The Effects of Blocking Gambling Behaviour on Craving

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by

Travis K. Szteinert

Department of Psychology
Carleton University

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Abstract

Craving is important to the progression and maintenance of gambling behaviour (Young, Wohl, Matheson, Baumann, & Anisman, 2007); however, a paucity of research examining craving to gamble exists. The current research examined craving prior to and during gambling, in pathological ($n = 30$) and recreational gamblers ($n = 30$). Participants were either initially blocked from engaging in gambling, or allowed to gamble freely. Results revealed that pathological and recreational gamblers craving increased over a 5 minute period after being blocked and during play. Craving during play mediated the relationship between gambling pathology and gambling persistence. Moreover, dissociation mediated the relationship between gambling pathology, and both craving during play and gambling persistence. Implications with respect to problem gambling prevention are discussed.

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The Effects of Blocking Gambling Behaviour on Craving

Imagine a person entering a casino. The lights on, the slot machines are flashing and the sound of coins dropping into a metal tray permeate the room. The person approaches a slot machine, sits on the chair in front of the console, then takes a \$20 bill from their wallet so that they can begin to play. Just prior to placing the bill into the machine, however, there is a power outage. All machines go dark and they are unable to play. How much will they now desire to gamble? The answer to this question is central for an understanding of craving to gamble.

Although craving has received considerable attention in research assessing the antecedents of smoking (e.g., Droungas, Childress, Ehrman, Semans & O'Brien, 1992) and drug addiction (e.g., Sinha, Fuse, Renee-Aubin, & O'Malley, 2000), there is a paucity of research examining craving to gamble. Yet, craving may play an important role in the progression and maintenance of gambling behaviour (Young, Wohl, Matheson, Baumann, & Anisman, 2007). Indeed, gamblers who crave tend to persist in the face of continued loss (Young & Wohl, in press).

In order to elicit craving, objects that are relevant to an addictive behaviour (i.e., cues) can be placed in the environment of the user (Monti et al., 1987; Niaura et al., 1988). After being exposed to cues, blocking an individual from engaging in an addictive behavior may further exacerbate this craving (Tiffany & Conklin, 2000). Within the gambling literature, pathological gamblers who were exposed to a casino environment reported a significant increase in craving (Kushner et al., 2007). The current study examined the effects of blocking gambling in both problem and recreational gamblers.

Insofar as blocking might be an antecedent to craving, blocking might also propel the gambler to engage in problematic gambling. In the proposed research, I will assess the relationship between blocking gamblers from engaging in play and their craving to gamble. Moreover, I will examine how increases in craving, which might result from blocking, influence gambling behaviour when the opportunity to play is eventually unblocked.

Craving

Generally, craving is a conscious experience of desire to engage in an addictive behaviour and has long been postulated as a central feature of addictions (Drummond, 2001). Theories of addiction have traditionally viewed craving as central to the development, progression and maintenance of addictive behaviours; existent literature on alcohol and other drugs, however, has failed to explicate fully the relationship between craving and those addictions (Drummond, 2001). The relationship between gambling addiction and craving is even less established due to the paucity of research examining craving among gamblers.

Although once considered an impulse control disorder, advances in the understanding of gambling have led researchers to consider it a form of addiction (Shaffer, 1999). Indeed, five of the seven criteria for substance dependence have parallel criteria in pathological gambling (Petty, 2006). Further, Potenza (2006) has argued that due to similarities between pathological gambling and substance abuse addictions in clinical characteristics, social factors and co-occurring disorders, gambling should be considered an addiction.

Since craving is central to understanding addictions, craving may also play a pivotal role in understanding pathological gambling. Indeed, craving may play an important role in maintaining and producing problem gambling behaviour (Young, Wohl, Matheson, Baumann, & Anisman, 2007). Thus in order to understand gambling behaviour, the antecedent and consequences of craving should be examined.

Classical conditioning has traditionally been the framework used to understand the antecedents and consequences of craving (see Tiffany, 1995; 1999). Due to repeated pairing of environmental stimuli with the effects of a drug, specific external cues become associated with the effects of the addiction (Drummond, Cooper & Glautier, 1990). That is, a neutral stimulus can become a conditioned stimulus by continually pairing it with an unconditioned response, which then elicits a conditioned response. For example, when a heroin addict feels the need to enter the euphoric state the drug elicits, they will typically search for a syringe to inject the drug into the body. After continued use the syringe becomes paired with the euphoric state. The consequence of this pairing is that, eventually, the syringe itself might elicit a desire for the euphoric state. In effect, the syringe becomes a cue that instigated a desire or craving for the substance. Within the addiction literature, this pairing is often called the cue reactivity paradigm (Drummond, Tiffany, Glautier & Remington, 1995; Drummond, 2001). In other words, to elicit craving in dependent individuals, addiction related stimuli have to be placed in the presence of the individual.

In a meta-analysis of cue reactivity research, Carter and Tiffany (1999) concluded that a significant increase in self-reported craving occurs when people are exposed to addiction-related versus neutral stimuli. More importantly for the current research, the

availability of the substance after cueing can also have a significant impact on reported levels of craving (MacKillop & Lisman, 2005). Specifically, if an addict is presented with a cue that is related to a drug, but that drug is unavailable or they are blocked from using it, they may crave more than when the drug is easily available. For example, smokers who see advertisements for cigarettes may crave more when they do not have cigarettes readily available to them (e.g., they forgot their cigarettes in the car). Craving also increases when consumption of the drug is externally blocked (the drug user is forced to remain abstinent). Indeed, Jacober, Hasenfratz and Battig (1994), showed that when smokers were told they could not smoke for 5 hours during a specified time period of the day, they reported greater cravings than those allowed to freely smoke. A similar reaction to forced abstinence has been found among alcoholics (e.g., MacKillop & Lisman, 2005; Rankin, Hodgson & Stockwell, 1979). For example, MacKillop and Lisman (2005) reported that alcoholics who were exposed to alcohol related cues craved more when they were told alcohol was unavailable, than when alcohol was perceived to be available. Thus, drug relevant cues are triggers that act as a catalyst for promoting craving and addictive behaviours. Blocking an addict from engaging in their addictive behaviour after being cued may serve to exacerbate craving.

Importantly, however, the classical condition framework of craving has failed to elucidate the relationship between blocking an addictive behaviour and craving.

According to classical conditioning frameworks, cues elicit craving, but there is no reason why blocking an individual from engaging in addictive behaviour would elicit craving. Tiffany (1990, 1999) has argued that in order to explain how blocking may elicit craving, cognitive concepts need to be integrated into frameworks explaining craving.

Specifically, the Cognitive Processing Model (CPM; Tiffany, 1990) argues that addictive behaviours become automatic overtime. Blocking a dependent individual from engaging in an automatic addictive behaviour will elicit craving.

The Cognitive Processing Model of Craving

According to the CPM (Tiffany, 1990), addictive behaviours are automatic action schemata's. In other words, addictive behaviour involves a collection of specific actions and skills that are necessary to acquire and engage in the behaviour (e.g., walking into a casino, sitting down at a slot machine, inserting coins, pulling the spin lever). Over repeated experience and practice, behaviours can become automatic; that is behaviours become "fast and efficient, readily enabled by particular stimulus configurations (i.e., stimulus bound), initiated and completed without intention, difficult to impede in the presence of triggering stimuli, effortless and enacted in the absence of awareness" (Tiffany, 1990, p.154). Once this occurs, the behavior is automatic, i.e., thought processes are absent from engagement. Automatic action schemata's are a collection of these automatic behaviours.

According to Tiffany (1990), craving is the result of non-automatic processes. Unlike automatic processes, non-automatic processes are dependent on attention and intention, and are effortful. Non-automatic processes occur when obstacles impede an automatic schema. Specifically, a person will compensate for the disruption in an automatic process with a non-automatic process. Within the CPM theoretical framework, craving is a non-automatic process that results from a block (or disruption) to automatic processing. In effect, craving motivates a person to meet the end goals of the automatic schemata (i.e. smoke, drink, gamble).

Craving, i.e., a non-automatic process, may be invoked under two situations. Firstly, craving is likely to be elicited when a person purposefully impedes or blocks engagement in an addictive behaviour. For example, a pathological gambler who is attempting to stop gambling requires focused and effortful attention in order remain abstinent, and through abstinence will likely experience craving. This is because, in order to remain abstinent, the gambler must be consciously aware of their actions, as to not engage in automatic gambling behaviour. If cues in the environment trigger automatic gambling behaviour (e.g. walking past a casino) but the gambler consciously stops this behaviour, craving may be elicited; the gambler has, in effect, blocked themselves from gambling. Indeed, dependent individuals attempting to remain abstinent often report heightened levels of craving, which interferes with their daily functioning and thinking (Brandon, Tiffany & Baker, 1987; Ludwig, 1988). That is to say, dependent individuals who are attempting to remain abstinent are easily cued by environmental stimuli to engage in an automatic addictive behaviour, and must use effortful and forceful cognition to stop themselves, resulting in craving.

Secondly, craving can be induced when external factors block or disrupt the engagement in an addictive behaviour. For example, if a gambler regularly takes money out of his wallet prior to gambling, but finds his wallet is missing or that he is out of money, craving may be elicited. This is because the gambler must now cognitively focus on finding money to enable him to gamble; this effortful act disrupts the automatic processes and may lead to increased craving. In either situation, if the gambler is not blocked from gambling they will gamble without experiencing craving. Therefore, craving is not needed in order for the gambler to engage in gambling.

Within the CPM, craving is neither necessary nor sufficient for ensuing addictive behaviour. Instead, craving results from automatic addictive behaviours being triggered, but blocked from being completed. Automatic addictive behaviours may be easily triggered (i.e. body physiology, time of day, external cues), and if the addictive behaviour cannot be easily (i.e. automatically) preformed, craving will be elicited. This is why seeing a billboard depicting gambling may induce craving; although popular treatment often regards craving as an automatic process, it is in fact an effortful attempt to motivate the gambler to make their way to a casino. While blocking access to an addictive behaviour has been shown to elicit craving in substance abusers (Jacobson, Hasenfratz and Battig & 1994; Rankin, Hodgson & Stockwell, 1979), blocking access to gamblers has yet to be examined. It is unclear if blocking gamblers from engaging in gambling will result in craving.

While there is some disagreement regarding the similarities between substance abuse and gambling (for a discussion on this see Petry, 2006; Potenza, 2006), applying the CPM to gambling may help to shed light on the craving process. According to the CPM, gamblers should crave when blocked. However, this craving would only be elicited in gamblers if gambling has become an automatic behaviour. Since pathological gamblers are also frequent gamblers, gambling may have become a well-practiced and automatic behaviour for them. Therefore, according to the CPM, a significant increase in craving for pathological gamblers who are blocked would be predicted, compared to those allowed to gamble freely.

