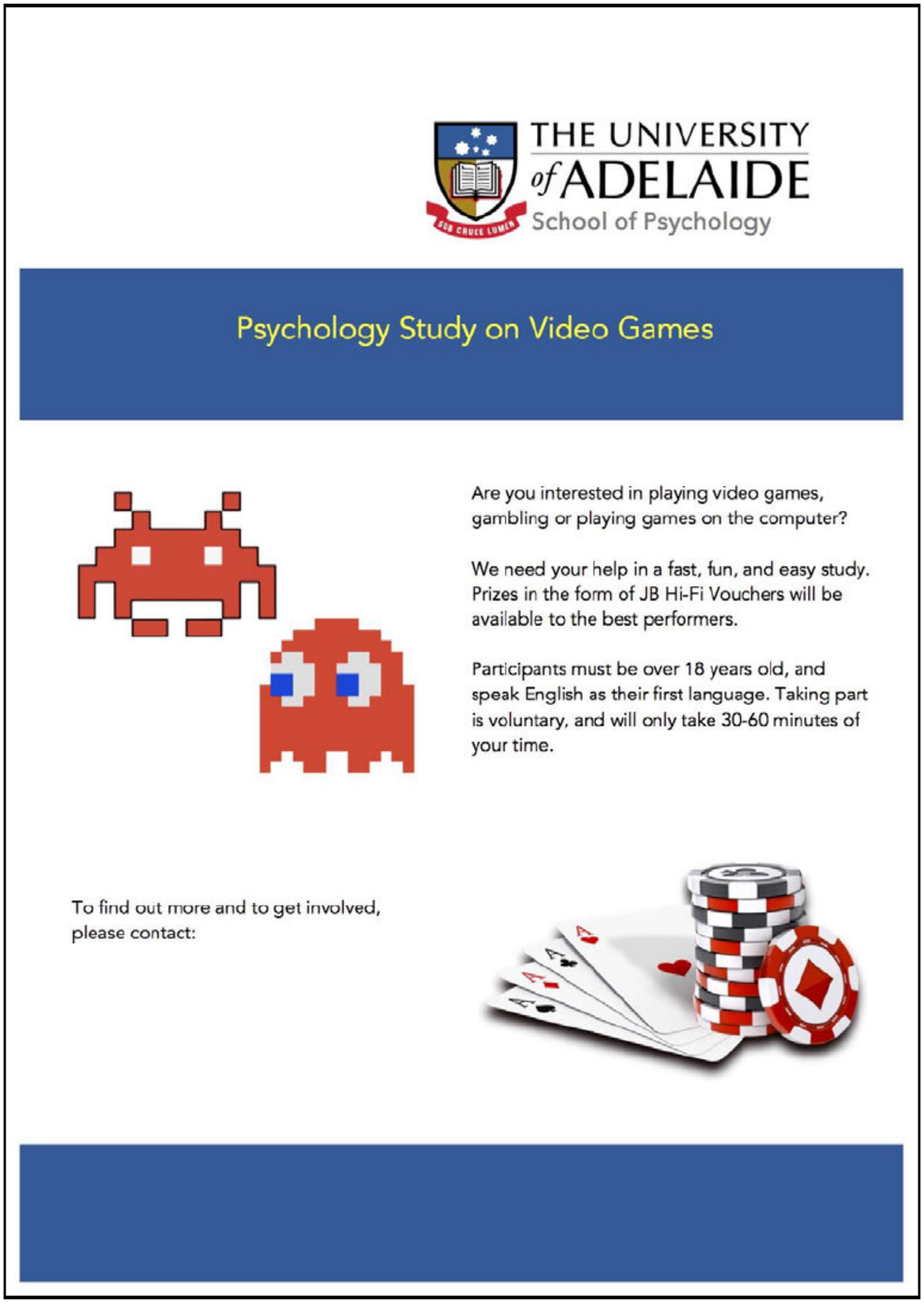
Appendix A: Advertising Material

Advertising slip used in print at the University of Adelaide (between 19th May and 31st August 2017) and as a JPEG file on social media site Facebook (posted 26th July 2017).



Appendix B: Demographic and Video Game Experience/Ability Measures

The information below will not be linked to your name or any contact details provided.

Are you a Psychology I student participating for course credit?

☐ Yes. EMS participation ID number: ______________________.

☐ No. An anonymous ID number will be generated for you.

What is your sex?

☐ Male
☐ Female

What is your current age in years? ______

What is your current work status, independent of study?

☐ Employed, full-time.

☐ Employed, part-time.

☐ Employed, casual.

☐ Unemployed.

☐ Other (please specify):

What is your highest level of *completed* education?

☐ Did not complete high school.

☐ High school

☐ Certificate

☐ Diploma

☐ Bachelor degree

☐ Masters degree

☐ Advanced graduate work/Ph.D.
What is your country of birth?

☐ Australia
☐ A country other than Australia (please specify): ___________________

In a typical week in the last 12 months, how many hours would you estimate you spend playing video games? If it ranges, give the average within that range (e.g. if it ranges between 5 and 10 hours, write “7.5 hours”).

____

Give a rating out of 10 indicating your perceived ability in playing video games involving skill and/or strategy, compared to an average person in the population. (1 = very below average, 5 = about average, 10 = very above average)

____

Give a rating out of 10 indicating your perceived ability in playing video games involving skill and/or strategy, compared to an average person who plays video games. (1 = very below average, 5 = about average, 10 = very above average)

____

What percentage of the population would you consider yourself to be more skilled than? (e.g. If you think you are more skilled than half of the population, write “50%”).

____

If you play video games, which of the following genres do you allocate the most playing time towards? Select ONE only.