Gambling

Since the introduction of pathological gambling as a recognized disorder in the DSM-III (American Psychiatric Association [APA], 1980), craving has been included within the criterion for the diagnosis of pathological gambling. For example, the DSM-IV states as a criterion that the individual “may be preoccupied with gambling (e.g., reliving past gambling experiences, planning the next gambling venture, or thinking of ways to get money with which to gamble)” and that “there may be restlessness or irritability when attempting to cut down or stop gambling” (APA, 1994, p.616). There is a paucity of research, however, on the relationship between craving and gambling. The lack of research is unfortunate because craving plays an important role in maintaining and producing gambling behaviour (Young, Wohl, Matheson, Baumann, & Anisman, 2007).

Most of the research that has examined craving has compared the craving levels of gamblers to substance abusers. For example, pathological gamblers have reported significantly higher levels of impulsivity and inability to resist craving than cocaine addicts (Castellani & Rugle, 1995). Moreover, pathological gamblers have reported higher levels of craving than alcohol-dependent subjects, and this craving correlated negatively with abstinence length (Tavares, Zilberman, Hodgins, & el-Guebaly, 2005). Taken together, craving appears to play a critical role in pathological gambling, and may be one of the underlying factors in preventing successful treatment of gambling problems.

Moreover, research examining the co-morbidity between smoking and gambling in relation to craving, found that compared to those who have never smoked, pathological gamblers who currently or previously smoked daily had significantly higher urges to

gamble (Grant & Potenza, 2005). Therefore, there may be underlying mechanisms for craving that are similar in substance abusers (e.g., smokers) and pathological gamblers.

Thus far, there have only been two studies using the cue reactivity paradigm to elicit craving in gamblers. Two-thirds of problem gamblers who were exposed to a casino environment experienced high to moderate levels of craving (Kushner et al., 2007). Similarly, Kushner and colleagues (2008) found that craving was greater in a gambling environment than in a neutral setting. Thus, gamblers who are exposed to gambling related cues are likely to experience craving. While gambling was allowed in one study (Kushner, et al., 2008), but not in the other (Kushner, et al., 2007), it is unclear if participants perceived gambling as available. That is to say, it is unclear the extent to which gamblers perceived their gambling behaviour to be blocked. The relationship between blocking gambling behaviour and craving has yet to be empirically tested.

According to the CPM, craving should increase among pathological gamblers when they are blocked from engaging in gambling. While gambling, pathological gamblers often report feelings of being in a trance like state and losing track of time while gambling (Jacobs, 1989, 1998; Wynne, 1994). This is similar to Tiffany's (1990) description of automatic processes, wherein behaviors are enacted in the absence of awareness, and completed without intention. More generally, this state is referred to as experiencing dissociation. This supports the assertion that gambling is a well-practiced and automatic behaviour for pathological gamblers.

Generally, dissociation occurs when people no longer see themselves as playing a conscious role in what they are doing or how they are feeling (Delfabbro, 2006). Griffiths, Wood, Parke and Parke (2006) suggest that dissociation in gambling is the

result of periods of low cognitive activity and arousal. Dissociation may therefore be a symptom of automaticity, and increased levels of dissociation should be reported by pathological gamblers. Perhaps not surprisingly then, research has found a strong relationship between dissociation and pathological gambling (Brown, 1996; Diskin & Hodgins, 1999; 2001; Gupta, & Derevensky, 1998; Kofoed, Morgan, Buchkowski & Carr, 1997). Importantly, pathological gamblers who dissociate during gambling do not necessarily experience dissociation in other aspects of life (Grant & Kim, 2003) and therefore, dissociation may be episodic, specific to the automaticity of the gambling experience itself.

Dissociation has been shown to predict craving to gamble when attempting to stop or slow down gambling (i.e. blocked themselves from gambling) (Rosenthal & Lesieur, 1992). It is argued herein that dissociation is thus likely to mediate the relationship between blocking and craving. Those who are blocked may elicit craving to the extent that gambling has become automatic, i.e. one has dissociated during gambling. As such, this proposed mediation model should be especially true for pathological gamblers, but not recreational gamblers, as gambling is likely to be automatic for those who have developed gambling problems.

If blocking increases dissociation and thus the craving to gamble, it may in turn predict an increase in gambling behavior. Indeed, gamblers with stronger cravings have been found to persist longer in the face of continued loss (Young & Wohl, in press). Moreover, gamblers often report losing track of time and feeling in a trance; for example, gamblers may begin intending to wager \$20 over a half an hour period, but subsequently find themselves still gambling hours later having spent several hundred dollars (Wynne,

1994; Diskin & Hodgins, 2001). Therefore, in addition to craving and dissociation, pathological gamblers who are blocked may also persist longer in the face of loss or spend well beyond preset limits. This situation may be akin to that experienced by food addicts (a similar behavioral addiction, see Holden, 2001; Lesieur & Blume, 1993; Orford, 2001) who restrict themselves from eating, but end up bingeing when eating behaviour is unblocked (for a review of this literature see Wardle & Beinart, 1981). In light of the extant literature, it is hypothesized that gamblers who are blocked will persist longer in the face of loss after being allowed to freely gamble. Dissociation (as a measure of automaticity) may be an important mediator for pathological gamblers on future craving and gambling persistence.

Overview of the Current Research

The primary goal of this study was to determine the effects of blocking gambling behaviour. It was first hypothesized that gambling would be an automatic behaviour for pathological gamblers, but not for recreational gamblers. Participants were either blocked from engaging in gambling, or allowed to gamble freely. Participants in the block condition, were prevented from gambling for a total of 5 minutes, after which they were then allowed to freely gamble. Participants in the control condition were allowed to freely gamble, and not prevented from gambling. Craving to gamble was assessed initially, and after participants were blocked (block condition) or before they were allowed to freely gamble (control condition). In addition, for the block condition, craving was also assessed after 5 minutes of being blocked. It was hypothesized that pathological gamblers would report increased initial levels of craving compared to recreational gamblers. When blocked, it was hypothesized that pathological gamblers would report a significant

increase in craving, and this craving would remain heightened so long as they were blocked (i.e. after 5 minutes of being blocked). Once all participants were allowed to gamble freely, craving was assessed after 5 minutes of gambling (in both conditions). Upon voluntary cessation of gambling behaviour, dissociation during the gambling session and gambling persistence in the face of loss was assessed. It was hypothesized that gambling pathology would interact with blocking gambling behaviour to influence craving. Since craving has been linked to gambling persistence, it was also hypothesized that gambling pathology, moderated by blocking gambling behaviour, would influence gambling persistence and that this effect would be mediated by craving. Finally, it was hypothesized that gambling pathology, moderated by blocking gambling behaviour, would influence craving and gambling persistence as mediated by dissociation.

Method

Participants

Sixty gamblers (25 males and 35 females) were recruited from a catalogue of community gamblers compiled by the Carleton University Gambling Laboratory ($n = 360$), who had previously indicated that they would be willing to participate in research pertaining to gambling at Carleton University. Potential participants were contacted via phone and/or e-mail (see Appendix A). On the basis of their previously obtained scores on the DSM-IV criteria for pathological gambling (APA, 2000) participants were categorized as *recreational* (0-2 DSM symptoms) or *pathological* gamblers (5-10 DSM symptoms). Participants who endorsed 3-4 DSM criteria of gambling pathology were not included in the study due to contested classification of these gamblers (see Stinchfield, 2003; Lesieur & Rosenthal, 1998; Bradford, Geller, Lesieur, Rosenthal & Wise, 1996). Of the 60 gamblers who participated in the current study, 30 were pathological gamblers and 30 were recreational gamblers. Fifty-seven percent of participants reported gambling more than once a month, 68% had gambled for 5 years or more, and 92.9% typically gambled at a casino. Participants ranged in age from 19 to 78 years old ($M = 49.05$, $SD = 14.33$). Participants were given \$20 for participating in the study.

Procedure

Prior to their arrival, participants were randomly assigned to either of two blocking manipulations: (a) blocked condition, in which participants' ability to gamble was halted just prior to play; or (b) control condition, in which participants were freely allowed to engage in gambling. Upon arrival at the laboratory, participants were greeted and told that the purpose of the experiment was to assess gambling behaviour within a

virtual reality casino. Participants were then asked to read and sign an informed consent (see Appendix B).

Participants were first asked to provide a baseline measure of craving and complete an automaticity scale (see Appendix E). Participants were then shown the virtual reality equipment and given instructions on how to use it. The experimenter demonstrated how to put on the head mounted display (Z800 3D Visor, eMagin Corporation, Fishkill, New York), and assisted participants if requested. The headset was connected to a computer that runs *VR Worlds* software (described in detail in Baumann et al., 2003) constructed by Psychology Software Tools.

Next, participants navigated throughout a virtual downtown environment displayed on the headset for 5 minutes. During this time, participants practiced using the joystick and mouse in order to familiarize themselves with navigation controls and interactions with objects in the virtual world. This acclimatization period also assisted in identifying any participants who experienced nausea or motion sickness (cybersickness) during the experiment. One such case did exist, and the participant continued the experiment using a 17" computer monitor instead of the display on the headset.

Following the acclimatization period, participants were instructed on how to play the slot machines:

Before you begin the virtual gambling session there are a few things I would like to explain. First, in this session I would like you to play slots. During this game you will have the opportunity to win money, depending on the outcome of the spins. We will start you off with \$15. As in the casino, each credit is worth 25 cents, so you will have a total of

60 credits when you start. Whatever amount you have left at the end of this session today you will be allowed to trade in for money that you will be allowed to keep. So if you end up with 10 tokens you will keep \$2.50. If you end up with 80 tokens you will receive \$20 to keep. We set the odds of winning in consultation with the Ottawa and Gatineau casinos. That is, the odds of winning in this casino are the same as those in real casinos.

If participants asked the payout amount, they were told that it was set at 85% - the standard payout rate in Ontario. Participants were instructed that they may play on any slot machine that they like. In addition, they were told that they were permitted to bet only one token per spin and that this was done in order to keep the bet amounts consistent. Participants were informed that they should gamble for at least 5 minutes and after that it was up to them to decide how much longer they wished to gamble. Participants then entered into either the control or block condition.