☐ First-person shooter (e.g. Call of Duty, Halo)

☐ Sport (e.g. FIFA, NBA 2K)

☐ Family/farm simulation (e.g. The Sims, Farmville)

☐ Open world (e.g. Grand Theft Auto, Red Dead Redemption)

☐ Massively multiplayer online role-playing games (e.g. World of Warcraft)

☐ Arcade games (e.g. Pacman, Space Invaders)

☐ Multiplayer online battle arena (e.g. League of Legends)

☐ Other (please specify, with examples of game/s):

____

Appendix C: Drake Beliefs about Chance Inventory

Use this scale to demonstrate your level of agreement with the following statements:
1 = Strongly disagree
2 = Disagree
3 = Neutral
4 = Agree
5 = Strongly agree

1. I like to carry a lucky coin, charm or taken when I'm doing something important.
☐1 ☐2 ☐3 ☐4 ☐5

2. I can improve my chances of winning by performing special rituals.
☐1 ☐2 ☐3 ☐4 ☐5

3. There may be magic in certain numbers.
☐1 ☐2 ☐3 ☐4 ☐5

4. When I take a test (or took them in the past), I use a lucky pen or pencil.
☐1 ☐2 ☐3 ☐4 ☐5

5. I have a special system for picking lottery numbers.
☐1 ☐2 ☐3 ☐4 ☐5

6. There is useful information in my daily horoscope.
☐1 ☐2 ☐3 ☐4 ☐5

7. When I need a little luck I wear lucky clothes or jewelry.
☐1 ☐2 ☐3 ☐4 ☐5

8. A game of chance is a contest of wills between the game and the player.
☐1 ☐2 ☐3 ☐4 ☐5

9. I believe that fate is against me when I lose.
☐1 ☐2 ☐3 ☐4 ☐5

10. Playing poker machines is a form of competition between the player and the machine.
☐1 ☐2 ☐3 ☐4 ☐5

11. I do not consider myself to be a superstitious person.

☐1 ☐2 ☐3 ☐4 ☐5

12. A good casino gambler is like a quarterback who knows winning plays and when to use them.
☐1 ☐2 ☐3 ☐4 ☐5

13. There are secrets to successful casino gambling that can be learned.
☐1 ☐2 ☐3 ☐4 ☐5

14. Wins are more likely to occur on a hot machine.
☐1 ☐2 ☐3 ☐4 ☐5

15. Show me a gambler with a well-planned system and I'll show you a winner.
☐1 ☐2 ☐3 ☐4 ☐5

16. The more familiar I am with a casino game, the more likely I am to win.
☐1 ☐2 ☐3 ☐4 ☐5

17. It is good advice to stay with the same pair of dice on a winning streak.
☐1 ☐2 ☐3 ☐4 ☐5

18. One should pay attention to lottery numbers that often win.
☐1 ☐2 ☐3 ☐4 ☐5

19. If a coin is tossed and comes up heads ten times in a row, the next toss is more likely to be tails.
☐1 ☐2 ☐3 ☐4 ☐5

20. I will be more successful if I have a system to play poker machines.
☐1 ☐2 ☐3 ☐4 ☐5

21. Some gamblers are just born lucky.
☐1 ☐2 ☐3 ☐4 ☐5

22. The longer I've been losing, the more likely I am to win.
☐1 ☐2 ☐3 ☐4 ☐5

Appendix D: Problem Gambling Severity Index

Thinking about the **last 12 months:**

1. Have you bet more than you could really afford to lose?

☐ Never ☐ Rarely ☐ Occasionally ☐ Often

2. Still thinking about the last 12 months, have you needed to gamble with larger amounts of money to get the same feeling of excitement?

☐ Never ☐ Rarely ☐ Occasionally ☐ Often

3. When you gambled, did you go back another day to try to win back the money you lost?

☐ Never ☐ Rarely ☐ Occasionally ☐ Often

4. Have you borrowed money or sold anything to get money to gamble?

☐ Never ☐ Rarely ☐ Occasionally ☐ Often

5. Have you felt that you might have a problem with gambling?

☐ Never ☐ Rarely ☐ Occasionally ☐ Often

6. Has gambling caused you any health problems, included stress or anxiety?

☐ Never ☐ Rarely ☐ Occasionally ☐ Often

7. Have people criticised your betting or told you that you had a gambling problem, regardless of whether or not you thought it was true?

☐ Never ☐ Rarely ☐ Occasionally ☐ Often

8. Has your gambling caused any financial problems for you or your household?

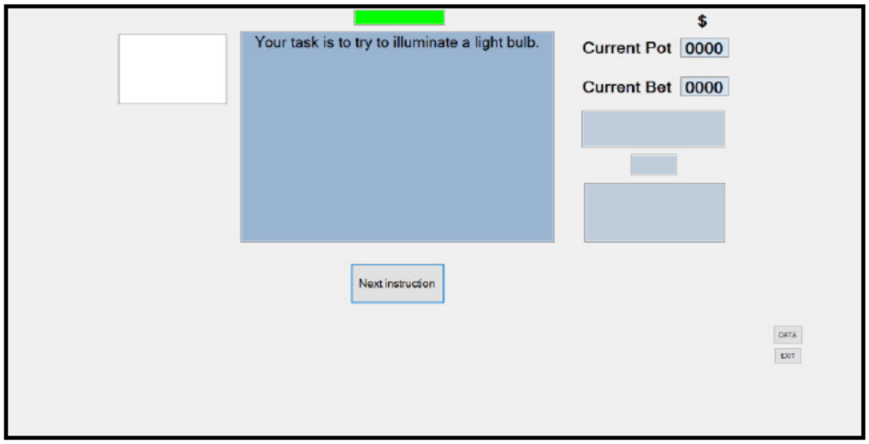
☐ Never ☐ Rarely ☐ Occasionally ☐ Often

9. Have you felt guilty about the way you gamble or what happens when you gamble?

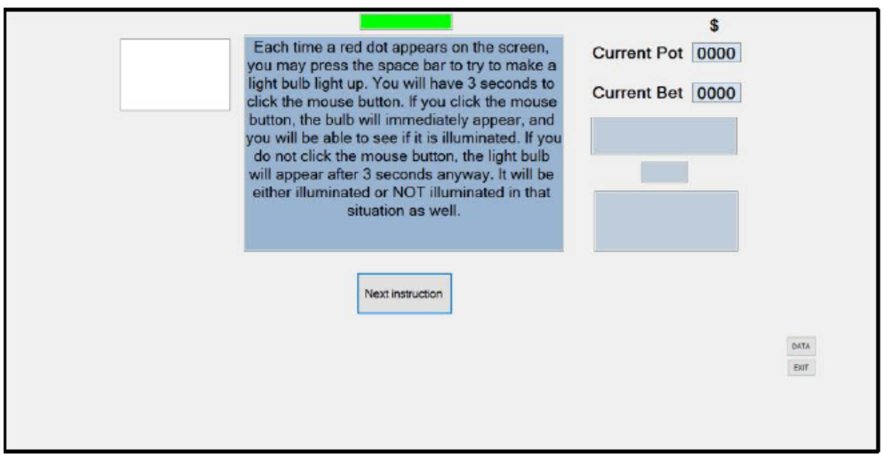
☐ Never ☐ Rarely ☐ Occasionally ☐ Often

Appendix E: Dissimilar Illusory Control Task

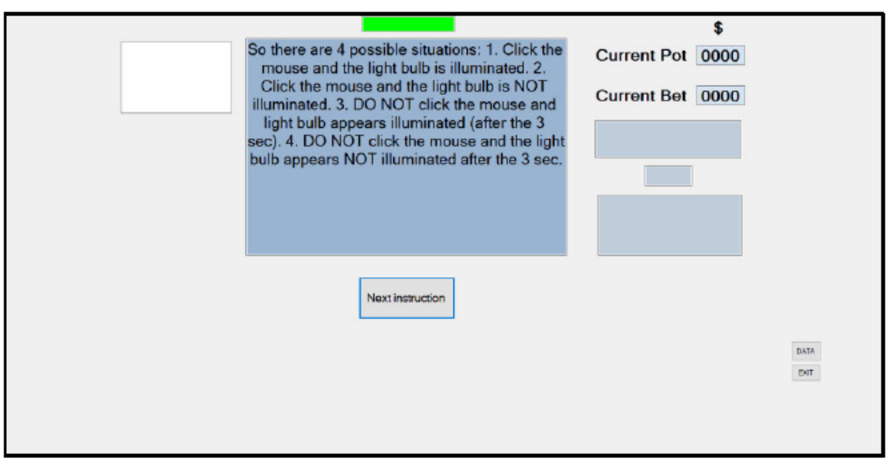
Instructions, Stimuli, Win Sequence and Post Task Items



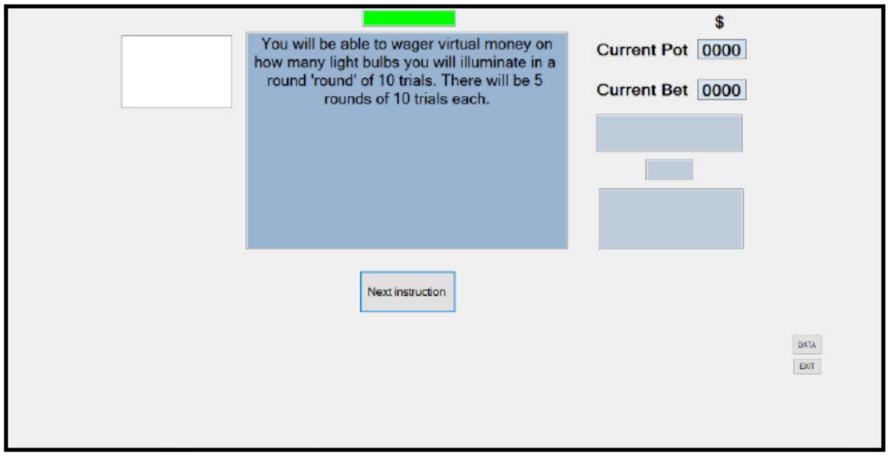
1.Task instructions - outlining of task objective.



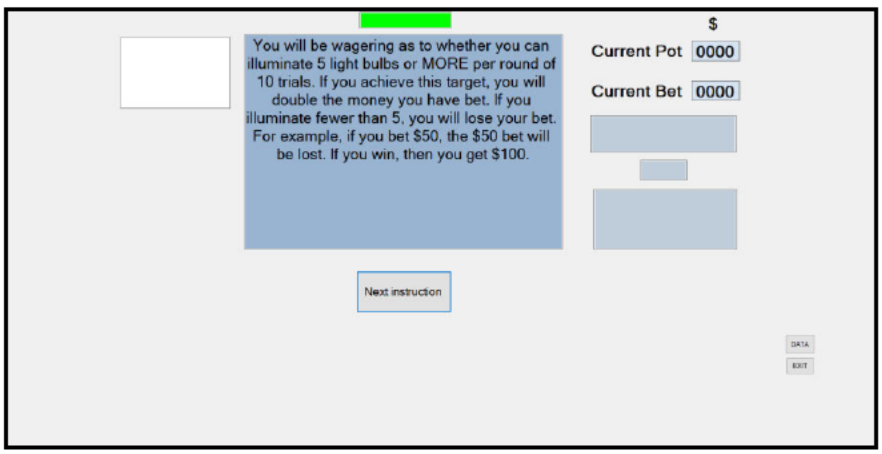
2. Task instructions - explanation of trial procedure. Note ‘space bar’ instructional error.