In the control condition, participants were directed to the slot machine floor where they could play slots for as long as they liked with \$15. Importantly, the outcomes of the slot machine spins were manipulated so that they would be the same in the control and block condition. During the first 5 minutes of play there were five small wins worth one credit each. After five minutes, when participants were told they could stop gambling whenever they like, all spins resulted in a loss. Craving was assessed directly before gambling and after 5 minutes of gambling. Please refer to Figure 1 for a detailed diagram illustrating the methodology of the current study.

Figure 1. Diagram illustrating the methodology of the current study.

In the block condition, participants were directed to the virtual slot machine floor to play slots with \$15. However, just prior to gambling on the slot machine, the computer, ostensibly, malfunctioned. This was accomplished by hitting the 'escape' key on a keyboard connected to the computer, which was hidden from the participant's view. Hitting the escape key caused the VR Worlds software to go blank and an error message to display, creating the illusion that the computer had broken-down. Participants were told that this was not their fault as the computer has been "acting up" lately, and that they may not be able to gamble today. Participants were then asked to do some filler questionnaires and informed that the experimenter would attempt to fix the computer. A measure of craving was assessed directly after computer break-down and after 5 minutes of waiting. After 5 minutes, participants were informed that the computer had been fixed "faster than expected", and they were offered the chance to gamble in the virtual casino

should they so desire. Participants then gambled for 5 minutes, after which they were told they could stop gambling whenever they like. Craving was again assessed after 5 minutes of play.

Upon voluntary cessation, regardless of blocking manipulation, participants were given a measure assessing dissociation during the gambling session. In addition, the experimenter recorded the number of spins the participant continued to play in the face of loss. At the end of the session, participants were verbally debriefed and also given a debriefing form (see Appendix G). This form explained the rationale behind the study, as well as provided additional information about problem gambling and numbers for the Ontario Problem Gambling Helpline and local distress centers. Regardless of which blocking manipulation the participant was in, participants were given \$20 as a thank-you for their time. As deception was involved in the study, participants were asked to sign a form permitting the use of the data for research and teaching purposes (see Appendix H).

Measures

Automaticity Scale. This scale was adapted from an automaticity subscale developed by Ikard, Green and Horn (1969). Originally developed for assessing automaticity in smoking, this sub-scale has been altered to assess gambling. Participants were asked to indicate how much a behaviour is typical of themselves, ranging from 1 (*never*) to 5 (*always*). Items included questions assessing different facets of automatic processing, such as “I’ve found myself driving to a casino without realizing that I’ve gotten into the car” and “I gamble without even being aware I’m doing it.” Higher scores reflected higher gambling automaticity, this scale demonstrated good internal validity, $\alpha = 0.87$.

Dissociation Scale. This scale was adapted from Jacobs (1988), and an additional item was added assessing the experience of 'loss of time' while gambling (similar to Gupta & Derevensky, 1998; Diskin & Hodgins, 2001). A series of 5 items assessed the degree to which participants experienced dissociation while gambling. Participants were asked to indicate how much they experienced different states during the gambling session, ranging from 0 (not at all) to 4 (the whole time). Higher scores reflected higher dissociation, this scale demonstrated good internal validity, $\alpha = 0.83$.

Craving. Participants were asked how strong their craving to gamble is on a 100 point line scale, ranging from "not very strong" to "very strong". Importantly, the line scale was exactly 25.5 centimeters long, therefore when coded the scale ranges from 0 to 25.5.

Persistence. After being allowed to gamble as long as they like, the number of slot trials played by participants until voluntary cessation was recorded. This number was used as a measure of gambling persistence, as it indicates the extent to which participants persisted with gambling in the face of loss.

Results

Preliminary Analysis

The distributions of scores for all variables were separated by gambler classification (recreational vs. pathological) and blocking manipulation (block vs. control) and examined by viewing frequency histograms, skewness and kurtosis plots. Missing values were imputed using regression substitution. In addition, significant univariate outliers were identified by examining participants' standardized scores. Those with a standardized score greater than ± 3 standard deviations on a given variable were examined as potential outliers. As modifying these scores to fit within three standard deviations did not significantly influence the analysis, outliers remained unadjusted.

In order to determine if the comparison groups (a) blocking manipulation (block vs. control) and (b) gambler classification (recreational vs. pathological) were equivalent with respect to age and gender, the following analysis were preformed. Between groups tests for age revealed no significant main effects for blocking manipulation, $F(1,56) = 1.61$, $p = .21$, $\eta_p^2 = .03$ or gambler classification, $F(1,56) < .001$, $p = .99$, $\eta_p^2 < .001$. However, there was a significant interaction between gambler classification and blocking manipulation with respect to age, $F(1,59) = 4.93$, $p = .03$, $\eta_p^2 = .08$. Further analysis of this interaction by gambler classification revealed that recreational gamblers ($M = 48.27$, $SD = 3.98$) in the control condition were not significantly different than in the block condition ($M = 51.53$, $SD = 3.98$), $F(1,28) = .34$, $p = .57$, $\eta_p^2 = .01$. However, pathological gamblers in the control condition ($M = 55.93$, $SD = 2.80$) were significantly older than in the block condition ($M = 43.93$, $SD = 2.80$), $F(1,28) = 9.20$, $p = .005$, $\eta_p^2 = .25$.

Automaticity was then examined in order to determine if pathological gamblers reported increased levels of automatic gambling behaviour. A 2 (gambler classification: recreational vs. pathological) $\times$ 2 (blocking manipulation: control vs. block) ANOVA was conducted with automaticity as the dependent variable in order to determine if pathological and recreational differed with respect to automaticity. There was both a significant effect of gambler classification, $F(1,56) = 9.70, p = .003, \eta_p^2 = .15$, and blocking manipulation, $F(1,56) = 8.26, p = .006, \eta_p^2 = .13$. Automaticity was higher for pathological gamblers ($M = 1.59, SD = 0.08$) than for recreational gamblers ($M = 1.21, SD = 0.08$). Automaticity was also higher for those assigned to the block condition ($M = 1.57, SD = 0.08$) than for the control condition ($M = 1.23, SD = 0.08$). There was no significant interaction between blocking manipulation and gambler classification, $F(1,56) = 2.30, p > .14, \eta_p^2 = .04$.

Dissociation

In order to determine if there were differences in dissociation, a 2 (gambler classification: recreational vs. pathological) $\times$ 2 (blocking manipulation: control vs. block) between subject ANOVA was conducted. Results revealed that pathological gamblers ($M = .67, SD = .10$) reported significantly higher levels of dissociation than recreational gamblers ($M = .30, SD = .10$), $F(1,56) = 6.63, p = .01, \eta_p^2 = .11$; however, there was no significant main effect of blocking manipulation, $F(1,56) = 3.73, p = .06, \eta_p^2 = .06$. The interaction between gambler classification and blocking manipulation was also not significant, $F(1,56) = 2.74, p = .10, \eta_p^2 = .05$.

Craving Before Play

In order to determine if there were baseline differences with respect to craving, a 2 (gambler classification: recreational vs. pathological) x 2 (blocking manipulation: control vs. block) between subject ANOVA was conducted at baseline craving. Results revealed that pathological gamblers ($M = 9.85$, $SD = 0.98$) reported significantly higher craving to gamble than recreational gamblers ($M = 5.41$, $SD = 0.98$), $F(1,56) = 10.30$, $p = .002$, $\eta_p^2 = .16$. There was no significant main effect of blocking manipulation, $F(1,56) = .08$, $p = .78$, $\eta_p^2 = .001$, or interaction between the blocking manipulation and gambler classification, $F(1,56) = .73$, $p = .40$, $\eta_p^2 = .01$.

To determine whether the blocking manipulation influenced the extent to which participants craved to gamble, craving just after being blocking in the block condition was compared to craving prior to play in the control condition. To accomplish this end, a 2 (gambler classification: recreational vs. pathological) x 2 (blocking manipulation: control vs. block) between subject ANOVA was conducted. Results revealed a significant main effect of gambler classification, $F(1,56) = 5.98$, $p = .02$, $\eta_p^2 = .10$, but not for blocking manipulation, $F(1,56) = .57$, $p = .45$, $\eta_p^2 = .01$. However, the main effect of gambler classification was accounted for by a significant interaction between gambler classification and the blocking manipulation, $F(1,56) = 5.06$, $p = .03$, $\eta_p^2 = .08$ (see Figure 2). In order to determine the nature of this interaction, separate ANOVA's were conducted by condition. Pathological ($M = 8.70$, $SD = 1.50$) and recreational ($M = 8.41$, $SD = 1.50$) gamblers did not differ in the control condition, $F(1,28) = .02$, $p = .89$, $\eta_p^2 = .001$. However in the block condition, pathological gamblers ($M = 13.12$, $SD =$

1.44) reported higher levels of craving than recreational gamblers ($M = 6.22$, $SD = 1.44$), $F(1,28) = 11.51$, $p = .002$, $\eta_p^2 = .29$.

Figure 2. Differences in craving at blocking manipulation by gambler classification and blocking manipulation.

Craving During Play

In order to determine if participants who were previously blocked from gambling reported increased craving 5 minutes into play, a 2 (gambler classification: recreational vs. pathological) x 2 (blocking manipulation: control vs. block) between subject ANOVA was conducted on craving after 5 minutes. Results revealed no significant main effects of gambler classification, $F(1,56) = 1.99$, $p = .16$, $\eta_p^2 = .03$, or the blocking manipulation, $F(1,56) = 2.52$, $p = .12$, $\eta_p^2 = .04$. However, there was a significant interaction between the blocking manipulation and gambler classification (see Figure 3), $F(1,56) = 4.57$, $p =$

.04, $\eta_p^2 = .08$. Follow up analysis by condition revealed that recreational ($M = 8.22$, $SD = 1.68$) and pathological ($M = 6.93$, $SD = 1.68$) gamblers did not significantly differ with respect to craving 5 minutes into play in the control condition, $F(1,28) = .30$, $p = .59$, $\eta_p^2 = .01$. In the block condition, pathological gamblers ($M = 13.56$, $SD = 1.88$) craved significantly more than recreational gamblers ($M = 7.24$, $SD = 1.88$), $F(1,28) = 5.65$, $p = .03$, $\eta_p^2 = .17$.

Figure 3. Differences in craving 5 minutes into play by gambler classification and blocking manipulation.

Craving in the Block Condition

Since there were significant differences in craving just after being blocked and 5 minutes into play in the block condition only, all craving time points were assessed using a repeated measures ANOVA for the block condition, in order to determine how craving

may have fluctuated before and after engaging in play. A 2 (gambler classification: recreational vs. pathological) by 4 (craving: baseline vs. after being blocked vs. 5 minutes after being blocked and just prior to play vs. 5 minutes into play) mixed measures ANOVA was conducted with craving as the repeated measure. Both a significant main effect for gambler classification, $F(1,28) = 10.63, p = .003, \eta_p^2 = .28$, and craving, $F(2,56) = 4.00, p = .01, \eta_p^2 = .13$, were observed (see Figure 4). Overall, in the block condition, pathological gamblers reported higher levels of craving ($M = 12.56, SD = 1.38$) than recreational gamblers ($M = 6.16, SD = 1.38$). In order to examine the overall effect of craving over time, post-hoc analysis was conducted.

First, comparing the baseline measure of craving against all other craving measure time points revealed that craving significantly increased from baseline ($M = 7.83, SD = .93$) to after being blocked ($M = 9.67, SD = 1.02$), $F(1,28) = 5.74, p = .02, \eta_p^2 = .17$. Craving also significantly increased from baseline to 5 minutes after being blocked and just before play ($M = 9.57, SD = 1.03$), $F(1,28) = 4.90, p = .04, \eta_p^2 = .15$, and from baseline to 5 minutes into play ($M = 10.40, SD = 1.33$), $F(1,28) = 4.53, p = .04, \eta_p^2 = .14$. Craving just after being blocked was not significantly different than craving 5 minutes after being blocked, $F(1,28) = .11, p = .74, \eta_p^2 = .004$. Similarly, craving just after being blocked was not significantly different than craving 5 minutes into play, $F(1,28) = 1.13, p = .30, \eta_p^2 = .04$. Lastly, craving 5 minutes after being blocked was not significantly different from craving 5 minutes into play, $F(1,28) = 2.07, p = .16, \eta_p^2 = .07$. The interaction between gambler classification and craving was also not significant, $F(3,84) = .27, p = .85, \eta_p^2 = .01$.

Figure 4. Differences in craving by gambler classification in the block condition.

Gambling Persistence

Gambling persistence was also subjected to a 2 (gambler classification: recreational vs. pathological) x 2 (blocking manipulation: control vs. block) between subject ANOVA to determine if there were any significant differences. There was no significant main effect of gambler classification, $F(1,56) = .01, p = .93, \eta_p^2 < .001$, or the blocking manipulation, $F(1,56) = .42, p = .52, \eta_p^2 = .007$. The interaction between gambler classification and blocking manipulation was also not significant, $F(1,56) = .99, p = .32, \eta_p^2 = .02$.

Moderated Mediation Analysis

Dissociation Predicting Craving. Previous ANOVA's established that there was a significant interaction of gambler classification and blocking manipulation on craving 5

minutes into play. A regression test confirmed that dissociation was related to craving 5 minutes into play, $\beta = .62$, $t(58) = 5.94$, $p < .001$. A full mediation model was then tested using Preacher and Hayes (2008)¹ macro to conduct moderated mediation. Results revealed that when the mediator (dissociation) was added to predict craving 5 minutes into play, the interaction between gambler classification and blocking manipulation no longer significantly predicted craving, $B = 1.09$, $t(58) = 1.42$, $p = .16$. Importantly however, dissociation remained a significant predictor of craving 5 minutes into play, $B = 6.80$, $t(58) = 4.93$, $p < .001$. Moderated mediation was then tested using Preacher and Hayes' (2008) bootstrapping macro with 5000 iterations was used for testing conditional indirect effects of the interaction term of gambler classification and blocking manipulation on craving through dissociation (controlling for the unique effects of gambler classification and blocking manipulation). Moderated mediation occurs when two predictor variables (i.e. gambler classification or blocking manipulation) interactively affect a mediator (i.e. dissociation), which in turn influences an outcome variable (i.e. craving) (Morgan-Lopez & MacKinnon, 2006). Results revealed a significant conditional indirect effect for the block condition, but not in the control condition. The indirect effect of dissociation on craving in the block condition was estimated to lie between .73 and 8.12 with 95% confidence. Since zero is not in the 95% confidence interval, the indirect effect is indeed significantly different from zero at $p < .05$. The confidence intervals for the control condition were estimated to lie between -.36 and 1.32, which included zero indicating no indirect effect of dissociation.

¹ The Preacher and Hayes (2008) macro to conduct moderated mediation produces unstandardized (B), but not standardized (β), regression weights. Therefore, B s were reported instead of β s.

A reverse moderated mediation was also tested with gambler classification predicting craving, which in turn predicted dissociation. This reverse moderated mediation analysis revealed a significant indirect effect of craving on dissociation in the block condition, $CI_{.95} = .02, .30$, but not in the control condition, $CI_{.95} = -.15, .58$. Therefore, the relationship between gambler classification and craving 5 minutes into play was mediated by dissociation for the block condition only. As Figure 5 illustrates, the standardized regression coefficient between gambler classification and craving decreased substantially when controlling for dissociation. The other conditions of mediation were also met: gambler classification was a significant predictor of craving and of dissociation, and dissociation was a significant predictor of craving while controlling for gambler classification.

* $p < .05$; ** $p < .001$

Figure 5. The simple mediation model of dissociation predicting craving 5 minutes into play in the block condition.

Caving Predicting Gambling Persistence. Although a between subjects ANOVA revealed no significant differences in gambling persistence by gambler classification and

blocking manipulation, a moderated mediation analysis was conducted in order to determine if craving 5 minutes into play mediated the relationship between the gambler classification by blocking manipulation interaction on gambling persistence. K. J. Preacher (personal communication, August 21, 2009; also see Hayes, in press) argues that a significant interaction between the independent variable and the mediator is not needed in order to test for moderated mediation, especially when the hypothesized process is a causal chain. Importantly, a regression test confirmed that craving 5 minutes into play predicted gambling persistence, $\beta = .35$, $t(58) = 2.80$, $p = .007$. A full mediation model was then tested using Preacher and Hayes (2008) macro to conduct moderated mediation. Results revealed that when the mediator (craving) was added to predict gambling persistence, the interaction between gambler classification and blocking manipulation still did not significantly predict gambling persistence, $B = .42$, $t(58) = 1.82$, $p = .82$. Importantly however, craving remained a significant predictor of gambling persistence, $B = .74$, $t(58) = 2.86$, $p = .006$. Preacher and Hayes' (2008) bootstrapping macro with 5000 iterations was used for testing conditional indirect effects of the interaction term of gambler classification and blocking manipulation on gambling persistence through craving (controlling for the unique effects of the gambler classification and block manipulation). Results revealed a significant conditional indirect effect for the block condition, but not in the control condition. The indirect effect of craving on gambling persistence in the block condition was estimated to lie between .14 and 5.59 with 95% confidence. Since zero is not in the 95% confidence interval, the indirect effect is indeed significantly different from zero at $p < .05$. The confidence

intervals for the control condition were estimated to lie between -2.81 and 1.24, which included zero indicating no indirect effect of craving.

Although improper temporally, because craving during play occurred before gambling persistence, a reverse moderated mediation model was tested, with gambling persistence predicting craving. Results revealed no significant indirect effects of gaming persistence on craving for both the control, $CI_{.95} = -1.40, .58$, and block, $CI_{.95} = -.50, 1.55$, conditions. Therefore, the relationship between gambler classification and gambling persistence was mediated by craving 5 minutes into play for the block condition only. As Figure 6 illustrates, the standardized regression coefficient between gambler classification and gambling persistence decreased, and switched direction when controlling for craving. Gambler classification was not a significant predictor of gambling persistence, but was a significant predictor of craving 5 minutes into play. Craving was also a significant predictor of gambling persistence while controlling for gambler classification.

* $p < .05$; ** $p < .01$;

Figure 6. The simple mediation model of craving 5 minutes into play predicting gambling persistence in the block condition.

Dissociation Predicting Gambling Persistence. Although previous analysis did not establish significant differences in gambling persistence by gambler classification and blocking manipulation, a regression test confirmed that dissociation was related to gambling persistence, $\beta = .38$, $t(58) = 3.13$, $p = .003$. A full mediation model was then tested using Preacher and Hayes (2008) macro to conduct moderated mediation. Results revealed that when the mediator (dissociation) was added to predict gambling persistence, the interaction between gambler classification and blocking manipulation still did not significantly predict gambling persistence, $B = .54$, $t(58) = .31$, $p = .76$. Importantly however, craving remained a significant predictor of gambling persistence, $B = 10.85$, $t(58) = 3.47$, $p = .001$. In order to determine if dissociation mediated the relationship between gambler classification and gambling persistence, a moderated mediation model was conducted examine this relationship by both block manipulation conditions. Preacher and Hayes' (2008) bootstrapping macro with 5000 iterations was used for testing conditional indirect effects of the interaction term of gambler classification and blocking manipulation on gambling persistence through dissociation (controlling for the unique effects of gambler classification and blocking manipulation). Results revealed a significant conditional indirect effect for the block condition, but not in the control condition. The indirect effect of dissociation on gambling persistence in the block condition was estimated to lie between .41 and 7.97 with 95% confidence. Since zero is not in the 95% confidence interval, the indirect effect is indeed significantly different from zero at $p < .05$ (see Figure 7). The confidence intervals for the control condition were estimated to lie between -.55 and 2.86, which included zero indicating no indirect effect of dissociation.

A reverse moderated mediation was also tested with gambler classification predicting gambling persistence, which in turn predicted dissociation. This reverse moderated mediation analysis revealed no significant indirect effect of gambling persistence on dissociation in the control, $CI_{.95} = -.13, .06$, or block, $CI_{.95} = -.04, .15$, conditions. Therefore, the relationship between gambler classification and gambling persistence was mediated by dissociation for the block condition only. As Figure 7 illustrates, the standardized regression coefficient between gambler classification and gambling persistence decreased, and switched direction when controlling for dissociation. Gambler classification was not a significant predictor of gambling persistence, but was a significant predictor of dissociation. Dissociation was also a significant predictor of gambling persistence while controlling for gambler classification.

* $p < .05$; ** $p < .01$

Figure 7. The simple mediation model of dissociation predicting gambling persistence in the block condition.

Gender as a Moderator

Past research has suggested that men and women differ in their preference of gambling activities (Delfabbro, 2000; Granero, et al, 2009; Ohtsuka, Bruton, DeLuca & Borg, 1997). Moreover, the progression of problem gambling behaviour has been reported as different between men and women (Tavares, Zilberman, Beites & Gentil, 2001), and men and women differ in problem gambling severity (Granero, et al, 2009). Therefore, gender was examined as a possible moderator in all mediation analysis since all mediation analysis examines gambling pathology.