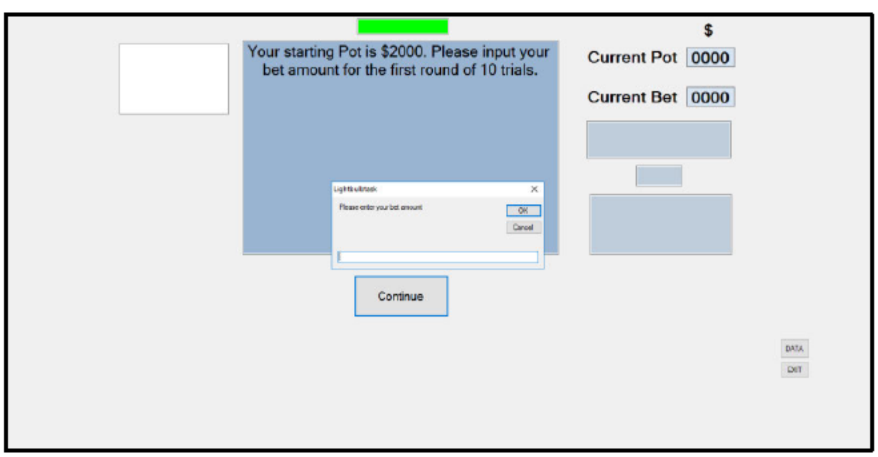
3. Task instructions - list of possible outcomes.



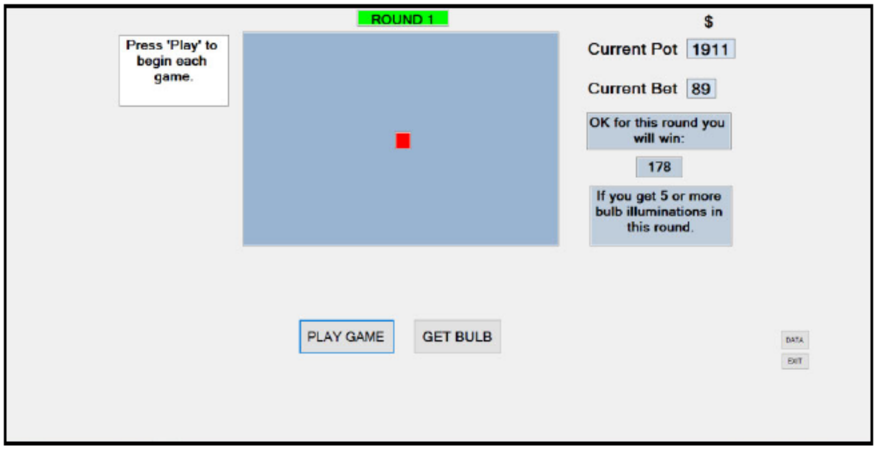
4. Task instructions - introduction of gambling elements.



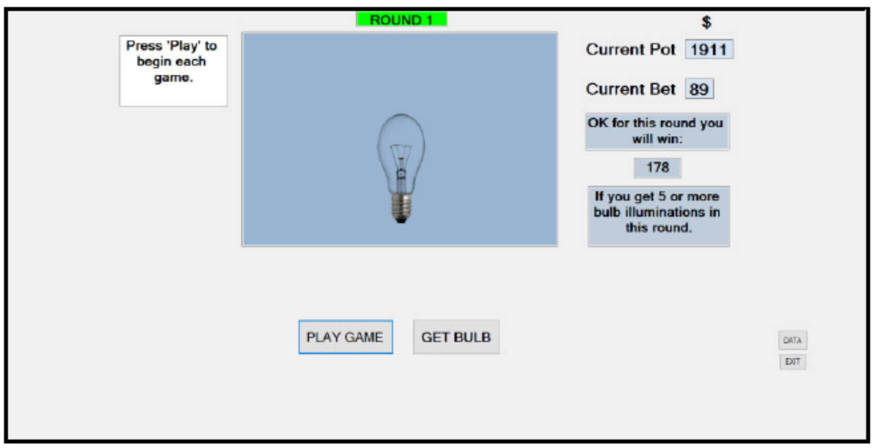
5. Task instructions - explanation of gambling system.



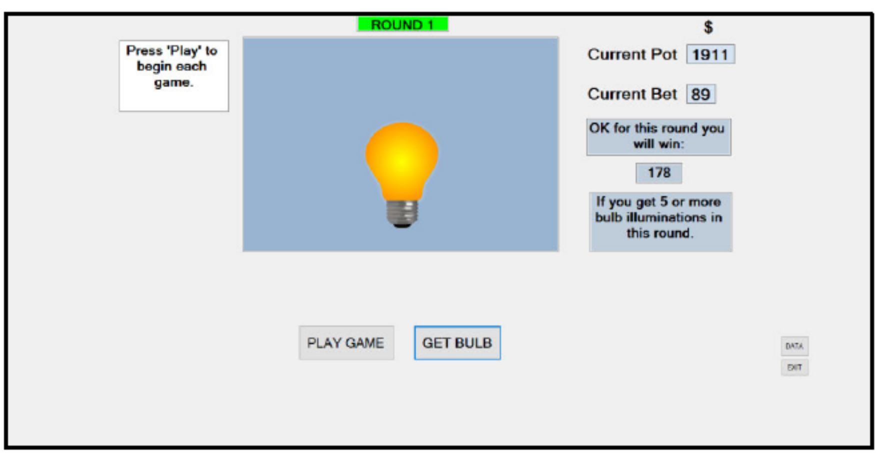
6. Task stimuli - initial wagering instruction.