In order to determine if there were gender difference with respect to blocking manipulation and gambler classification, a 2 (gambler classification: recreational vs. pathological) x 2 (blocking manipulation: control vs. block) x 2 (gender: male vs. female) between subjects ANOVA was run on all dependent variables: craving, dissociation and gambling persistence. The main effect of gender was not significant for any of the dependent variables, $ps > .26$, nor were the interactions, $ps > .06$. Although there were no significant effects of gender on craving, dissociation or gambling persistence, gender may have still moderated the proposed mediation analyses. Therefore, moderated mediation analyses were conducted with gender as the moderator.

Dissociation Predicting Craving. A previous regression test confirmed that dissociation was related to craving 5 minutes into play. A MMR was then conducted to predict craving 5 minutes into play by gambler classification, gender and dissociation. Results revealed that neither gambler classification, $B = -.22$, $t(58) = -.27$, $p = .79$, gender, $B = .08$, $t(58) = .10$, $p = .92$, nor the interaction between gambler classification and gender, $B = .57$, $t(58) = .73$, $p = .47$, significantly predicted craving when

dissociation was added to predict craving 5 minutes into play. Importantly however, dissociation remained a significant predictor of craving 5 minutes into play, $B = 7.43$, $t(58) = 5.56$, $p < .001$. In order to determine if dissociation mediated the relationship between gambler classification and craving, a moderated mediation model was conducted to examine this relationship by males and females. Preacher and Hayes' (2008) bootstrapping macro with 5000 iterations was used for testing conditional indirect effects of the interaction term of gambler classification and gender on craving 5 minutes into play through dissociation (controlling for the unique effects of gambler classification and gender). Results revealed no significant indirect effects of dissociation on craving 5 minutes into play for males, $CI_{.95} = -.30, 3.47$, or females $CI_{.95} = -.10, 3.03$. Therefore, gender was not a significant moderator on the relationship between gambler classification, dissociation and craving 5 minutes into play.

Craving Predicting Gambling Persistence. A previous regression test confirmed that craving 5 minutes into play was related to gambling persistence. A MMR was then conducted to predict gambling persistence by gambler classification, gender and craving 5 minutes into play. Results revealed that neither gambler classification, $B = -1.22$, $t(58) = -.61$, $p = .54$, gender, $B = -.77$, $t(58) = -.43$, $p = .67$, nor the interaction between gambler classification and gender, $B = .08$, $t(58) = .04$, $p = .97$, significantly predicted gambling persistence when craving 5 minutes into play was added to predict gambling persistence. Importantly however, craving 5 minutes into play remained a significant predictor of gambling persistence, $B = .69$, $t(58) = 2.76$, $p = .008$. In order to determine if craving 5 minutes into play mediated the relationship between gambler classification and gambling persistence, a moderated mediation model was conducted to examine this

relationship by males and females. Preacher and Hayes' (2008) bootstrapping macro with 5000 iterations was used for testing conditional indirect effects of the interaction term of gambler classification and gender on gambling persistence through craving 5 minutes into play (controlling for the unique effects of gambler classification and gender). Results revealed no significant indirect effects of craving 5 minutes into play on gambling persistence for males, $CI_{95} = -1.54, 3.12$, or females $CI_{95} = -.53, 3.18$. Therefore, gender was not a significant moderator on the relationship between gambler classification, craving 5 minutes into play and gambling persistence.

Dissociation Predicting Gambling Persistence. A previous regression test confirmed that dissociation was related to gambling persistence. A MMR was then conducted to predict gambling persistence by gambler classification, gender and dissociation. Results revealed that neither gambler classification, $B = -2.11, t(58) = -1.14, p = .26$, gender, $B = -.38, t(58) = -.22, p = .83$, nor the interaction between gambler classification and gender, $B = .50, t(58) = .29, p = .78$, significantly predicted gambling persistence when dissociation was added to predict gambling persistence. Importantly however, dissociation remained a significant predictor of gambling persistence, $B = 9.82, t(58) = 3.22, p = .002$. In order to determine if dissociation mediated the relationship between gambler classification and gambling persistence, a moderated mediation model was conducted to examine this relationship by males and females. Preacher and Hayes' (2008) bootstrapping macro with 5000 iterations was used for testing conditional indirect effects of the interaction term of gambler classification and gender on gambling persistence through dissociation (controlling for the unique effects of gambler classification and gender). Results revealed no significant indirect effects of dissociation

on gambling persistence for males, $CI_{.95} = -.23, 6.50$, or females $CI_{.95} = -.22, 4.14$.

Therefore, gender was not a significant moderator on the relationship between gambler classification, dissociation and craving 5 minutes into play.

General Discussion

As hypothesized, blocking gambling behaviour resulted in a significant increase in craving before play. The CPM states that blocking an addictive behavior leads to craving in dependent individuals (i.e., pathological gamblers); hence, it is not surprising that pathological gamblers who were blocked reported higher levels of craving than recreational gamblers. Craving measured at baseline revealed that pathological gamblers in both the control and block conditions experienced higher levels of craving than recreational gamblers, however pathological and recreational gamblers did not significantly differ on craving measured directly before play if they were not blocked. Again, this supports prediction of the CPM, as participants were not blocked and perceived gambling to be easily available, participants would not be expected to report high levels of craving. Pathological gamblers may have reported increased levels of craving measured at baseline compared to recreational gamblers because they were blocked (i.e. they had to go through a neutral acclimatization period).

These findings replicate previous research in smokers and alcoholics, where blocking access to addictive behaviours has elicited craving (Jacobson, Hasenfratz and Battig & 1994; Rankin, Hodgson & Stockwell, 1979). This suggests that there may be similar underlying mechanisms in the craving process between gamblers and substance abusers. If this is the case, intervention strategies developed to curb craving in substance abusers may prove useful for gamblers. Future research is needed to substantiate this claim.

After participants were allowed to gamble, craving was assessed 5 minutes into play. As hypothesized, craving during play was significantly increased in pathological

gamblers compared to recreational gamblers. This may be due to a rebound effect, similar to food craving, where blocking an addictive behaviour results in an increase in craving thereafter (Hill, 2007). Indeed, examining craving among those in the block condition reveals that both pathological and recreational gamblers reported a significant increase in craving just after being blocked. This increased craving just after being blocked remained increased 5 minutes after being blocked, and after 5 minutes into play. It was hypothesized that there would be a significant interaction between pathological and recreational gamblers who were blocked. However, results revealed that recreational gamblers in the current study reported an increase in craving over time similar to pathological gamblers.

The CPM, however, may explain this increase in craving after blocking for recreational gamblers if they were *frequent* recreational gamblers. That is, gambling may become a practiced (i.e., automatic) activity for frequent recreational gamblers if they often gamble in similar casino environments with repetitive and stereotyped actions (e.g., pulling a slot machine lever). Research in alcohol has suggested that frequent recreational drinkers report craving in a similar manner as dependent individuals (Field, Mogg & Bradley, 2005; Leeman, Corbin & Fromme, 2009). It should be noted that 50% of recreational gamblers in the current study stated they gamble more than once a month, 73% had gambled for 5 years or more, and 90% typically gamble at a casino. It stands to reason that gambling may be a well-practiced behaviour among the recreational gamblers in the present study. Recreational and pathological gamblers in the blocked condition also reported higher levels of pre-existing automaticity in gambling behaviour. Since the CPM stipulates that blocking will elicit craving in those for whom gambling has become an

automatic behaviour, this may explain why both recreational and pathological gamblers reported a significant increase in craving just after being blocked from gambling.

Dissociation was found to mediate the relationship between gambling pathology and craving 5 minutes into play among participants who were previously blocked. Specifically, an increase in gambling pathology (from recreational to pathological) predicted an increase in dissociation, which in turn predicted an increase in craving 5 minutes into play. However, reverse mediation was also significant, and craving 5 minutes into play was found to mediate the relationship between gambling pathology and dissociation. *These unclear results may be due to the post-hoc nature of the dissociation measure.*

Dissociation was measured retrospectively for the entire gambling experience, not just the initial five minutes of play. Dissociation was measured upon voluntary cessation as to not block participants for an extended period of time while gambling (i.e. not block participants from gambling), therefore, the reported dissociation may have occurred during the extinction phase of the study, where participants were allowed to gamble until voluntary cessation. If this were the case, it could be hypothesized that craving would predict dissociation because the craving measure itself may have blocked participants; leading to a rebound effect and predicting increased levels of dissociation thereafter. Caution is needed when interpreting these results, as it is currently unclear whether dissociation during the first 5 minutes of play predicted subsequent craving after 5 minutes of play, or if the craving experience at 5 minutes of play predicted resulting dissociation during the extinction phase. Regardless of explanation, however, results suggest that once automatic gambling behaviour is blocked it may rebound when allowed

thereafter, predicting increases in dissociation or craving. Since past research has suggested that dissociation is related to craving after being blocked from gambling (Rosenthal & Lesieur, 1992) and increased gambling behaviour (Wynne, 1994; Diskin & Hodgins, 2001), minimizing dissociative experiences or stopping them from developing may be key to reducing both craving.

It is important to note that, dissociation did not cause increases in craving, rather it predicted increases in craving. In this way, dissociation does not explain the process whereby blocking leads to an increase in craving. The process by which blocking leads to an increase in craving may be due to a rebound effect of craving just after blocking, the current findings suggest that automatic gambling (revealed by experiences of dissociation) behaviour may play an important factor when examining blocking gambling behaviour. In other words, blocking may lead to an increase in craving insofar as gambling has become an automatic behaviour.

Dissociation experienced during play may be due to the repetitive and monotonous behaviour involved in slot machine gambling. Perhaps slot machine design lends itself to the development of automatic processing and therefore dissociation. Increased experience with slot machine gambling may alter the behaviour from being cognitively controlled to automatic (Griffiths, 1991, 1994; Ericsson & Simon, 1980). Moreover, Griffiths, Wood, Parke and Parke (2006) argued that the simplistic game play offered by most forms of slot machine gambling may encourage experiences of dissociation. This would explain the addictive nature of slot machines and explain why they are colloquially considered the “crack cocaine of gambling” (for a review of this claim, see Dowling, Smith & Thomas, 2005). In order to assess the role of repetitive and

monotonous behaviour in gambling, further research needs to be conducted comparing the craving levels of recreational and pathological gamblers in other, less repetitive forms of gambling. These results of this study may not apply to games involving a high demand of cognitive recourses, such as poker or blackjack.