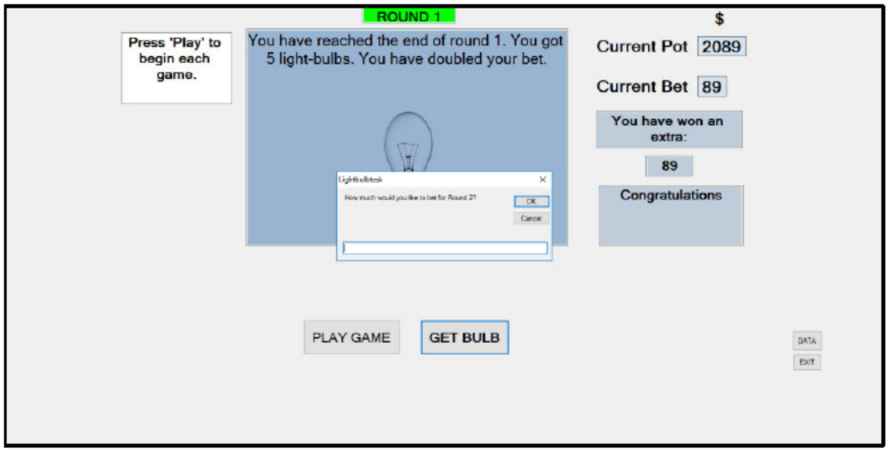
7. Task stimuli - red dot prompting action or inaction.



8. Task stimuli - non-illuminated light bulb (failure).



9. Task stimuli - illuminated light bulb (success).



10. Task stimuli - indication of round success or failure, transition to next round.

Pre-programmed outcome sequence per trial =

No illumination (N), illumination (I), I, I, N, N, I, N, I, N, N, I, I, I, N, N, N, N, I, N, N, I, I, I, N, N, I, I, I, I, I, N, N, N, I, N, I, N, N, I, N, N, I, I, N, N, I, I, N, I.

Post-task *perceived control* and *perceived connection* items:

On a scale of 0-100, how much control do you think you had over the light bulb's illumination?

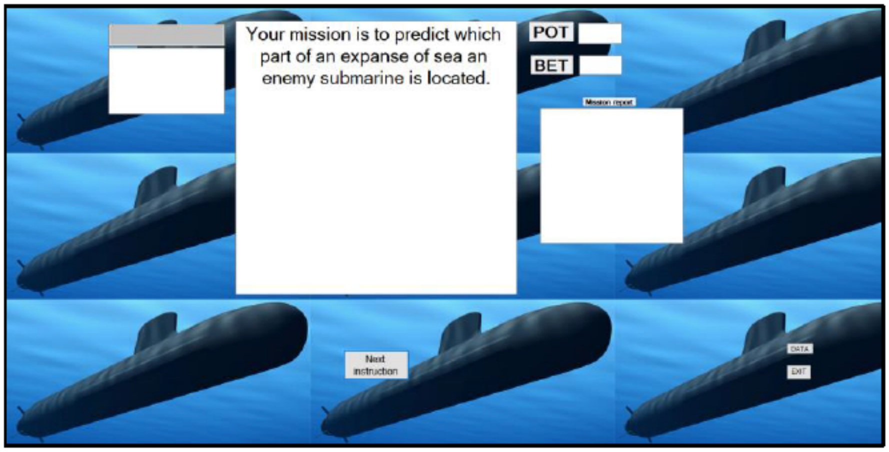
____

Of the fifty trials you participated in, how many times do you think the light bulb's illumination status was the result of your actions?

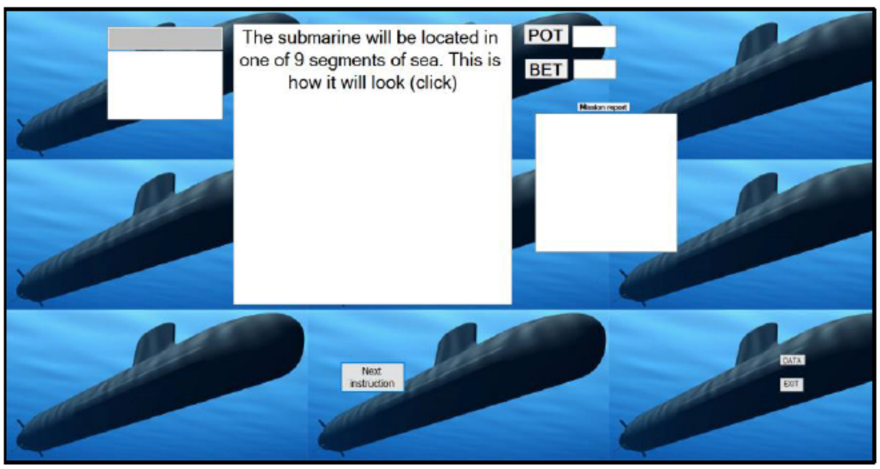
____

Appendix F:

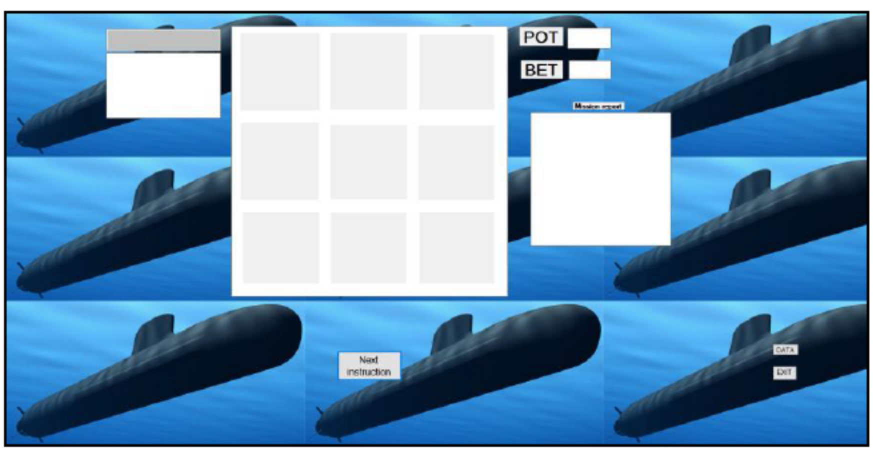
Instructions, Stimuli, Win Sequence and Post-Task Items for the Submarine Task



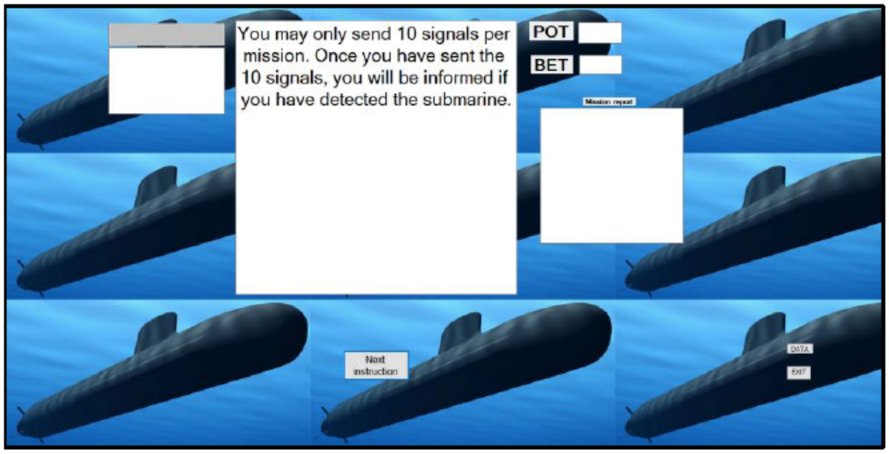
1. Task instructions - outlining of task objective.



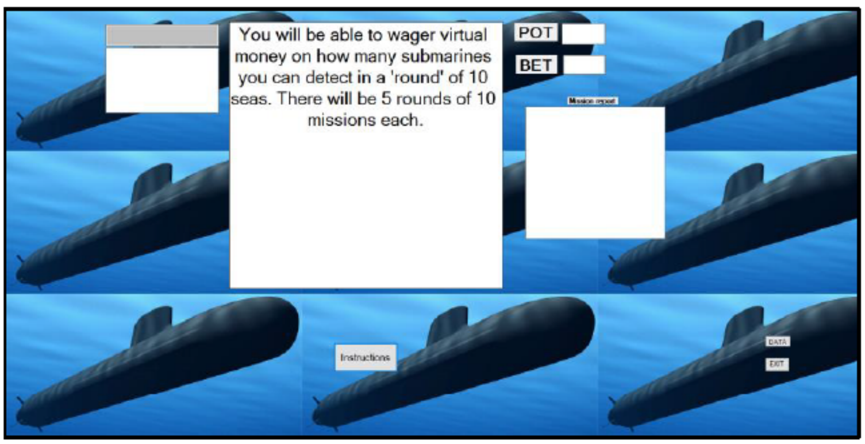
2. Task instructions - explanation of topography.



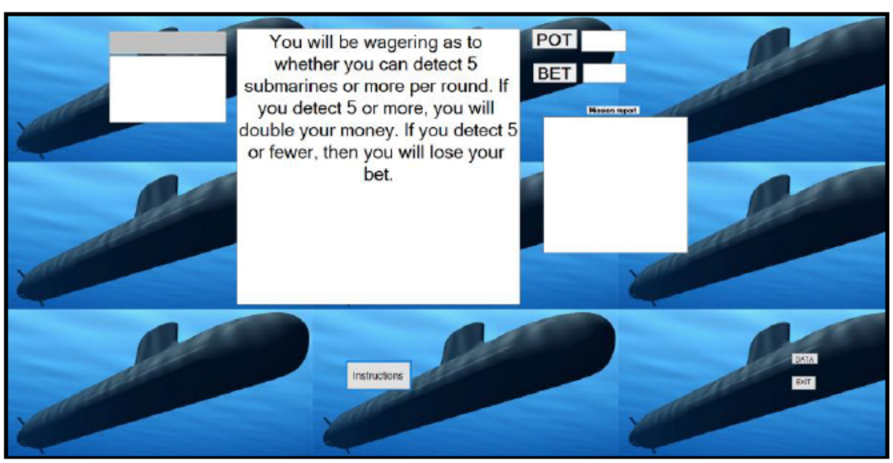
3. Task instructions - sea exemplar.