As hypothesized, craving mediated the relationship between gambling pathology and gambling persistence. An increase in gambling pathology predicted an increase in craving, which predicted an increase in gambling persistence in the block condition only. This replicates previous research, which suggests craving predicts continued gambling in the face of loss (Young & Wohl, *in press*). Results of reverse mediation revealed no significant indirect effects. Given the temporal order of craving 5 minutes into play and gambling persistence and the fact that reverse mediation was not significant, it stand to reason that reducing craving in pathological gamblers may be an effective way of reducing problematic gambling behaviour, and not the other way around. Future intervention strategies aiming to reduce problematic gambling behaviour should therefore target and reduce craving to gamble. For example, if a drug or therapy could be designed to reduce craving, it may also reduce problem gambling behaviour.

Results revealed a significant mediation between gambling pathology, dissociation and gambling persistence for participants who were previously blocked from gambling. This mediation analysis further confirms the two previous mediation relationships between (1) gambling pathology, dissociation, and craving and (2) gambling pathology, craving, and gambling persistence. Again, the results of this mediation should not be interpreted as blocking causing increased dissociation and gambling persistence. Instead, this mediation further stresses the importance of automaticity in the relationship

between gamblers who are blocked and problematic gambling behaviour (i.e. gambling persistence). In order to reduce problem gambling behaviour, craving needs to be reduced. Since craving increases after blocking in those for whom gambling has become automatic, prevention of automatic gambling activity is central. Reduction of automatic gambling behaviour may also serve to reduce problematic gambling behaviour.

Finally, the resulting mediation models were not moderated by gender. Although past research has reported significant differences with respect to men and women's gambling experiences (Delfabbro, 2000; Granero, et al, 2009; Ohtsuka, Bruton, DeLuca & Borg, 1997; Tavares, Zilberman, Beites & Gentil, 2001), the current research suggests that gender does not significantly affect any of the reported mediations. This is important as it rules out an important confounding variable that might have otherwise accounted for the significant differences between those who were blocked, and those who were not.

As a whole, the results of this study have important implications for developing strategies to combat gambling craving and problematic gambling behaviour. It has been suggested, that interrupting slot machine gamblers with pop-up messages might reduce excessive gambling (for a review, see Monaghan, 2008). Pop-up messages are windows that are displayed on electronic gambling machines (EMGs) that ask the gambling patron if they wish to continue gambling. It is hoped that by having pop-up messages patrons will reduce their gambling behaviour, as they must read and acknowledge how long they have gambled for in order to continue. However, research has suggested that exposure to pop-up messages and mandatory cash outs may increase time and money spent gambling (Schellink & Schrans, 2002). While this may seem counterintuitive, if pop-up messages and mandatory cash outs block a gambler from engaging in play, they may

counterproductively increase craving, dissociation and gambling persistence. According to the current study, an effective way to lower craving and problematic gambling behaviour may be to stop dissociation from occurring in the first place. In other words, more research needs to be conducted to identify structural characteristics of gambling that may lead to dissociation, and how to combat them.

Caveats

The current study has some limitations. First, preliminary analysis revealed that automaticity significantly differed between the control and block conditions.

Automaticity in gambling was lower for those in the control condition. Lower levels of automaticity in gambling behaviour would lead to less endorsement of craving according to the CPM. Hence, it is not unexpected that there were no significant differences between pathological and recreational gamblers in the control condition, considering that participants were not blocked and gambling was not automatic for those participants. As participants were randomly assigned to blocking manipulation, further research needs to replicate the finding in this study while pre-assessing gambling automaticity, in order to have an equivalent groups design. An equivalent groups design would assist in teasing apart the impact of automatic processing on craving in gamblers who are blocked compared to those allowed to gamble freely.

Similarly, age significantly differed for pathological gamblers in the control and block conditions; pathological gamblers in the control condition were older than those in the block condition. Since participants (regardless of gambling pathology) were randomly assigned to either the control or block condition, this finding was unexpected. It is possible that there may be extraneous variables related to age that account for observed

differences in craving. For example, perhaps older individuals did not feel as comfortable using the virtual reality, thereby leading to decreases in craving. Again, an equivalent groups design would assist in ruling age out as a influencing factor.

A second limitation is that, when comparing mediation models in the control versus block condition, moderated mediation compares each model to zero (i.e. the null hypothesis). Moderated mediation does not inform us if the mediation models in the block and control conditions are significantly different from each other. Consequently, caution is warranted when interpreting the effect of blocking gambling on the mediation models in the current study. While the resulting mediation models occur when gambling behaviour is blocked, one cannot conclude that they are significantly different from the same mediation models when gambling behaviour is not blocked. Therefore, the effects of blocking gambling behaviour over and above allowing participants to gamble (i.e. not blocking gambling behaviour) has yet to be determined.

Third, by using a virtual reality casino, it could be argued that participants were removed from their natural gambling environment; thereby compromising external validity. However, this was necessary in order to achieve proper methodology, and have control over the gambling environment. Since the virtual reality casino was pre-programmed, the casino environment stayed static, and each participant had the same experience with the slot machine, regardless of which machine they chose or blocking manipulation they were in. Additionally, while it may be argued that using a virtual casino may not trigger the same cues as in a real casino, this study and previous research suggests that craving can be successfully elicited within a virtual casino (Young, Wohl, Matheson & Anisman, 2007, see also Baumann & Sayette, 2006).

Fourth, participants were given money to gamble with. Although \$15 was given to participants as credits to use in the virtual casino and were told that they could keep any money left at the end of the session, participants may have seen this \$15 as an extra surplus of money. I was hoped that participants did see this initial \$15 as their own, participants may have acted differently if they had brought in their own money to use towards credits on the slot machine. However, it was not ethically feasible to let participants use their own money. In addition, the \$15 that was given to them to gamble with also served as an incentive to get participants to participate in the study.

Lastly, a single item measure was used to assess craving. Previous research suggests however, that craving is a multidimensional concept and that a single item measure, although face valid, may miss important features that are central to understanding why a gambler may be craving. Nevertheless, a single item measure was used as it was quick and would cause the least interference in the experiment. Insofar as blocking gambling produces craving, the craving measure was as quick as possible to minimize any blocking to gambling.

Concluding Remarks

In conclusion, the present research supports the hypothesis that blocking an individual from engaging in gambling will elicit craving. Both pathological and recreational gamblers report an increase in craving after being blocked; this increase in craving lasts over a 5 minute waiting period, and after engaging in gambling. An increase in gambling pathology (from recreational to pathological) predicted increased craving levels, which in turn predicted increased gambling persistence in those who were previously blocked. Moreover, an increase in gambling pathology predicted increased

dissociation during gambling, which predicted increased craving and gambling persistence. It is suggested that in order to decrease problematic gambling behaviour, strategies need to be developed to decrease craving. To decrease craving, factors which enable dissociation need to be identified and eliminated or minimized.

References

- American Psychiatric Association (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC, American Psychiatric Association.
- Baumann S. B., Neff C., Fetzick S., Stangl G., Basler L., Vereneck R., & Schneider W. (2003). A virtual reality system for neurobehavioural and functional MRI studies. *Cyberpsychology & Behaviour*, 6, 259–266.
- Baumann, S. B., & Sayette, M. A. (2006). Smoking Cues in a Virtual World Provoke Craving in Cigarette Smokers. *Psychology of Addictive Behaviors*, 20(4), 484–489.
- Bradford, J., Geller, J., Lesieur, H. R., Rosenthal, R. J., & Wise, M. (1996). Impulse control disorders. In T. A. Widiger, A. J. Frances, H. A. Pincus et al. (Eds.), *DSM-IV Sourcebook: Volume 2* (pp. 1007–1031). Washington, D.C.: American Psychiatric Press.
- Brandon, T. H., Tiffany, S. T., & Baker, T., B. (1987) Characterization of the process of smoking relapse. In Tims, F. & Leukfeld, C. (Eds.) *Relapse and recovery in drug abuse* (NIDA Research Monograph, No. 72) US Government Printing Office, Washington: DC, 104–107.
- Brown, R. (1996). *The role of dissociative experiences in problem gambling*. Paper presented at the Second Annual Conference on Gambling and Policy Issues, Amsterdam.
- Carter, B. L., & Tiffany, S. T. (1999). Meta-analytical review of cue reactivity measures in addiction research, *Addiction*, 94, 327–340.

- Castellani, B., & Rugle, L. (1995). A comparison of pathological gamblers to alcoholics and cocaine misusers on impulsivity, sensation seeking and craving. *International Journal of Addictions, 30*, 275–289.
- Delfabbro, P. (2000). Gender differences in Australian gambling: A critical summary of sociological and psychological research. *Australian Journal of Social Issues, 35*, 145–158.
- Delfabbro, P. (2006). Dissociation and problem gambling: A critical overview. In C. Allcock (Eds.), *Current issues related to dissociation* (pp. 10-14). Melbourne: Australian Gaming Council.
- Diskin, K. & Hodgins, D. (1999). Narrowing of attention and dissociation in pathological video lottery gamblers. *Journal of Gambling Studies, 15*, 17-28.
- Diskin, K. M. & Hodgins, D. C. (2001). Narrowed focus and dissociative experiences in a community sample of experienced video lottery gamblers. *Canadian Journal of Behavioural Science, 33*, 58-64.
- Dowling, N., Smith, D., & Thomas, T. (2005). Electronic gaming machines: Are they the "crack-cocaine" of gambling? *Addiction, 100*, 33-45.
- Droungas, A., Childress, A. R., Ehrman, R., Semans, M., & O'Brien, C. (1992). *Effect of smoking cues on physiological reactivity, subjective report of craving and latency to smoke in smokers*. Paper presented at the International Narcotics Research Conference, Keystone, CO.
- Drummond, D. C. (2001). Theories of drug craving, ancient and modern. *Addiction, 96*, 33-46.

- Drummond, D. C., Cooper, T., & Glautier, S. P. (1990). Conditioned learning in alcohol dependence: Implications for cue exposure treatment. *British Journal of Addiction*, 85, 725-743.
- Drummond, D. C., Tiffany, S. T., Glautier, S., & Remington, B. (1995). Cue exposure in understanding and treating addictive behaviours. In D. C. Drummond, S. T. Tiffany, S. Glautier & B. Remington (Eds.), *Addictive behaviours: Cue exposure theory and practice* (pp 1-17) Chichester, John Wiley & Sons.
- Ericsson, K. A. & Simon, H. A. (1980). Verbal reports as data. *Psychological Review*, 87, 215-251.
- Field, M., Karin, M., & Brendan, B. (2005). Craving and cognitive biases for alcohol cues in social drinkers. *Alcohol and Alcoholism*, 40(6), 504-510.
- Granero, R., Penelo, E., Martínez-Giménez, R., Álvarez-Moya, E., Gómez-Peña, M., Neus Aymamí, M., et al. (2009). Sex differences among treatment-seeking adult pathological gamblers. *Comprehensive Psychiatry*, 50(2), 173-180.
- Grant, J. E., & Kim, S.W. (2003). Dissociative symptoms in pathological gambling. *Psychopathology*, 36, 200-203.
- Grant J. E., & Potenza M. N. (2005). Tobacco use and pathological gambling. *Annals of Clinical Psychiatry*, 17(4), 237-241.
- Griffiths, M. D. (1991). The observational study of adolescent gambling in UK amusement arcades. *Journal of Community and Applied Social Psychology*, 1, 309-320.
- Griffiths, M. D. (1994). The role of cognitive bias and skill in fruit machine gambling. *British Journal of Psychology*, 85, 351-369.

- Griffiths, M. D., Wood, R. T. A., Parke, J., & Parke, A. (2006). Dissociative states in problem gambling. In C. Allcock (Eds.), *Current issues related to dissociation* (pp. 27-37). Melbourne: Australian Gaming Council.
- Gupta, R., & Derevensky, J. (1998). An empirical examination of Jacobs' general theory of addictions: Do adolescent gamblers fit the theory? *Journal of Gambling Studies*, 14, 17-49.
- Hill, A.J. (2007). The psychology of food craving. *Proceedings of the Nutrition Society*, 66, 277-285.
- Holden, C. (2001). 'Behavioral' addictions: Do they exist? *Science*, 294(2), 980-982.
- Ikard, F. F., Green, D. E., & Horn, D. (1969). A scale to differentiate between types of smoking as related to the management of affect. *International Journal of the Addictions*, 4, 649-659.
- Jacober, A., Hasenfratz, M., & Bättig, K. (1994). Cigarette smoking: habit or nicotine maintenance? Effects of short-term smoking abstinence and oversmoking. *Human Psychopharmacology*, 9, 117-123.
- Jacobs, D. F. (1988). Evidence for a common dissociative-like reaction among addicts. *Journal of Gambling Behavior*, 4(1), 27-37.
- Jacobs, D. F. (1989). A general theory of addictions: Rationale for and evidence supporting a new approach for understanding and treating addictive behaviors. In H. J. Shaffer, S. A. Stein, B. Gambino & T. N. Cummings (Eds.), *Compulsive Gambling: Theory, Research and Practice* (pp. 35-64). Lexington, MS: Lexington Books.

- Jacobs, D. F. (1998). An Overarching Theory of Addictions: A New Paradigm for Understanding and Treating Addictive Behaviors. (Unpublished manuscript).
- Kofoed, L., Morgan, T., Buchkowski, J., & Carr, R. (1997). Dissociative experiences scale and MMPI-2 scores in video poker gamblers, other gamblers and alcoholic controls. *Journal of Nervous and Mental Disease*, 185, 58-60.
- Kushner, M., Thuras, P., Sletten, S., Frye, B., Abrams, K., Adson, D., Demark, J. V., Maurer, E., & Donahue, C. (2008) Urge to gamble in a simulated gambling environment. *Journal of Gambling Studies*, 24(2), 219-227.
- Kushner, M. G., Abrams, K., Thuras, P., Frost, R., Kim, S. W., & Donahue, C. B. (2007). Urge to gamble in pathological gamblers exposed to a casino environment. *Journal of Gambling Studies*, 23, 121-132.
- Leeman, R. F., Corbin, W. R., & Fromme, K. (2009). Craving predicts within session drinking behavior following placebo. *Personality and Individual Differences*, 46, 693-698.
- Lesieur, H. R., & Blume, S. B. (1993). Pathological gambling, eating disorders, and the psychoactive substance use disorders. *Comorbidity of Addictive and Psychiatric Disorders*, 89-102.
- Lesieur, H. R., & Rosenthal, R. J. (1998). Analysis of Pathological Gambling. In T. A. Widiger, A. J. Francis, H. A. Pincus, R. Ross, M. B. First, W. Davis & M. Kline (Eds.), *DSM-IV Sourcebook: Volume 4* (pp. 393-401). Washington, D.C.: American Psychiatric Association.
- Ludwig, A. M. (1988). *Understanding the alcoholic's mind: The nature of craving and how to control it*. New York: Oxford University Press.

- MacKillop, J., & Lisman, S.A. (2005). Reactivity to alcohol cues: Isolating the role of perceived availability. *Experimental and Clinical Psychopharmacology*, 13, 229-237.
- Monaghan, S. (2008). Review of pop-up messages on electronic gaming machines as a proposed responsible gambling strategy. *International Journal of Mental Health and Addiction*, 6(2), 214-222
- Monti, P. M., Binkoff, J. A., Abrams, D. B., Zwick, W. R., Nirenberg, T. D., & Liepman, M. R. (1987). Reactivity of alcoholics and nonalcoholics to drinking cues. *Journal of Abnormal Psychology*, 96, 122-126.
- Niaura, R. S., Rohsenow, D. J., Binkoff, J. A., Monti, P. M., Pedraza, M., & Abrams, D. B. (1988). Relevance of cue reactivity to understanding alcohol and smoking relapse. *Journal of Abnormal Psychology*, 97, 133-152.
- Ohtsuka, K., Bruton, E., DeLuca, L., & Borg, V. (1997). Sex differences in pathological gambling using gaming machines. *Psychological Reports*, 80, 1051-1057.
- Orford, J. (2001). Addiction as excessive appetite. *Addiction*, 96(1), 15-31.
- Petry, N. M. (2006). Should the scope of addictive behaviours be broadened to include pathological gambling? *Addiction*, 101, 152-160.
- Potenza, M. N. (2006). Should addictive disorder include non-substance-related disorders? *Addiction*, 101, 145-151.
- Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavioral Research Methods*, 40, 879-891.

- Rankin, H., Hodgson R., & Stockwell, T. (1979). The concept of craving and its measurement. *Behaviour Research and Therapy*, 17, 389–396.
- Rosenthal, R. J., & Lesieur, H. R. (1992). Self-reported withdrawal symptoms and pathological gambling. *American Journal on Addictions*, 1, 150-154.
- Schellink, T., and Schrans, T. (2002). *Responsible Gaming Features on Video Lottery Terminals: Impact and Promise*. Paper presented at the 12th Annual National Association for Gambling Studies Conference, Melbourne.
- Shaffer, H. J. (1999). Strange bedfellows: a critical view of pathological gambling and addiction. *Addiction*, 94, 1445–1448.
- Sinha, R., Fuse, T., Renee-Aubin, L., & O'Malley, S. S. (2000). Psychological stress, drug cues and cocaine craving. *Psychopharmacology*, 152(2), 140-148.
- Stinchfield, R. (2003). Reliability, validity, and classification accuracy of a measure of DSM-IV diagnostic criteria for pathological gambling. *American Journal of Psychiatry*, 160, 180-182.
- Tavares, H., Zilberman, M., Beites, F. J., & Gentil, V. (2001). Brief communications: Gender differences in gambling progression. *Journal of Gambling Studies*, 17(2), 151-159.
- Tavares, H., Zilberman, M., Hodgins D. C., & el-Guebaly, N. (2005). Comparison of craving between pathological gamblers and alcoholics, *Alcoholism, Clinical and Experimental Research*, 29, 1427–1431.
- Tiffany, S. T. (1990). A cognitive model of drug urges and drug-use behaviour: Role of automatic and non-automatic processes. *Psychological Review*, 97(2), 147-168.

- Tiffany, S. T. (1995). Potential functions of classical conditioning in drug addiction. In D. C. Drummond, S. T. Tiffany, S. Glautier, & B. Remington (Eds.), *Addictive behaviour: Cue exposure theory and practice* (pp. 47-71) Chichester, John Wiley & Sons.
- Tiffany, S. T. (1999). Cognitive concepts of craving. *Alcohol Research & Health*, 23(3), 215-224.
- Tiffany, S. T. (2000). Evaluating relationships between craving and drug use. *Addiction*, 95, 1106–1107.
- Tiffany, S. T., & Conklin, C. A. (2000). A cognitive processing model of alcohol craving and compulsive alcohol use. *Addiction*, 95, 145–153.
- Wardle, J., & Beinart, H. (1981). Binge eating: A theoretical overview. *The British Journal of Clinical Psychology*, 20(2), 97-109.
- Wynne, H. (1994). *A description of problem gamblers in Alberta: A secondary analysis of the gambling and problem gambling in Alberta Study*. Edmonton, AB: Alberta Alcohol and Drug Abuse Commission.
- Young, M. M., & Wohl, M. J. (in press). The gambling craving scale: Psychometric validation and behavioral outcomes. *Psychology of Addictive Behaviors*.
- Young, M. M., Wohl, M. J. A., Matheson, K., Baumann, S., and Anisman H. (2008). The desire to gamble: The influence of outcomes on the priming effects of a gambling episode. *Journal of Gambling Studies*, 24(3), 275-293.
- Young, M. M., Wohl, M. J. A., Matheson, K., & Anisman, H. (2007). *An Investigation of craving using a virtual reality casino*. Paper presented at the 6th annual Alberta Gaming Research Institute Conference, Banff, AB.

Appendices

Appendix A: Phone and E-mail Recruitment

Phone

Hi, my name is Travis Sztainert; I'm with a team of researchers at Carleton University. You have previously indicated that we can contact you to see if you would be willing to participate in future studies, before I get into that, I was just wondering if this is a good time for me to call.

If yes, continue.

If no, schedule another time to call.

Fist of all, I just need to ask you a question about your gambling behaviour: Are you currently or have you been in treatment for your gambling behaviour?

If yes, thanks and good-bye

If no, continue

In the current study being run, you will be asked to complete a number of questionnaires assessing your perceptions of gambling, as well as engage in gambling in a virtual reality environment. Virtual reality involves you putting on a head mounted display and gambling in a computer simulated casino. In addition to using the virtual reality equipment, we will also ask you to complete a non-invasive physiological measure, namely to take your blood pressure and heart rate. This will be done using an automatic blood pressure monitor. Basically, a cuff will be placed around your arm; it will automatically inflate and then deflate. The entire process takes less then a minute. This process does not hurt; however, you may feel tension around your arm while your blood pressure is being taken, but not afterwards. To play in the virtual Casino you will receive \$15.00 Canadian with the opportunity to win more money, which you can take home with you.

If interested, arrange time.

If no, thanks and good-bye

E-mail

Good day,

My name is Travis Sztainert; I'm with a team of researchers at Carleton University. You have previously indicated that we can contact you to see if you would be willing to participate in gambling studies.