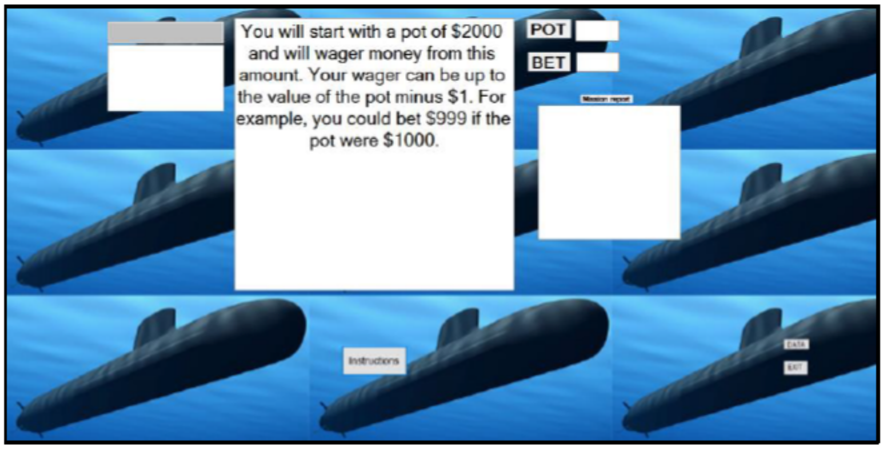
4. Task instructions - explanation of trial procedure.



5. Task instructions - introduction of gambling elements.

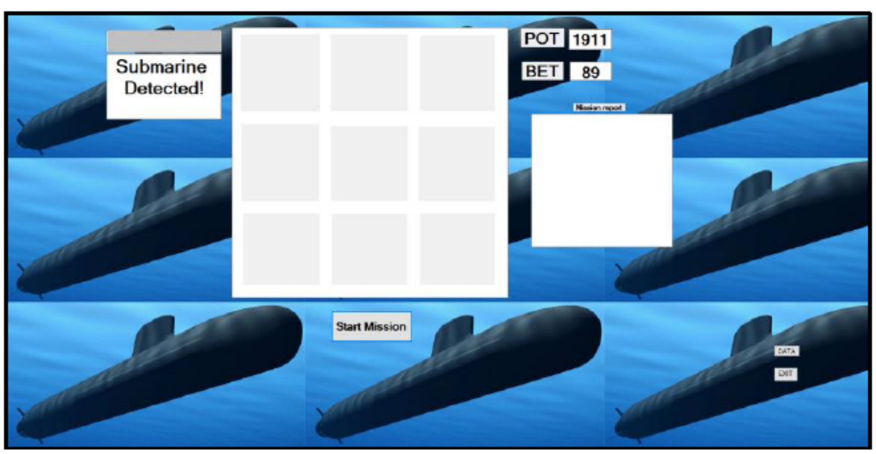


6. Task instructions - explanation of gambling system.

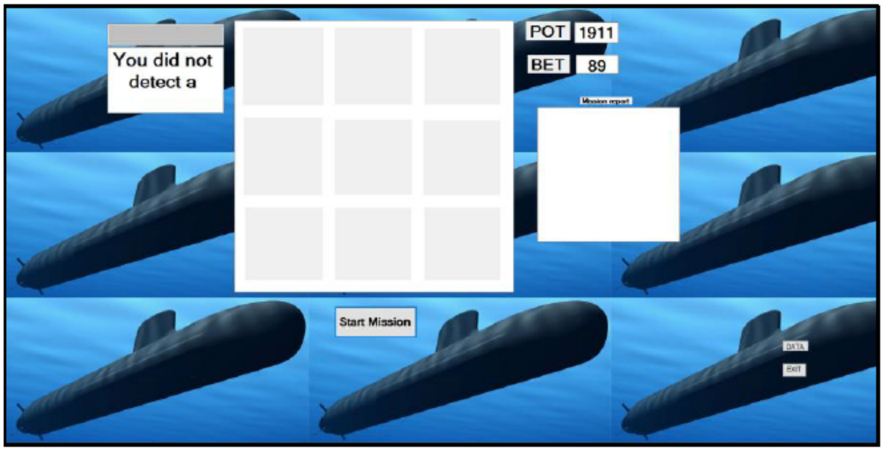


7. Task instructions - explanation of pot and wagering limits.

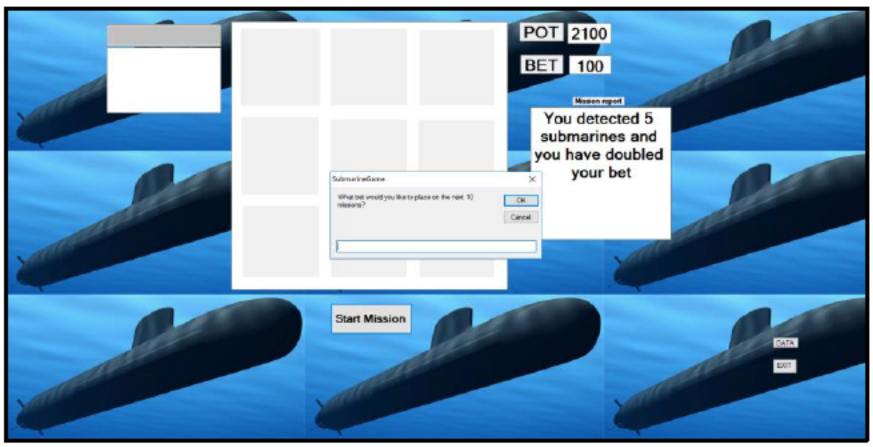
8. Task instructions - initial wagering instruction.



9. Task stimuli - indication of trial success.



10. Task stimuli - indication of trial failure.



11. Task stimuli - indication of round success or failure, transition to next round.

Pre-programmed outcome sequence per trial =

No detection (N), detection (D), D, D, N, N, D, N, D, N, N, D, D, D, N, N, N, N, D, N, N, D, D, D, N, N, D, D, D, D, D, N, N, N, D, N, D, N, N, D, N, N, D, D, N, N, D, D, N, D.