In the current study being run, you would be asked to complete a number of questionnaires assessing your perceptions of gambling, as well as engage in gambling in a virtual reality environment. Virtual reality involves you putting on a head mounted display and gambling in a computer simulated casino. In addition to using the virtual

reality equipment, we will also ask you to complete a non-invasive physiological measure, namely to take your blood pressure and heart rate.

Blood pressure and heart rate will be taken using an automatic blood pressure monitor (similar to the ones you see in mainstream pharmacies). Basically, a cuff will be placed around your arm; it will automatically inflate and then deflate. The entire process takes less than a minute. This process does not hurt; however, you may feel tension around your arm while your blood pressure is being taken, but not afterwards.

To play in the virtual Casino you will receive \$15.00 Canadian with the opportunity to win more money, which you can take home with you. We would also cover any transportation costs to get to Carleton. The study takes about (45 min. to) an hour, and runs everyday from 9AM to 10PM (including weekends). If you are interested in participating in this study please reply to this e-mail, and we can set up a time and date that works for you. Alternatively, you can give me a call Monday-Friday 12-5 at 613-520-2600, ex. 6312. If you can't get ahold of me there, you can call ex. 2683, ask for Jessica, leave your name and number and I can call you back.

All the best,
Travis Sztainert

Appendix B: Informed Consent

Informed Consent

The purpose of an informed consent is to ensure that you understand the purpose of the study and the nature of your involvement. The informed consent has to provide sufficient information such that you have the opportunity to determine whether you wish to participate in the study.

Study Title: Reactions to virtual gaming

Study Personnel:

- Travis Sztainert, MA
Phone: (613) 520-2600 ext 6312
- Dr. Michael Wohl, Department of Psychology, Carleton University
Phone: (613) 520-2600 ext 2908
- Matthew Young, MA, Department of Psychology, Carleton University
Phone: (613) 520-2600 ext 6312
- Dr. Hymie Anisman, Department of Psychology, Carleton University
Phone: (613) 520-2699
- Dr. Kim Matheson, Department of Psychology, Carleton University
Phone: (613) 520-2684

If you have any ethical concerns about this study please contact Dr. J. Mantler, (Chair of the Carleton University Research Ethics Committee for Psychological Research, 520-2600, ext. 4173), or Dr. M. Gick, (Chair, Department of Psychology, Carleton University at 520-2600, ext. 2648).

Purpose and Task Requirements: The purpose of this study is to assess gambling behaviour. We will be asking you to wear virtual reality headgear which creates a realistic and interactive casino atmosphere (sights and sounds). The user has the capability of interacting with the virtual casino in a gaming situation, and you will have the opportunity to do so. You will also be asked to complete a series of questionnaires about your background (e.g., family history), and gambling (e.g., propensity to gamble and attitudes toward gambling). In addition, your heart rate and blood pressure will be taken via an Automatic Blood Pressure Monitor (ABPM).

Potential Risk and Discomfort: There are no physical risks in this study. Some individuals may experience discomfort when asked to respond to personal, sensitive questions. In addition, some individuals may experience discomfort or nausea when interacting with the virtual reality console (a.k.a. "Cyber-sickness"). If you do feel nauseous when using the virtual reality console, please take a break (i.e., close your eyes). If the nausea continues, please tell the experimenter and he or she will terminate the study. In addition, some participants may feel some discomfort when having their blood pressure taken, if this occurs please inform the experimenter, and the process will be terminated.

Anonymity/Confidentiality: The data collected in this study will be kept confidential. Your informed consent form will be separated from your questionnaire and kept in a separate and secured file by one of the research investigators who will keep this information confidential.

Right to Withdraw: Your participation in this study is entirely voluntary. At any point during the study you have the right to not complete certain questions or to withdraw with no penalty whatsoever.

I have read the above description of the study concerning my reactions to virtual gaming. The data collected will be used in research publications and/or for teaching purposes. My signature indicates that I agree to participate in the study, and this in no way constitutes a waiver of my rights.

Full Name (please print): _____
Participant Signature: _____
Date: _____
Researcher Signature: _____

Date:

Appendix C: Measure of Craving

Please make a tic anywhere along the line.

How strong is your craving to gamble?

Appendix D: Automaticity Scale

Please indicate how much the following behaviours are typical of you:

1. I've found myself engaging in gambling activities without realizing it.

5	4	3	2	1
Always	Frequently	Occasionally	Seldom	Never

2. I place a second wager without knowing the outcome of the first.

5	4	3	2	1
Always	Frequently	Occasionally	Seldom	Never

3. I gamble automatically without even being aware of it.

5	4	3	2	1
Always	Frequently	Occasionally	Seldom	Never

4. I gamble just from habit, without even really wanting to currently do so.

5	4	3	2	1
Always	Frequently	Occasionally	Seldom	Never

5. I find myself gambling but I don't remember deciding to engage in the activity.

5	4	3	2	1
Always	Frequently	Occasionally	Seldom	Never

6. I've found myself driving to a casino without realizing that I've gotten into the car.

5	4	3	2	1
Always	Frequently	Occasionally	Seldom	Never

7. I gamble without even being aware I'm doing it.

5	4	3	2	1
Always	Frequently	Occasionally	Seldom	Never

*Appendix E: Dissociation Scale***DQ**

In the previous gambling session how much did you

	Never	Rarely	Occasionally	Frequently	All the time
1.lose track of time?	0	1	2	3	4
2. ... feel like you were a different person?	0	1	2	3	4
3.feel like you were outside of yourself, watching yourself gamble?	0	1	2	3	4
4.feel like you were in a trance?	0	1	2	3	4
5. ...experience a memory blackout for things that happened while you were gambling	0	1	2	3	4

Appendix F: Debriefing

Debriefing

This post-test information is designed to help you understand the nature of the research. This experiment is part of a larger research project being conducted to examine gambling behaviour and attitudes. Specifically, the purpose of this study is to assess craving to gamble among individuals with varying degrees of previous gambling interest. Using a virtual reality gambling simulation, we assessed craving before and after gambling when gambling had either been prevented or allowed. Results from this project will facilitate the identification of features that render individuals vulnerable to gambling pathology, and will provide the basis for us to develop workshops and materials that may be used as an intervention strategy for problem-gambling among.

Though empirical evidence suggests that craving is central to substance addiction, it has yet to receive much investigation in the context of gambling. Therefore we conducted this study to learn more about the nature of craving within the context of gambling behaviour. Previous research conducted has examined the influence structural characteristics of gambling on craving. The theoretical model accounting for this craving however, has yet to be examined.

Previous research (Wohl, Young, & Hart, 2005) has found that some gamblers have extreme beliefs in personal luck or optimism, so that they over-attribute their wins to the self, and have exaggerated expectations of future gambling successes. As such, among some gamblers, anticipation of gambling may provoke a 'high' (eustress) similar to that experienced by people engaging in other risk-taking behaviours (e.g., skydivers). This process may contribute to a strong desire to gamble (craving) and a persistent reluctance to seek treatment when gambling reaches problematic levels. To assess this possibility, we asked you to complete measures that assess your belief in personal luck, your expectations of success at the gambling game, your mood while gambling, and your craving to gamble.

The virtual reality machine was programmed to either malfunction or to work normally, and the slot machines were programmed for you to continually loose. We did not inform you of this, as it may have biased your answers. As such, after you finish reading this debriefing form, the experimenter will present a new informed consent form. The purpose of an informed consent is to ensure that you now understand the true purpose of the study and that you agree to allow your data to be used for research and teaching purposes. Because you were only told of the procedures and not the purpose of this study at the outset, we will be asking for your consent to allow your data to be used for research and teaching purposes.

If you have any questions about this study when you leave, please feel free to use the contact information on this debriefing form that you are allowed to keep. If you feel that this experiment has influenced your behaviour towards gambling in any way (i.e. if you now have a craving, or urges, to gamble), please contact or speak to the experimenter immediately.

Lastly, gambling may become harmful to ones relationships and well being, both emotionally and financially. The current research is in no way an endorsement to gamble but rather aims to discover ways to help and prevent gambling. If you think you may have gambling problems, it is suggested that you contact one of the organizations listed below. It is not a good idea to allow problems to fester, as ruminating over these problems will typically not make them go away. In addition, your family physician or counselor will may also be able to help you or to refer you to someone who can help.

Ontario Problem Gambling helpline 1-888-230-3505 <http://www.opgh.on.ca/>
Addictions and Problem Gambling Services of Ottawa (613) 789-8941 http://www.apgso-stjpo.ca/find_eng.html
Distress Centre: Ottawa And Region (613) 238-1089 <http://www.dcottawa.on.ca>
Health and Counselling Services at Carleton University (613) 520-6674.

If you have any questions or comments about this research, then please feel free to contact Travis Sztainert (520.2600 ext. 6312; tsztaine@connect.carleton.ca), Dr. Michael Wohl (520.2600 ext. 2908; mwohl@connect.carleton.ca), Dr. Hymie Anisman (520.2600 ext. 2699; hymie_anisman@carleton.ca), or Dr. Kim Matheson (520-2684; kimmatheson@pigeon.carleton.ca).

If you have any ethical concerns about this study please contact Dr. A. Parush, (Chair of the Carleton University Research Ethics Committee for Psychological Research, 520-2600, ext. 4173), or Dr. J. Mantler, (Chair, Department of Psychology, Carleton University at 520-2600, ext. 4173) for any additional concerns.

We thank you very much for participating in this study. Your assistance will help us better understand gambling behaviour.

Appendix G: Informed Consent

Informed Consent to the Use of Data

The purpose of an informed consent is to ensure that you now understand the true purpose of the study and that you agree to allow your data to be used for research and teaching purposes. Because you were only told of the procedures and not the purpose of this study at the outset, we are now asking for your consent to allow your data to be used for research and teaching purposes.

Purpose. The purpose of this study is to assess whether gamblers with differing levels of pathology crave more or less when craving is either prevented or allowed.

Anonymity/Confidentiality. The data collected in this study are kept anonymous and confidential. The consent forms are kept separate from your responses.

Right to withdraw data. You have the right to indicate that you do not wish your data to be used in this study. If you indicate this is your choice, then all measures you have provided will be destroyed.

Signatures: I have read the above description of the study investigating craving to gamble. The data in the study will be used in research publications or for teaching purposes. My signature indicates that I agree to allow the data I have provided to be used for these purposes.

Full Name (Print): _____

Participant Signature: _____

Date: _____

Researcher Signature: _____

Date: _____

Author Notes

Requests for reprints or further information should be sent to Travis K. Sztainert.

In addition, you can reach me by e-mail

at tsztaine@connect.careton.ca.