Post-task *perceived control* and *perceived connection* items:

On a scale of 0-100, how much control do you think you had over the submarine's detection?

____

Of the fifty missions you participated in, how many times do you think the submarine's detection status was the result of your actions?

____

Appendix G: Study Information Sheet

Dear Participant,

You are invited to participate in a research project investigating the thoughts and behaviours involved in video gaming and gambling.

What is the project about?

This study's purpose is to better understand how thoughts and behaviours encouraged by video games may be related to thoughts and behaviours in gambling.

Who is undertaking the project?

This project is being undertaken by as part of his Honours in Psychology at the University of Adelaide. It is being supervised by and has been authorised by the Human Research Ethics Subcommittee in the School of Psychology, approval number 17/33.

What will I be asked to do?

You will be asked to complete a short survey, then directed to complete a series of tasks via a desktop computer in our laboratory. At the conclusion of the tasks, you will be asked to make a pair of judgements about your performance.

How much time will the study take?

It is estimated that the study will take between 20 and 45 minutes.

If you are a Psychology I student, you will receive 1 credit for your participation through the school's online research participation system. If this credit is not given within the next few working days, please contact via the contact details below. If you are a volunteer from the community you will go into the draw to win a $50 JB Hi-Fi voucher. Unfortunately, we cannot put you into the draw unless you complete the study.

Are there any risks associated with participating in this project?

There are no anticipated risks or side effects associated with participation in this study. However, you are free to end your participation at any time. You can leave the study by simply communicating with the researcher you are talking to now.

At the beginning of the study, you will be asked to enter in information about your gambling frequency, and any problems that may result from your gambling. Because of this, you will be provided with gambling information and contacts for gambling support service upon exiting the study.

What are the benefits of the research project?

There are unlikely to be any direct benefits to your personal association with the study, except that it will provide you with an opportunity to be involved in psychological research

What will happen to my information?

All data obtained from your participation has been listed under an anonymous ID number, and is completely confidential. No information will be released that can be used to identify you, and will be stored separately from any personal details you may have shared during our contact with you. While the research findings may eventually be published, all data and statistics used will be completely anonymous.

Who do I contact if I have questions about the project?

For any questions about the ethical conduct of the research, please contact Dr. Linley Denson, the Acting Chair of the Human Research Subcommittee in the School of Psychology (Linley.Denson@adelaide.edu.au).

Warm regards,

Before proceeding, ensure that you meet the following participation criteria by ticking all of the boxes that apply to you.

☐ I have not already participated in this study.

☐ I am aged 18 or above.

☐ I have no visual impairment that significantly reduces my ability to use a computer.

☐ I am not receiving treatment for gambling-related problems.

Appendix H: Study Consent Form

THE UNIVERSITY of ADELAIDE

Human Research Ethics Committee (HREC)

CONSENT FORM

1. I have read the attached Information Sheet and agree to take part in the following research project:

Title:	**Video games and gambling: cognition and behaviour.**
Ethics Approval Number:	**17/33**

2. I have had the project, so far as it affects me, fully explained to my satisfaction by the research worker. My consent is given freely.

3. Although I understand the purpose of the research project it has also been explained that involvement may not be of any benefit to me.

4. I have been informed that, while information gained during the study may be published, I will not be identified and my personal results will not be divulged.

5. I understand that I am free to withdraw from the project at any time.

6. I am aware that I should keep a copy of this Consent Form, when completed, and the attached Information Sheet.

Participant to complete:

Name: ____________________ Signature: ______________________ Date: ___________

Email address (for release of findings/information about prize draw) (optional):

____

Researcher/Witness to complete:

I have described the nature of the research to ____________________________________

(print name of participant)

and in my opinion she/he understood the explanation.

Signature: _________________ Position: _______________________ Date: ___________

Appendix I: Gambling Debrief

Tips for Safer Gambling

Don’t think of gambling as a way to make money.
The bottom line is that gambling establishments like land-based casinos and online gambling sites are set up to take in more money than they pay out. This means that over time, you will lose more money than you win. And, remember it's not just casinos. All forms of gambling have the same principle – the vast majority of people lose so that a very small minority can have big wins. Virtually all people with gambling problems hold the false expectation that they are the ones who will be the big winners. That belief feeds the problem.

Always gambling with money that you can afford to lose.
Gamble with money that you set aside for fun, like going to the movies or going out for drinks. Never use money that you need for important things like rent, bills, tuition, etc.

Never chase losses.
If you lose money, never try to get it back by going over your limit. This usually leads to even bigger losses.

Set a money limit.
Decide how much money you can afford to lose before you play. When you have lost that amount of money, quit. If you win – enjoy, but remember it won’t happen most of the time.

Set a time limit.
Decide how much time you can afford to spend gambling. When you reach that time limit, stop gambling.

Don’t gamble when you are depressed or upset.
It is hard to make good decisions about gambling when you are feeling down.

Balance gambling with other activities.
It’s important to enjoy other activities so that gambling doesn’t become too big a part of your life.

Gambling and alcohol are not a good combination.
Gambling under the influence is common, but it generally leads people to make bad decisions that they regret later.

These tips were taken with thanks from: http://www.responsiblegambling.org/safer-play

Where to Get Help

If you (or someone you know) is having problems with their gambling, the Gambling Helpline is available 24 hours, 7 days a week on 1800 060 757. This support is also available online via www.gamblinghelponline.org.au.

For more information, please visit: www.problemgambling.sa.gov.au